

# LOGIC LAB

## 5035T

HEWLETT  PACKARD

## LOGIC LAB

### 5035T

**SERIAL PREFIX: 1624A**

This manual applies directly to HP Model 5035T Logic Labs having serial prefix 1624A.

#### NEWER UNITS

This manual, with enclosed "Manual Changes" sheet, applies to HP Model 5035T Logic Labs having serial number prefixes as listed on the "Manual Changes" sheet.

#### OLDER UNITS

For HP Model 5035T Logic Labs with serial number prefix 1540A, see page 3-1. For instruments with serial prefix 1504A and lower, coverage is available in Service Manual HP Part No. 05035-90001.

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## CERTIFICATION

*The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.*

## WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

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

See additional warranty information in Table 2-3 for separate components included with the logic lab.

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**WARNING**

IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTO-TRANSFORMER (FOR VOLTAGE REDUCTION) MAKE SURE THE COMMON TERMINAL IS CONNECTED TO THE EARTHED POLE OF THE POWER SOURCE.

**WARNING**

BEFORE SWITCHING ON THE INSTRUMENT, THE PROTECTIVE EARTH TERMINALS OF THE INSTRUMENT MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR OF THE (MAINS) POWER CORD. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLES) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

**WARNING**

THE SERVICE INFORMATION FOUND IN THIS MANUAL IS OFTEN USED WITH POWER SUPPLIED AND PROTECTIVE COVERS REMOVED FROM THE INSTRUMENT. ENERGY AVAILABLE AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

## SAFETY CONSIDERATIONS

### GENERAL

This is a Safety Class I instrument. This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring Apparatus".

### OPERATION

BEFORE APPLYING POWER verify that the power transformer primary is matched to the available line voltage and the correct fuse is installed (see Section I, Paragraph 1-21). Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

### SERVICE

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

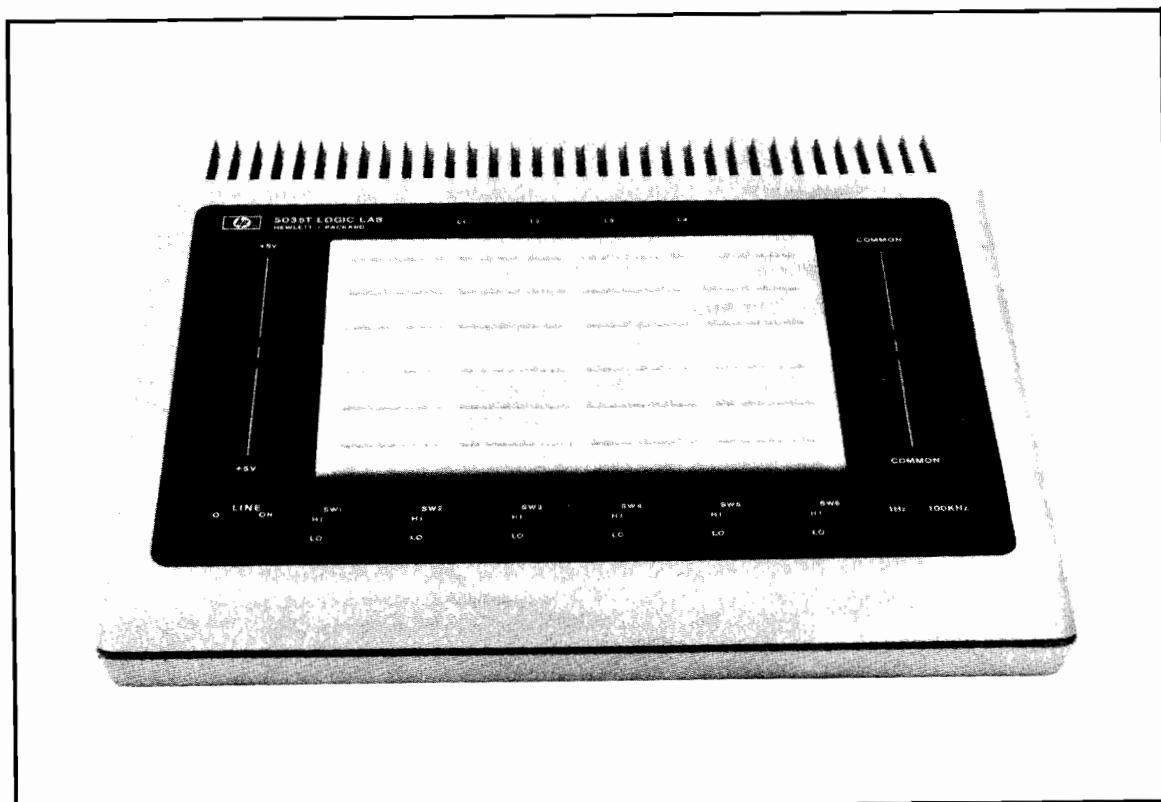


Figure 1-1. HP Model 5035T Logic Lab

## SECTION I

### GENERAL INFORMATION

#### 1-1. INTRODUCTION

1-2. This service manual provides general information and maintenance instructions for the HP 5035T Logic Lab. Additional documentation is supplied with the logic lab as follows:

- a. A logic lab textbook entitled "*Practical Digital Electronics — An Introductory Course*" (part number 05035-90002), which provides a tutorial presentation of digital theory and contains a collection of circuit-design experiments intended to familiarize the user with modern design and troubleshooting techniques.
- b. Three operating and service manuals for the accessory logic test equipment included with the logic lab.

#### 1-3. INSTRUMENT DESCRIPTION

1-4. The HP 5035T Logic Lab is a circuit breadboarding tool that includes a power supply, signal sources, visual logic level indicators, switch circuits, and the breadboard assembly itself (see Figure 1-1). The logic lab incorporates these items into one tabletop cabinet, and provides for power, signal, and designed-circuit interconnections by means of wire jumpers and solderless connectors. When combined with the included logic test accessories (see Table 1-1), the logic lab allows the user to breadboard and analyze digital circuits in a minimum amount of time.

- c. Option 003. The logic lab is supplied without the logic lab textbook, part number 05035-90002.
- d. Option 004. The logic lab is supplied without the component and wire kit, accessory number 10657A.

1-9. The following accessories are available for use with the logic lab:

- a. Accessory number 10656A. This accessory consists of 10 logic lab textbooks, part number 05035-90002.
- b. Accessory number 10657A. This accessory consists of an additional IC component kit, part number 05035-60007, and an additional wire jumper kit, part number 05035-60006.
- c. Additional breadboard assemblies may be ordered for the logic lab. Order HP part number 1258-0121 (or part number C929599 from AP Incorporated, 72 Corwin Dr., Painseville, Ohio).

#### 1-10. INSTRUMENT IDENTIFICATION

1-11. Hewlett-Packard uses a two-section, nine-digit serial number (0000A00000) to identify the instrument. The first four digits are the serial number prefix which identifies a group of instruments, and the last five digits identify the specific instrument. If the serial number prefix of your instrument (located on the bottom of the unit) differs from the prefix given on the title page of this manual, there are differences between the manual and your instrument. These differences are covered in a "manual changes" sheet which is included with the manual.

