

64000

**HP64000
Logic Development
System**

**Model 64050A
Screen Printer Interface**



**HEWLETT
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Service Manual, Model 64050A
Screen Printer Interface
64050-90901, July 1982

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SERVICE MANUAL
MODEL 64050A
SCREEN PRINTER
INTERFACE

REPAIR NUMBERS

This manual applies directly to
Screen Printers with repair
number prefix of 2230A.

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LOGIC SYSTEMS DIVISION
COLORADO SPRINGS, COLORADO, U.S.A.

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Manual Part Number 64050-90901

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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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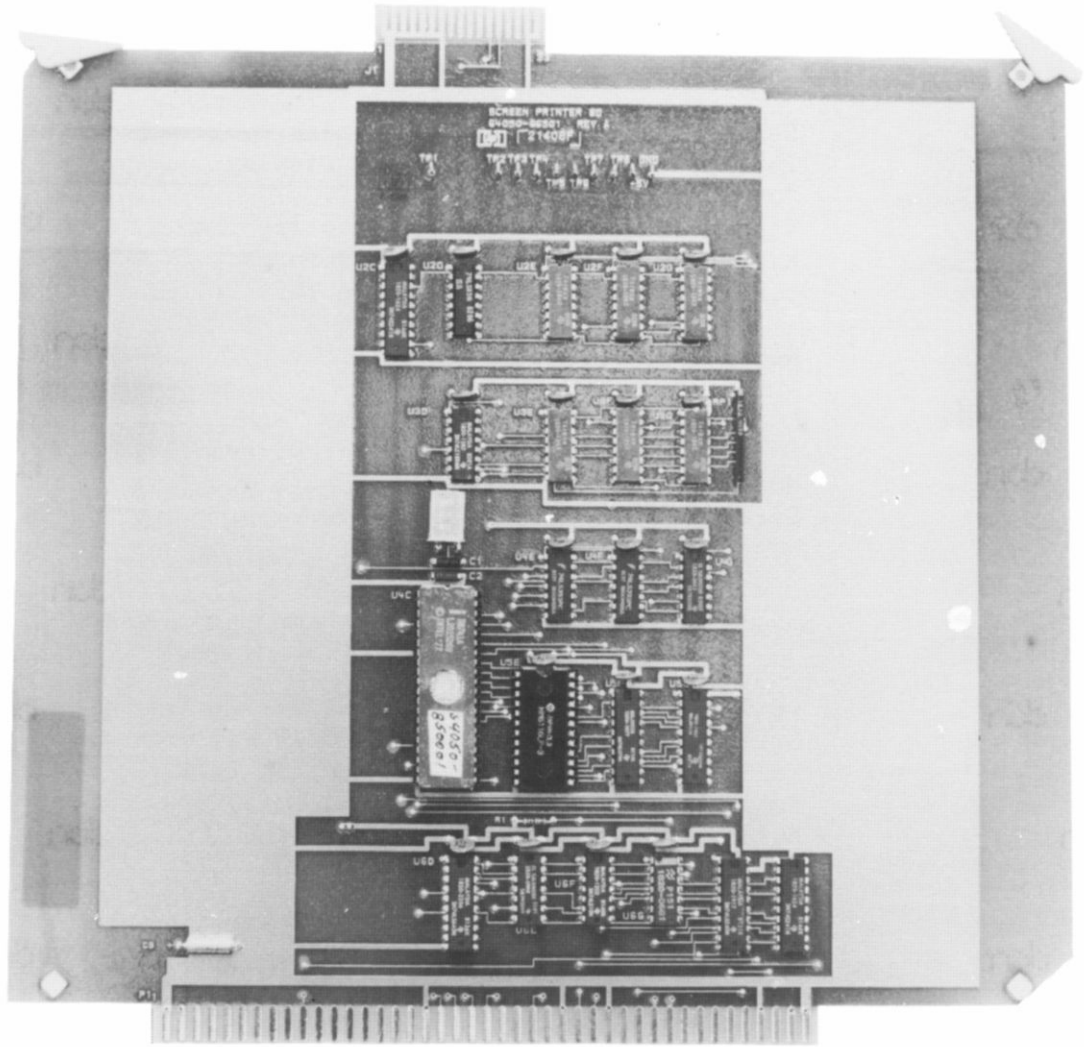


Figure 1-1. Model 64050A Screen Printer Interface

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This Service Manual contains information required to install, test and service the Hewlett-Packard Model 64050A Screen Printer.

