

**64000**

**HP64000  
Logic Development  
System**

**Model 64211A  
Emulator Control  
Board**



## **CERTIFICATION**

*Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.*

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

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## **ASSISTANCE**

*Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.*

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



ABBREVIATED SERVICE MANUAL

**MODEL 64211A  
EMULATOR CONTROL BOARD**

**REPAIR NUMBERS**

This manual applies directly to Emulator Control Boards with repair numbers prefixed **2227A**. For additional information about repair numbers see Section I, paragraph 1-3.

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Manual Part Number 64211-90902  
Microfiche Part Number 64211-90802

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## SAFETY SUMMARY

***The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.***

### **GROUND THE INSTRUMENT.**

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

### **DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.**

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

### **KEEP AWAY FROM LIVE CIRCUITS.**

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

### **DO NOT SERVICE OR ADJUST ALONE.**

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

### **DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.**

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

### **DANGEROUS PROCEDURE WARNINGS.**

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

**WARNING**

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

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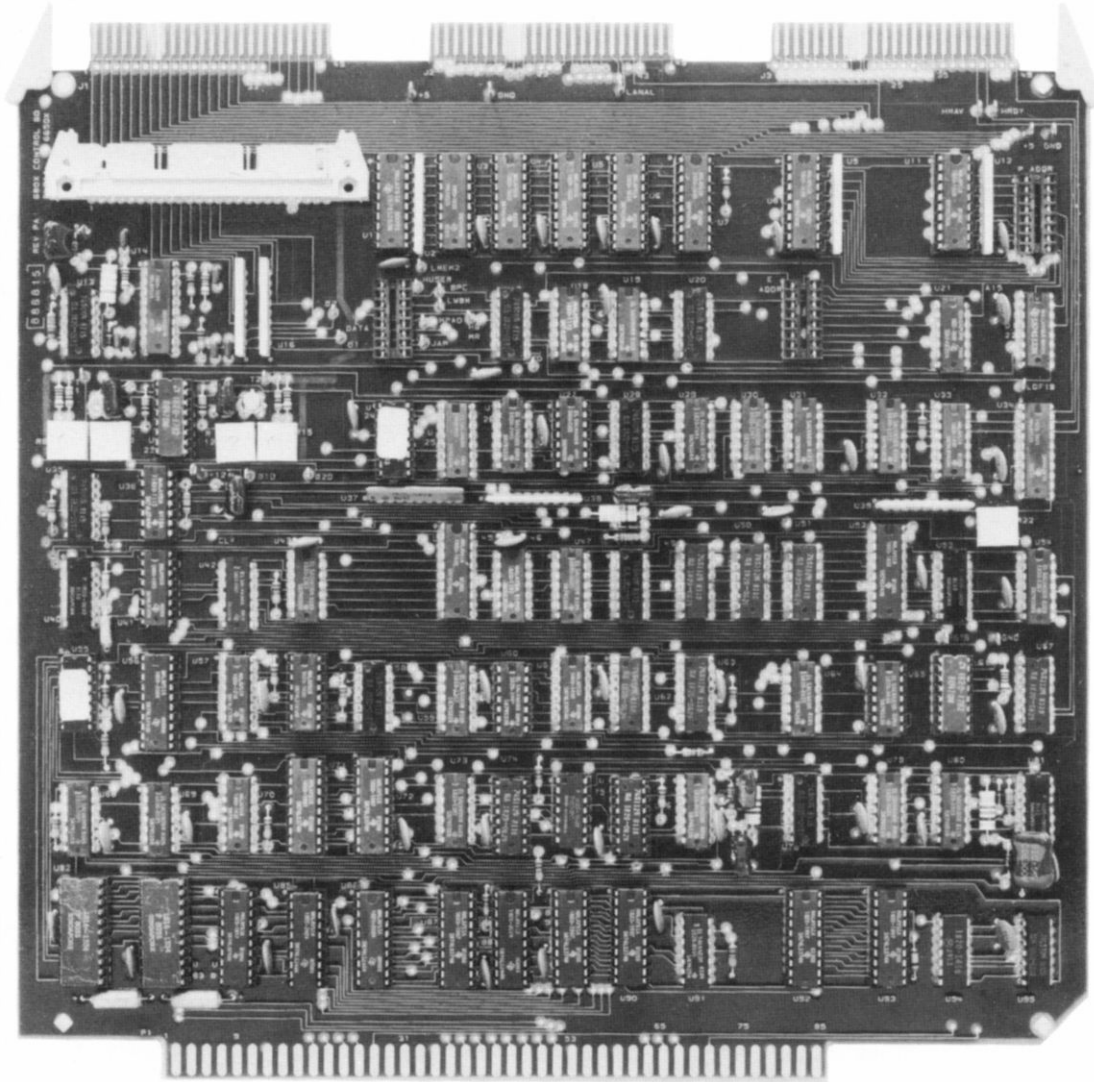
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*Figure 1-1. Model 64211A Emulator Control Board*



## **SECTION I**

### **GENERAL INFORMATION**

#### **1-1. INTRODUCTION.**

1-2. This Abbreviated Service Manual contains installation information and the parts list, component locator and schematic for the 64211A Emulator Control Board. No operating or servicing procedures are provided. Refer to the 6800/6802 Emulation Subsystem Manual for operation and servicing procedures.

1-3. This manual is organized with eight sections: Section I provides a brief physical and functional description. Section II outlines installation and removal. Section III, Operation, and Section IV, Performance Verification, reference other manuals containing this material. Section V describes Adjustments. Section VI lists replaceable parts. Section VII explains backdating needed to make this manual applicable to older units. Section VIII contains the schematic diagram and the component locator.

#### **1-4. INSTRUMENTS COVERED BY THIS MANUAL.**

1-5. Printed on each 64211A Emulator Control Board is the repair number. The repair number is in two parts, in the form 0000A00000. The first four digits and the letter are the repair prefix and the last five are the suffix. The prefix is the same for all identical boards. The suffix is assigned sequentially and is different for each board. The contents of this manual apply to boards with the repair number prefixes listed under REPAIR NUMBERS on the title page.

1-6. Any board manufactured after the printing of this manual may have a repair prefix that is not listed on the title page. This unlisted repair number prefix indicates that the board may be different from those described in this manual. Updating the manual for this newer board is accomplished by a manual changes supplement. The supplement contains "change information" that explains how to adapt this manual for the newer board.

1-7. In addition to change information, The supplement contains information for correcting errors in this manual. To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest manual changes supplement. The supplement for this manual is identified with the manual print date and the part number, which both appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-8. For information concerning a repair number prefix that is not listed on the title page or in the manual changes supplement, contact your nearest Hewlett-Packard Sales/Service Office.

#### **1-9. DESCRIPTION.**

1-10. The Model 64211A Emulator Control Board is a single printed circuit board which installs in the 64000 mainframe. This board provides emulation control for 6800 and 6802/6808 emulator subsystems. A detailed functional description of this board is provided in the applicable subsystem service manuals. The 6800 (option 212) and 6802/6808 (option 213) each require a 64211A Emulator Control Board.

#### **1-11. ACCESSORIES SUPPLIED.**

1-12. Supplied with the Emulator Control Board are two 64151-61602 bus cables which are required to connect the board to the Model 64151A Emulation Memory Controller option. The installation of these cables is discussed in Section II.

**1-13. ADDITIONAL EQUIPMENT REQUIRED.**

1-14. The Model 64211A must be plugged into the 64000 mainframe to operate. It must also be connected to an emulation pod to have a minimum emulation subsystem. The 6800 (option 212) and 6802/6808 (option 213) each require a 64211A Emulator Control Board.

**1-15. POWER SUPPLY LOADING.**

1-16. The power requirements of the Emulator Control Board when configured with each of the applicable emulator probes are listed in table 1-1.

*Table 1-1. Power Supply Requirements*

	<b>64211A</b>	<b>w/64212A</b>	<b>w/64213A</b>
+5 V	4 A	5.38 A	5.79 A
-5 V	Not used in any configuration.		
+12V	Approx 2 mA for all configurations.		

No other voltages are required.

## SECTION II

### INSTALLATION

#### 2-1. INTRODUCTION.

2-2. This section contains information required to install the Model 64211A in the Model 64200 Mainframe. Also included are the initial inspection procedures, damage claim information, and the operating, storage, and shipment environmental considerations.

#### 2-3. INITIAL INSPECTION.

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until contents of the shipment have been checked mechanically and electrically. Procedures for checking performance are given in the applicable subsystem manual. If the contents are not complete, if there is mechanical damage or defect, or if the board does not pass the performance tests, notify the carrier as well as Hewlett-Packard Sales/Service office. Keep the shipping materials for carriers inspection. The Hewlett-Packard Sales/Service office will arrange for repair or replacement at HP option without waiting for claim settlement.

#### 2-5. INSTALLATION AND REMOVAL.

2-6. Figure 2-1 shows a top view of the 64100A mainframe card cage and the recommended position for the Emulator Control Board and for the Static RAM Controller Board, Static RAM Boards, and the Internal Analysis Boards which are optional. The recommended slot for the 64211A is the rearmost position. This maximizes the free cable length to the emulator pod.

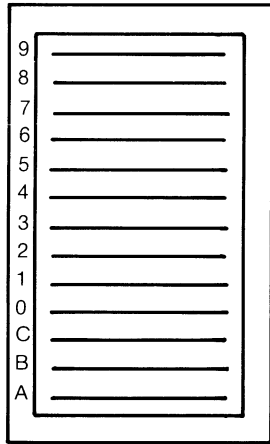
**WARNING**

To prevent personal injury, refer to the safety requirements listed in the mainframe manual before installing this option.

**CAUTION**

The 64211A Emulator Control Board must be installed and removed with the 64000 power turned off. Damage to the unit may otherwise result.

A. EMULATION AND MEMORY



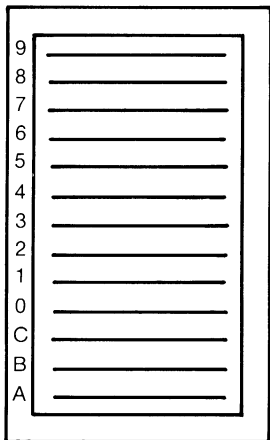
64100 STATION FRONT

EMULATOR CONTROL BOARD  
 EMULATION MEMORY CONTROLLER  
 EMULATION MEMORY BOARD  
 EMULATION MEMORY BOARD

PROM PROGRAMMER CONTROL BOARD  
 MAY BE INSTALLED IN ANY SLOT  
 (1 THROUGH 5)

TAPE CONTROLLER BOARD  
 CPU BOARD  
 DISPLAY CONTROL BOARD  
 I/O BOARD

B. EMULATION/ANALYSIS AND MEMORY



64100 STATION FRONT

EMULATOR CONTROL BOARD  
 ANALYSIS BOARD  
 EMULATION MEMORY CONTROLLER  
 EMULATION MEMORY BOARD  
 EMULATION MEMORY BOARD

PROM PROGRAMMER CONTROL BOARD  
 MAY BE INSTALLED IN ANY SLOT  
 (1 THROUGH 4)

TAPE CONTROLLER BOARD  
 CPU BOARD  
 DISPLAY CONTROL BOARD  
 I/O BOARD

October 1981

Figure 2-1. Recommended Card Cage Configuration

2-6. To install the 64211A, proceed as follows:

- a. Turn 64100A power OFF.
- b. Loosen the two hold down screws and remove the card cage access cover.
- c. Connect the selected emulator pod to the Emulator Control Board prior to the installation of the board in the card cage. This is done to simplify the connection of the the multi-conductor pod bus cables to the board. Two multi-colored ribbon cables are used to connect the pod to the Emulator Control Board. One cable terminates in a female card-edge connector, the other terminates in a female socket-type connector. Pin 1 is indicated by a triangle molded into the body of each connector. The mating connectors for the cable connectors are located at the top left corner of the board as viewed from the component side. Pin 1 of the card-edge connector (J1) is indicated by a "1" etched into the board. Pin 1 of the connector block located directly below J1 (J4) is indicated by a triangle molded into the connector block. The connector block and the mating female connector on the cable have matching colored dots on their surfaces. The connector block is a latching type connector. Before installing the cable connector into the connector block insure that the latching tips are open (spread toward the outside edges of the board). Connect the card-edge connectors first, then connect the socket-type connector to the connector block. Push the socket-type connector into the connector block until the latching tips snap over the top of the connector.
- d. Grasp the board by the extractor levers located at the top of the board. Be very careful not to dislodge the cables. Hold the board with the component side toward the front of the development station and the card-edge connector labeled P1 toward the bottom of the card cage. Insert the board into the selected card slot guide rails, make sure P1 and the motherboard connector are aligned, and push the board down until seated firmly in the connector.
- e. The bus cables supplied with the Emulator Control Board are used to connect to the optional Emulation Memory Controller. The bus cables are keyed so that they will seat on the edge connector in only one position.
- f. Stack the emulator pod cables flat across one of the cable rests at the back of the development station.
- g. Reinstall the card cage access cover and tighten the two screws.

2-7. To remove the 64211A, reverse the installation procedure.

2-8. If the optional Emulation Memory Controller is installed, connect the emulation bus cables as follows. Align pin one of each ribbon cable connector, indicated by the dark stripe on the side of the cable and by a colored dot on the connector, with pin one on the card edge connectors J2 and J3 of each board, also indicated by a colored dot. Press the connector on until it seats firmly on the edge connector.

**2-9. OPERATING ENVIRONMENT.**

2-10. The 64211A May be operated in environments within the following limits:

Temperature .....	0°C to +40°C
Humidity .....	5% to 80% relative humidity
Altitude .....	4 600 m (15 000 ft)

It should be protected from temperature extremes which cause condensation within the unit.

**2-10. STORAGE AND SHIPMENT ENVIRONMENT.**

2-11. The 64211A may be stored or shipped within the following limits:

Temperature .....	-40°C to +75°C
Humidity .....	5% to 80% relative humidity
Altitude .....	15 240 m (50 000 ft)

## 2-12. PACKAGING.

**2-13. ORIGINAL PACKAGING.** Containers identical to those used in factory packaging are available through Hewlett-Packard Sales/Services offices.

**2-14. OTHER PACKAGING.** The following general instructions should be used for repacking with commercially available materials:

- a. Wrap the Emulator Control Board in heavy paper or plastic.
- b. Use a strong shipping container. A double-wall shipping container of 350 pound test material is adequate.
- c. Use a layer of shock absorbing material 70 to 100 mm (3 to 4 inch) thick around all sides of the board to provide firm cushioning and to prevent movement inside the container.
- d. Seal shipping container securely.
- e. Mark shipping container FRAGILE to ensure careful handling.
- f. In any correspondence, refer to the board by model number and full repair number.

**CAUTION**

The following precautions should be taken while using Hewlett-Packard Emulator Pods. Damage to the emulator circuitry may result if these precautions are not observed.

**POWER DOWN TARGET SYSTEM.**

Turn off power to the user target system and the emulation development station before inserting the user plug to avoid circuit damage resulting from voltage transients or mis-insertion of the user plug.

**VERIFY USER PLUG ORIENTATION.**

Make certain that Pin 1 of the target system microprocessor socket and Pin 1 of the user plug are properly aligned before inserting the user plug in the socket. Failure to do so may result in damage to the emulator circuitry.

**PROTECT AGAINST STATIC DISCHARGE.**

The emulator pod contains devices which are susceptible to damage by static discharge. Therefore, operators should take precautionary measures before handling the user plug to avoid emulator damage.

**CAUTION**

**SECTION III**  
**OPERATION**

**3-1. INTRODUCTION.**

3-2. The functions of the 64211A Emulator Control Board are transparent to the operator and require no interaction with the operator. Refer to the Emulator/Analyzer Operator's manual for an explanation of emulation and the use of the emulator option in the target system.





## SECTION IV

### PERFORMANCE TESTS

#### 4-1. INTRODUCTION.

4-2. Performance verification is a subset of the Option Test PV. The Option Test PV tests options which may be configured in the expansion slots of the 64000 card cage. The PV for the 64211A Emulator Control Board is covered in the emulation subsystem manual. Refer to Sections IV and VIII of 6800/6802 Emulation Subsystem manual.



**SECTION V**  
**ADJUSTMENTS**

**5-1. INTRODUCTION.**

5-2. There are no adjustments for the 64211A Emulator Control Board which can be made in the field. The potentiometers on the Emulator Control Board are set at the factory and require no adjustment for proper operation.

**NOTE**

Adjustment of the potentiometers on this board requires the use of special test fixtures and procedures. No field adjustment should be attempted.



## SECTION VI

### REPLACEABLE PARTS

#### 6-1. INTRODUCTION.

6-2. This section contains information needed to order replacement parts. Section 6-3 explains the Blue Stripe Program for replaceable assemblies. Table 6-1 lists reference designators and abbreviations used throughout the manual. Table 6-2 lists all Emulator Control Board replaceable parts in assembly/reference designator order. Table 6-3 contains the names and addresses corresponding to the manufacturers' five-digit code numbers.

#### 6-3. BLUE STRIPE PROGRAM.

6-4. The Blue Stripe Program offers factory repaired and tested replacement boards, on an exchange basis only. Exchange assemblies carry a part number different from brand new assemblies and are available at a reduced cost. Emulator Control Board exchange assemblies, Part Number 64211-69501 are available through the Hewlett-Packard Corporate Parts Center. New boards are ordered using Part Number 64211-66501.

#### 6-5. REFERENCE DESIGNATORS AND ABBREVIATIONS.

6-6. Table 6-1 lists the reference designators and abbreviations used in the parts list, schematics and throughout the manual. Reference designators are presented in upper case only. Abbreviations are presented in upper case only in the parts list. Abbreviations with both upper and lower case letters are used in the schematics and other parts of the manual. This results in two forms of the abbreviation. Table 6-1 lists only the upper case form of each.

#### 6-7. REPLACEABLE PARTS LIST.

6-8. Table 6-2 is the list of replaceable parts and is organized with the board components in alphanumeric order by reference designator. The information given for each part consists of the following:

- a. The Hewlett-Packard part number and the check digit.
- b. The total quantity in the instrument.
- c. The description of the part.
- d. A five digit code indicating the manufacturer.
- e. The manufacturers' part number.

#### 6-9. MANUFACTURERS' CODES.

6-10. Table 6-3, gives the manufacturers' codes organized in the order they appear in the parts list. The five digit manufacturers' code is followed by the name, address and zip code of the manufacturer.

#### 6-11. ORDERING INFORMATION.

6-12. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number and check digit, indicate the quantity required, and address the order to the nearest Hewlett-Packard Sales/Service Office.

6-13. To order a part that is not listed in the replaceable parts table include the instrument model number, instrument repair number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard Sales/Service Office.

#### **6-14. DIRECT MAIL ORDER SYSTEM.**

6-15. Within the USA Hewlett-Packard can supply parts through the direct mail order system. The advantages of using the system are as follows:

- a. Direct ordering and shipment from the Hewlett-Packard parts center in Mountain View, California.
- b. No minimum amount on any mail order (there is a minimum order amount for parts ordered through a local HP office when the order requires billing and invoicing).
- c. Prepaid transportation (there is a small handling charge for each order).
- d. No-invoices. To receive these advantages, a check or money order must accompany each order.

6-16. Mail-order forms and specific ordering information are available through your local HP office. Addresses and phone numbers are provided at the back of this manual.