1-12. The printed circuit board within the unit is identified by a two-section, ten-digit part number (e.g., 05035-60001) and a four-digit series number (e.g., "SERIES 1140A"). The series number identifies the

**1-5. EQUIPMENT SUPPLIED**

1-6. Table 1-1 lists the equipment supplied with the Logic Lab.

*Table 1-1. Equipment Supplied*

DESCRIPTION	QTY.	HP PART OR MODEL NO.
Logic Probe	1	Model 10525T
Logic Pulser	1	Model 10526T
Logic Clip	1	Model 10528A
Logic Lab Textbook (1 set)	1	Part #05035-90002
Wire Jumpers (assorted)	275	Part #05035-60006
		See Replaceable Parts List (Table 2-3)
Integrated Circuits (assorted)	36	Part #05035-60007
		See Replaceable Parts List (Table 2-3)
Carrying Case	1	Part #1540-0258

**1-7. OPTIONS AND ACCESSORIES**

1-8. The following options are available for the logic lab:

- a. Option 001. The logic lab is supplied without the 10525T Logic Probe, 10526T Logic Pulser, 10528A Logic Clip, and without the related documentation.
- b. Option 002. The logic lab is supplied without the carrying case, part number 1540-0258.

electrical characteristics of the complete printed-circuit assembly. A replacement circuit-board assembly may have a different series number than the assembly originally supplied with the instrument. Therefore, when troubleshooting the circuit-board assembly, ensure that the series number on the schematic diagram matches the series number on the board assembly. If the series number on the assembly is lower than the number on the schematic diagram, backdating information will be supplied in the manual. If the series number on the assembly is higher than the number on the schematic diagram, the change information is provided in a manual change sheet which is available from the nearest Hewlett-Packard Sales and Service Office.

**1-13. SPECIFICATIONS**

1-14. Table 1-2 lists all specifications for the logic lab.

**1-15. UNPACKING AND INSPECTION**

1-16. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damages such as scratches, dents, broken switches, etc. If the instrument is damaged or fails to meet performance tests, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately. Retain the shipping carton and the padding material for the carrier's inspection. The Sales and Service Office will arrange for the repair or replacement of the instrument without waiting for the claim against the carrier to be settled.

**1-17. STORAGE AND SHIPMENT**

1-18. **PACKAGING.** To protect valuable electronic equipment during storage or shipment, always use the best packaging methods available. Your Hewlett-Packard Sales and Service Office can provide packaging

Table 1-2. Specifications

<p><b>POWER SUPPLY</b>  <b>Voltage:</b> +5V <math>\pm</math>5% over load range  <b>Load Range:</b> 0-1 ampere  <b>Ripple:</b> 10 mV rms max  <b>Short-Circuit Protection:</b> continuous</p> <p><b>SWITCHES (6, bounce-free operation)</b>  <b>Output:</b> TTL logic levels  <b>Fan-Out:</b> 10 TTL loads (will sink &gt;16 ma)</p> <p><b>CLOCKS (2)</b>  <b>Frequency:</b> 1 Hz <math>\pm</math> line freq. accuracy;  100 kHz <math>\pm</math>30%, nominal squarewave  <b>Output:</b> TTL logic levels  <b>Fan-Out:</b> 10 TTL loads (will sink  &gt;16 ma)</p> <p><b>INDICATORS (4)</b>  <b>Input:</b> indicators off below  +0.6 volts  <b>Input Impedance:</b> &lt;1 TTL load fan-in</p>	<p><b>POWER REQUIREMENTS</b>  <b>Voltage:</b> 100, 120, 220, 240 volts +5%,  -10% 50 Hz or 60 Hz  <b>Power Dissipation:</b> 30 Watts max  <b>Temperature Range:</b> 0-55°C</p> <p><b>WEIGHTS:</b>  <b>Net:</b> Lab only, 5 lbs, 10 oz. (2.55 kg);  with case and documentation  13 lb (5.9 kg)  <b>Shipping:</b> Lab only, 7 lbs, 12 oz. (3.5 kg);  with case and documentation 15 lbs,  2 oz. (6.86 kg)</p> <p><b>DIMENSIONS:</b>  Lab only: Height 3-1/2" (89 mm),  Width 12-1/4" (311 mm), and depth:  10-1/2" (267 mm)  With carrying case and documentation  Height 8" (203 mm), Width 14"  (356 mm), and Depth 11-1/2" (292 mm)</p>
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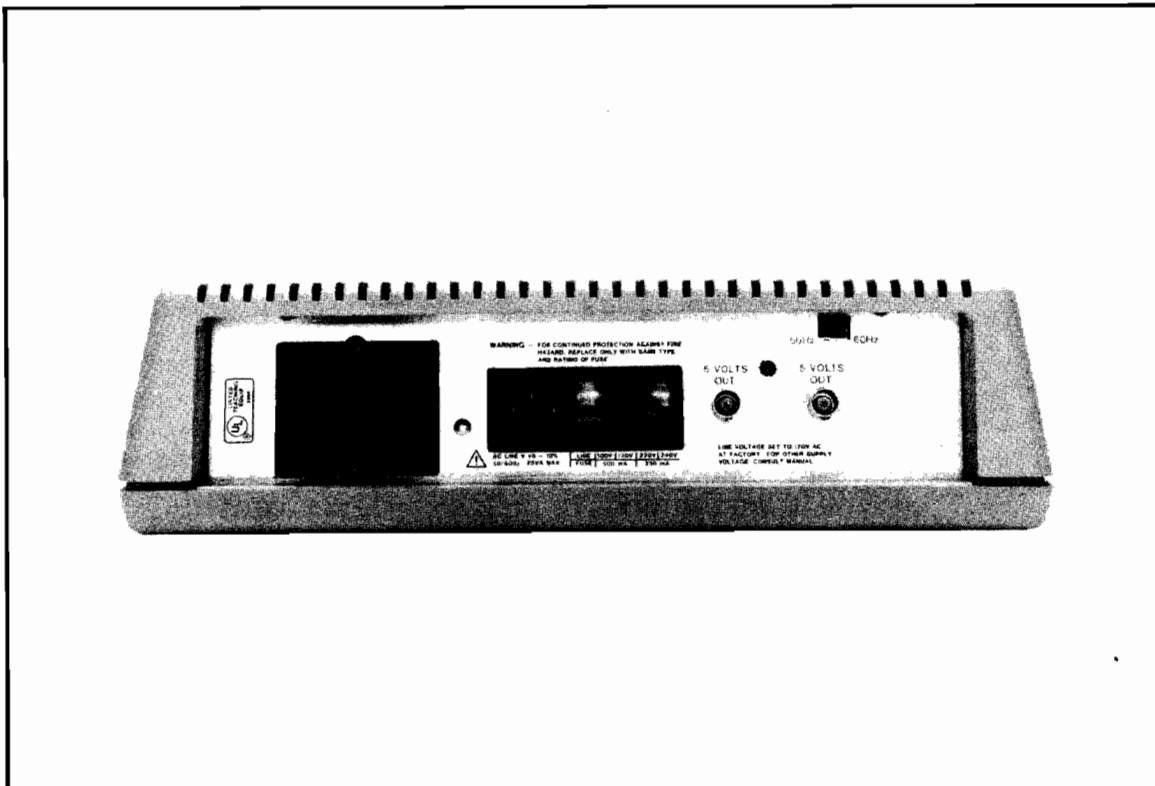


Figure 1-2. View of Rear Panel

material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice.