1-3. Shown on the title page is a microfiche part number. This number can be used to order a 4 X 6-inch microfilm transparency of the manual. Each microfiche contains up to 96 photoduplicates of the manual pages.

1-4. INSTRUMENTS COVERED BY THIS MANUAL.

1-5. Attached to the instrument or printed on the printed circuit board is the repair number. The repair number is in the form: 0000A00000. It is in two parts; 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 instruments. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the repair number prefix(es) listed under REPAIR NUMBERS on the title page.

1-6. An instrument manufactured after the printing of this manual may have a repair number prefix that is not listed on the title page. This unlisted repair number prefix indicates that the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a Manual Changes Supplement. The supplement contains "change information" that explains how to adapt the manual for the newer instrument.

1-7. In addition to change information, the supplement contains information for correcting errors in the 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 part number, both of which appear on the manual title page.

1-8. For information concerning a repair number prefix that is not listed on the title page or in the Manual Changes Supplement, call your nearest Hewlett-Packard office.

1-9. DESCRIPTION.

1-10. The Model 64050A Screen Printer Interface (SPI) provides the 64000 system with the ability to reproduce graphic video displays in hard copy. By monitoring the video bus directly and converting the serial data stream found there to parallel data, the screen printer Interface permits a dot by dot reconstruction of the CRT display on graphics printers.

1-11. Using the Screen Printer Interface Board, any of the graphics (including ASCII characters, timing diagrams, and histograms) displayed on the 64000 series CRT's can now be reproduced in hard copy.

1-12. The 64000 system busses open collector video lines to all option card slots. Application hardware, such as timing, then generate their own displays and overlay them on the system display by pulling on these video lines. This video bus is monitored by the Screen Printer Interface and the signals are converted to a data form which can be used by a graphics printer, output to a device over RS-232, or written to a file.

1-13. ACCESSORIES SUPPLIED.

1-14. A 64050-61601 cable is supplied to connect the Screen Printer Interface board to the Display Controller Board.

1-15. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-16. The Screen Printer Interface is used with a 64100-66519 Display Control board and a Timing Analysis Subsystem. The Model 64100-66507 Display Control Board, which may be found in mainframes with a serial prefix number of 2033A or below, is not compatible with the Model 64050A; it must be replaced by the 64100-66519. The Screen Printer Interface may be used with either an HP Model 2631G or 2673A Graphics Printer.

1-17. RECOMMENDED TEST EQUIPMENT.

Dual channel Oscilloscope	100 MHz, dual channel, delayed sweep, time interval measurement, 0.1 nS resolution, .5 nS accuracy	HP1722B
Extender Board		64110-66503
Cable - Extended 34 pin		8120-4084

1-18. Related Manuals

Service Manuals

State Timing Control Manual

State Timing Acquisition Manual

64100A or 64110A Mainframe Manual (Display Controller)

Operation Manuals

Logic Timing Analyzer Reference Manual

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information for installing and removing the Model 64050A. Included are initial inspection procedures and instructions for repacking the instrument for shipment.

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 for completeness and the instrument has been checked mechanically and electrically. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the Performance Tests, notify the nearest Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement at HP's option without waiting for claim settlement.

2-5. INSTALLATION.

2-6. Figure 2-1 shows a top view of the 64100A and 64110A mainframe cardcages and the recommended position for the Screen Printer Interface. The Model 64050A Screen Printer Interface can be installed in either the 64100A or 64110A mainframes. To install the 64050A select the appropriate mainframe model number then follow the procedure for that mainframe.

WARNING

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

CAUTION

The 64050A Screen Printer Interface must be installed and removed with the 64000 power turned off. Damage to the unit may otherwise result.