Table 6-1. Reference Designators and Abbreviations

REFERENCE DESIGNATORS							
<b>A</b>	= assembly	<b>F</b>	= fuse	<b>MP</b>	= mechanical part	<b>U</b>	= integrated circuit
<b>B</b>	= motor	<b>FL</b>	= filter	<b>P</b>	= plug	<b>V</b>	= vacuum, tube, neon bulb, photocell, etc
<b>BT</b>	= battery	<b>IC</b>	= integrated circuit	<b>Q</b>	= transistor	<b>VR</b>	= voltage regulator
<b>C</b>	= capacitor	<b>J</b>	= jack	<b>R</b>	= resistor	<b>W</b>	= cable
<b>CP</b>	= coupler	<b>K</b>	= relay	<b>RT</b>	= thermistor	<b>X</b>	= socket
<b>CR</b>	= diode	<b>L</b>	= inductor	<b>S</b>	= switch	<b>Y</b>	= crystal
<b>DL</b>	= delay line	<b>LS</b>	= loud speaker	<b>T</b>	= transformer	<b>Z</b>	= tuned cavity network
<b>DS</b>	= device signaling (lamp)	<b>M</b>	= meter	<b>TB</b>	= terminal board		
<b>E</b>	= misc electronic part	<b>MK</b>	= microphone	<b>TP</b>	= test point		
ABBREVIATIONS							
<b>A</b>	= amperes	<b>H</b>	= henries	<b>N/O</b>	= normally open	<b>RMO</b>	= rack mount only
<b>AFC</b>	= automatic frequency control	<b>HDW</b>	= hardware	<b>NOM</b>	= nominal	<b>RMS</b>	= root-mean square
<b>AMPL</b>	= amplifier	<b>HEX</b>	= hexagonal	<b>NPO</b>	= negative positive zero (zero temperature coefficient)	<b>RWV</b>	= reverse working voltage
<b>BFO</b>	= beat frequency oscillator	<b>HG</b>	= mercury	<b>NPN</b>	= negative-positive-negative	<b>S-B</b>	= slow-blow
<b>BE CU</b>	= beryllium copper	<b>HR</b>	= hour(s)	<b>NRFR</b>	= not recommended for field replacement	<b>SCR</b>	= screw
<b>BH</b>	= binder head	<b>HZ</b>	= hertz	<b>NSR</b>	= not separately replaceable	<b>SE</b>	= selenium
<b>BP</b>	= bandpass	<b>IF</b>	= intermediate freq	<b>OB</b>	= order by description	<b>SECT</b>	= section(s)
<b>BRS</b>	= brass	<b>IMPG</b>	= impregnated	<b>OH</b>	= oval head	<b>SEMICON</b>	= semiconductor
<b>BWO</b>	= backward wave oscillator	<b>INCD</b>	= incandescent	<b>OX</b>	= oxide	<b>SI</b>	= silicon
<b>CCW</b>	= counter-clockwise	<b>INCL</b>	= include(s)	<b>P</b>	= peak	<b>SL</b>	= slide
<b>CER</b>	= ceramic	<b>INS</b>	= insulation(led)	<b>PC</b>	= printed circuit	<b>SPG</b>	= spring
<b>CMO</b>	= cabinet mount only	<b>INT</b>	= internal	<b>PF</b>	= picofarads= 10 <sup>-12</sup> farads	<b>SPL</b>	= special
<b>COEF</b>	= coefficient	<b>K</b>	= kilo=1000	<b>PH BRZ</b>	= phosphor bronze	<b>SST</b>	= stainless steel
<b>COM</b>	= common	<b>LH</b>	= left hand	<b>PHL</b>	= phillips	<b>SR</b>	= split ring
<b>COMP</b>	= composition	<b>LIN</b>	= linear taper	<b>PIV</b>	= peak inverse voltage	<b>STL</b>	= steel
<b>COMPL</b>	= complete	<b>LK WASH</b>	= lock washer	<b>PNP</b>	= positive-negative-positive	<b>TA</b>	= tantalum
<b>CONN</b>	= connector	<b>LOG</b>	= logarithmic taper	<b>P/O</b>	= part of	<b>TD</b>	= time delay
<b>CP</b>	= cadmium plate	<b>LPF</b>	= low pass filter	<b>POLY</b>	= polystyrene	<b>TGL</b>	= toggle
<b>CRT</b>	= cathode-ray tube	<b>M</b>	= milli=10 <sup>-3</sup>	<b>PORC</b>	= porcelain	<b>THD</b>	= thread
<b>CW</b>	= clockwise	<b>MEG</b>	= meg=10 <sup>6</sup>	<b>POS</b>	= position(s)	<b>TI</b>	= titanium
<b>DEPC</b>	= deposited carbon	<b>MET FLM</b>	= metal film	<b>POT</b>	= potentiometer	<b>TOL</b>	= tolerance
<b>DR</b>	= drive	<b>MET OX</b>	= metallic oxide	<b>PP</b>	= peak-to-peak	<b>TRIM</b>	= trimmer
<b>ELECT</b>	= electrolytic	<b>MFR</b>	= manufacturer	<b>PT</b>	= point	<b>TWT</b>	= traveling wave tube
<b>ENCAP</b>	= encapsulated	<b>MHZ</b>	= mega hertz	<b>PWV</b>	= peak working voltage	<b>U</b>	= micro=10 <sup>-6</sup>
<b>EXT</b>	= external	<b>MINAT</b>	= miniature	<b>RECT</b>	= rectifier	<b>VAR</b>	= variable
<b>F</b>	= farads	<b>MOM</b>	= momentary	<b>RF</b>	= radio frequency	<b>VDCW</b>	= dc working volts
<b>FH</b>	= flat head	<b>MOS</b>	= metal oxide substrate	<b>RH</b>	= round head or right hand	<b>W/</b>	= with
<b>FIL H</b>	= fillister head	<b>MTG</b>	= mounting			<b>W</b>	= watts
<b>FXD</b>	= fixed	<b>MY</b>	= "mylar"			<b>WIV</b>	= working inverse voltage
<b>G</b>	= giga (10 <sup>9</sup> )	<b>N</b>	= nano (10 <sup>-9</sup> )			<b>WW</b>	= wirewound
<b>GE</b>	= germanium	<b>N/C</b>	= normally closed			<b>W/O</b>	= without
<b>GL</b>	= glass	<b>NE</b>	= neon				
<b>GRD</b>	= grounded	<b>NI PL</b>	= nickel plate				

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	64211-66501	9	1	EMULATOR CONTROL BOARD ASSEMBLY	28480	64211-66501
C1	0160-2204	0	3	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
C2	0160-3622	8	6	CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C3	0160-2055	9	47	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C10	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C12	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C13	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C14	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C15	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C16	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C17	0160-3622	8		CAPACITOR-FXD .1UF +80-20% 100VDC CER	26654	2130Y5V100R104Z
C18	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C19	0160-2198	1	2	CAPACITOR-FXD 20PF +-5% 300VDC MICA	28480	0160-2198
C20	0160-2198	1		CAPACITOR-FXD 20PF +-5% 300VDC MICA	28480	0160-2198
C21	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C22	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C23	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C25	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C26	0160-0207	7	2	CAPACITOR-FXD 330PF +-5% 500VDC MICA	72136	DM15F331J0500WV1CR
C27	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
C28	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C29	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C30	0160-2020	8	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-2020
C31	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C32	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C33	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C35	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C36	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C37	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C38	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C39	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C40	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C41	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C42	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C43	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C44	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C45	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C46	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C47	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C48	0160-0207	7		CAPACITOR-FXD 330PF +-5% 500VDC MICA	72136	DM15F331J0500WV1CR
C49	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C50	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
C51	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C52	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C53	0160-2211	9	1	CAPACITOR-FXD 510PF +-5% 300VDC MICA	28480	0160-2211
C54	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C55	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C56	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C57	0180-1746	5	2	CAPACITOR-FXD 150H+-10% 20VDC TA	56289	150D156X9020B2
C58	0180-1746	5		CAPACITOR-FXD 150H+-10% 20VDC TA	56289	150D156X9020B2
C59	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C60	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C61	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C62	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C63	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
C64	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
CR1	1901-0535	9	7	DIODE-SM SIG SCHOTTKY	28480	1901-0535
CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
CR4	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
CR5	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
CR6	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535

See introduction to this section for ordering information



Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
J4	1251-3141	0	1	CONNECTOR 50-PIN M RECTANGULAR	28480	1251-3141
L1	9140-0105	3	2	INDUCTOR RF-CR-MID 8.2UH 10%	28480	9140-0105
L2	9140-0105	3	3	INDUCTOR RF-CR-MID 8.2UH 10%	28480	9140-0105
L3	9140-0114	4	1	INDUCTOR RF-CR-MID 10UH 10% .166DX.385LG	28480	9140-0114
L4	9100-1620	5	1	INDUCTOR RF-CR-MID 15UH 10% .166DX.385LG	28480	9100-1620
MP1	64211-85001	4	1	EXTRACTOR-PC BOARD	28480	64211-85001
MP2	64211-85002	5	1	EXTRACTOR-PC BOARD	28480	64211-85002
MP3	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
MP4	1251-5595	2	2	POLARIZING KEY	28480	1251-5595
Q1	1853-0316	1	2	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
Q2	1853-0316	1	2	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
R1	0684-1021	7	20	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R2	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
R3	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R4	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
R5	0757-0416	7	4	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
R6	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R7	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
R8	2100-0580	7	2	RESISTOR-TRMR 500K 10% C TOP-ADJ 1-TRN	28480	2100-0580
R9	2100-0554	5	2	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
R10	0757-0405	4	2	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
R11	0757-0411	2	2	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
R12	2100-0554	5	5	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
R13	0757-0411	2	2	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
R14	0757-0405	4	2	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
R15	2100-0580	7	7	RESISTOR-TRMR 500K 10% C TOP-ADJ 1-TRN	28480	2100-0580
R16	0757-0442	9	9	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
R17	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R18	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R19	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R20	0698-3444	2	2	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
R21	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R22	2100-3210	6	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	28480	2100-3210
R23	0757-0416	7	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
R24	0757-0474	3	1	RESISTOR 162K 1% .125W F TC=0+-100	24546	C4-1/8-T0-162K-F
R25	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R26	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R27	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R28	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	C4-1/8-T0
R29	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R30	0757-0280	3	3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
R31	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R32	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R33	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R34	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R35	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R36	0698-3444	2	2	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
R37	0757-0416	7	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
R38	0757-0416	7	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
R39	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R40	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R41	0684-1021	7	7	RESISTOR 1K 10% .25W FC TC=-400/+600	01121	CR1021
R42	0757-0409	8	1	RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
R43-45	0684-1021	7	7	RESISTOR 1K 10%	01121	C4-1/8-T0-1002-F
TP1	0360-0535	0	24	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP2	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP3	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP4	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP5	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP6	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP7	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP8	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP9	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP10	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP11	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP12	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP13	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP14	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP15	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP16	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP17	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP18	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP19	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP20	0360-0535	0	0	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
TP21	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP22	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP23	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
TP24	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
U1	1820-1633	8	9	IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U2	1810-0430	0	5	NETWORK-RES 10-STP MULTI-VALUE	28480	1810-0430
U3	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U4	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U5	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U6	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U7	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U8	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U9	1810-0430	0		NETWORK-RES 10-STP MULTI-VALUE	28480	1810-0430
U12	1810-0430	0		NETWORK-RES 10-STP MULTI-VALUE	28480	1810-0430
U13	1820-0681	4	7	IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U14	1820-1624	7	2	IC BFR TTL S OCTL 1-INP	01295	SN74S241N
U15	1810-0430	0		NETWORK-RES 10-STP MULTI-VALUE	28480	1810-0430
U16	1810-0430	0		NETWORK-RES 10-STP MULTI-VALUE	28480	1810-0430
U17	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U18	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
U19	1820-0691	6	3	IC GATE TTL S AND-OR-INV	01295	SN74S64N
U20	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U21	1820-0683	1	1	IC GATE TTL S NAND DUAL 4-INP	01295	SN74S20N
U22	1820-1130	0	2	IC GATE TTL S NAND 13-INP	01295	SN74S133N
U23	1820-1782	8	2	IC MV TTL S MONOSTBL RETRIG/RESET DUAL	34335	AM26S02PC
U24	1816-1384	7	1	IC-RAM 74S287	01295	TBP 14510N PROGRAMMED
U25	1820-1453	0	1	IC CNTR TTL S BIN SYNCHRD POS-EDGE-TRIG	01295	SN74S163N
U26	1820-1449	4	2	IC GATE TTL S OR QUAD 2-INP	01295	SN74S32N
U27	1820-1322	2	3	IC GATE TTL S NOR QUAD 2-INP	01295	SN74S02N
U28	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U29	1820-0691	6		IC GATE TTL S AND-OR-INV	01295	SN74S64N
U30	1820-1367	5	5	IC GATE TTL S AND QUAD 2-INP	01295	SN74S08N
U31	1820-0691	6		IC GATE TTL S AND-OR-INV	01295	SN74S64N
U32	1820-1322	2		IC GATE TTL S NOR QUAD 2-INP	01295	SN74S02N
U33	1820-1432	5	2	IC CNTR TTL LS BIN SYNCHRD POS-EDGE-TRIG	01295	SN74LS163AN
U34	1820-1624	7		IC BFR TTL S OCTL 1-INP	01295	SN74S241N
U36	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
U37	1810-0273	9	1	NETWORK-RES 10-STP1.0K OHM X 9	01121	210A471
U38	1810-0275	1	2	NETWORK-RES 10-STP1.0K OHM X 9	01121	210A102
U39	1810-0275	1		NETWORK-RES 10-STP1.0K OHM X 9	01121	210A102
U40	1820-0693	8	3	IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
U41	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
U42	1820-0907	7	1	IC GATE TTL NAND TPL 3-INP	01295	SN7412N
U43	1820-1367	5		IC GATE TTL S AND QUAD 2-INP	01295	SN74S08N
U45	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U46	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
U47	1820-0685	8	3	IC GATE TTL S NAND TPL 3-INP	01295	SN74S10N
U48	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U49	1820-0629	0	8	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
U50	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
U51	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
U52	1820-1633	8		IC BFR TTL S INV OCTL 1-INP	01295	SN74S240N
U53	1820-0693	8		IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N
U54	1820-1367	5		IC GATE TTL S AND QUAD 2-INP	01295	SN74S08N
U55	1816-1385	8	1	IC-RAM 74S287	01295	TBP 14510N PROGRAMMED
U56	1820-2024	3	4	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
U57	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
U58	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N
U59	1820-1367	5		IC GATE TTL S AND QUAD 2-INP	01295	SN74S08N
U60	1820-1449	4		IC GATE TTL S OR QUAD 2-INP	01295	SN74S32N
U61	1820-1430	3	1	IC CNTR TTL LS BIN SYNCHRD POS-EDGE-TRIG	01295	SN74LS161AN
U62	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
U63	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
U64	1820-0655	2	2	IC GATE TTL NOR DUAL 4-INP	01295	SN7425N
U65	1820-0686	9	3	IC GATE TTL S AND TPL 3-INP	01295	SN74S11N
U66	1820-1782	8		IC MV TTL S MONOSTBL RETRIG/RESET DUAL	34335	AM26S02PC
U67	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N
U68	1820-0685	8		IC GATE TTL S NAND TPL 3-INP	01295	SN74S10N
U69	1820-0685	8		IC GATE TTL S NAND TPL 3-INP	01295	SN74S10N
U70	1820-1432	5		IC CNTR TTL LS BIN SYNCHRD POS-EDGE-TRIG	01295	SN74LS163AN
U71	1820-1997	7	7	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRI-IN	01295	SN74LS374N
U72	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N
U73	1820-1367	5		IC GATE TTL S AND QUAD 2-INP	01295	SN74S08N

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number	
U74	1820-0629	0	1	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N	
U75	1820-0683	6		IC INV TTL S HEX 1-INP	01295	SN74S04N	
U76	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN74S112N	
U77	1820-0686	9		IC GATE TTL S AND TPL 3-INP	01295	SN74S11N	
U78	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN74S00N	
U79	1820-0686	9	2	IC GATE TTL S AND TPL 3-INP	01295	SN74S11N	
U80	1820-1322	2		IC GATE TTL S NOR QUAD 2-INP	01295	SN74S02N	
U81	1820-0693	8		IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN74S74N	
U82	1816-1334	7		IC-RAM 93422	07263	93422DC	
U83	1816-1334	7		IC-RAM 93422	07263	93422DC	
U84	1820-1917	1	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS240N	
U85	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N	
U86	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N	
U87	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N	
U88	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N	
U89	1820-1997	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N	
U90	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N	
U91	1820-0655	2		IC GATE TTL NOR DUAL 4-INP	01295	SN74S25N	
U92	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N	
U93	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	01295	SN74LS374N	
U94	1820-1416	5	1	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N	
U95	1820-1202	7		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N	
U96	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS EDGE TRIG	01295	74LS161AN	
X1	1200-0607	0		9	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
X2	1200-0607	0			SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
X3	1200-0607	0	SOCKET-IC 16-CONT DIP DIP-SLDR		28480	1200-0607	
XU1	1200-0639	8	20		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639
XU3	1200-0639	8			SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639
XU4	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU5	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU6	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU7	1200-0639	8	8	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU8	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU11	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU23	1200-0607	0		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607	
XU24	1200-0607	0		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607	
XU36	1200-0638	7	2	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638	
XU41	1200-0607	0		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607	
XU55	1200-0607	0		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607	
XU56	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU60	1200-0638	7		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0638	
XU65	1200-0607	0	8	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607	
XU71	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU72	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU82	1200-0612	7		SOCKET-IC 22-CONT DIP DIP-SLDR	28480	1200-0612	
XU83	1200-0612	7		SOCKET-IC 22-CONT DIP DIP-SLDR	28480	1200-0612	
XU84	1200-0639	8	8	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU85	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU86	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU87	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU88	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU89	1200-0639	8	8	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU90	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU92	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
XU93	1200-0639	8		SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639	
	7120-6830	9		1	LABEL-INFO	85480	7120-6830
	7124-0269	4	LABEL-RED DOT		85480	0025 TAPE B 010-R0	
	7124-0270	7	LABEL-YELLOW DOT		85480	0025 TAPE B 010-YL	
	7124-0271	8	LABEL-ORANGE DOT		85480	0025 TAPE B 010-OR	

See introduction to this section for ordering information

Table 6-3. Manufacturers' Codes

Mfr No.	Manufacturer Name	Address	Zip Code
00000	ANY SATISFACTORY SUPPLIER		
01121	ALLEN-BRADLEY CO	MILWAUKEE WI	53204
01295	TEXAS INSTR INC SEMICOND CMPT DIV	DALLAS TX	75222
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94042
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
26654	VARADYNE INC	SANTA MONICA CA	90404
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE CA	94086
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
72136	ELECTRO MOTIVE CORP SUB IEC	WILLEMANTIC CT	06226
85480	BRADY W H CO	MILWAUKEE WI	53209

See introduction to this section for ordering information

**SECTION VII  
MANUAL CHANGES**

**7-1. INTRODUCTION.**

7-2. This section contains information required to backdate or update this manual for a specific instrument.

**7-3. MANUAL CHANGES.**

7-4. This manual applies directly to the instrument having the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, find your serial prefix in Table 7-1 and make the changes to the manual that are listed for that serial prefix. When making changes listed in Table 7-1, make the change with the highest number first. Example: if backdating changes 1, 2 and 3 are required for our serial prefix, do change 3 first, then change 2 and finally change 1.

7-5. If the serial prefix of your instrument is not listed either on the title page or in Table 7-1, refer to an enclosed MANUAL CHANGES sheet for updating information. Also, if a MANUAL CHANGES sheet is supplied, make all indicated ERRATA changes.

*Table 7-1. Manual Changes*

<b>6800</b>	
<b>Serial Prefixes</b>	<b>Make Changes</b>
<b>1952A</b>	<b>1</b>

**▲CHANGE 1**

Section VI,  
Page 6-1, Paragraph 6-4,

Make the following changes to the Table 6-2. Replaceable Parts,

Reference Designation	HP Part Number	C D	Description	Mfr Code	Mfr Part Number
			<b>ADD</b>		
U44	1820-1130	0	IC GATE TTL S NAND 13 INP	01295	74S133N
XU10	1200-0607	0	SOCKET IC 16 CONT. DIP-SLDR	28480	1200-0607
R28	0684-1021	7	RESISTOR 1K 10% FC TC -400/+600	01121	C4-1/8-T0 -1002-F

Reference Designation	HP Part Number	C D	Description	Mfr Code	Mfr Part Number
			<b>DELETE</b>		
U96	1820-1430	3	IC CNTR TTL LS BIN SYNCHRO POS EDGE TRIG	01295	74LS161AN
R43-45	0684-1021	7	RESISTOR 1K 10%	01121	C4-1/8-T0-1002-F
TP22-25	0360-0535	0	TERM. TEST PT. PCB	00000	ORDER BY DESCRIPTION
			<b>MODIFY</b>		
A1	64211-66502	0	EMULATOR CNTRL BD.	28480	64211-66502
C30	0180-0309	4	CAPACITOR FIXED TA 4.7 $\mu$ F 10V	28480	0160-2020
R20	0698-3444	1	RESISTOR 316 1% .125W F TC 01-100	24546	C4-1/8-T0-316R-F
R24	0757-470	7	RESISTOR 243K 1% .125W F TC 01-100	24546	C4-1/8-T0-2433-F

## Section VIII,

Page 8-18, Figure 8-1. Component Locator,

Move: TP7 to above U21 from just below J2-49.

Delete: TP22-25 as shown in figure 7-1.

Add: U44.

Delete: U96 between U57 and U58.

Move: C30 to between R24 and U41 from directly below R24.

Move: C37 to the left side of U58 from the right side of U58 as shown in figure 1.

Delete: R43-45 as shown in figure 8-1.

Page 8-19, Figure 8-2. Service Sheet 1, Data and Address Buffers,

These changes are illustrated in figure 2, a foldout of Service Sheet 1 with the following revisions included.

Add: XU10 and associated lines.

Add: U60C and associated lines, including mnemonic LBKGWR (Reference  $\text{\textcircled{C}}$ ) from Service Sheet 5, U13-13.

Add: U60 to table titled "ICS ON THIS SCHEMATIC".

Add: U60 and XU10 to table titled "PARTS ON THIS SCHEMATIC".

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.

Page 8-21, Figure 8-4. Service Sheet 3, Background Memory Controller,

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.

Page 8-23, Figure 8-3. Service Sheet 3, Background Memory Controller,

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.

Page 8-25, Figure 8-5. Service Sheet 4, Jam and Foreground Memory Control,

The following changes are illustrated in figure 3, a foldout of Service Sheet 4.