1-19. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

- a. Maximum altitude: 25,000 ft.
- b. Minimum temperature:  $-40^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$ ).
- c. Maximum temperature:  $+167^{\circ}\text{F}$  ( $+75^{\circ}\text{C}$ ).

## 1-20. LINE VOLTAGE SELECTION

### CAUTION

**Before connecting this instrument to an ac power line, be sure that the line voltage selector switch on the rear panel is set to proper position as shown in Figure 1-2.**

1-21. The power input module on the rear panel of the logic lab allows for operation from 100, 120, 220, or 240 volt ac, 50 or 60 Hz power sources. The logic lab is shipped from the factory with the input module set for 120 volt 60 Hz ac operation. Change the input module to allow operation from one of the other three ac line voltages as follows:

- a. Remove power line cord from input module.
- b. Move sliding plastic fuse cover to the extreme left position to allow access to fuse compartment.

- c. Remove fuse by pivoting FUSE PULL lever out and left.
- d. Using needle-nose pliers, pull the small printed-circuit board straight out of the fuse compartment.
- e. Insert the printed-circuit board into the fuse compartment so the desired line voltage marking is visible at the lower left side of the fuse compartment.
- f. Insert the correct Listed fuse for the selected line voltage: 0.25 ampere fuse for 220/240 volt operation, or 0.50 ampere fuse for 100/120 volt operation.
- g. Slide the 50 Hz-60 Hz switch to correspond to your local line frequency.
- h. Slide plastic fuse cover to the extreme right position and connect power cord to input module.

### WARNING

**TO PROTECT OPERATING AND SERVICING PERSONNEL, THIS INSTRUMENT IS EQUIPPED WITH A THREE-PIN POWER RECEPTACLE. THE CENTER PIN OF THE RECEPTACLE CONNECTS THE INSTRUMENT CHASSIS AND PANELS TO EARTH GROUND WHEN USED WITH A PROPERLY WIRED THREE-CONDUCTOR OUTLET AND POWER CABLE. IMPROPERLY GROUNDED EQUIPMENT CAN RESULT IN HAZARDOUS POTENTIALS BETWEEN EQUIPMENT.**

1-22. If the logic lab is to be used in the USA with a 240-volt, 60 Hz power source, a power cord must be fabricated. Use a Listed connector with a pin arrangement as shown in Figure 1-3.

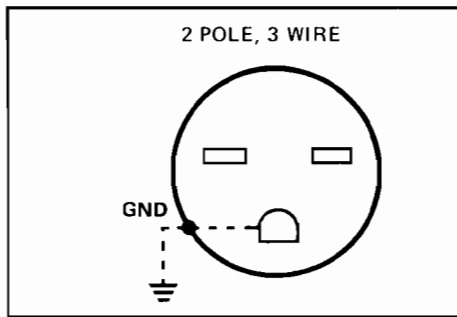


Figure 1-3. Power Cord Connector for 240V Operation

### 1-23. BREADBOARD ASSEMBLY REMOVAL

1-24. The breadboard assembly can be removed from the logic lab panel to allow circuits on different breadboard assemblies to be used with one logic lab. Magnetic strips hold the breadboard assembly in position on the panel. To remove the breadboard assembly, apply firm, downward pressure to the front corners of the breadboard assembly. This causes the rear edge of the breadboard to raise and allows the breadboard to be lifted from the panel.

## SECTION II MAINTENANCE

### 2-1. INTRODUCTION

2-2. This section of the manual provides theory of circuit operation and service information necessary to maintain the logic lab. An in-cabinet performance check, component location illustrations, and a schematic diagram are included.

### 2-3. THEORY OF OPERATION

2-4. The logic lab contains a 5 volt power supply, two oscillators, switch circuits with switch debouncers (P/O U1), and light-emitting diode indicators with LED drivers. The operation of each of these items is discussed in the following paragraphs.

### 2-5. Power Supply

2-6. AC power supply from the power source is applied, through the A2 Power Line Module, to the primary windings of transformer T1. The transformer steps the voltage down to approximately 9.0 volts RMS between each side of the secondary windings and the common center-tap connections.

2-7. Diodes A1CR5 and A1C6 full-wave rectify this AC voltage, and capacitors A1C1 and A1C2 filter the resulting DC voltage. The filtered DC voltage (approximately 11.0 volts DC) is then applied to the 5 volt

regulator IC, U1. The output of the 5 volt regulator remains between +4.75 and +5.25 volts over the load range of 0 to 1 ampere.

### **2-8. Oscillators**

2-9. The logic lab includes two oscillators: a 1 Hz oscillator, which is derived from the line frequency, and a 100 kHz oscillator, generated by a local oscillator.

2-10. The operating principle of the 100 kHz oscillator is as follows: when power is first applied to the logic lab, the input to inverter A1U2F (pin 13) goes to a high logic level. This causes the output of inverter A1U2F to go low and the output of inverter A1U2E to go high. Capacitor A1C5 charges through resistor A1R2 until the voltage at the input of A1U2F becomes sufficiently low to cause the output of A1U2F to switch to a high state. When this occurs, A1U2E also changes states (high input, low output). Capacitor A1C5 now discharges through resistor A1R2 until the voltage at the input of A1U2F is sufficiently high to cause A1U2F to switch back to the original state. The rate at which this switching back and forth occurs is essentially determined by the values of capacitor A1C5 and resistor A1R2. The output inverter, A1U2D, provides isolation between the frequency determining portion of the oscillator and the circuits that connected to the oscillator output.

2-11. The 1 Hz oscillator is derived from the line frequency by means of a divide by 50/60 line frequency divider. A switch is provided to select either 50 Hz or 60 Hz, the local line frequency. The line divider circuit is comprised of U3, Q1 and U2C. The output inverter, A1U2C, provides buffer between the frequency source and the circuits connected to the output of the oscillator.

### **2-12. Switch Circuits**

2-13. The logic lab contains six switch circuits that can be used to apply fixed high or low logic levels to a breadboard circuit. The switch bouncing effects produced when it is positioned from a LOW to HIGH or from HIGH to LOW are suppressed by the D-type flip-flops (p/o U1) clocked at half the line frequency.