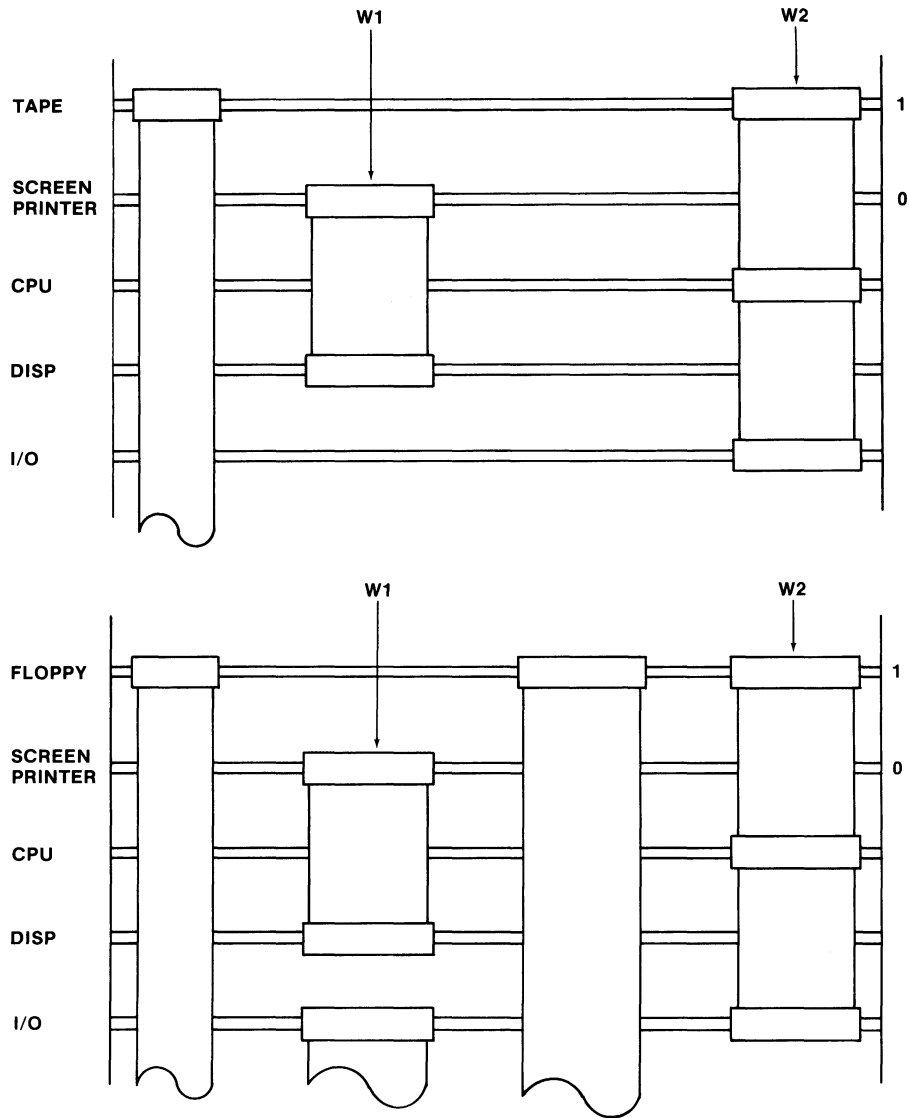
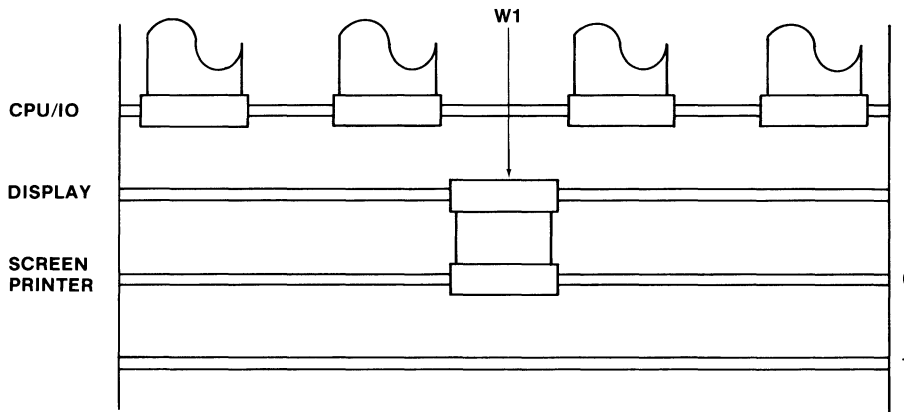


Figure 2-1. Screen Printer Interface Installation in Model 64100A



1. 64050-61601 Screen Printer Cable W1
2. 64050-61602 New IOD Cable W2

Figure 2-2. Screen Printer Interface Installation in Model 64110A

2-7. Model 64100A Option Board Installation Procedure.

- a. Remove power from the 64100A.
- b. (omitted)
- c. The recommended position for the Model 64050A Screen Printer Interface Board is option slot #0, the first option slot from the front of the development station. If a tape controller board or a floppy disc controller board is already present in slot #0, it should be moved to slot #1 and the IOD cable replaced with the enclosed cable.
- d. Grasp the board by the extractor levers located at the top of the board. 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 mother board connector are aligned, and push the board down until seated firmly in the connector.
- e. Use the bus cable (W1) which is supplied with the Model 64050A to connect the Screen Printer Interface Board to the Display Board. Use the new IOD cable (W2) included to re-connect the Tape or Floppy Disc Board to the CPU and I/O boards.