Add: U62A and associated lines as shown on figure 3.

Delete: U96 as shown on figure 3.

Add: line from U76-9 to U65-9. Reconnect U65-9 to U58-8.

Delete: U96 from table titled "ICS ON THIS SCHEMATIC".

Delete: U96 from table titled "PARTS ON THIS SCHEMATIC".

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.

Page 8-27, Figure 8-6. Service Sheet 5, Illegal Opcode Detector,

Add: mnemonic signal line HBREAK (Reference  $\text{\textcircled{C}}$ ) to Service Sheet 1, U60-9 from U13-13.

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.

Page 8-29, Figure 8-7. Service Sheet 6, Emulator Synchronizer

Delete: TP22 from line between U51B-13 and U23B-12.

Delete: TP23 from line between mnemonic signal line E $\Phi$ 1 (Reference  $\text{\textcircled{AU}}$ ) from Service Sheet 7, J4-29 to U23A-4.

Delete: TP24 from line between U23A-6 and U52-4.

Delete: TP25 from line between U23B-10 and U51A-1.

Delete: TP22-25 to table titled "PARTS ON THIS SCHEMATIC".

Add: trace from U51B pin 7 to U51A pin 15.

Delete: trace from U50B pin 9 to U51A pin 15.

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.

Page 8-31, Figure 8-8. Service Sheet 7, Emulator Selection and Control,

The following changes are illustrated in figure 4, a foldout of Service Sheet 7 including the following revisions.

Add: the line from U45-9 to the mnemonic LID2 (Reference **BT**) to U44-10 on sheet 8.

Add: the connection from U45-11 to U46C-8.

Add: the section of U45 which contained pins 11 and 9.

Add: the connection from U46C-10 to U46B-5.

Add: the connection from U46C-9 to line between U46D-13 and mnemonic signal line ID1 (Reference **GG**) to U88-4 on Service Sheet 3.

Add: U46C.

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.

Page 8-33, Figure 8-9. Service Sheet 8, Emulator Memory Control,

The following changes are illustrated in figure 5, a foldout of Service Sheet 8 including the following revisions.

Add: U44.

Add: the section of U45 which includes pins 6 and 14.

Add: U18A.

Add: U50A.

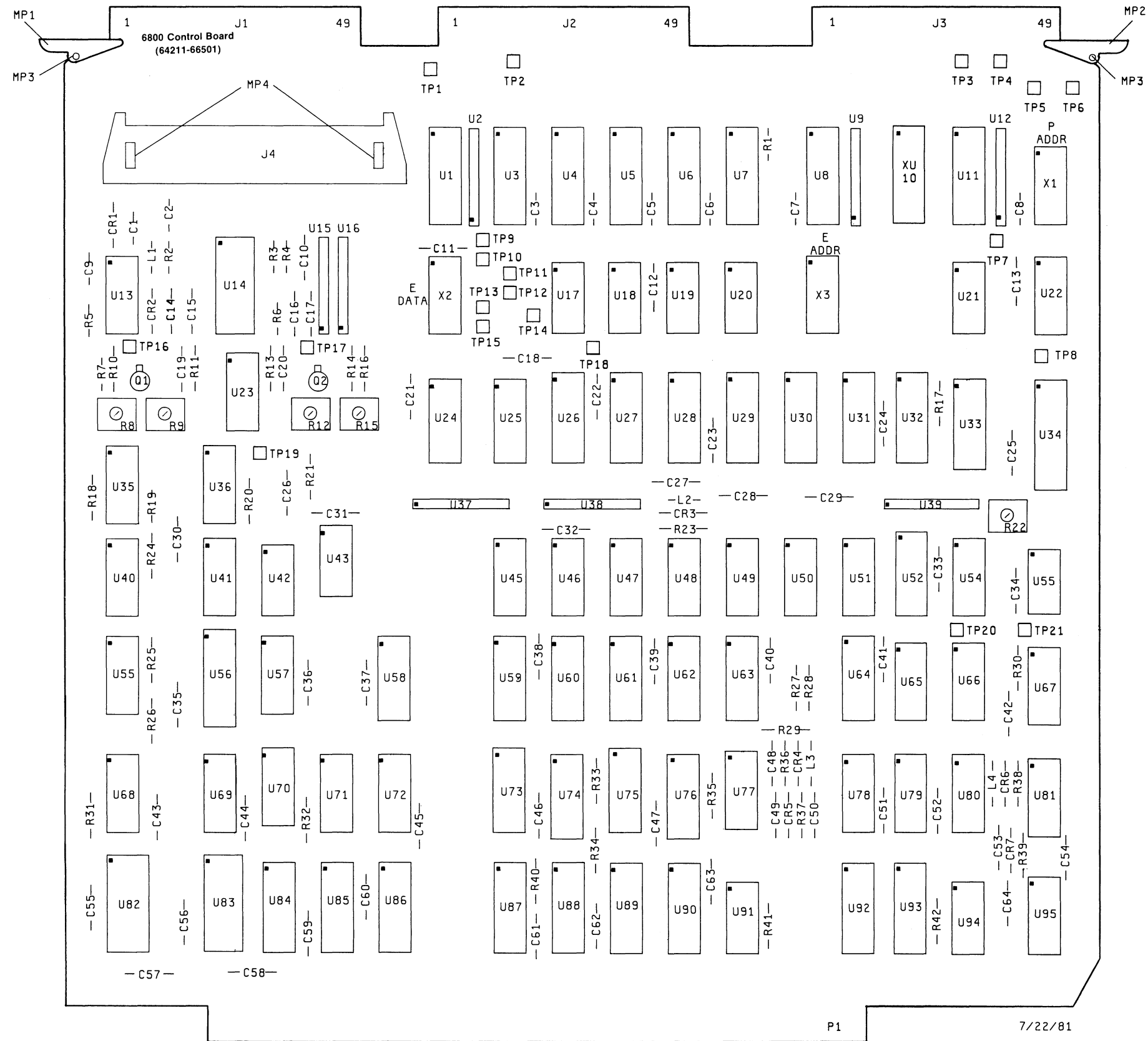
Add: the traces to connect these components as illustrated in figure 5.

Add: U18A, U44, U50A to the table, "ICS ON THIS SCHEMATIC".

Change: HP Part No. 64211-66502 in upper left hand corner to 64211-66501.



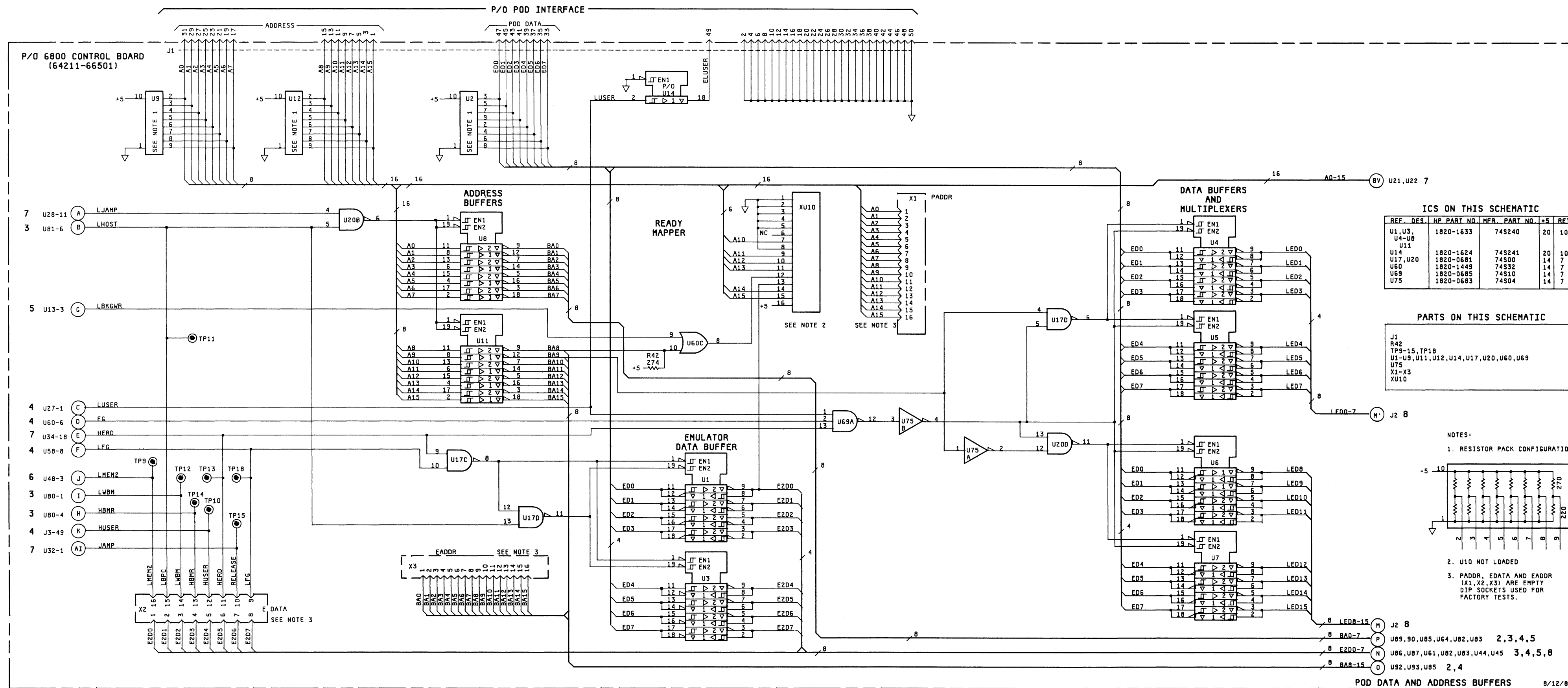




Component Locator  
Figure 8-1. 6800 Control Board

Figure 7-1.  
Replacement for Figure 8-1. Component Locator  
7-5/(7-6 blank)





**ICS ON THIS SCHEMATIC**

REF. DES.	HP PART NO.	MFR. PART NO.	+5	RET.
U1, U3, U4-U8, U11	1820-1633	74S240	20	10
U14	1820-1624	74S241	20	10
U17, U20	1820-0681	74S00	14	7
U60	1820-1449	74S32	14	7
U69	1820-0685	74S10	14	7
U75	1820-0683	74S04	14	7

**PARTS ON THIS SCHEMATIC**

J1  
R42  
TP9-15, TP18  
U1-U9, U11, U12, U14, U17, U20, U60, U69  
U75  
X1-X3  
XU10

- NOTES:**
- RESISTOR PACK CONFIGURATION
- 
- U10 NOT LOADED
  - PADDR, EDATA AND EADDR (X1, X2, X3) ARE EMPTY DIP SOCKETS USED FOR FACTORY TESTS.

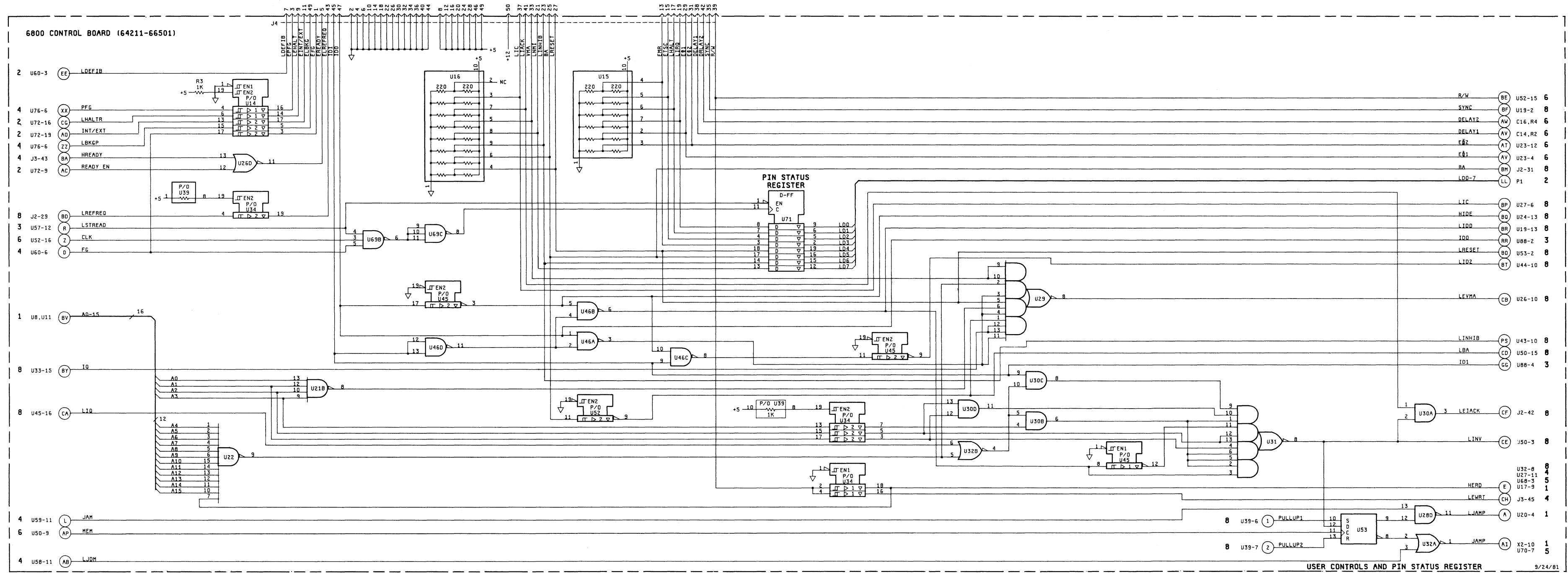
POD DATA AND ADDRESS BUFFERS 8/12/81

Figure 7-2. Replacement for Figure 8-2. Data and Address Buffers 7-7/(7-8 blank)









**ICS ON THIS SCHEMATIC**

REF.	DES.	HP PART NO.	MFR. PART NO.	*S	RET.
U14, U34		1820-1624	745241	20	10
U21		1820-0868	74520	16	8
U22		1820-1130	745133	14	7
U26		1820-1449	74532	14	7
U28		1820-0661	74500	14	7
U29, U31		1820-0691	74564	14	7
U30		1820-1367	74508	14	7
U32		1820-1322	74502	14	7
U45, U52		1820-1633	745240	20	10
U53		1820-0693	74574	14	7
U69		1820-0685	74510	14	7
U71		1820-1937	74LS374	20	10

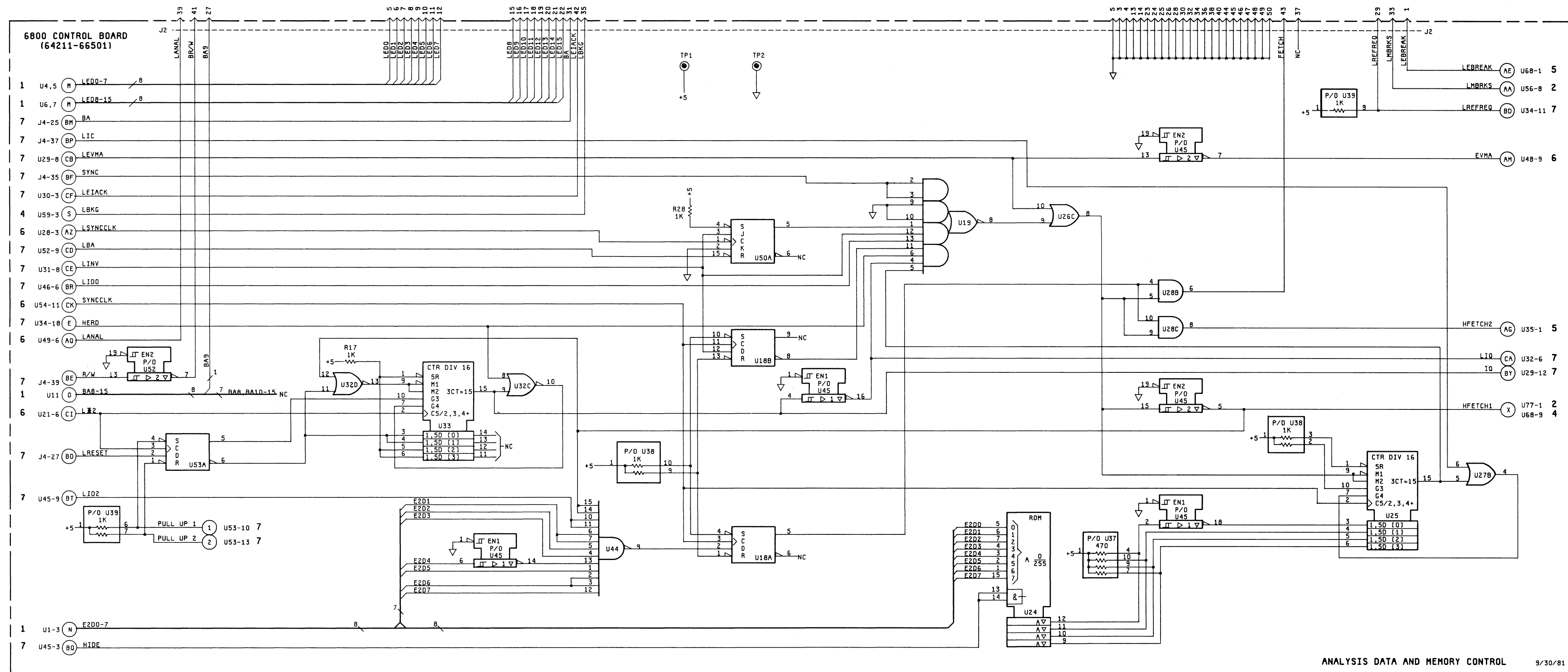
**PARTS ON THIS SCHEMATIC**

C3-C9, C11-C13, C18, C21-C25, C28, C29  
 C31-C47, C49, C51, C52, C54-C56, C59-C64  
 J4  
 U14-U16, U21, U22, U26, U28, U32, U34  
 U39, U45, U64, U52, U53, U69, U71

Figure 7-4.  
 Replacement for Figure 8-8. Emulator Selection and Control  
 7-11/(7-12 blank)







ICS USED ON THIS SCHEMATIC

REF DES	HP PART NO	MFG PART NO	*S	RET
U18	1820-1112	74LS74	14	7
U19	1820-0691	74S64	16	8
U24	1816-1384	74S287	16	8
U25	1820-1453	74S163	16	8
U26	1820-1449	74S32	14	7
U27, 32	1820-1322	74S02	14	7
U28	1820-0681	74S00	14	7
U33	1820-1432	74LS163	16	8
U44	1820-1130	74S133	16	8
U45, U52	1820-1633	74S240	20	10
U50	1820-0629	74S112	16	8
U53	1820-0693	74S74	14	7

PARTS USED ON THIS SCHEMATIC

J2  
R17, 28  
U18, 19, 24-28, 32, 33, 37-39, 44, 45, 50, 52, 53  
TP1, 2

ANALYSIS DATA AND MEMORY CONTROL 9/30/81

Figure 7-5.  
Replacement for Figure 8-9. Emulator Memory Control  
7-13/(7-14 blank)



## SECTION VIII

### SERVICE

#### 8-1. INTRODUCTION.

8-2. This section contains information for servicing the Emulator Control Board. Table 8-1 contains a listing of the mnemonics (signal names) used in the schematics. Table 8-2 explains the techniques used to develop the logic symbols used in the schematic. Table 8-3 explains other schematic symbols. Figure 8-1 is a component locator for the board and figures 8-2 through 8-9 are the schematic. The material in this section is provided for reference purposes only. Refer to the 6800/6802 emulation subsystem manual for detailed troubleshooting procedures and a discussion of the theory of operation.

#### 8-3. SAFETY.

8-4. Read the safety warnings at the front of this book and at the front of the mainframe service manual, the service overview manual and the applicable emulator subsystem manual before servicing this Emulator Control Board.

#### 8-5. MNEMONICS.

8-6. Table 8-1 lists all mnemonics used on the schematics for the 64211A. Mnemonics are listed alphabetically, in four sections: the inter-schematic mnemonics, Pod Interface mnemonics, Mainframe interface mnemonics, and the Memory and Analysis Interface mnemonics. The signal name, a functional description including the active level, the source pin, and the schematic pages affected, are provided.