Table 2-2. In-Cabinet Performance Check (Continued)

<b>OSCILLATORS</b>	
Test Equipment Required: HP 5328A Frequency Counter (or equivalent instrument).	
Check the frequency of the two logic lab oscillators as follows:	
a.	Connect the frequency counter to the 100 kHz output jack on the logic lab panel.
b.	Set the counter's FUNCTION switch to <b>FREQ A</b> and the <b>FREQ RESOLUTION</b> switch to 10 Hz.
c.	Observe that the displayed value is between 70.0 kHz and 130.0 kHz.
d.	Connect the frequency counter to the 1 Hz output jack on the logic lab panel and set the counter's FUNCTION switch to <b>PERIOD A</b> and <b>MULTIPLIER</b> switch to 10 <sup>2</sup> .
e.	Observe that the displayed value is 1000 ms $\pm$ the local line frequency accuracy.
f.	Remove test equipment.
<b>SWITCH AND INDICATOR CIRCUITS</b>	
Check the panel indicators (L1 through L4) and HI/LO switch circuits as follows:	
a.	Using the logic probe, check each switch output jack for high and low levels as the switch is set to <b>HI</b> and <b>LO</b> , respectively.
b.	Connect a wire jumper between one of the HI/LO switch output jacks and one of the indicator input jacks.
c.	Set the switch to <b>HI</b> ; the indicator should illuminate. Set the switch to <b>LO</b> ; the indicator should turn off.
d.	Repeat steps b and c, above, until all indicator circuits have been checked.

**2-14. LED Indicators**

2-15. Four LED (light-emitting-diode) indicators are provided on the logic lab panel to indicate logic levels of various points in a designated circuit. Each of the four indicator circuits operates as follows: When a high logic level signal is applied to one of the lamp input jacks (L1 through L4 on the logic lab panel), the associated LED driver will allow current to flow through the LED and thus causing the LED to illuminate. When a low logic level is applied to one of the lamp input jacks, the associated LED driver will not allow current to flow through the LED, and the LED indicator will turn off.

**2-16. TEST EQUIPMENT**

2-17. A logic probe, logic pulser, and logic clip are included with the logic lab and can be used to verify operation of a circuit or to isolate circuit troubles to the component level. Additional test equipment, as listed in Table 2-1, is required for the In-Cabinet Performance Check of Table 2-2. Equivalent test equipment may be used.

Table 2-1. Required Test Equipment

<b>INSTRUMENT TYPE</b>	<b>REQUIRED CHARACTERISTICS</b>	<b>RECOMMENDED INSTRUMENT</b>
AC and DC Voltmeters	6 Vdc range, 0.5% accuracy, 15 mV rms ac range, 1% accuracy, 1 mV resolution	HP 5300A/5306A
Frequency Counter	Period measurements of 1000 ms and frequency to 130 kHz	HP 5328A
Resistor	5 $\Omega$ , 10W	HP Part Number 0811-1893

**2-20. INSTRUMENT ACCESS**

2-21. Remove the printed-circuit board assembly from the logic lab cabinet according to the following procedure:

**WARNING**

**BEFORE PERFORMING THE FOLLOWING PROCEDURE, ENSURE THAT THE LOGIC LAB POWER CORD IS DISCONNECTED FROM THE AC POWER SOURCE. IF CORD IS NOT DISCONNECTED, THE AC LINE VOLTAGE, WHICH IS SUFFICIENT TO CAUSE PERSONAL INJURY OR DEATH, IS PRESENT ON SEVERAL EXPOSED TERMINALS.**

- a. Remove the four machine screws from the bottom corners of the logic lab.
- b. Remove top cover from logic lab by lifting cover straight up.
- c. Remove printed-circuit board and rear panel by first lifting front edge of circuit board then lifting bottom edge of rear panel out of the retaining grooves in the bottom cover.
- d. When reinstalling the circuit board and rear panel, be sure that bottom edge of rear panel is positioned in retaining grooves on bottom cover.

**2-22. PREVENTIVE MAINTENANCE**

2-23. Periodically, perform the In-Cabinet Performance Check of Table 2-2 to verify proper operation of the logic lab. Additionally, whenever the covers are removed, check for broken or burned components, damaged wires, excess dust, etc.

**2-18. IN-CABINET PERFORMANCE CHECK**

2-19. Use the performance check in Table 2-2 to verify proper operation of all circuits within the logic lab. The check should be used at any time that improper operation or nonconformance to specifications is suspected.

*Table 2-2. In-Cabinet Performance Check*

**POWER SUPPLY**

Test Equipment Required:

HP 5306A Multimeter/Counter (or equivalent ac and dc voltmeters).

A 5 ohm, 10-watt resistor (HP part number 0811-1893).

Check the power supply output voltage and ripple specifications as follows:

- a. Using the multimeter/counter, measure the voltage between one of the front-panel +5V jacks and one of the COMMON jacks. The measured value should be +5V dc  $\pm 0.25$  Vdc.
- b. Using suitable clip leads, connect the 5 ohm, 10-watt resistor between an unused +5V output jack and an unused COMMON jack. The output voltage of the supply should remain between +4.75 Vdc and +5.25 Vdc.
- c. Press the ACV pushbutton on the multimeter/counter and observe that the displayed ripple voltage is less than 10 mV rms.
- d. Set the LINE switch to OFF and remove test equipment.

## 2-24. GENERAL REPAIR

2-25. The following paragraphs provide general repair information for the logic lab.

2-26. **COMPONENT REPLACEMENT.** When replacing a circuit board component, use a low heat soldering iron. Heat must be used sparingly as damage to the circuit foil may otherwise occur. Mounting holes may be cleaned with a toothpick while heat is applied. After component removal and replacement, clean connections with a suitable cleaning solution.

2-27. **INTEGRATED CIRCUIT REPLACEMENT.** Two methods are recommended for removing integrated circuits:

- a. **Solder Gobbler.** Solder is removed from board by soldering iron with a hollow tip that is connected to a vacuum source. The IC is removed intact, so it may be reinstalled if it is later proven not to be defective.
- b. **Clip Out.** This method is used when an IC is proven defective. Clip leads close to case, apply heat, and remove leads with long-nose pliers. Clean board holes with a toothpick and cleaning solution.

## 2-28. TROUBLESHOOTING

2-29. Troubleshoot malfunctions of the logic lab by combining the information given in the theory of operation portion of this manual (Paragraph 2-3) with the information given in the In-Cabinet Performance Check of Table 2-2. The theory of operation paragraphs describe how the various logic lab circuits operate, and the performance check verifies proper operation of the circuits.