2-8. Model 64110A Option Board Installation Procedure.

- a. Remove power from the 64110A.
- b. (omitted)
- c. The recommended position for the Model 64050A Screen Printer Interface Board is option slot #0, the third option slot from the top of the development station.
- d. Grasp the board by the extractor levers located at the top of the board. Hold the board with the component side toward the top of the development station and the card-edge connector labeled P1 toward the front of the card cage. Insert the board into the selected card slot guide rails, make sure P1 and the mother board connector are aligned, and push the board in until seated firmly in the connector.
- e. Use the bus cable (W1) which is supplied with the Model 64050A to connect the Screen Printer Interface Option Board to the Display Board.

2-9. PREPARATION FOR USE.

2-10. Power Requirements.

	min	nom	max
+5.0 V	0.5 A	1.0 A	1.5 A

2-11. OPERATING ENVIRONMENT.

2-12. The instrument 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.

2-13. STORAGE AND SHIPMENT ENVIRONMENT.

2-14. The instrument may be stored and shipped in environments within the following limits:

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

2-15. Packaging.

2-16. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-17. Other Packaging. The following general instructions should be used for repacking with commercially available materials:

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

- b. Use strong shipping container. A double-wall carton made 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 instrument to provide firm cushioning and prevent movement inside container.
- d. Seal shipping container securely.
- e. Mark shipping container FRAGILE to ensure careful handling.
- f. In any correspondence, refer to instrument by model number and full serial number.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. Operation of the Model 64050A is beyond the scope of this manual; however, the small sample of operating procedure which follows will illustrate the use of the softkey choices which are available with this 64000 series option.

3-3. EXAMPLE. (With timing analysis boards in the mainframe)

3-4. The first softkey display depends on the number of measurement systems loaded in the mainframe. If more than one system is present the first selections will be:

```
meas_sys      RETURN
timing    <slot#>  RETURN
```

If only one timing system is present the first selection will be:

```
timing      RETURN
```

The remainder of the selection process will be:

```
show      diagram      RETURN
copy  timing_diagram  graphic  to  printer  RETURN
```

3-5. If the graphic softkey does not appear, the 64050A is not being recognized. If "copy timing_diagram" does not appear, the newest version of timing software is not present.

SECTION IV

PERFORMANCE VERIFICATION AND TROUBLESHOOTING

4-1. INTRODUCTION.

4-2. This section provides an explanation of the performance verification tests and a troubleshooting guide. The performance verification provides approximately 90% assurance that the Screen Printer Interface Board is operating properly. The troubleshooting guide explores the failure indications of the Performance Verification to pinpoint the failure to component level. The guide includes a troubleshooting flowchart as an aid in the highspeed hardware block.

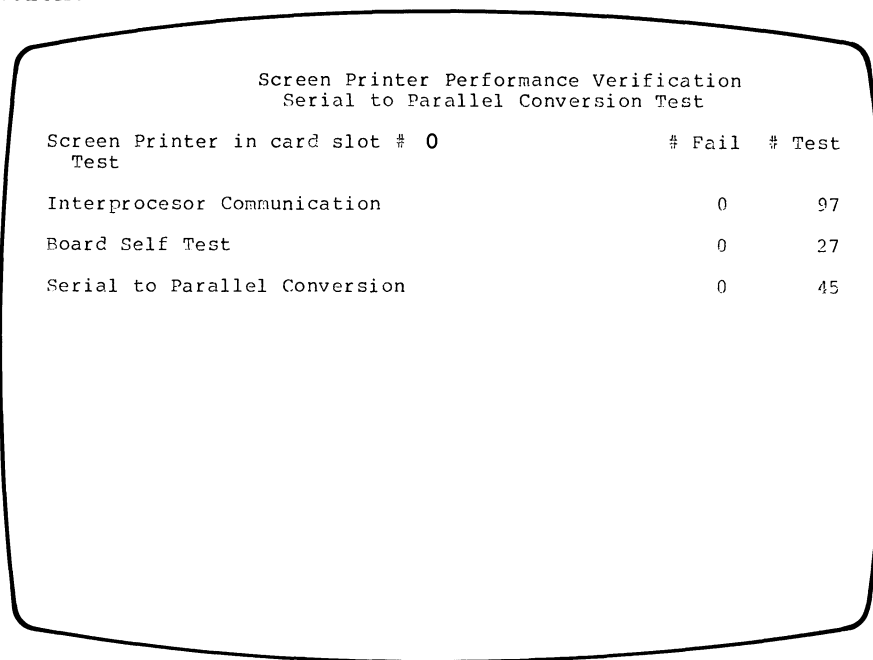
4-3. PERFORMANCE VERIFICATION.