Table 8-1. Mnemonics

Mnemonic	Definition	Used On Sheets	Source
A0-15	Emulator Address bits 0-15. Input from emulation micro-processor in the pod to the address buffers U-8 and U11. Also a Pod Interface mnemonic.	1,7	Sheet 1 J1
BA	Bus Available. From the Emulation Microprocessor. Goes high to indicate a processor halt or wait state. Also a Pod Interface, and a Memory and Analysis Interface mnemonic.	7,8	Sheet 7 J4-25
BA0-7	Buffered Address 0-7. Used to access background and emulation memory. Also a Memory and Analysis Interface mnemonic.	1,2,3,4,5	Sheet 1 U-8
BA8-15	Buffered Address 8-15. Used Sht. 1 to access Background and emulation memory. Also a Memory and Analysis Interface mnemonic.	1,2,4,8	Sheet 1 U-11
BRK	Break. Causes the emulator to transition from foreground state to background state.	2,6	Sheet 2 U72-6
CLK	Clock. $\Phi 1$ of the emulation processor clock, delayed by 227 nsec.	6,7	Sheet 6 U52-16
CNREGCLK	Control Register Clock. Gates mainframe processor data into the control register.	2,3	Sheet 3 U57-7
DELAY1	Delay 1. To allow for different delays for different processors used with the control board, the passive components for U23 are located on the Emulator Pod board. Delay 1 sets the 227 nsec delay for the inverted $\Phi 1$ clock. Also a Pod Interface mnemonic.	6,7	Sheet 7 J4-38
DELAY2	Delay 2. Sets a 206 nsec delay for the inverted $\Phi 2$ clock. Also a Pod Interface mnemonic.	6,7	Sheet 7 J4-42
E $\Phi 1$	Phase 1. Phase 1 of the emulator processor clock. Also a Pod Interface mnemonic.	6,7	Sheet 7 J4-29
E $\Phi 2$	Phase 2. Phase 2 of the emulator processor clock. Also a Pod Interface mnemonic.	6,7	Sheet 7 J4-31
ENILLOP	Enable Illegal Opcode Detector. Enables the Illegal opcode detector ROM under control of the control register.	2,5	Sheet 2 U72-5
ENJAMCTR	Enable Jam Counter. Goes high to enable the Jam counter.	4,5	Sheet 4 U62-7
E2DO-7	Second Emulation Data Bus. Non-multiplexed 8-bit bi-directional data bus used for background memory, illegal opcode detector and synchronizer operations.	1,3,4,5,8	Sheet 1 U1, U3
EVMA	Emulator Valid Memory Address. Derived from the pod VMA, goes high to indicate a valid address is on the address bus.	6,8	Sheet 8 U45-7
FG	Foreground. Goes high to indicate the emulation subsystem is running in the foreground memory.	1,4	Sheet 4 U60-6

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
HANAL	High Analysis. Goes high to store the last referenced memory address into the last address register.	2,6	Sheet 6 U49-5
HBGKCS	High Background Chip Select. Enables Background Memory RAMs.	4,5	Sheet 4 U27-10
HBMR	High Background Memory Request. Goes high when the mainframe processor requests a Background Memory operation.	1,3	Sheet 3 U80-4
HBREAK	High Break. Goes high to cause an emulator processor break.	2,4,5	Sheet 5 U68-12
HERD	High Emulation Read. Buffered R/W. Goes high when emulator is in a read cycle.	1,4,5,7,8	Sheet 7 U34-18
HEWRT	High Emulator Write. Inverted R/W signal. Goes high to indicate the emulation processor is performing a write operation.	4,6	Sheet 6 U52-5
HIDE	High ID Even. High when ID0 is low. For the 6800/6802 this line is always low to enable the synchronizer ROM.	7,8	Sheet 7 U45-3
HFETCH1	High Fetch 1. Goes high during an emulator opcode fetch.	2,4,6,8	Sheet 8 U45-5
HFETCH2	High Fetch 2. Goes high to indicate opcode fetches. Same as HFETCH1 in 6800/6802.	5,8	Sheet 8 U28-8
HILLOP	High Illegal Opcode. Goes high to indicate an illegal opcode was detected.	2,4,5	Sheet 5 U40-8
HMAV	High Memory Available. Goes high when the emulator is not using memory. Also a Memory and Analysis Interface mnemonic.	4,6	Sheet 6 U49-7
HNCLK	High No Clock. Output of slow clock detector. Goes high to indicate no memory transactions are occurring.	2,3	Sheet 3 U41-4
HREADY	High Ready. Goes high when emulation memory timing is complete. Also a Memory and Analysis Interface mnemonic.	4,7	Sheet 4 J3-43
HUSER	High User. Goes high when the current addresses on the emulation address bus is mapped to user memory. Also a Memory and Analysis Interface mnemonic.	1,4	Sheet 4 J3-49
HWDV	High Write Data Valid. Goes High to enable emulation processor writes to background memory.	5,6	Sheet 6 U51-5
ID0,ID1	Identification Bits 0,1. Used to to detect what emulator pod is being used. For both the 6800 and the 6802 ID0 is held high and ID1 is grounded. Also Pod Interface mnemonic.	3,7	Sheet 7 J4-47 J4-45
ILLOPCLK	Illegal Opcode Clock. Latches the output of the illegal opcode detector into the illegal opcode detected storage register.	5,6	Sheet 6 U54-6

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
INT/EXT	Internal/External Clock. Clock select signal sent to the pod by the mainframe processor through the control register. When high the oscillator in the pod is selected, when low the target system clock will be used.	2,7	Sheet 2 U72-19
IQ	Interrupt Qualifier. Goes high to indicate three or more successive writes to the stack have occurred. This occurs only when the processor is handling an interrupt. Used to maintain synchronization.	7,8	Sheet 8 U33-15
JAM	Jam. Goes high when the Background Controller is outputting the jam addresses onto the address bus.	4,5,7	Sheet 4 U59-11
JAMP	Jam Prime. Goes high to enable the JAM counter and the address buffer from the JAM counter to the lower 8 bits of BA0-7.	1,5,7	Sheet 7 U32-1
LA0-7	Low Address 0-7. The low-order eight bits from the mainframe P1 address bus. Also a Mainframe Interface mnemonic.	2,3	Sheet 3 P1
LA8	Low Address 8. The ninth bit from the mainframe address bus. Also a Mainframe Interface mnemonic.	2,3	Sheet 2 P1-27
LANAL	Low Analysis. Goes high to store analysis data into the internal analysis board. Also a Memory and Analysis Interface mnemonic.	6,8	Sheet 6 U49-6
LBA	Low Bus Available. Inverted BA signal. Goes low when the emulation processor is not using the bus.	7,8	Sheet 7 U52-9
LBDEFIB2	Low Buffered Defibrilate 2. Buffered LDEFIB2 signal which is part of the emulation reset function. Goes low when mainframe processor resets the emulator.	4,6	Sheet 4 U34-12
LBKG	Low Background. Goes low when the background controller enters the background mode. Also a Memory and Analysis Interface mnemonic.	2,4,6,8	Sheet 4 U59-3
LBKGP	Low Background Prime. Goes low to signal the pod that the system is in the background mode.	4,7	Sheet 4 U76-6
LBKGWR	Low Background Write. Goes low to indicated a write to background RAM is enabled. Not used with 6800/6802.	1,5	Sheet 5 U13-3
LDEFIB	Low Defibrilation. Goes low when the mainframe processor resets the processor in the emulator pod. Also a Pod Interface mnemonic.	2,7	Sheet 2 U72-15
LDEFIB2	Low Defibrilation 2. Goes low to initialize timing circuits when the mainframe processor resets the emulation subsystem.	2,3,4	Sheet 2 U72-12
LDEFIB3	Low Defibrilation 3. Goes low to initialize the memory operation sequence in the background controller when the mainframe processor resets the emulation subsystem. Also a Pod Interface mnemonic.	2,4	Sheet 2 U72-2

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
LD0-7	Low Data 0-7. Bidirectional 8 bit data bus. Communications path from the mainframe processor to the emulator control card. Also a Mainframe Interface mnemonic.	2,3	Sheet 2 P1
LEBREAK	Low Emulation Break. Goes low when the emulation bus requests a break of the emulation system. Also a Memory and Analysis Interface mnemonic.	5,8	Sheet 8 J2-1
LED0-7	Low Emulation Data 0-7. Lower 8 bits of emulation data to the memory and internal analysis cards. Also a Memory and Analysis Interface mnemonic.	1,8	Sheet 1 U4,U5
LED8-15	Low Emulation Data 8-15. Upper 8 bits of emulation data bus. Also a Memory and Analysis Interface mnemonic.	1,8	Sheet 1 U6,U7
LEIACK	Low Emulator Interrupt Acknowledge. Emulator status bit which goes low to indicate a valid interrupt vector is present on A0-A15.	7,8	Sheet 7 U30-3
LEVMA	Low Emulator Valid Memory Address. Inverted EVMA. Goes low when a valid memory address is present on the emulation address bus.	7,8	Sheet 7 U29-8
LEWRT	Low Emulator Write. Buffered emulator R/W signal. Goes low when the emulator is in a write cycle. Also a Memory and Analysis Interface mnemonic.	4,7	Sheet 7 U34-16
LFG	Low Foreground. Goes low when the Background Controller is in the foreground mode.	1,4,5	Sheet 4 U58-8
LHALTR	Low Halt Request. Goes low to request an emulator processor halt.	2,7	Sheet 2 U72-16
LHOST	Low Host. Goes low when the mainframe processor initiates a background cycle.	1,3,5	Sheet 3 U81-6
LHOSTBRK	Low Host Processor Break. Goes low when the mainframe processor requests an interrupt of the emulation processor.	5,6	Sheet 6 U74-9
LIC	Last Instruction Cycle. Not used. Grounded in 6800/6802 pods. Also a Pod Interface mnemonic.	7,8	Sheet 7 J4-37
LIDEN	Low Identification Enable. Goes low when the Mainframe processor scans the ID codes of the cards on the mainframe bus to enable each card to respond with its ID. Also a Mainframe Interface mnemonic.	2,3	Sheet 2 P1-67
LID0	Low ID=0. Goes low when the pod ID code of zero is detected. Always high for 6800 or 6802.	7,8	Sheet 7 U46-6
LID2	Low ID=2. Goes low to indicate a pod with an ID code of 2 is connected. High always with 6800 or 6802.	7,8	Sheet 7 U45-9
LIMPJAM	Low Impending Jam. Goes low to indicate that a Jam cycle will occur on the next falling edge of LMEM1.	4,6	Sheet 4 U68-8

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
LINHIB	Low Inhibit. A low on this line inhibits emulation memory cycles independently from the memory mapper. The 6802 uses this line to overlay 6802 internal RAM and to allow optional writes to ROM space without a memory break occurring. Held high in the 6800 pod. Also a Pod Interface Mnemonic.	6,7	Sheet 7 J4-23
LINV	Low Interrupt Valid. Indicates a valid interrupt vector is present on the address bus.	7,8	Sheet 7 U31-8
LIQ	Low Interrupt Qualifier. Inverted IQ signal.	7,8	Sheet 8 U45-16
LJAM	Low Jam. Goes low to indicate the emulator is in the JAM mode.	4,7	Sheet 4 U58-11
LJAMP	Low Jam Prime. Used to select the source for the emulator address signals on the emulation bus. Selects between the Jam Counter and the emulation processor.	1,7	Sheet 7 U28-11
LLADDRESS	Low Last Address Read. Goes low when the mainframe processor reads the Last Address Storage Register and resets the Background Interrupt and Illegal Opcode flip-flops.	2,3,5	Sheet 3 U57-13
LLOPREAD	Low Last Opcode Address Read. Goes low when the mainframe processor reads the Last Opcode Address Register.	2,3	Sheet 3 U57-14
LMBRKS	Low Memory Break Status. Goes low when the Emulation Memory Board asserts a break. Also a Memory and Analysis Interface mnemonic.	2,8	Sheet 8 J2-33
LMEM	Low Memory. Used to synchronize the background memory controller to the emulation processor.	3,4,5,6	Sheet 6 U50-7
LMEM2	Low Memory 2. Goes low to indicate that the address currently on the address bus is valid, used as a clock by the Background Controller.	1,4,6	Sheet 6 U48-3
LMSYN	Low Memory Sync. Goes low to force the mainframe processor to wait until completion of the current read or write cycle by the emulator. Also a Mainframe Interface mnemonic.	2,3	Sheet 3 U42-12
LΦ2	Low Phase 2. Inverted Φ2 of processor clock.	6,8	Sheet 6 U21-6
LREFREQ	Low Refresh Request. Not used with current memory and analysis boards. When used, would allow the emulation processor in the pod to be stopped for emulation memory refresh cycles. Since no dynamic memory is now used, this line is held high. Also a Memory and Analysis Interface mnemonic.	7,8	Sheet 8 J2-29
LRESET	Low Reset. Buffered emulation reset line. Goes low whenever a reset is applied to the emulation processor. Also a Pod Interface mnemonic.	7,8	Sheet 7 J4-27
LSEL	Low Select. Input from mainframe I/O board LSS0-9. Goes low when the mainframe processor selects this board. Also a Mainframe Interface mnemonic.	2,3	Sheet 2 P1-72



Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
LSTB	Low Strobe. Goes low during a mainframe processor read to allow the device addressed to drive the data bus. Goes low during a write when bus data is valid. Also a Mainframe Interface mnemonic.	2,3	Sheet 2 P1-64
LSTM	Low Start Memory. Goes low when the mainframe processor initiates a memory cycle to indicate the address bus data is valid. Also a Mainframe Interface mnemonic.	2,3	Sheet 2 P1-63
LSTREAD	Low Status Register Read. Goes low when the mainframe processor reads the contents of the Microprocessor Pin Status and Miscellaneous Status registers.	2,3	Sheet 3 U57-12
LSYNCCLK	Low Synchronizer Clock. A negative edge clock for the synchronizer circuitry.	6,8	Sheet 6 U28-3
LUSER	Low User. Goes low to indicate the current address on the emulation address bus is mapped to user memory.	1,4,6	Sheet 4 U27-1
LWBM	Low write Background Memory. Goes low to enable writes to background memory.	1,3	Sheet 3 U80-4
LWDV	Low Write Data Valid. Goes low during a memory or I/O write cycle when data on the emulation data bus is valid. Also a Memory and Analysis Interface mnemonic.	4,6	Sheet 6 U51-6
LWRT	Low Write. Goes low to indicate a mainframe processor write to the addressed device. Also a Mainframe Interface mnemonic	2,3	Sheet 2 P1-65
MEM	Memory. Goes high to indicate the address on the emulation address bus is valid. Used to clock the Start Jam Counter flip-flop.		
PFG	Pre-Foreground. Goes high to indicate the background controller is going to change from background to foreground mode.	6,7	Sheet 6 U50-9
PMOP	Pre-Memory Operation. Goes high to indicate a read or write operation on user memory by the emulator will take place on the next falling edge of LMEM2.	4,7	Sheet 4 U60-3
RDBGSTB	Read Background Strobe. Goes low to indicate the mainframe processor is performing a read of background memory.	4,6	Sheet 4 U61-15
READYEN	Ready Enable. When high, allows emulation memory to generate wait states for the 6802. When low, wait states are inhibited. Not used with 6800.	3,5	Sheet 3 U78-11
R/W	Read/Low Write. The emulation processor holds this line high for read operations and low for write operations. Also a Pod Interface mnemonic.	6,7,8	Sheet 7 J4-39
SYNC	Synchronize. Unused input from pod. Grounded in 6800 and 6802. Also a Pod Interface mnemonic.	7,8	Sheet 7 J4-35
SYNCCLK	Synchronizer Clock. Positive edge clock for synchronizer.	6,8	Sheet 6 U54-11

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
WRBKGSTB	Write Background Strobe. Goes low to indicate a mainframe processor write to background memory.	3,5	Sheet 3 U78-6
XBKG	Exit Background. One of four modes for the background Controller. Goes high when the controller is exiting the background mode and will enter the foreground mode on the next opcode fetch.	4,6	Sheet 4 U59-6
<b>Pod Interface Signals</b>			
A0-15	Emulator Address bits 0-15. Input from emulation microprocessor in the pod to the address buffers U-8 and U11. Also an Inter-schematic mnemonic.	1,7	Sheet 1 J1
BA	Bus Available. Input from Emulation Microprocessor. Goes high to indicate a processor halt or wait state. Also an inter-schematic mnemonic.	7,8	Sheet 7 J4-25
DELAY1	Delay 1. To allow for different delays for different processors the passive components for U23 are located in the emulator pods. The delay set by the Delay 1 components is 227 nsec for the inverted $\Phi 1$ clock. Also used as an Inter-Schematic mnemonic.	6,7	Sheet 7 J4-38
DELAY2	Delay 2. Sets the 206 nsec delay for the inverted $\Phi 2$ clock. Also an Inter-schematic mnemonic.	6,7	Sheet 7 J4-42
ED0-7	Emulation Data 0-7. Eight Bit wide bidirectional emulation data bus.	1	Sheet 1 J1
EFG	Emulator Foreground. Goes high to indicate the emulation subsystem is running in the foreground memory.	7	Sheet 7 U14-3
EINT/EXT	Emulator Internal/External Clock. Buffered INT/EXT signal. Clock select signal sent to the pod from the mainframe processor through the control register. When high the oscillator in the pod is enabled, when low the target system clock is used.	7	Sheet 7 U14-7
ELBKG	Emulator Low Background. Goes low to signal the pod that the system is in background mode.	7	Sheet 7 U14-5
ELREFREQ	Emulator Low Refresh Request. Not used with current memory and analysis boards. When used, would provide for stopping the emulator processor for an emulation memory refresh cycle. Held high.	7	Sheet 7 U34-19
ELUSER	Emulator Low User. Buffer control signal to emulator. Goes low when address on emulator address bus is mapped to user memory space.	1	Sheet 1 U14-18
EMR	Emulator Memory Ready. Buffered MR signal from the 6802 emulator pod brought to the microprocessor pin status register. Not used with 6800 pod.	7	Sheet 7 J4-13

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
EΦ1	Phase 1. Phase 1 of the emulator processor clock. Also used as an Inter-schematic mnemonic.	6,7	Sheet 7 J4-29
EΦ2	Phase 2. Phase 2 of the emulator processor clock. Also used as an Inter-schematic mnemonic.	6,7	Sheet 7 J4-31
EPFG	Emulator Pre-Foreground. Goes high to indicate the background controller is going to change from background to foreground mode.	7	Sheet 7 U14-16
EREADY	Emulation Ready. Used to insert wait states in the emulator processor by blocking MR operation in the pod. Goes low to inhibit operation. Not used in 6800 operation.	7	Sheet 7 U26-11
ETSC	Emulator Three-State Control. A microprocessor pin status bit from the emulator pod.	7	Sheet 7 J4-15
ID0,ID1	Identification Bits 0,1. Used to detect what emulator pod is being used. For both the 6800 and the 6802 ID0 is held high and ID1 is grounded. Also Inter-schematic mnemonic.	3,7	Sheet 7
LEHALT	Low Emulation Halt. Goes low to request an emulator processor halt.	7	Sheet 7 U14-14
LDEFIB	Low Defibrillation. Goes low when the mainframe processor resets the emulation processor in the pod. Also an Inter-schematic mnemonic.	2,7	Sheet 2
LHALT	Low Halt. A microprocessor pin status register bit. From pod emulator processor HALT pin.	7	Sheet 7 J4-17
LIACK	Low Interrupt Acknowledge. Not used. Held high by internal pullup.	7	Sheet 7 J4-41
LIC	Last Instruction Cycle. Not used. Grounded in 6800/6802 pods. Also an Inter-schematic mnemonic.	4,7,8	Sheet 4
LINHIB	Low Inhibit. A low on this line inhibits emulation memory cycles independently from the memory mapper. The 6802 uses this line to overlay 6802 internal RAM and to allow optional writes to ROM space without a memory break occurring. Held high in the 6800 pod. Also an Inter-schematic mnemonic.	6,7	Sheet 7 J4-23
LIRQ	Low Interrupt Request. A processor status bit from the 6800 pod to the microprocessor pin status register to indicate a pending interrupt. Not used with the 6802.	7	Sheet 7 J4-19
LNMI	Low Non-Maskable Interrupt. This is a microprocessor status bit which is used in the 6800 pod to indicate the emulator processor is handling a non-maskable interrupt. In the 6802 pod this line is not connected.	7	Sheet 7 J4-21
LRESET	Low Reset. Buffered emulation reset line. Goes low whenever a reset is applied to the emulation processor. Also an Inter-schematic mnemonic.	7,8	Sheet 7 J4-27

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
R/W	Read/Low Write. The emulation processor holds this line high for read operations and low for write operations. Also an Inter-schematic mnemonic.	6,7,8	Sheet 7 J4-39
SYNC	Synchronize. Unused input from pod. Grounded in 6800 and 6802. Also an Inter-schematic mnemonic.	7,8	Sheet 7 J4-35
VMA	Valid Memory Address. Inverted LVMA from the emulator processor. Goes high when the emulator processor placed a valid memory address on the emulator address bus.	7	Sheet 7 J4-33
<b>Mainframe Interface</b>			
LA0-7	Low Address 0-7. The low-order eight bits from the mainframe processor address bus. Also an Inter-schematic mnemonic.	2,3	Sheet 3 P1
LA8	Low Address 8. The ninth bit from the mainframe address bus. Also an Inter-schematic mnemonic.	2,3	Sheet 2 P1-27
LD0-7	Low Data 0-7. Bi-directional 8-bit data bus. Lower half of 16 bit communications path from the mainframe processor to the emulator control card. Also an Inter-schematic mnemonic.	2,3,	Sheet 2 P1
LD8-15	Low Data 8-15. Bi-directional 8-bit data bus. Upper half of the 16 bit communications path from the mainframe processor to the emulator control card.	2	Sheet 2 P1
LIDEN	Low Identification Enable. Goes low when the mainframe processor scans the ID codes of the cards on the mainframe bus to enable each card to respond with its ID.	2,3	Sheet 2 P1-67
LIR1	Low Interrupt 1. Goes low to signal the mainframe processor when an emulator needs service.	2	Sheet 2 U42-6
LMSYN	Low Memory Sync. Goes low to force the mainframe processor to wait for the current read or write cycle to be completed by the emulation subsystem. Also an Inter-schematic mnemonic.	2,3	Sheet 3 U42-12
LSEL	Low Select. Input from mainframe (LSS0-9) I/O board. Goes low when the mainframe processor selects this board. Also an Inter-schematic mnemonic.	2,3	Sheet 2 P1-72
LSTB	Low Strobe. Goes low during a mainframe processor read to allow the selected device to drive the data bus. Goes low during a mainframe processor read to indicate bus data is valid. Also an Inter-schematic mnemonic.	2,3	Sheet 2 P1-64
LSTM	Low Start Memory. Goes low when the mainframe processor initiates a memory cycle and address bus and bus data is valid. Also an Inter-schematic mnemonic.	2,3	Sheet 2 P1-63
LWRT	Low Write. Goes low to indicate a mainframe processor write to the selected device. Also an Inter-schematic mnemonic.	2,3	Sheet 2