Table 2-3. Replaceable Parts

Reference Designation	HP Part Number	Description
A1	05305-60008	BD AY-MAIN
A1C1	0180-2596	CF 5200 UF 20V
A1C2	0180-0374	CF 10 UF 20V
A1C3	0180-0374	CF 10 UF 20V
A1C4	0160-0157	CF .0047 UF
A1C5	0160-0162	CF .022 UF 200V
A1C6	0160-2055	CF .01 UF 100V
A1C7	0160-2055	CF .01 UF 100V
A1CR1	1990-0404	DIODE: LGT EMIT
A1CR2	1990-0404	DIODE: LGT EMIT
A1CR3	1990-0404	DIODE: LGT EMIT
A1CR4	1990-0404	DIODE: LGT EMIT
A1CR5	1901-1081	DIODE: POWER RECT.
A1CR6	1901-1081	DIODE: POWER RECT.
A1Q1	1854-0071	TRANSISTOR NPN
A1Q2	1854-0071	TRANSISTOR NPN
A1R1	0683-8245	RF 820K 5% .250W
A1R2	0683-1515	RF 150 5% .250W
A1R3	1810-0041	RESISTOR: ARRAY (8x2700)
A1S1	3101-0574	SWITCH: SLIDE
A1S2	3101-0574	SWITCH: SLIDE
A1S3	3101-0574	SWITCH: SLIDE

## 2-30. SCHEMATIC DIAGRAM

2-31. Figure 2-4 shows the schematic diagram for the Logic Lab. Figure 2-3 is a top view of the circuit locations. Figure 2-1 gives details of the IC's and resistor packs. Figure 2-2. details the breadboard bus arrangement.

## 2-32. REPLACEABLE PARTS

2-33. Table 2-3 lists parts in alphabetical order of reference designations and provides the following information for each part:

- a. Hewlett-Packard part number.
- b. Description of part.

2-34. Miscellaneous parts are listed at the end of Table 2-3.

2-35. To obtain replaceable parts, address order to your local Hewlett-Packard Sales and Service Office (see lists at the back of this manual). Identify parts by their Hewlett-Packard part number. To obtain a part that is not listed, include:

- a. Instrument model number.
- b. Instrument serial number.
- c. Description of the part.
- d. Function and location of the part.

Table 2-3. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Description
A1S4	3101-0574	SWITCH: SLIDE
A1S5	3101-0574	SWITCH: SLIDE
A1S6	3101-0574	SWITCH: SLIDE
A1S7	3101-2046	SWITCH: SLIDE
A1S8	3101-0174	SWITCH: SLIDE
A1U1	1820-0788	IC-TTL: 74174
A1U2	1820-0174	IC-TTL: 7404
A1U3	1820-1588	IC-CMOS: 14566
A1U4	1820-1587	IC-TTL: 8859
A2	5060-9422	PWR LINE MODULE
A2F1 OR	2110-0004	FUSE: 0.25 AMP 250V (240V OPERATION)
A2F1	2110-0012	FUSE: 0.5 AMP 250V (120V OPERATION)
A3	1258-0121	BREADBOARD ASSY
J1	1250-0083	CONN: RF BNC
J2	1250-0083	CONN: RF BNC
T1	9100-3857	TRANSFORMER: POWER
U1	1826-0122	IC-LIN: 7805
W1	8120-1378	CORD: LINE
W2 includes:	05035-60009	CBL AY: MODULE
A1S7	0360-1632	LUG, CONNECTOR: BNC SHELL (FOR J1)

Table 2-3. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty.	Description
			<b>MISCELLANEOUS</b>
	1540-0258	1	CASE CARRYING
	05035-00005	1	PNL-REAR
	05035-00002	2	PAD-MAGNET
	05035-00004	1	COV-XFMR
	05035-00006	1	PNL-FR
	05035-40002	1	COVER-TOP
	05035-40003	1	COV-BOT
	05035-40004	4	FOOT
	0360-1514	7	TERMINAL, PIN
A1J1 thru A1J20	1251-0690	20	SOCKET PIN
	1400-0315	1	CLIP-COMPONENT
	05000-20017	4	SPCR-LED SINGLE
	05035-00003	1	BKT-SW
	05035-20001	1	BD-BLANK
A1J1 thru A1J20	05035-40005	20	STANDOFF-PIN
	1251-0655	1	RECEPTACLE POST

Table 2-3. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty.	Description
	05035-80011	4	IC-TTL 7490 (1820-0055)
	05035-80012	1	IC-TTL 7492 (1820-0056)
	05035-80013	1	IC-TTL 7451 (1820-0063)
	05035-80014	2	IC-TTL 7410 (1820-0068)
	05035-80015	1	IC-TTL 7420 (1820-0069)
	05035-80016	1	IC-TTL 7430 (1820-0070)
	05035-80017	2	IC-TTL 7476 (1820-0076)
	05035-80018	2	IC-TTL 7474 (1820-0077)
	05035-80019	1	IC-TTL 7493 (1820-0099)
	05035-80020	2	IC-TTL 7404 (1820-0174)
	05035-80021	1	IC-TTL 7442 (1820-0214)
	05035-80022	1	IC-TTL 74121 (1820-0261)
	05035-80023	1	IC-TTL 7486 (1820-0282)
	05035-80024	1	IC-TTL 7475 (1820-0301)
	05035-80025	1	IC-TTL 7402 (1820-0328)
	05035-80026	1	IC-TTL 74181 (1820-0606)
	05035-80027	2	IC-TTL 7408 (1820-0511)
	05035-80028	1	IC-TTL 7432 (1820-0661)
	05035-80029	1	IC-TTL 74194 (1820-0743)
	05035-80030	1	IC-TTL 74164 (1820-1064)
<p>*The listed HP part numbers for the above integrated circuits identify specially marked circuits. To order equivalent circuits without special markings, order the HP part numbers given in parenthesis ( ) in the description column.</p>			

Table 2-3. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty.	Description
	<b>05035-60006</b>	<b>1</b>	<b>KIT-WIRE JUMPER</b>
	Consists of the following items:		
	9220-0001	1	BAG
	05035-80001	1	WIRE BUNDLE: 25, blk, 2 inch lg.
	05035-80002	1	WIRE BUNDLE: 25, red, 2 inch lg.
	05035-80003	1	WIRE BUNDLE: 75, orn, 2 inch lg.
	05035-80004	1	WIRE BUNDLE: 75, yel, 3 inch lg.
	05035-80005	1	WIRE BUNDLE: 25, blue, 6 inch lg.
	05035-80006	1	WIRE BUNDLE: 50, grn, 4 inch lg.
	05035-80007	1	WIRE BUNDLE: 10, vio, 10 inch lg.
	<b>05035-60007</b>	<b>1</b>	<b>KIT IC&amp;LED</b>
	Consists of the following items:		
	<b>NOTE</b>		
	Hewlett-Packard warrants the following parts to be free of defects upon receipt, and will replace any defective parts if they are returned to Hewlett-Packard within 90 days of delivery.*		
	1200-0466	1	SOCKET 40 PIN IC
	1990-0329	4	SOLID STATE DISP Δ
	05035-80010	4	IC-TTL 7400 (1820-0054)
	8710-0585	1	IC EXTRACTOR

ΔDistributors of Hewlett-Packard opto-electronics components carry an equivalent LED display under Part No. 5082-7300.

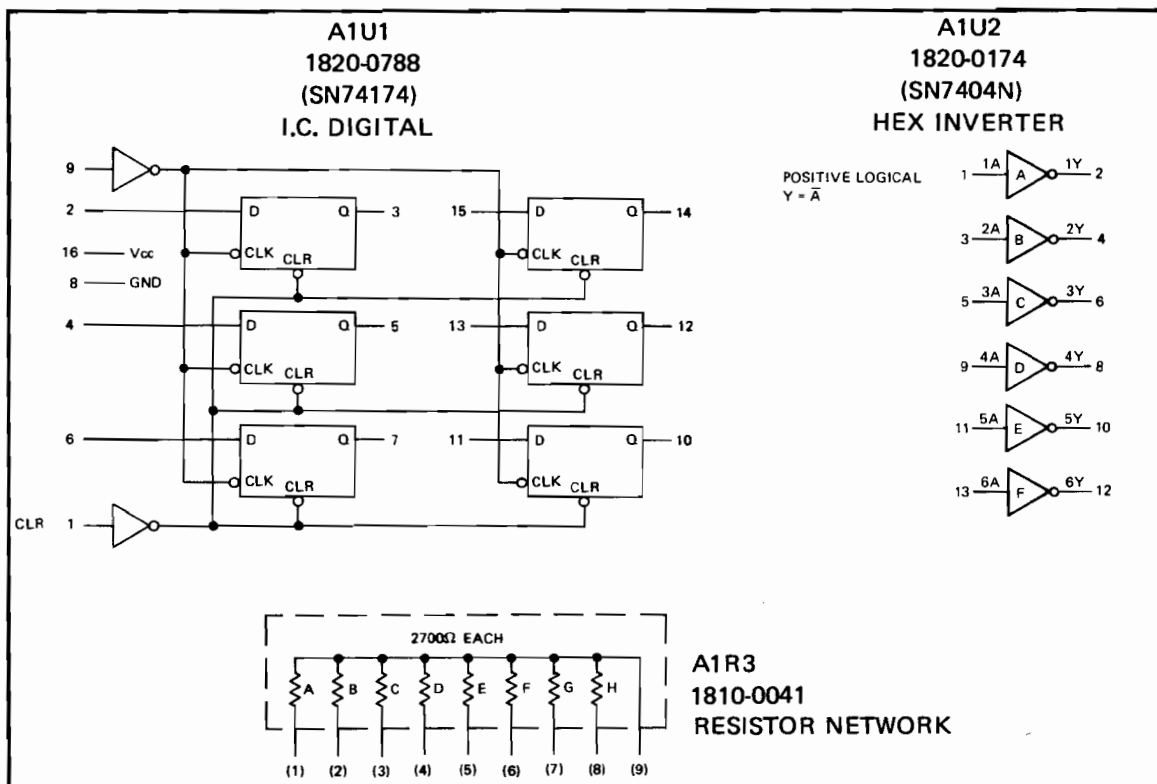
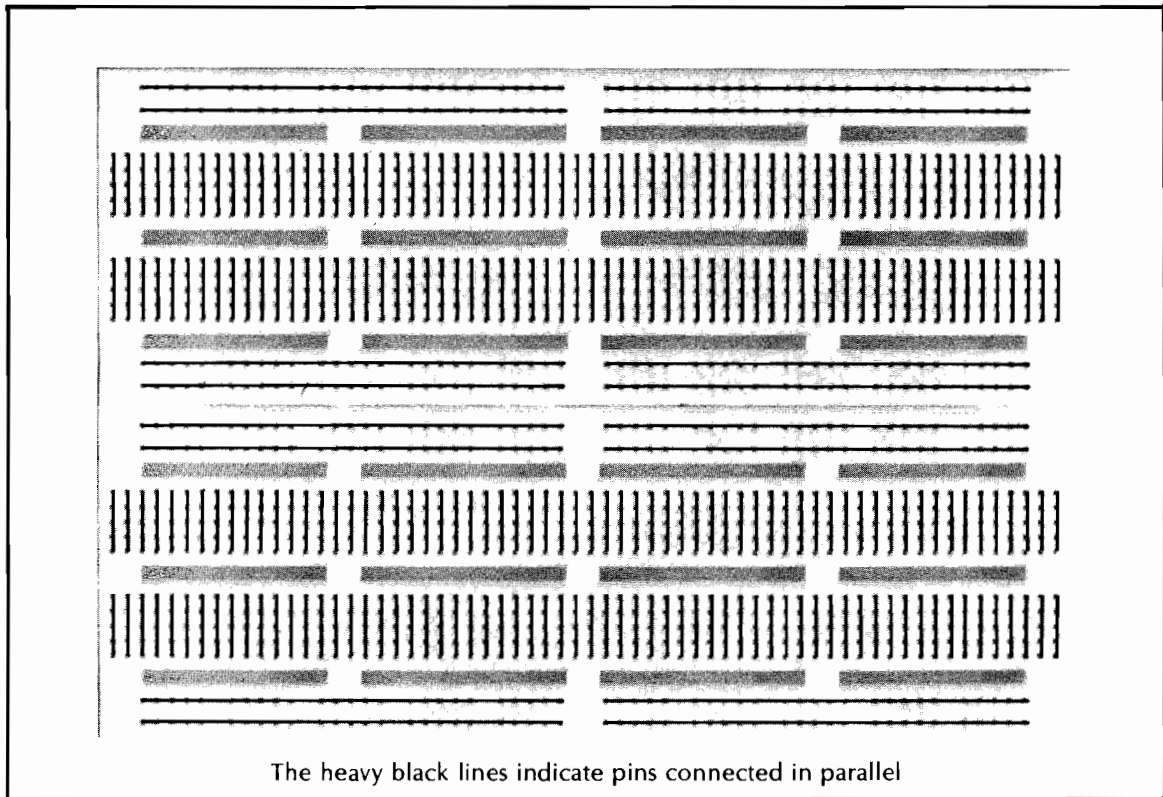