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
<b>Memory and Analysis Interface</b>			
BA	Bus Available. From the Emulation Microprocessor. Goes high to indicate a processor halt or wait state. Also a Pod Interface, and an Inter-schematic mnemonic.	7,8	Sheet 7 J4-25
BA0-7	Buffered Address 0-7. Used to access background and emulation memory. Also an Inter-schematic mnemonic.	1,2,3,4,5	Sheet 1 U-8
BA8-15	Buffered Address 8-15. Used to access Background and emulation memory. Also an Inter-schematic mnemonic.	1,2,4,8	Sheet 1 U-11
BR/W	Buffered Read/Low Write. A buffered R/W. This line is high for read and low for write operations.	8	Sheet 8 J4-39
FETCH	Fetch. Goes high to indicate opcode prefetches. Not used with 6800/6802.	8	Sheet 8 U28-6
HMAV	High Memory Available. Goes high during $\Phi 1$ when the emulator is not using memory. Also an Inter-schematic mnemonic.	4,6	Sheet 6 U49-7
HREADY	High Ready. Goes high when address referenced is mapped to emulation memory. Also an Inter-schematic mnemonic.	4,7	Sheet 4 J3-43
HUSER	High User. Goes high when the current address on the emulation address bus is mapped to user memory. Also an Inter-schematic mnemonic.	1,4,6	Sheet 4 J3-49
LANAL	Low Analysis. Goes high to store analysis data into the internal analysis board. Also used as an Inter-schematic mnemonic.	6,8	Sheet 6 U49-6
LBKG	Low Background. Goes low when the background controller enters the background mode. Also an Inter-schematic mnemonic.	2,4,6,8	Sheet 4 U59-3
LEBREAK	Low Emulation Break. Goes low when the emulation bus requests a break of the emulation system. Also an Inter-schematic mnemonic.	5,8	Sheet 8 J2-1
LED0-7	Low Emulation Data 0-7. Lower 8 bits of emulation data to the memory and internal analysis cards. Also an Inter-schematic mnemonic.	1,8	Sheet 1 U4, U5
LED8-15	Low Emulation Data 8-15. Upper 8 bits of emulation data bus. Also an Inter-schematic mnemonic.	1,8	Sheet 1 U6, U7
LEWRT	Low Emulator Write. Buffered emulator R/W signal. Goes low when the emulator is in a write cycle. Also an Inter-schematic mnemonic.	4,7	Sheet 7 U34-16
LMBRKS	Low Memory Break Status. Goes low when the Emulation Memory Board asserts a break. Also an Inter-schematic mnemonic.	2,8	Sheet 8 J2-33

Table 8-1. Mnemonics (Cont'd)

Mnemonic	Definition	Used On Sheets	Source
LREFREQ	Low Refresh Request. Not used with current memory and analysis boards. When used, would allow the emulation processor in the pod to be stopped for emulation memory refresh cycles. Since no dynamic memory is now used, this line is held high. Also an Inter-schematic mnemonic.	7,8	Sheet 8 J2-29
LWDV	Low Write Data Valid. Goes low during a memory or I/O write cycle when data on the emulation data bus is valid. Also an Inter-schematic mnemonic.	4,6	Sheet 6 U51-6

**8-7. COMPONENT LOCATOR.**

8-8. The component locator provides the reference designators and locations for each replaceable part contained on the printed circuit assembly. The component locator is provided as a fold-out drawing.

**8-8. SCHEMATIC DIAGRAMS.**

8-9. The schematic diagrams are presented as eight fold-out sheets using ANSI Standard Y32.14 symbols. A list of standard reference designators and abbreviations is presented in Section VI of this manual. Table 8-2 describes the techniques used in the development of the logic symbols. Table 8-3 describes other schematic symbols.

Table 8-2. Logic Symbols

**GENERAL**

All signals flow from left to right, relative to the symbol's orientation with inputs on the left side of the symbol, and outputs on the right side of the symbol (the symbol may be reversed if the dependency notation is a single term.)

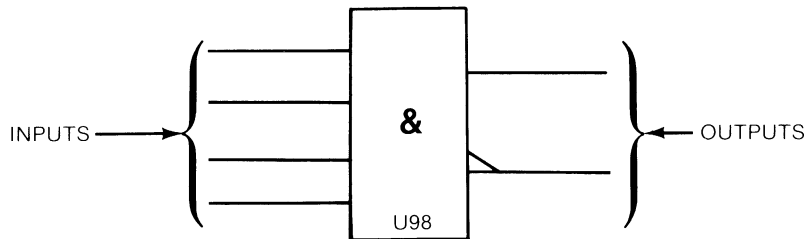
All dependency notation is read from left to right (relative to the symbol's orientation).

An external state is the state of an input or output outside the logic symbol.

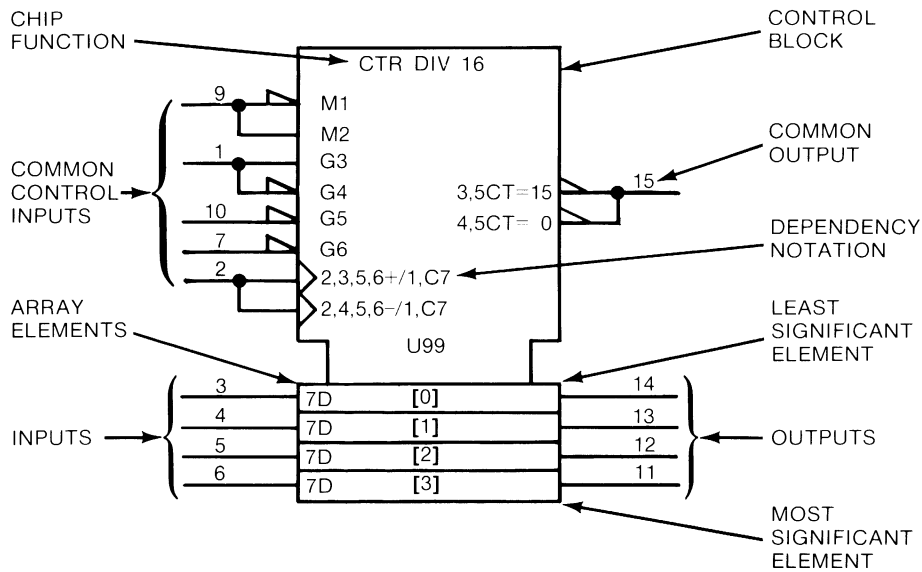
An internal state is the state of an input or output inside the logic symbol. All internal states are True = High.

**SYMBOL CONSTRUCTION**

Some symbols consist of an outline or combination of outlines together with one or more qualifying symbols, and the representation of input and output lines.



Some have a common Control Block with an array of elements:



**CONTROL BLOCK** - All inputs and dependency notation affect the array elements directly. Common outputs are located in the control block. (Control blocks may be above or below the array elements.)

**ARRAY ELEMENTS** -All array elements are controlled by the control block as a function of the dependency notation. Any array element is independent of all other array elements. Unless indicated, the least significant element is always closest to the control block. The array elements are arranged by binary weight. The weights are indicated by powers of 2 (shown in [ ]).



Table 8-2. Logic Symbols (Cont'd)

**INPUTS** - Inputs are located on the left side of the symbol and are affected by their dependency notation.

Common control inputs are located in the control block and control the inputs/outputs to the array elements according to the dependency notation.

Inputs to the array elements are located with the corresponding array element with the least significant element closest to the control block.

**OUTPUTS** - Outputs are located on the right side of the symbol and are effected by their dependency notation.

Common control outputs are located in the control block.

Outputs of array elements are located in the corresponding array element with the least significant bit closest to the control block.

**CHIP FUNCTION** - The labels for chip functions are defined, i.e., CTR - counter, MUX - multiplexer.

**DEPENDENCY NOTATION**

Dependency notation is always read from left to right relative to the symbol's orientation.

Dependency notation indicates the relationship between inputs, outputs, or inputs and outputs. Signals having a common relationship will have a common number, i.e., C7 and 7D....C7 controls D. Dependency notation 2,3,5,6+/1,C7 is read as when 2 and 3 and 5 and 6 are true, the input will cause the counter to increment by one count....or (/) the input (C7) will control the loading of the input value (7D) into the D flip-flops.

The following types of dependencies are defined:

- a. AND (G), OR (V), and Negate (N) denote Boolean relationship between inputs and outputs in any combination.
- b. Interconnection (Z) indicates connections inside the symbol.
- c. Control (C) identifies a timing input or a clock input of a sequential element and indicates which inputs are controlled by it.
- d. Set (S) and Reset (R) specify the internal logic states (outputs) of an RS bistable element when the R or S input stands at its internal 1 state.
- e. Enable (EN) identifies an enable input and indicates which inputs and outputs are controlled by it (which outputs can be in their high impedance state).
- f. Mode (M) identifies an input that selects the mode of operation of an element and indicates the inputs and outputs depending on that mode.
- g. Address (A) identifies the address inputs.
- h. Transmission (X) identifies bi-directional inputs and outputs that are connected together when the transmission input is true.

**DEPENDENCY NOTATION SYMBOLS**

A	Address (selects inputs/outputs) (indicates binary range)	N	Negate (compliments state)
C	Control (permits action)	R	Reset Input
EN	Enable (permits action)	S	Set Input
G	AND (permits action)	V	OR (permits action)
M	Mode (selects action)	Z	Interconnection
		X	Transmission

Table 8-2. Logic Symbols (Cont'd)

**OTHER SYMBOLS**

	Analog Signal		Inversion		Shift Right (or up)
	AND		Negation		Solidus (allows an input or output to have more than one function)
	Bit Grouping		Nonlogic Input/Output		Tri-State
	Buffer		Open Circuit (external resistor)		Causes notation and symbols to effect inputs/outputs in an AND relationship, and to occur in the order read from left to right.
	Compare		Open Circuit (external resistor)		Used for factoring terms using algebraic techniques.
	Dynamic	$\geq 1$	OR		Information not defined.
$\neq 1$	Exclusive OR		Passive Pull Down (internal resistor)		Logic symbol not defined due to complexity.
	Hysteresis		Passive Pull Up (internal resistor)		
	Interrogation		Postponed		
	Internal Connection		Shift Left (or down)		

**LABELS**

BG	Borrow Generate	CO	Carry Output	J	J Input
BI	Borrow Input	CP	Carry Propagate	K	K Input
BO	Borrow Output	CT	Content	P	Operand
BP	Borrow Propagate	D	Data Input	T	Transition
CG	Carry Generate	E	Extension (input or output)	+	Count Up
CI	Carry Input	F	Function	-	Count Down

**MATH FUNCTIONS**

$\Sigma$	Adder	>	Greater Than
ALU	Arithmetic Logic Unit	<	Less Than
COMP	Comparator	CPG	Look Ahead Carry Generator
DIV	Divide By	$\pi$	Multiplier
=	Equal To	P-Q	Subtractor


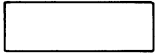









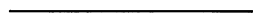
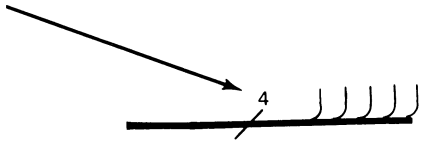
**CHIP FUNCTIONS**

BCD	Binary Coded Decimal	DIR	Directional	RAM	Random Access Memory
BIN	Binary	DMUX	Demultiplexer	RCVR	Line Receiver
BUF	Buffer	FF	Flip-Flop	ROM	Read Only Memory
CTR	Counter	MUX	Multiplexer	SEG	Segment
DEC	Decimal	OCT	Octal	SRG	Shift Register

**DELAY and MULTIVIBRATORS**

	Astable
	Delay
	Nonretriggerable Monostable
NV	Nonvolatile
	Retriggerable Monostable

Table 8-3. Schematic Diagram Notes

	ETCHED CIRCUIT BOARD	(925)	WIRE COLORS ARE GIVEN BY NUMBERS IN PARENTHESES USING THE RESISTOR COLOR CODE
	FRONT PANEL MARKING		[ (925) IS WHT-RED-GRN ]
	REAR-PANEL MARKING		0 - BLACK    5 - GREEN 1 - BROWN   6 - BLUE 2 - RED      7 - VIOLET 3 - ORANGE   8 - GRAY 4 - YELLOW   9 - WHITE
	MANUAL CONTROL		
	SCREWDRIVER ADJUSTMENT		
	ELECTRICAL TEST POINT TP (WITH NUMBER)		
	NUMBERED WAVEFORM NUMBER CORRESPONDS TO ELECTRICAL TEST POINT NO.		
	LETTERED TEST POINT NO MEASUREMENT AID PROVIDED		
	COMMON CONNECTIONS. ALL LIKE-DESIGNATED POINTS ARE CONNECTED.		
	NUMBER ON WHITE BACKGROUND = OFF-PAGE CONNECTION. LARGE NUMBER ADJACENT = SERVICE SHEET NUMBER FOR OFF-PAGE CONNECTION.		
	CIRCLED LETTER = OFF-PAGE CONNECTION BETWEEN PAGES OF SAME SERVICE SHEET.		
	INDICATES SINGLE SIGNAL LINE		
	NUMBER OF LINES ON A BUS		
			

\* OPTIMUM VALUE SELECTED AT FACTORY, TYPICAL VALUE SHOWN; PART MAY HAVE BEEN OMITTED.