Figure 2-1. Integrated Circuits



The heavy black lines indicate pins connected in parallel

Figure 2-2. A3 Breadboard Bus Arrangement

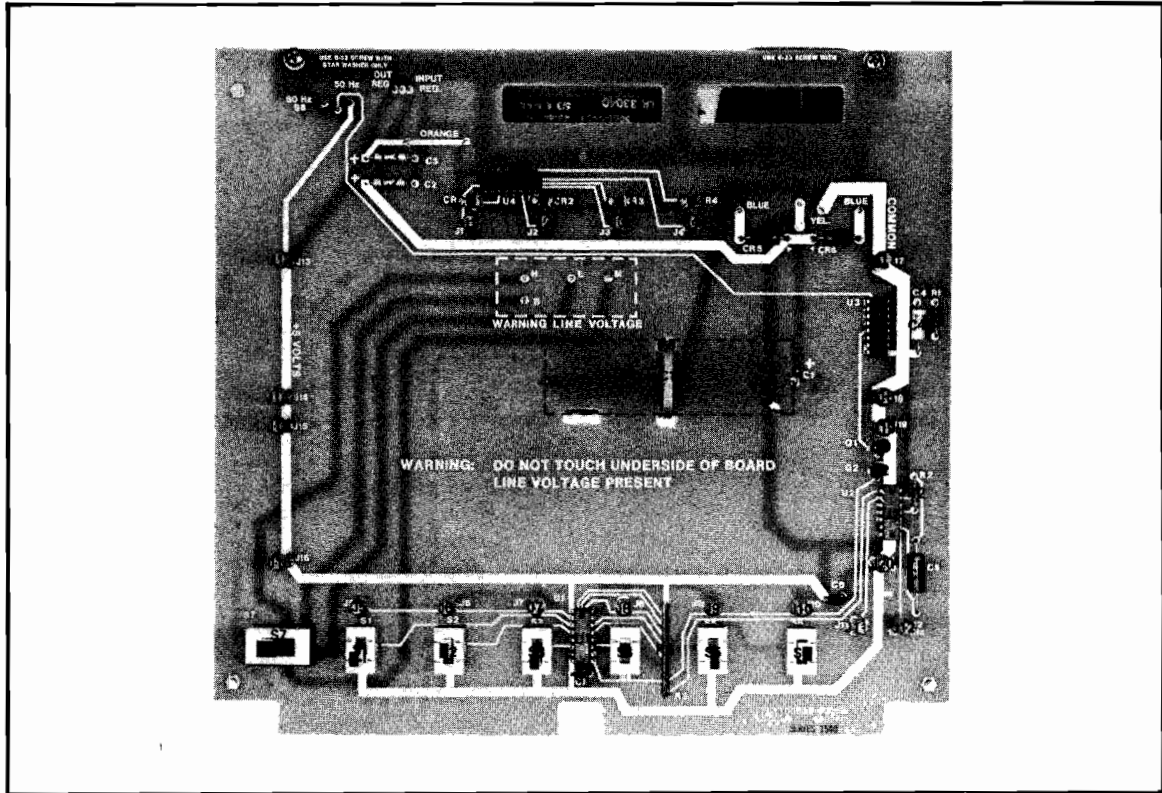
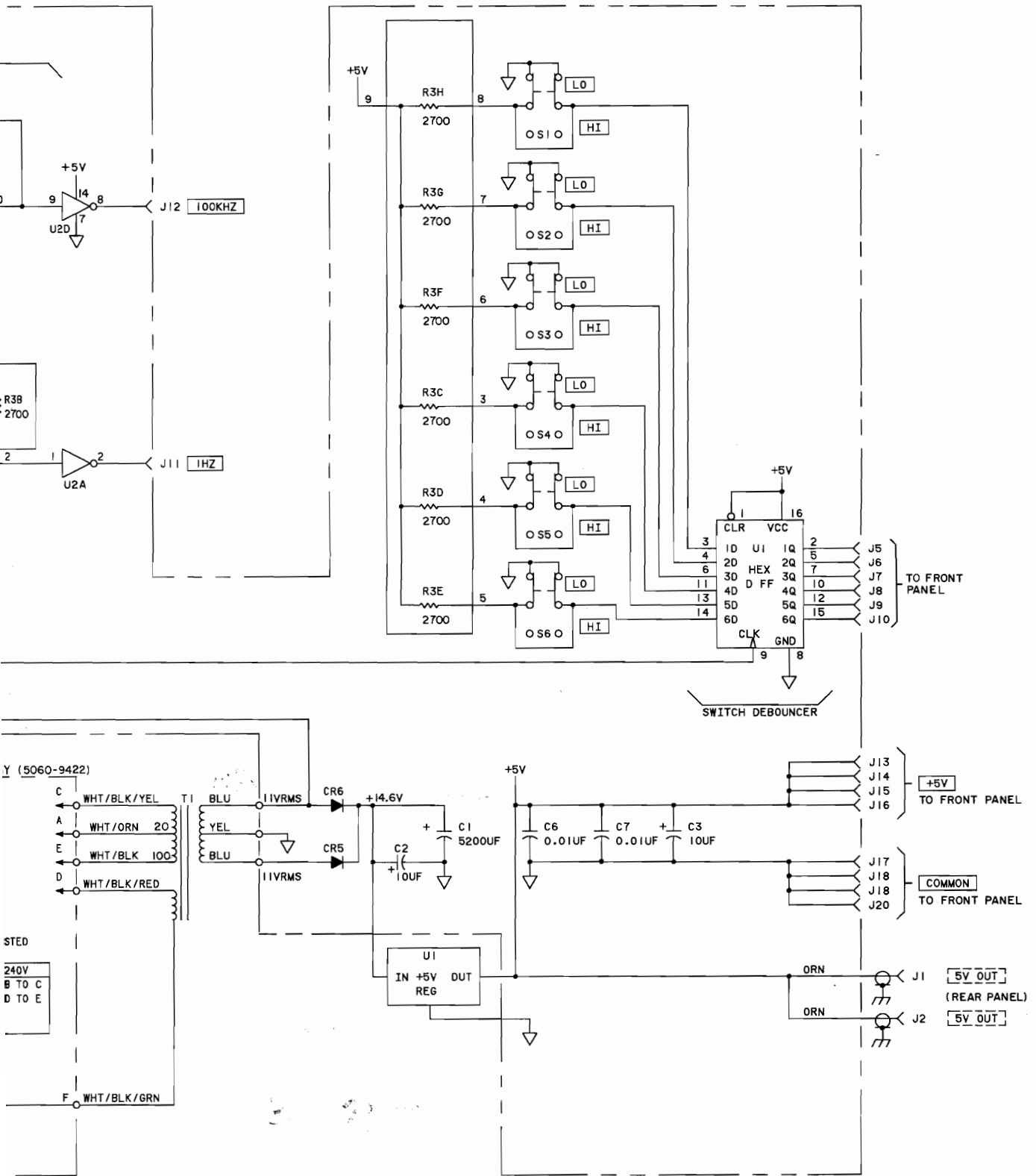


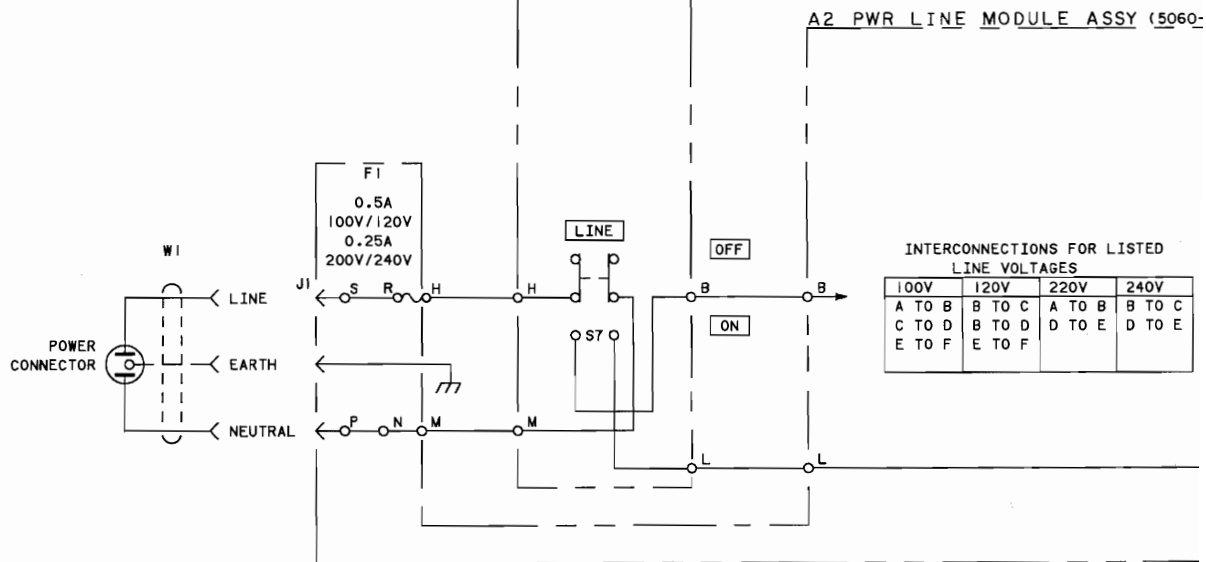
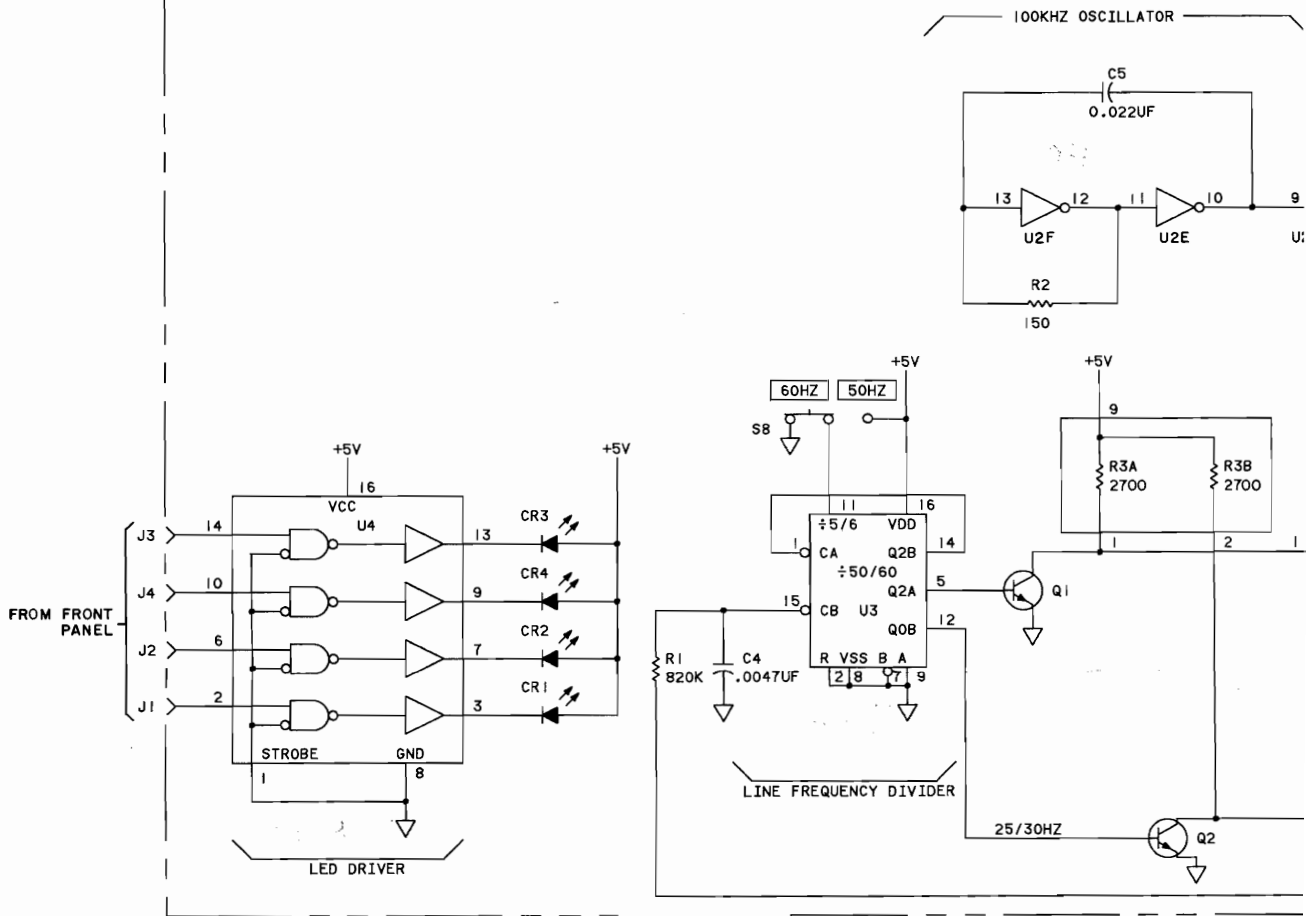
Figure 2-3. Top View of Circuit Board





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Figure 2-4. Schematic Diagram

A1 MAIN BOARD ASSEMBLY (05035-60008) SERIES 1624



INTERCONNECTIONS FOR LISTED LINE VOLTAGES

100V	120V	220V	240V
A TO B	B TO C	A TO B	B TO C
C TO D	B TO D	D TO E	D TO E
E TO F	E TO F		

## SECTION III BACKDATING

### 3-1. INTRODUCTION

3-2. This manual applies directly to 5035T Logic Labs with serial prefix 1624A. Instruments with serial prefix 1540A are covered in the backdating section below. Instruments with serial prefix 1504A and below are covered in a separate manual HP Part Number 05035-90001.

### 3-3. Newer Instruments

3-4. As change are made, newer instruments may have serial prefixes that are not listed in this manual. The manual for these instruments are supplied with a manual change sheet which contains the required updating information. If this sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed at the back of this manual.

### 3-5. Backdating

3-6. If your instrument has serial prefix 1540A, make the following changes to this manual:

- a. Table 2-3, Replaceable Parts:  
Change T1 from 9100-3857 to 9100-3033, Transformer:Power
- b. Figure 2-5, Schematic Diagram:  
Change "11.0 VRMS" by each blue wire from secondary to T1 to "9 VRMS".  
Change "+14.6V" at junction of C1 and C2 positive terminals to "+11V".  
Change SERIES 1624 (at top of A1 schematic) to SERIES 1540.

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