UNLESS OTHERWISE INDICATED:  
RESISTANCE IN OHMS  
CAPACITANCE IN PICOFARADS  
INDUCTANCE IN MICROHENRIES

$\mu$ P = MICROPROCESSOR  
P/O = PART OF  
NC = NO CONNECTION  
CW = CLOCKWISE END OF VARIABLE RESISTOR

STD-20-09-81

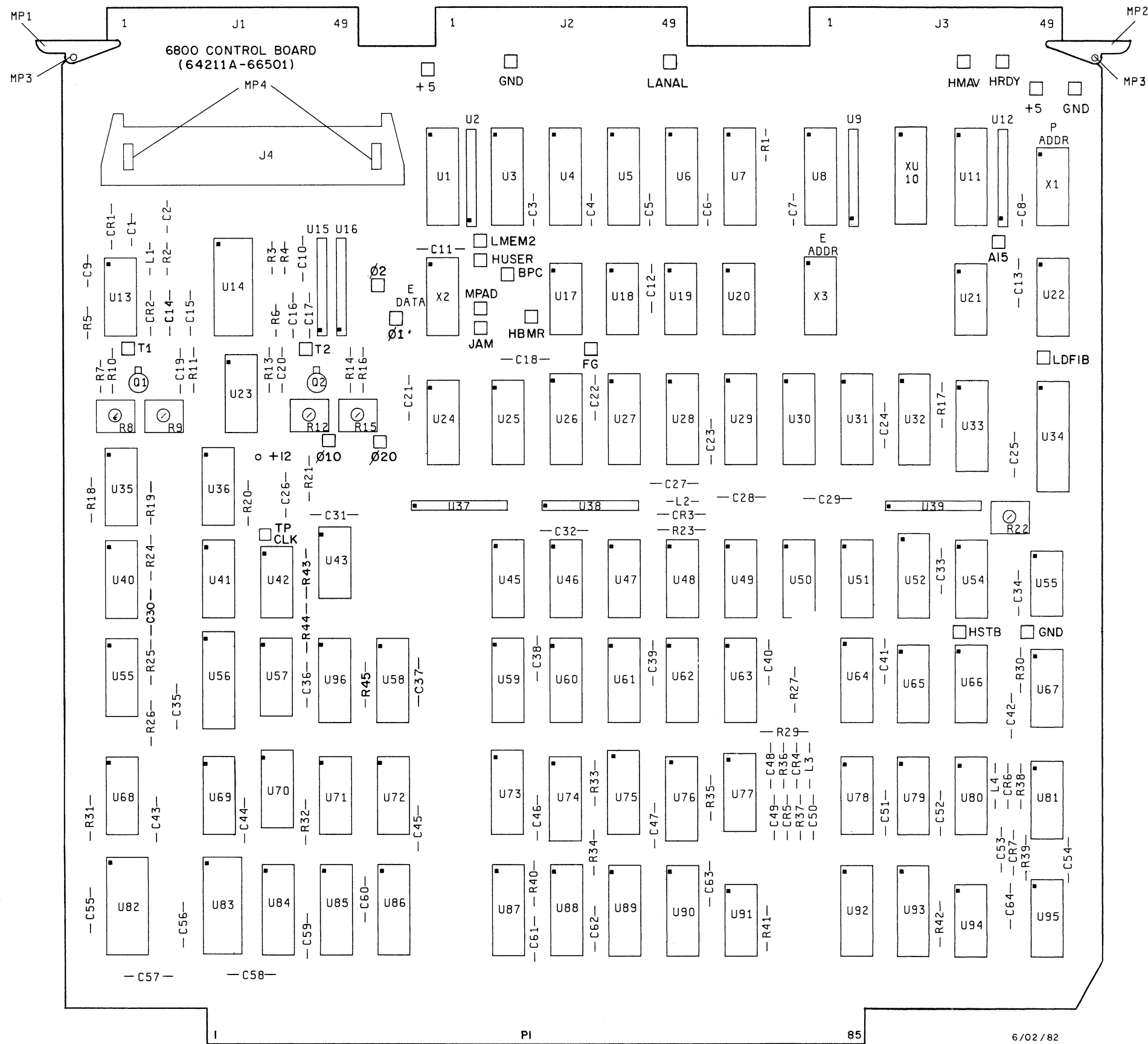


Figure 8-1.  
6800 Control Board,  
8-18

Component Locator

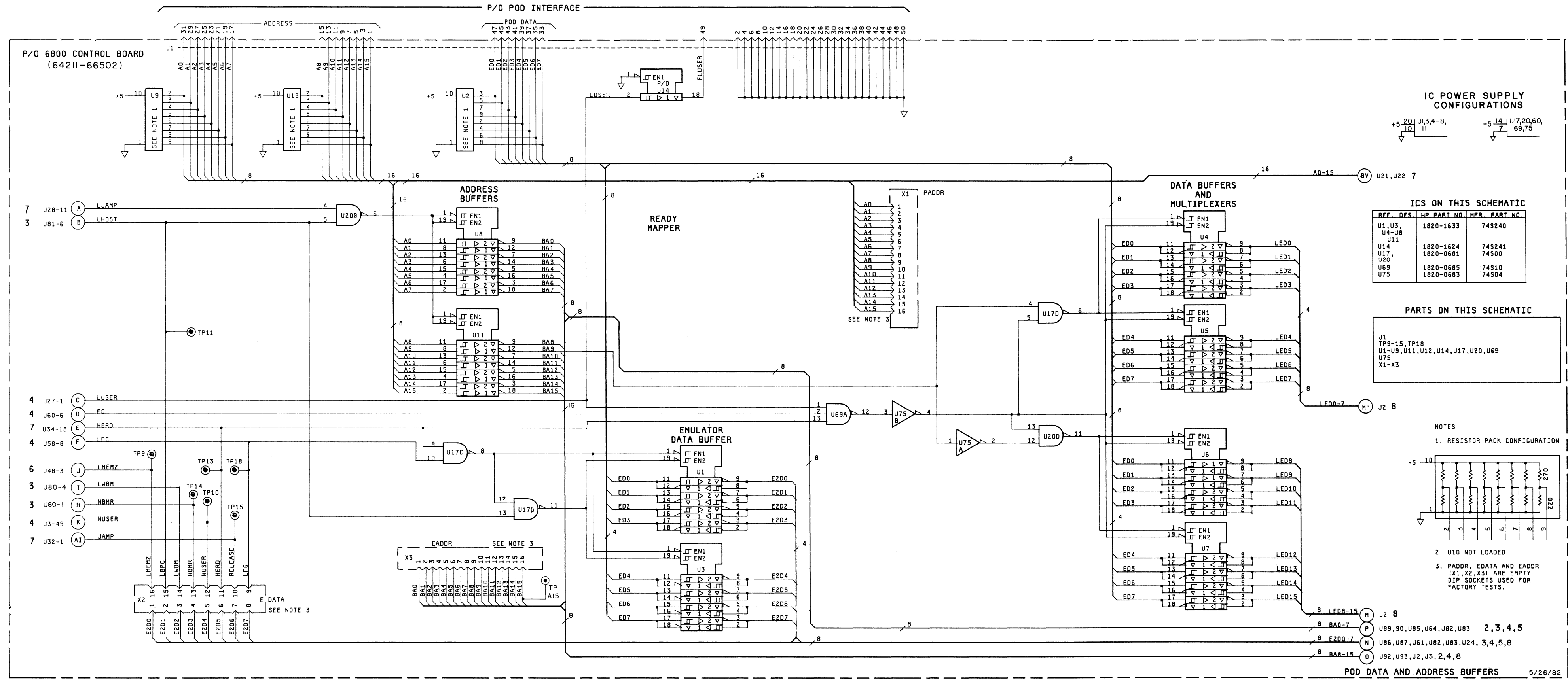
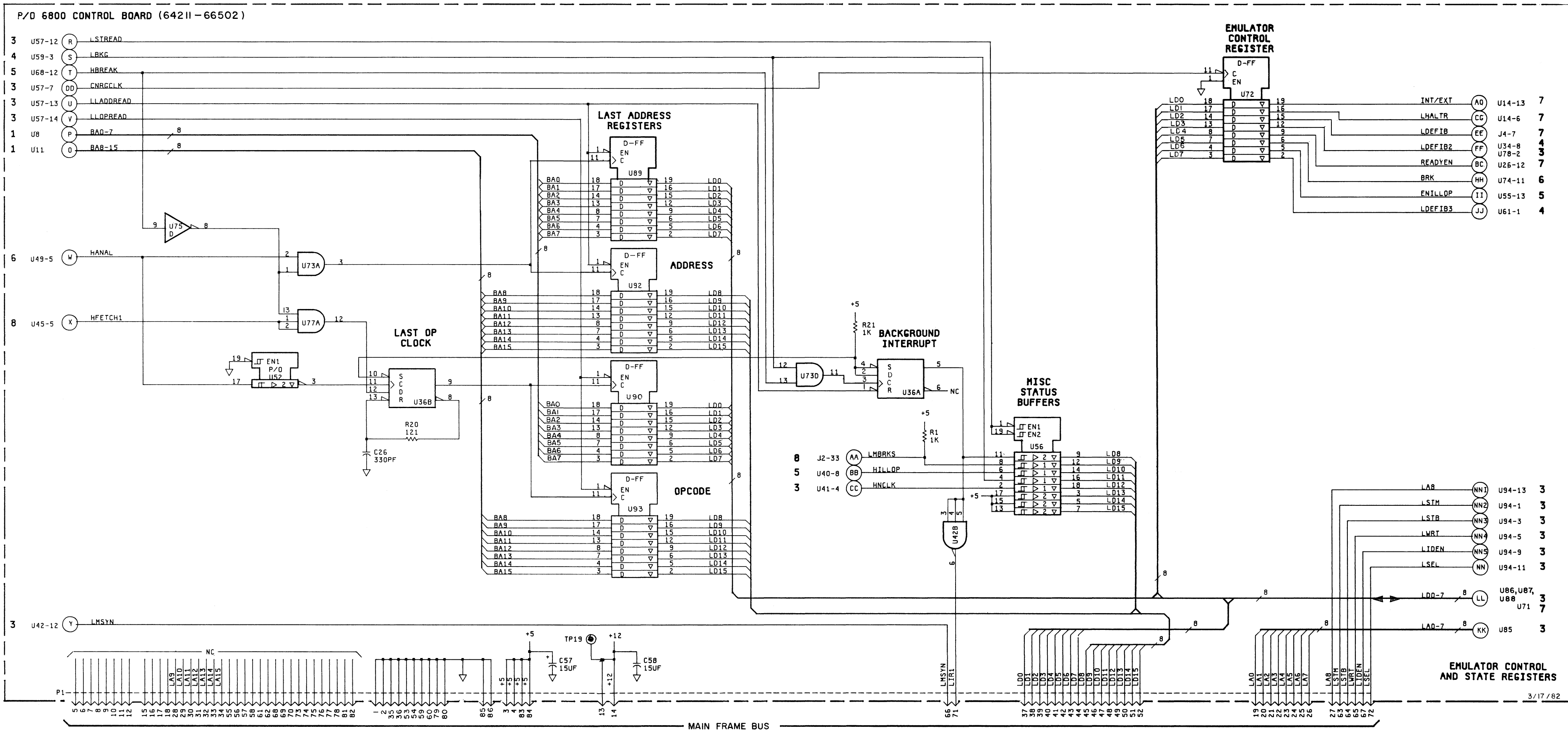


Figure 8-2.  
Service Sheet 1, Data and Address Buffers  
8-19/(8-20 blank)



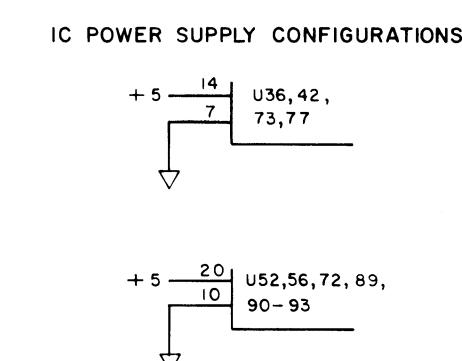


**ICS ON THIS SCHEMATIC**

REF. DES.	HP PART NO.	MFR. PART NO.
U36	1820-1112	74LS74
U42	1820-0907	7412
U52	1820-1633	745240
U56	1820-2024	74LS244
U72, U89	1820-1997	74LS374
U90, U92		
U93		
U73	1820-1367	74S08
U75	1820-0683	74S04
U77	1820-0686	74S11

**PARTS ON THIS SCHEMATIC**

C26, C57, C58  
 R1, R20, R21  
 U36, U42, U52, U56, U72, U73, U75, U77, U89, U90, U92  
 U93  
 TP19



LA8	NN1	U94-13	3
LSTM	NN2	U94-1	3
LSTB	NN3	U94-3	3
LWRT	NN4	U94-5	3
LIDEN	NN5	U94-9	3
LSEL	NN	U94-11	3
LDD-7	LL	U86, U87, U88	3
		U71	7
LA0-7	KK	U85	3

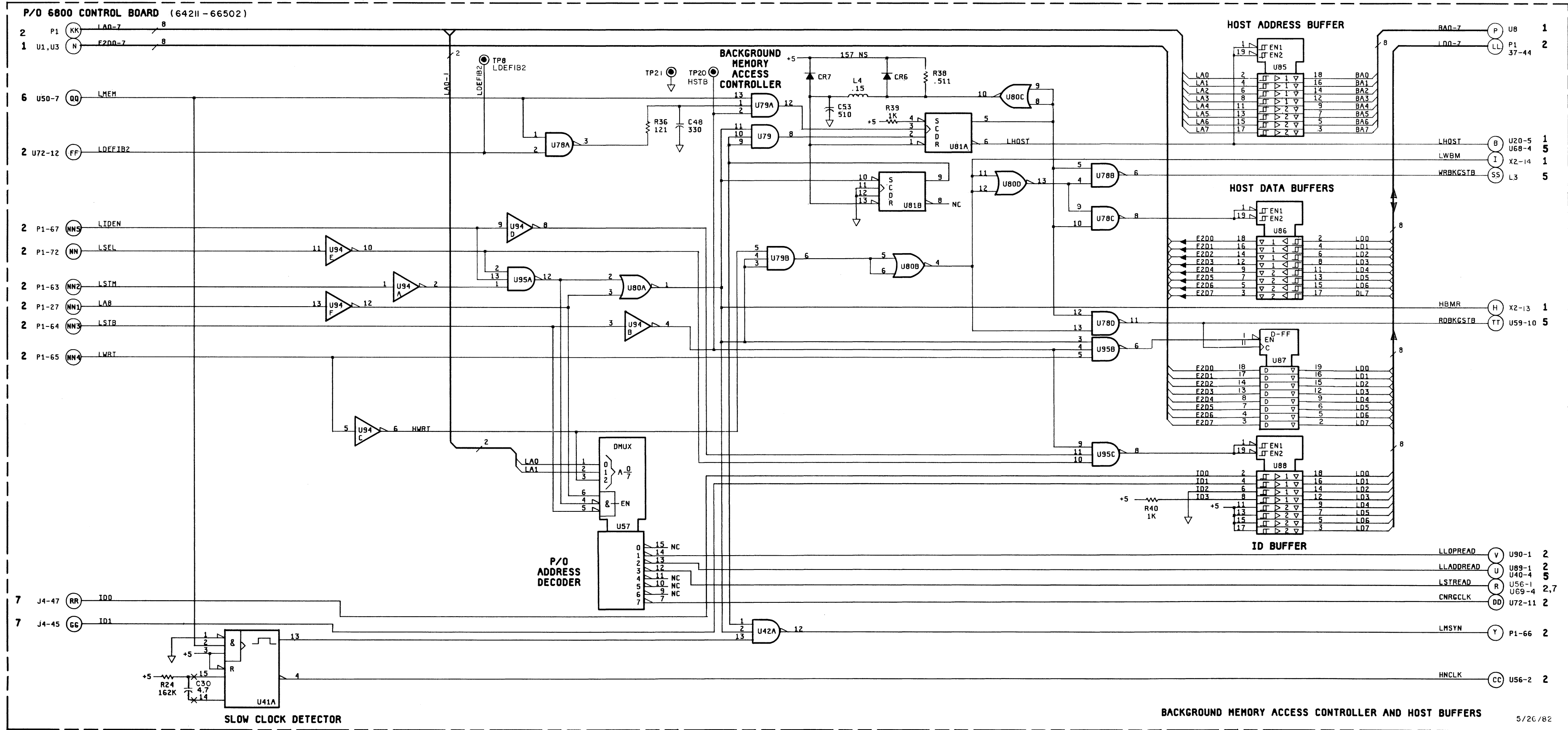
3/17/82

2

Figure 8-3.  
 Service Sheet 2, Mainframe Interface Logic  
 8-21/(8-22 blank)







**ICS ON THIS SCHEMATIC**

REF. DES.	HP PART NO.	MFR. PART NO.
U41	1820-1423	74LS123
U57	1820-1216	74LS138
U78	1820-0681	74S00
U79	1820-0686	74S11
U80	1820-1322	74S02
U81	1820-0693	74S74
U85, U86	1820-2024	74LS244
U88		
U87	1820-1997	74LS374
U94	1820-1416	74LS14
U95	1820-1202	74LS10

**PARTS ON THIS SCHEMATIC**

C30, C48, C53
CR6, CR7
L4
R24, R36, R38-R40
TP8, TP20, TP21
U41, U57, U78-U81, U85-U88, U94, U95

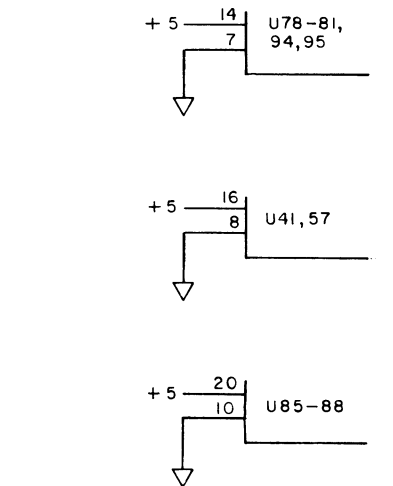
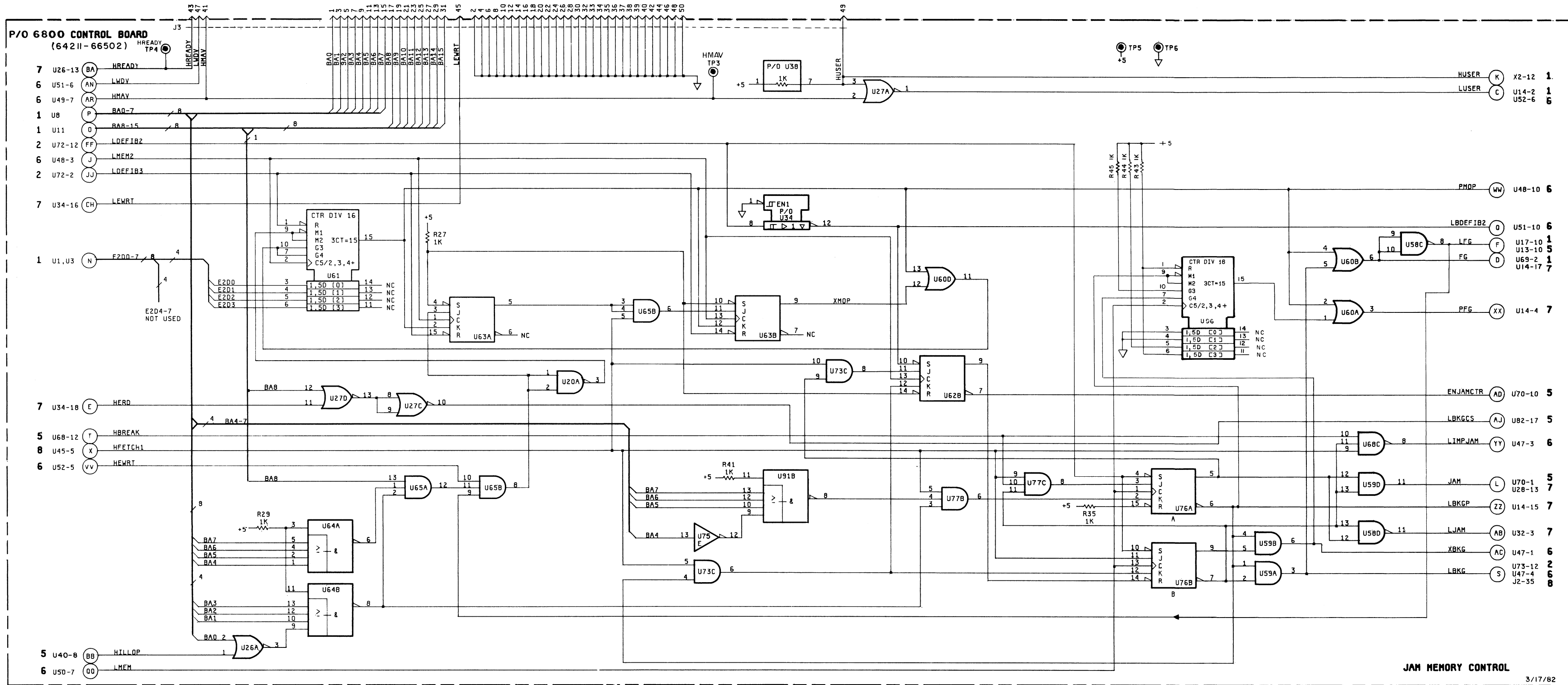


Figure 8-4.  
Service Sheet 3, Background Memory Controller  
8-23/(8-24 blank)





**ICS ON THIS SCHEMATIC**

REF DES	HP PART NO	MFR. PART NO.
U20, U58	1820-0681	74S00
U26, U60	1820-1449	74S32
U72	1820-1322	74S02
U34	1820-1624	74S241
U59, U73	1820-0681	74S08
U61, U96	1820-1430	74LS161
U62, U63, U76	1820-0629	74S112
U64, U91	1820-0655	7425
U65, U77	1820-0686	74S11
U68	1820-0685	74S10
U75	1820-0683	74S04

**PARTS ON THIS SCHEMATIC**

J3  
R27, R29, R35, R41, R43-45  
TP3, TP4, TP5, TP6, TP7  
U20, U26, U27, U34, U38, U58-U65, U68  
U73, U75, U76, U77, U91, U96

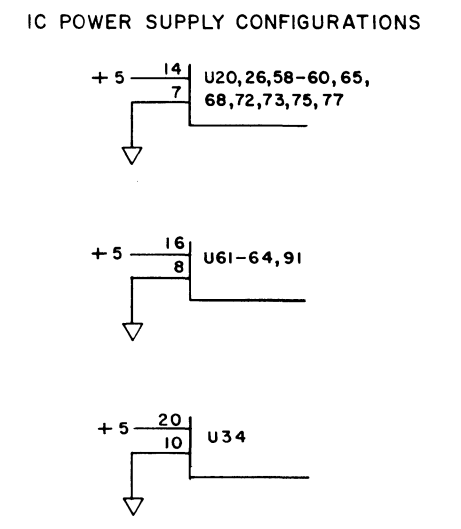
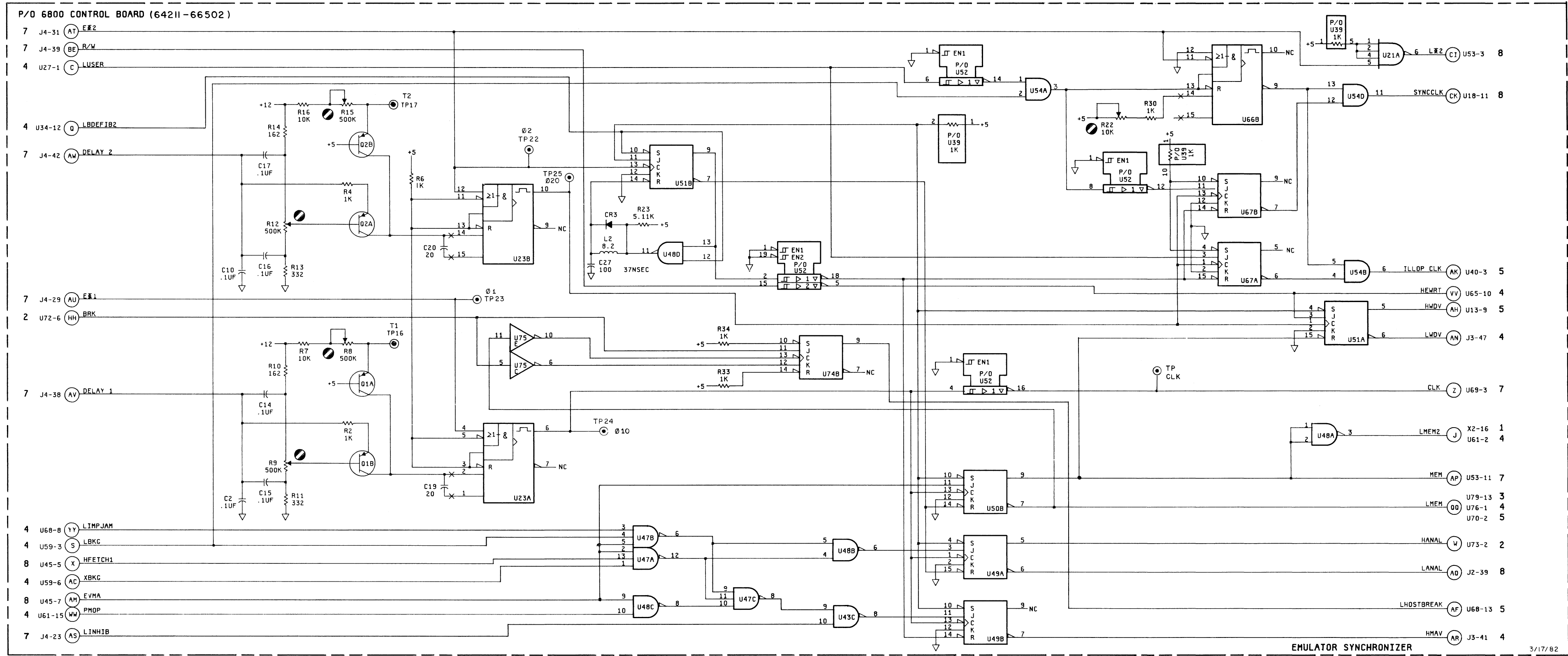


Figure 8-5.  
Service Sheet 4, Jam and Foreground Memory Control  
8-25/(8-26 blank)









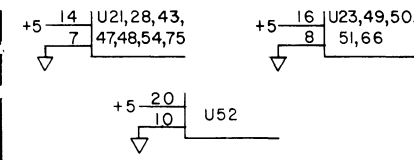
ICS USED ON THIS SCHEMATIC

REF DES	HP PART NO	MFG PART NO
U21	1820-0688	74520
U23, 66	1820-1782	26502
U48	1820-0681	74500
U43, 54	1820-1367	74508
U47	1820-0685	74510
U49-51, 64, 67	1820-0629	745112
U52	1820-1633	745240
U75	1820-0683	74504

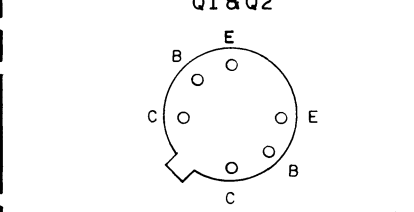
PARTS ON THIS SCHEMATIC

C2, 10, 14-17, 19, 20, 27
CR3
L2
Q1, 2
R2, 4, 6-16, 22, 23, 30, 33, 34
TP16, 17, 22-25
U21, 23, 28, 39, 43, 49-52
54, 66, 67, 74, 75

IC POWER SUPPLY CONFIGURATIONS



CONFIGURATIONS OF Q1 & Q2

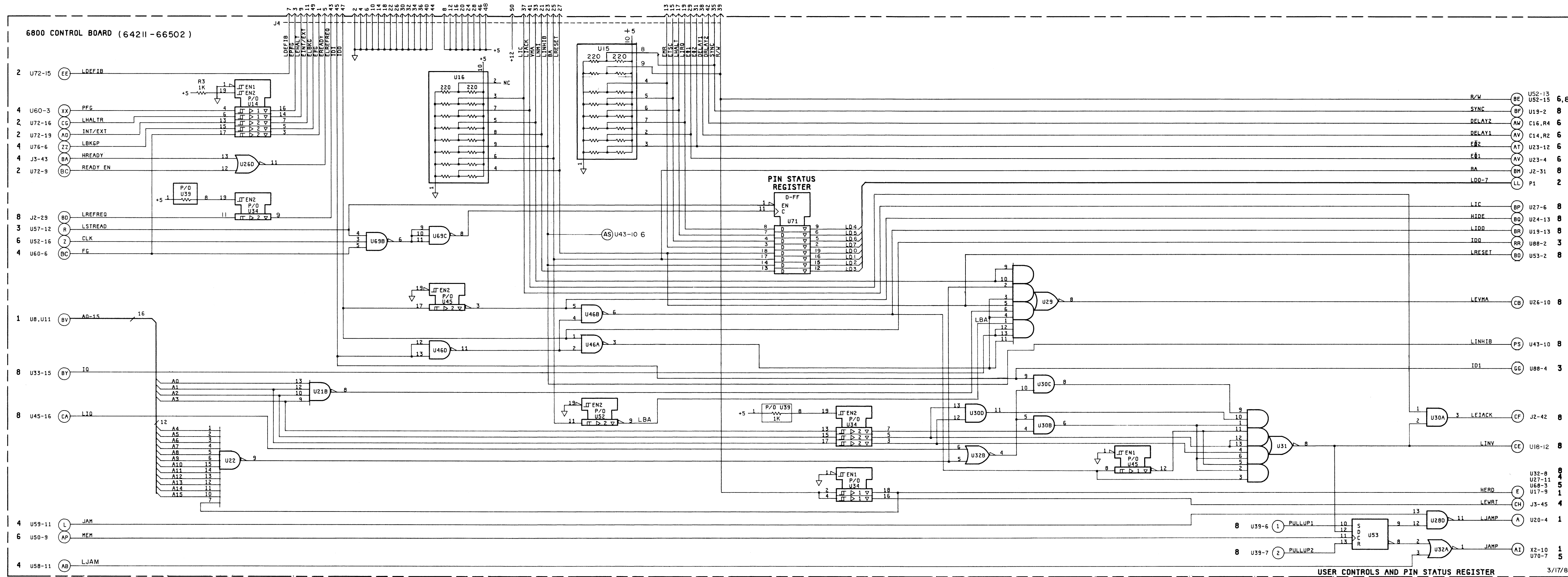


EMULATOR SYNCHRONIZER 3/17/82

Figure 8-7. Service Sheet 6, Emulator Synchronizer 8-29/(8-30 blank)







**ICS ON THIS SCHEMATIC**

REF. DES.	HP PART NO.	MFR. PART NO.
U14, U34	1820-1624	74S241
U21	1820-0688	74S20
U22	1820-1130	74S133
U26	1820-1449	74S32
U28	1820-0681	74S00
U29, U31	1820-0691	74S64
U30	1820-1367	74S08
U32	1820-1322	74S02
U45, U52	1820-1633	74S240
U53	1820-0693	74S74
U69	1820-0685	74S10
U71	1820-1997	74LS374

**PARTS ON THIS SCHEMATIC**

C3-C9, C11-C13, C18, C21-C25, C28, C29  
 C31-C47, C49, C51, C52, C54-C56, C59-C64  
 J4  
 R3  
 U14-U16, U21, U22, U26, U28, U32, U34  
 U39, U45, U64, U52, U53, U69, U71

**IC POWER SUPPLY CONFIGURATIONS**

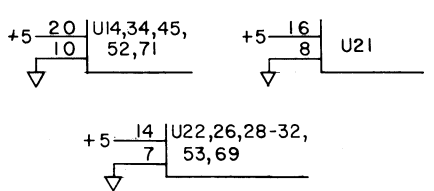


Figure 8-8.  
 Service Sheet 7, Emulator Selection and Control  
 8-31/(8-32 blank)





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Place Romée de Villeneuve  
F-13090 **AIX-EN-PROVENCE**  
Tel: (42) 59-41-02  
Telex: 410770F  
A,CM,CS,E,MS,P\*

### Hewlett-Packard France

Bureau de Vente de Lyon  
Chemin des Mouilles  
Boite Postale No. 162  
F-69130 **ECULLY** Cédex  
Tel: (78) 33-81-25  
Telex: 310617F  
A,CM,CP,E,MP

### Hewlett-Packard France

Immeuble France Evry  
Tour Lorraine  
Boulevard de France  
F-91035 **EVRY** Cédex  
Tel: (60) 77-96-60  
Telex: 692315F  
CM,E

### Hewlett-Packard France

Technisches Büro Bbblingen  
Herrenberger Strasse 110  
D-7030 **BOBLINGEN**  
Tel: (07031) 667-1  
Telex: 07265739 bbn or 07265743  
A,CM,CP,E,MP,P

### FRANCE (Cont.)

Hewlett-Packard France  
Boite Postale No. 503  
F-25026 **BESANCON**  
28 Rue de la Republique  
F-25000 **BESANCON**  
Tel: (81) 83-16-22  
C,M

Hewlett-Packard France  
Bureau de Vente de Lille  
Immeuble Péricentre  
Rue Van Gogh  
F-59650 **VILLENEUVE D'ASQ**  
Tel: (20) 91-41-25  
Telex: 160124F  
CM,CS,E,MS,P\*

### GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH  
Technisches Büro Berlin  
Keithstrasse 2-4  
D-1000 **BERLIN** 30  
Tel: (030) 24-90-86  
Telex: 018 3405 hpbm d  
A,CM,CS,E,X,M,P

### Hewlett-Packard GmbH

Technisches Büro Bbblingen  
Herrenberger Strasse 110  
D-7030 **BOBLINGEN**  
Tel: (07031) 667-1  
Telex: 07265739 bbn or 07265743  
A,CM,CP,E,MP,P

### Hewlett-Packard GmbH

Technisches Büro Düsseldorf  
Emanuel-Leutze-Strasse 1  
D-4000 **DUSSELDORF**  
Tel: (0211) 5971-1  
Telex: 085786 533 hpdd d  
A,CM,CP,E,MS,P

### Hewlett-Packard GmbH

Vertreibszentrale Frankfurt  
Berner Strasse 117  
Postfach 560 140  
D-6000 **FRANKFURT** 56  
Tel: (0611) 50-04-1  
Telex: 04 13249 hpffm d  
A,CM,CP,E,MP,P

### Hewlett-Packard GmbH

Technisches Büro Hamburg  
Kapsladring 5  
D-2000 **HAMBURG** 60  
Tel: (040) 63804-1  
Telex: 21 63 032 hpht d  
A,CM,CP,E,MS,P

### Hewlett-Packard GmbH

Technisches Büro Hannover  
Am Grossmarkt 6  
D-3000 **HANNOVER** 91  
Tel: (0511) 46-60-01  
Telex: 092 3259  
A,CM,CS,E,MS,P

### Hewlett-Packard GmbH

Technisches Büro Mannheim  
Rosslauer Weg 2-4  
D-6800 **MANNHEIM**  
Tel: (621) 70050  
Telex: 0462105  
A,C,E

### Hewlett-Packard GmbH

Technisches Büro Neu Ulm  
Messerschmittstrasse 7  
D-7910 **NEU ULM**  
Tel: 847178  
Telex: C

### Hewlett-Packard GmbH

Technisches Büro Nürnberg  
Neumeyerstrasse 90  
D-8500 **NURNBERG**  
Tel: (0911) 56-30-83  
Telex: 021 7655  
CM,CS,E,MS,P

Hewlett-Packard France  
20 Chemin de la Céprière  
F-31081 **TOULOUSE** Cédex  
Tel: (61) 40-11-12  
Telex: 531639F  
A,CM,CS,E,P\*

### Hewlett-Packard France

Bureau de Vente de Lille  
Immeuble Péricentre  
Rue Van Gogh  
F-59650 **VILLENEUVE D'ASQ**  
Tel: (20) 91-41-25  
Telex: 160124F  
CM,CS,E,MS,P\*

### GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH  
Technisches Büro Berlin  
Keithstrasse 2-4  
D-1000 **BERLIN** 30  
Tel: (030) 24-90-86  
Telex: 018 3405 hpbm d  
A,CM,CS,E,X,M,P

### Hewlett-Packard GmbH

Technisches Büro Bbblingen  
Herrenberger Strasse 110  
D-7030 **BOBLINGEN**  
Tel: (07031) 667-1  
Telex: 07265739 bbn or 07265743  
A,CM,CP,E,MP,P

### Hewlett-Packard GmbH

Technisches Büro Düsseldorf  
Emanuel-Leutze-Strasse 1  
D-4000 **DUSSELDORF**  
Tel: (0211) 5971-1  
Telex: 085786 533 hpdd d  
A,CM,CP,E,MS,P

### Hewlett-Packard GmbH

Vertreibszentrale Frankfurt  
Berner Strasse 117  
Postfach 560 140  
D-6000 **FRANKFURT** 56  
Tel: (0611) 50-04-1  
Telex: 04 13249 hpffm d  
A,CM,CP,E,MP,P

### Hewlett-Packard GmbH

Technisches Büro Hamburg  
Kapsladring 5  
D-2000 **HAMBURG** 60  
Tel: (040) 63804-1  
Telex: 21 63 032 hpht d  
A,CM,CP,E,MS,P

### Hewlett-Packard GmbH

Technisches Büro Hannover  
Am Grossmarkt 6  
D-3000 **HANNOVER** 91  
Tel: (0511) 46-60-01  
Telex: 092 3259  
A,CM,CS,E,MS,P

### Hewlett-Packard GmbH

Technisches Büro Mannheim  
Rosslauer Weg 2-4  
D-6800 **MANNHEIM**  
Tel: (621) 70050  
Telex: 0462105  
A,C,E

### Hewlett-Packard GmbH

Technisches Büro Neu Ulm  
Messerschmittstrasse 7  
D-7910 **NEU ULM**  
Tel: 847178  
Telex: C

### Hewlett-Packard GmbH

Technisches Büro Nürnberg  
Neumeyerstrasse 90  
D-8500 **NURNBERG**  
Tel: (0911) 56-30-83  
Telex: 021 7655  
CM,CS,E,MS,P

Hewlett-Packard GmbH  
Technisches Büro München  
Eschenstrasse 5  
D-8021 **TAUFKIRCHEN**  
Tel: (089) 6117-1  
Telex: 0524985  
A,CM,CP,E,MS,P

### GREAT BRITAIN

Hewlett-Packard Ltd.  
Trafaigar House  
Navigation Road  
**ALTRINCHAM**  
Cheshire WA14 1NU  
Tel: (061) 928-6422  
Telex: 668068  
A,C,E,M

### Hewlett-Packard Ltd.

Oakfield House, Oakfield Grove  
Clifton  
**BRISTOL** BS8 2BN  
Tel: (030) 24-90-86  
Telex: 444302  
P

### Hewlett-Packard Ltd.

Oakfield House, 7th/8th Floors  
91 Nehru Place  
**NEW DELHI** 110 024  
Tel: 682547  
Telex: 031-2463  
**HONG KONG**  
Tel: 5-8323211  
Cable: 66678 HEWPA HX  
E,CP,P

### Hewlett-Packard Ltd.

Castleford  
Yorkshire WF10 1AE  
Tel: (0977) 550016  
Telex: 5557355  
C

### Hewlett-Packard Ltd.

Fourier House  
257-263 High Street  
**LONDON COLNEY**  
Herts., AL2 1HA  
Tel: (0727) 24400  
Telex: 1-8952716  
C,E

### Hewlett-Packard Ltd.

Tradax House, St. Mary's Walk  
**MAIDENHEAD**  
Berkshire, SL6 1ST  
Tel: (0628) 39151  
E,P

### Hewlett-Packard Ltd.

308/314 Kings Road  
**REDBRIDGE**, Surrey  
Tel: (02932)  
Telex: 012-234  
Cable: BLUEFROST  
E

### Hewlett-Packard Ltd.

Quadrangle  
Westminster House  
190 Stratford Road  
**SHIRLEY**, Solihull  
West Midlands B90 3BJ  
Tel: (0211) 7458800  
Telex: 339105  
C

### Hewlett-Packard Ltd.

King Street Lane  
**WINNERSH**, Wokingham  
Berkshire RG11 5AR  
Tel: (0734) 784774  
Telex: 847178  
A,C,E,M

### GREECE

*Kostas Karaynnis*  
*8 Omirou Street*  
**ATHENS** 133  
*Post: 32-30-303, 32-37-371*  
*Tel: 21 59 62 PKAR GR*  
*E,M,P*

*"Plaiso"*  
*G. Gerardos*  
*24 Stournara Street*  
**ATHENS**  
*Tel: 36-11-160*  
<

# SALES & SUPPORT OFFICES

2

Arranged alphabetically by country



## PORTUGAL

Telectra-Empresa Técnica de Equipamentos Eléctricos S.a.r.l.  
Rua Rodrigo da Fonseca 103  
P.O. Box 2531

P-LISBON 1

Tel: (19) 68-60-72

Telex: 12598

A,C,E,P

Mundinter

Intercambio Mundial de Comércio S.a.r.l.

P.O. Box 2761

Avenida Antonio Augusto de Aguiar 138

P-LISBON

Tel: (19) 53-21-31, 53-21-37

Telex: 16691 munter p

M

## PUERTO RICO

Hewlett-Packard Puerto Rico  
P.O. Box 4407

CAROLINA, Puerto Rico 00630

Calle 272 Edificio 203

Urb. Country Club

RIO PIEDRAS, Puerto Rico 00924

Tel: (809) 762-7255

Telex: 345 0514

A,CP

## QATAR

Nasser Trading & Contracting  
P.O. Box 1563

DOHA

Tel: 22170

Telex: 4439 NASSER

M

Scitecharabia

P.O. Box 2750

I'DOHA

Tel: 329515

Telex: 4806 CMPARB

P

## ROMANIA

Hewlett-Packard Reprezentanta  
Boulevard Nicolae Balcescu 16

BUCURESTI

Tel: 130725

Telex: 10440

## SAUDI ARABIA

Modern Electronic Establishment  
P.O. Box 193

AL-KHOBAR

Tel: 44-678, 44-813

Telex: 670136

Cable: ELECTA AL-KHOBAR

C,E,M,P

Modern Electronic Establishment  
P.O. Box 1228, Baghdadiah Street

JEDDAH

Tel: 27-798

Telex: 401035

Cable: ELECTA JEDDAH

C,E,M,P

Modern Electronic Establishment  
P.O. Box 2728

RIYADH

Tel: 62-596, 66-232

Telex: 202049

C,E,M,P

## SCOTLAND

Hewlett-Packard Ltd.  
Royal Bank Buildings

Swan Street

BRECHIN, Angus, Scotland

Tel: 3101, 3102

CM,CS

Hewlett-Packard Ltd.

SOUTH QUEENSFERRY

West Lothian, EH30 9TG

GB-Scotland

Tel: (031) 3311000

Telex: 72682

A,CM,E,M

## SINGAPORE

Hewlett-Packard Singapore (Pty.)

Ltd.

P.O. Box 58 Alexandra Post Office

SINGAPORE, 9115

6th Floor, Inchcape House

450-452 Alexandra Road

SINGAPORE 0511

Tel: 631788

Telex: HPSGSO RS 34209

Cable: HEWPACK, Singapore

A,CP,E,MS,P

## SOUTH AFRICA

Hewlett-Packard South Africa (Pty.)

Ltd.

P.O. Box 120

Howard Place

Pine Park Center, Forest Drive,

Pinelands

CAPE PROVINCE 7450

Tel: 53-7955, 53-7956, 53-7957

Telex: 57-0006

A,CM,CS,E,MS,P

Hewlett-Packard South Africa (Pty.)

Ltd.

P.O. Box 37066

Overport

DURBAN 4067

Tel: 28-4178, 28-4179, 28-4110

CM,CS

Hewlett-Packard South Africa (Pty.)

Ltd.

P.O. Box 33345

Gienstantia 0010 TRANSVAAL

1st Floor East

Constantia Park Ridge Shopping

Centre

Constantia Park

PRETORIA Tel: 98-1126 or 98-1220

Telex: 32163

C,E

Hewlett-Packard South Africa (Pty.)

Ltd.

Daphny Street

Private Bag Wendywood

SANDTON 2144

Tel: 802-5111, 802-5125

Telex: 89-84782

Cable: HEWPACK Johannesburg

A,CM,CP,E,MS,P

## SPAIN

Hewlett-Packard Española S.A.

c/Entenza, 321

E-BARCELONA 29

Tel: (3) 322-24-51, 321-73-54

Telex: 52603 hpbee

A,CM,CP,E,MS,P

Hewlett-Packard Española S.A.

c/San Vicente S/N

Edificio Albia II, 7 B

E-BILBAO 1

Tel: (944) 423-8306, 423-8206

A,CM,E,MS

Hewlett-Packard Española S.A.

Calle Jerez 3

E-MADRID 16

Tel: 458-2600

Telex: 23515 hpe

A,CM,E,MP,P

Hewlett-Packard Española S.A.

Colonia Mirasierra

Edificio Juban

c/o Costa Brava 13, 2.

E-MADRID 34

Tel: 734-8061, 734-1162

CM,CP

Hewlett-Packard Española S.A.

Av Ramón y Cajal 1-9

Edificio Sevilla 1,

E-SEVILLA 5

Tel: 64-44-54, 64-44-58

Telex: 72933

A,CM,CS,MS,P

Hewlett-Packard Española S.A.

C/Ramon Gordillo, 1 (Entlo.3)

E-VALENCIA 10

Tel: 361-1354, 361-1358

CM,CS,P

## SWEDEN

Hewlett-Packard Sverige AB

Enghetsvägen 3, Fack

P.O. Box 20502

S-16120 BROMMA

Tel: (08) 730-0550

Telex: (854) 10721 MESSAGES

Cable: MEASUREMENTS

STOCKHOLM

A,CM,CP,E,MS,P

Hewlett-Packard Sverige AB

Sunnanvagen 14K

S-22226 LUND

Tel: (46) 13-69-79

Telex: (854) 10721 (via BROMMA

office)

CM,CS

Hewlett-Packard Sverige AB

Vastra Vintergatan 9

S-70344 ÖREBRO

Tel: (19) 10-48-80

Telex: (854) 10721 (via BROMMA

office)

CM,CS

Hewlett-Packard Sverige AB

Fritällsgatan 30

S-42132 VÄSTRA-FRÖLUNDA

Tel: (031) 49-09-50

Telex: (854) 10721 (via BROMMA

office)

CM,CS,E,P

## SWITZERLAND

Hewlett-Packard (Schweiz) AG

Clarastrasse 12

CH-4058 BASLE

Tel: (61) 33-59-20

A,CM

Hewlett-Packard (Schweiz) AG

47 Avenue Blanc

CH-1202 GENEVA

Tel: (022) 32-30-05, 32-48-00

CM,CP

Hewlett-Packard (Schweiz) AG

29 Chemin Château Bloc

CH-1219 LE LIGNON-Geneva

Tel: (022) 96-03-22

Telex: 27333 hpag ch

Cable: HEWPACKAG Geneva

A,CM,E,MS,P

Hewlett-Packard (Schweiz) AG

Zürcherstrasse 20

Allmend 2

CH-8967 WIDEN

Tel: (57) 50-111

Telex: 59933 hpag ch

Cable: HPAG CH

A,CM,CP,E,MS,P

## SYRIA

General Electronic Inc.

Nuri Basha-Ahmad Ebn Kays Street

P.O. Box 5781

DAMASCUS

Tel: 33-24-87

Telex: 11215 ITIKAL

Cable: ELECTROBOR DAMASCUS

E

Sawah & Co.

Place Azmé

Boite Postale 2308

DAMASCUS

Tel: 16-367, 19-697, 14-268

Telex: 11304 SATACO SY

Cable: SAWAH, DAMASCUS

M

## TAIWAN

Hewlett-Packard Far East Ltd.

Kaohsiung Branch

68-2, Chung Cheng 3rd Road

Shin Shin, Chu

KAOHSIUNG

Tel: 24-2318, 26-3253

CS,E,MS,P

Hewlett-Packard Far East Ltd.

Taiwan Branch

5th Floor

205 Tun Hwa North Road

TAIPEI

Tel: (02) 751-0404

Cable: HEWPACK Taipei

A,CP,E,MS,P

Hewlett-Packard Far East Ltd.

Taichung Branch

#33, Cheng Yih Street

10th Floor, Room 5

TAICHUNG

Tel: 289274

Ing Lih Trading Co.

3rd Floor 18, Po-la Road

TAIPEI

Tel:

Telex:

Cable: INGLIH TAIPEI

A

## THAILAND

UNIMESA Co. Ltd.

Elcom Research Building

2538 Sukhumvit Ave.

Bangchak, BANGKOK

Tel: 393-2387, 393-0338

Telex: TH81160, 82938, 81038

Cable: UNIMESA Bangkok

A,C,E,M

Bangkok Business Equipment Ltd.

5/5-6 Dejo Road

BANGKOK

Tel: 234-8670, 234-8671,

234-8672

Cable: BUSIQUIPT Bangkok

P

## TRINIDAD & TOBAGO

Caribbean Telecoms Ltd.

P.O. Box 732

50/A Jerminham Avenue

PORT-OF-SPAIN

Tel: 624 4213, 624 4214

A,CM,E,M,P

## TUNISIA

Tunisie Electronique

31 Avenue de la Liberté

TUNIS

Tel: 280-144

E,P

Corema

1 ter. Av. de Carthage

TUNIS

Tel: 253-821

Telex: 12319 CABAM TN



# SALES & SUPPORT OFFICES

Arranged alphabetically by country

## UNITED STATES (Cont.)

### California

Hewlett-Packard Co.  
7621 Canoga Avenue  
CANOGA PARK, CA 91304  
Tel: (213) 702-8300  
A,CM,CP,E,P

Hewlett-Packard Co.  
1579 W. Shaw Avenue  
FRESNO, CA 93771  
Tel: (209) 224-0582  
CM,MS

Hewlett-Packard Co.  
1430 East Orangethorpe  
FULLERTON, CA 92631  
Tel: (714) 870-1000  
CM,CP,E,MP

Hewlett-Packard Co.  
5400 W. Rosecrans Boulevard  
LAWNDALE, CA 90260  
P.O. Box 92105  
LOS ANGELES, CA 90009  
Tel: (213) 970-7500  
CM,CP,MP

Hewlett-Packard Co.  
3939 Lankershim Blvd.  
NORTH HOLLYWOOD, CA 91604  
Tel: (213) 877-1282  
Regional Headquarters

Hewlett-Packard Co.  
3200 Hillview Avenue  
PALO ALTO, CA 94304  
Tel: (415) 857-8000  
CM,CP,E

Hewlett-Packard Co.  
646 W. North Market Boulevard  
SACRAMENTO, CA 95834  
Tel: (916) 929-7222  
A\*,CM,CP,E,MS

Hewlett-Packard Co.  
9606 Aero Drive  
P.O. Box 23333  
SAN DIEGO, CA 92123  
Tel: (714) 279-3200  
CM,CP,E,MP

Hewlett-Packard Co.  
3003 Scott Boulevard  
SANTA CLARA, CA 95050  
Tel: (408) 988-7000  
A,CM,CP,E,MP

Hewlett-Packard Co.  
454 Carlton Court  
SO. SAN FRANCISCO, CA 94080  
Tel: (415) 877-0772  
CM,CP

### Colorado

Hewlett-Packard Co.  
24 Inverness Place, East  
ENGLEWOOD, CO 80112  
Tel: (303) 771-3455  
A,CM,CP,E,MS

### Connecticut

Hewlett-Packard Co.  
47 Barnes Industrial Road South  
P.O. Box 5007  
WALLINGFORD, CT 06492  
Tel: (203) 265-7801  
A,CM,CP,E,MS

### Florida

Hewlett-Packard Co.  
P.O. Box 24210  
2727 N.W. 62nd Street  
FORT LAUDERDALE, FL 33309  
Tel: (305) 973-2600  
CM,CP,E,MP

Hewlett-Packard Co.  
4080 Woodcock Drive, #132  
Brownett Building  
JACKSONVILLE, FL 32207  
Tel: (904) 398-0663  
CM,C\*,E\*,MS\*\*

Hewlett-Packard Co.  
P.O. Box 13910  
6177 Lake Ellenor Drive  
ORLANDO, FL 32809  
Tel: (305) 859-2900  
A,CM,CP,E,MS

Hewlett-Packard Co.  
6425 N. Pensacola Blvd.  
Suite 4, Building 1  
PENSACOLA, FL 32575  
Tel: (904) 476-8422  
A,CM,MS

Hewlett-Packard Co.  
110 South Hoover, Suite 120  
Vanguard Bldg.  
TAMPA, FL 33609  
Tel: (813) 872-0900  
A\*,CM,CS,E\*,M\*

### Georgia

Hewlett-Packard Co.  
P.O. Box 105005  
2000 South Park Place  
ATLANTA, GA 30339  
Tel: (404) 955-1500  
Telex: 810-766-4890  
A,CM,CP,E,MP

Hewlett-Packard Co.  
Executive Park Suite 306  
P.O. Box 816  
AUGUSTA, GA 30907  
Tel: (404) 736-0592  
CM,MS

Hewlett-Packard Co.  
P.O. Box 2103  
1172 N. Davis Drive  
WARNER ROBINS, GA 31098  
Tel: (912) 922-0449  
CM,E

### Hawaii

Hewlett-Packard Co.  
Kawaiahao Plaza, Suite 190  
567 South King Street  
HONOLULU, HI 96813  
Tel: (808) 526-1555  
A,CM,CS,E,MS

### Idaho

Hewlett-Packard Co.  
11311 Chinden Boulevard  
BOISE, ID 83707  
Tel: (208) 376-6000  
CM,CS,M\*

### Illinois

Hewlett-Packard Co.  
211 Prospect Road  
BLOOMINGTON, IL 61701  
Tel: (309) 663-0383  
CM,CS,MS\*\*

Hewlett-Packard Co.  
1100 31st Street  
DOWNERS GROVE, IL 60515  
Tel: (312) 960-5760  
CM,CP

Hewlett-Packard Co.  
5201 Tollview Drive  
ROLLING MEADOWS, IL 60008  
Tel: (312) 255-9800  
A,CM,CP,E,MP

### Indiana

Hewlett-Packard Co.  
P.O. Box 50807  
7301 No. Shadeland Avenue  
INDIANAPOLIS, IN 46250  
Tel: (317) 842-1000  
A,CM,CS,E,MS

### Iowa

Hewlett-Packard Co.  
2415 Heinz Road  
IOWA CITY, IA 52240  
Tel: (319) 351-1020  
CM,CS,E\*,MS

### Kansas

Hewlett-Packard Co.  
1644 S. Rock  
WICHITA, KA 67207  
Tel: (316) 265-5200  
CM,CS

### Kentucky

Hewlett-Packard Co.  
10170 Linn Station Road  
Suite 525  
LOUISVILLE, KY 40223  
Tel: (502) 426-0100  
A,CM,CS,MS

### Louisiana

Hewlett-Packard Co.  
P.O. Box 1449  
3229 Williams Boulevard  
KENNER, LA 70062  
Tel: (504) 443-6201  
A,CM,CS,E,MS

### Maryland

Hewlett-Packard Co.  
7121 Standard Drive  
HANOVER, MD 21076  
Tel: (301) 796-7700  
A,CM,CP,E,MS

Hewlett-Packard Co.  
2 Choke Cherry Road  
ROCKVILLE, MD 20850  
Tel: (301) 948-6370  
Telex: 710-828-9685  
A,CM,CP,E,MP

### Massachusetts

Hewlett-Packard Co.  
32 Hartwell Avenue  
LEXINGTON, MA 02173  
Tel: (617) 861-8960  
A,CM,CP,E,MP

### Michigan

Hewlett-Packard Co.  
23855 Research Drive  
FARMINGTON HILLS, MI 48024  
Tel: (313) 476-6400  
A,CM,CP,E,MP

Hewlett-Packard Co.  
4326 Cascade Road S.E.  
GRAND RAPIDS, MI 49506  
Tel: (616) 957-1970  
CM,CS,MS

### Minnesota

Hewlett-Packard Co.  
2025 W. Larpenteur Ave.  
ST. PAUL, MN 55113  
Tel: (612) 644-1100  
A,CM,CP,E,MP

### Mississippi

Hewlett-Packard Co.  
P.O. Box 5028  
322 N. Mart Plaza  
JACKSON, MS 39216  
Tel: (601) 982-9363  
CM,MS

### Missouri

Hewlett-Packard Co.  
11131 Colorado Avenue  
KANSAS CITY, MO 64137  
Tel: (816) 763-8000  
Telex: 910-771-2087  
A,CM,CS,E,MS

Hewlett-Packard Co.  
1024 Executive Parkway  
ST. LOUIS, MO 63141  
Tel: (314) 878-0200  
A,CM,CP,E,MP

### Nebraska

Hewlett-Packard  
7101 Mercy Road  
Suite 101, IBX Building  
OMAHA, NE 68106  
Tel: (402) 392-0948  
CM,MS

### Nevada

Hewlett-Packard Co.  
Suite D-130  
5030 Paradise Blvd.  
LAS VEGAS, NV 89119  
Tel: (702) 736-6610  
CM,MS\*\*

### New Jersey

Hewlett-Packard Co.  
Crystal Brook Professional Building  
Route 35  
EATONTOWN, NJ 07724  
Tel: (201) 542-1384  
A\*,CM,C\*,E\*,P\*

Hewlett-Packard Co.  
W120 Century Road  
PARAMUS, NJ 07652  
Tel: (201) 265-5000  
A,CM,CP,E,MP

Hewlett-Packard Co.  
60 New England Avenue West  
PISCATAWAY, NJ 08854  
Tel: (201) 981-1199  
A,CM,CP,E

### New Mexico

Hewlett-Packard Co.  
P.O. Box 11634  
11300 Lomas Blvd., N.E.  
ALBUQUERQUE, NM 87123  
Tel: (505) 292-1330  
Telex: 910-989-1185  
CM,CP,E,MS

### New York

Hewlett-Packard Co.  
5 Computer Drive South  
ALBANY, NY 12205  
Tel: (518) 458-1550  
Telex: 710-444-4691  
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Hewlett-Packard Co.  
9600 Main Street  
CLARENCE, NY 14031  
Tel: (716) 759-8621  
Telex: 710-523-1893

Hewlett-Packard Co.  
200 Cross Keys Office  
FAIRPORT, NY 14450  
Tel: (716) 223-9950  
Telex: 510-253-0092  
CM,CP,E,MS

Hewlett-Packard Co.  
No. 1 Pennsylvania Plaza  
55th Floor  
34th Street & 8th Avenue  
NEW YORK, NY 10119  
Tel: (212) 971-0800  
CM,CP,E\*,M\*

Hewlett-Packard Co.  
5858 East Molloy Road  
SYRACUSE NY 13211  
Tel: (315) 455-2486  
A,CM,CS,E,MS

Hewlett-Packard Co.  
3 Crossways Park West  
WOODBURY, NY 11797  
Tel: (516) 921-0300  
Telex: 510-221-2183  
A,CM,CP,E,MS

### North Carolina

Hewlett-Packard Co.  
P.O. Box 15579  
2905 Guess Road (27705)  
DURHAM, NC 27704  
Tel: (919) 471-8466  
C,M

Hewlett-Packard Co.  
5605 Roanne Way  
GREENSBORO, NC 27409  
Tel: (919) 852-1800  
A,CM,CP,E,MS

### Ohio

Hewlett-Packard Co.  
9920 Carver Road  
CINCINNATI, OH 45242  
Tel: (513) 891-9870  
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Hewlett-Packard Co.  
16500 Sprague Road  
CLEVELAND, OH 44130  
Tel: (216) 243-7300  
Telex: 810-423-9430  
A,CM,CP,E,MS

Hewlett-Packard Co.  
962 Crupper Ave.  
COLUMBUS, OH 43229  
Tel: (614) 436-1041  
CM,CP,E\*

Hewlett-Packard Co.  
330 Progress Rd.  
DAYTON, OH 45449  
Tel: (513) 859-8202  
A,CM,CP,E\*,MS

### Oklahoma

Hewlett-Packard Co.  
P.O. Box 366  
1503 W. Gore Blvd., Suite #2  
LAWTON, OK 73502  
Tel: (405) 248-4248  
C

Hewlett-Packard Co.  
P.O. Box 32008  
304 N. Meridan Avenue, Suite A  
OKLAHOMA CITY, OK 73107  
Tel: (405) 946-9499  
A\*,CM,CP,E\*,MS

Hewlett-Packard Co.  
Suite 121  
9920 E. 42nd Street  
TULSA, OK 74145  
Tel: (918) 665-3300  
A\*\*,CM,CS,M\*

### Oregon

Hewlett-Packard Co.  
1500 Valley River Drive, Suite 330  
EUGENE, OR 97401  
Tel: (503) 683-8075  
C

Hewlett-Packard Co.  
9255 S. W. Pioneer Court  
WILSONVILLE, OR 97070  
Tel: (503) 682-8000  
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### Pennsylvania

Hewlett-Packard Co.  
1021 8th Avenue  
King of Prussia Industrial Park  
KING OF PRUSSIA, PA 19406  
Tel: (215) 265-7000  
Telex: 510-660-2670  
A,CM,CP,E,MP

Hewlett-Packard Co.  
111 Zeta Drive  
PITTSBURGH, PA 15238  
Tel: (412) 782-0400  
A,CM,CP,E,MP

### South Carolina

Hewlett-Packard Co.  
P.O. Box 6442  
6941-0 N. Trenholm Road  
COLUMBIA, SC 29260  
Tel: (803) 782-6493  
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# SALES & SUPPORT OFFICES

Arranged alphabetically by country

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## UNITED STATES (Cont.)

### South Carolina (Cont.)

Hewlett-Packard Co.  
814 Wade Hampton Blvd.  
Suite 10  
GREENVILLE, SC 29609  
Tel: (803) 232-0917  
C

### Tennessee

Hewlett-Packard Co.  
P.O. Box 22490  
224 Peters Road  
Suite 102

KNOXVILLE, TN 37922  
Tel: (615) 691-2371  
A\*,CM,MS

Hewlett-Packard Co.  
3070 Directors Row  
MEMPHIS, TN 38131  
Tel: (901) 346-8370  
A,CM,CS,MS

Hewlett-Packard Co.  
Suite 103  
478 Craighead Street  
NASHVILLE, TN 37204  
Tel: (615) 383-9136  
CM,MS\*\*

### Texas

Hewlett-Packard Co.  
Suite 310W  
7800 Shoal creek Blvd.  
AUSTIN, TX 78757  
Tel: (512) 459-3143  
CM,E

Hewlett-Packard Co.  
Suite C-110  
4171 North Mesa  
EL PASO, TX 79902  
Tel: (915) 533-3555  
CM,CS,E\*,MS\*\*

Hewlett-Packard Co.  
5020 Mark IV Parkway  
FORT WORTH, TX 76106  
Tel: (817) 625-6361  
CM,C\*

Hewlett-Packard Co.  
P.O. Box 42816  
10535 Harwin Street  
HOUSTON, TX 77036  
Tel: (713) 776-6400  
A,CM,CP,E,MP

Hewlett-Packard Co.  
3309 67th Street  
Suite 24  
LUBBOCK, TX 79413  
Tel: (806) 799-4472  
M

Hewlett-Packard Co.  
P.O. Box 1270  
930 E. Campbell Rd.  
RICHARDSON, TX 75081  
Tel: (214) 231-6101  
A,CM,CP,E,MP

Hewlett-Packard Co.  
205 Billy Mitchell Road  
SAN ANTONIO, TX 78226  
Tel: (512) 434-8241  
CM,CS,E,MS

### Utah

Hewlett-Packard Co.  
3530 W. 2100 South Street  
SALT LAKE CITY, UT 84119  
Tel: (801) 974-1700  
A,CM,CP,E,MS

### Virginia

Hewlett-Packard Co.  
P.O. Box 9669  
2914 Hungary Spring Road  
RICHMOND, VA 23228  
Tel: (804) 285-3431  
A,CM,CP,E,MS

Hewlett-Packard Co.  
P.O. Box 4786  
3110 Peters Creek Road, N.W.  
ROANOKE, VA 24015  
Tel: (703) 563-2205  
CM,CS,E\*\*

Hewlett-Packard Co.  
P.O. Box 12778  
5700 Thurston Avenue  
Suite 111  
VIRGINIA BEACH, VA 23455  
Tel: (804) 460-2471  
CM,CS,MS

### Washington

Hewlett-Packard Co.  
15815 S.E. 37th Street  
BELLEVUE, WA 98006  
Tel: (206) 643-4000  
A,CM,CP,E,MP

Hewlett-Packard Co.  
Suite A  
708 North Argonne Road  
SPOKANE, WA 99206  
Tel: (509) 922-7000  
CM,CS

### West Virginia

Hewlett-Packard Co.  
4604 MacCorkle Ave., S.E.  
CHARLESTON, WV 25304  
Tel: (304) 925-0492  
A,CM,MS

### Wisconsin

Hewlett-Packard Co.  
150 S. Sunny Slope Road  
BROOKFIELD, WI 53005  
Tel: (414) 784-8800  
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### URUGUAY

Pablo Ferrando S.A.C. e.l.  
Avenida Italia 2877  
Casilla de Correo 370  
MONTEVIDEO  
Tel: 403102  
Telex: 901 Public Booth Para Pablo  
Ferrando 919520  
Cable: RADIUM Montevideo  
A,CM,E,M

Guillermo Kraft del Uruguay S.A.  
Avda. Libertador Brig. Gral.  
Lavalleja 2083  
MONTEVIDEO  
Tel: 234588, 234808, 208830  
Telex: 6245 ACTOUR UY  
P

### U.S.S.R.

Hewlett-Packard Co.  
Representative Office  
Pokrovsky Blvd. 4/17 KV12  
MOSCOW 101000 Tel: 294-2024  
Telex: 7825 HEWPACK SU

### VENEZUELA

Hewlett-Packard de Venezuela C.A.  
Apartado 50933  
3A Transversal Los Ruices Norte  
Edificio Segre Y3  
CARACAS 1071  
Tel: 239-4133, 239-4777,  
239-4244  
Telex: 25146 HEWPACK  
Cable: HEWPACK Caracas  
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### YUGOSLAVIA

Iskra-Commerce-Representation of  
Hewlett-Packard  
Sava Centar Delegacija 30  
Milentija Popovica 9  
11170 BEOGRAD  
Tel: 638-762  
Telex: 12042, 12322 YU SAV CEN

Iskra-Commerce-Representation of  
Hewlett-Packard  
Kopraska 46  
61000 LJUBLJANA  
Tel: 321674, 315879  
Telex:

### ZAMBIA

R. J. Tilbury (Zambia) Ltd.  
P.O. Box 2792  
LUSAKA  
Tel: 81243  
A,E,M,P

### ZIMBABWE

Field Technical Sales  
45 Kelvin Road, North  
P.B. 3458  
SALISBURY  
Tel:  
C,E,M,P

## FOR COUNTRIES AND AREAS NOT LISTED:

### CANADA

Ontario  
Hewlett-Packard (Canada) Ltd.  
6877 Goreway Drive  
MISSISSAUGA, Ontario L4V 1M8  
Tel: (416) 678-9430  
Telex: 610-492-4246

### EASTERN USA

Maryland  
Hewlett-Packard Co.  
4 Choke Cherry Road  
Rockville, MD 20850  
Tel: (301) 258-2000

### MIDWESTERN USA

Illinois  
Hewlett-Packard Co.  
5201 Tollview Drive  
ROLLING MEADOWS, IL 60008  
Tel: (312) 255-9800

### SOUTHERN USA

Georgia  
Hewlett-Packard Co.  
P.O. Box 105005  
450 Interstate N. Parkway  
ATLANTA, GA 30339  
Tel: (404) 955-1500

### WESTERN USA

California  
Hewlett-Packard Co.  
3939 Lankersim Blvd.  
LOS ANGELES, CA 91604  
Tel: (213) 877-1282

## EUROPEAN AREAS NOT LISTED, CONTACT

### SWITZERLAND

Hewlett-Packard S.A.  
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CH-1217 MEYRIN 2, Switzerland  
Tel: (022) 83-81-11  
Telex: 27835 hpse  
Cable: HEWPACKSA Geneve

## EAST EUROPEAN AREAS NOT LISTED, CONTACT

### AUSTRIA

Hewlett-Packard Ges.m.b.h.  
Wehlstrasse 29  
P.O. Box 7  
A-1205 VIENNA  
Tel: (222) 35-16-210  
Telex: 135823/135066

## MEDITERRANEAN AND MIDDLE EAST AREAS NOT LISTED, CONTACT

### GREECE

Hewlett-Packard S.A.  
Mediterranean & Middle East  
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35, Kolokotroni Street  
Platia Kefallariou  
GR-Kifissia, ATHENS, Greece  
Tel: 808-0359, 808-0429  
Telex: 21-6588  
Cable: HEWPACKSA Athens

## INTERNATIONAL AREAS NOT LISTED, CONTACT

### OTHER AREAS

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