4-4. Description.

4-5. Performance Verification includes three tests: Interprocessor Communications Test, Board Self Test and Serial to Parallel Conversion Test. Any of these tests may be chosen separately, started and stopped; or they may be automatically cycled through in order. If the board is not functioning correctly, cycle through the tests before running one of them individually. The CRT displays the total number of tests and the total number of failed tests. Refer to Subsection 4-11 TROUBLESHOOTING for a detailed description of the Performance Tests.

4-6. Equipment.

4-7. No external test equipment is needed for Performance Verification.



Screen Printer Performance Verification Serial to Parallel Conversion Test		
Screen Printer in card slot #	# Fail	# Test
Test		
Interprocessor Communication	0	97
Board Self Test	0	27
Serial to Parallel Conversion	0	45

Figure 4-1. Performance Verification Display

4-8. Procedure. The softkeys used in the Performance Verification are defined in Table 4-1.

4-9. To cycle through all three tests repeatedly. See Figure 4-1.

```
opt_test  RETURN
<slot#>  RETURN
cycle
```

(the softkey display will be highlighted while the software runs the tests)

To stop the tests depress:

```
cycle
```

4-10. To select and run one test:

```
opt_test  RETURN
<slot#>  RETURN
next_test (until correct test is highlighted on CRT display)
start     RETURN
```

To end test:

```
end      RETURN
```

Table 4-1. Option Test Softkey Selections

cycle	Loops continually through all three tests until manually stopped.
end	Returns display to beginning of option selection process.
next_test	Selects the next subtest in the sequence.
print	Prints the current display.
Return	Prompts the operator to depress RETURN on the keyboard.
<slot#>	Prompts the operator to select the slot number of the board to be tested.
start	Begins execution of a test.

4-11. TROUBLESHOOTING.

4-12. The troubleshooting guide is organized in a separate section for each of the three Performance tests. For example the Inter-processor Communication Test guide includes a sample CRT display, a description of the PV software, and a list of probable causes for the subtest failures. In addition, the Board Self Test includes a troubleshooting tree for the Highspeed Hardware section. Tables 4-2 through 4-5 list possible causes for failure in each test.

4-13. If PV indicates a failure first reseal the Screen Printer Board in the motherboard and verify the +5 volt supply. If the failure persists follow the troubleshooting guidelines.

4-14. Equipment.

- Dual Channel Oscilloscope.....HP1722B
- Extender Board.....64110-66503
- Cable, Extended 34 pin.....8120-4084

4-15. Board ID Failure.

4-16. A hex code identifies each option board in the 64000 system; the Screen Printer Interface is identified by 1003H. Table 4-2 lists possible causes for failures when the mainframe attempts to read the Screen Printer Interface ID code.

Table 4-2. Screen Printer Interface Board ID Failures

POSSIBLE CAUSES	CONCLUSIONS IF IF THIS IS NOT A PROBLEM
<p>NO BOARD ID</p> <p>U6F pin 8 stuck high</p> <p>U6H pins 5,9 or 12 stuck low</p>	<p>no conclusions</p>
<p>INCORRECT BOARD ID</p> <p>U6E pins 3,6 or 8 stuck high</p> <p>U6F pin 6 stuck low</p> <p>U6I pin 9 stuck high</p> <p>U6D pins 4,5,6,7,8 or 9 stuck low</p>	<p>board ID ok</p> <p>U6E pins 3,6, and 8 are ok</p> <p>U6F pin 8 is ok</p> <p>U6H pins 5,9, and 12 are ok</p>

Screen Printer Performance Verification Interprocessor Communication Test		
Screen Printer in card slot # 0 Test	# Fail	# Test
Reset Response	0	40
Echo Data = 55H	0	
Echo Data = AAH	0	

Figure 4-2. Interprocessor Communication Test Display

4-17. Interprocessor Communication Test. See Figure 4-2.

4-18. This test, made up of three subtests, exercises the communication path between the 8741 microprocessor located on the SPI Board and the mainframe. The 8741 is a peripheral processor which acts as an interface between the display hardware and the mainframe.

4-19. Reset Response Test. The PV software reads the 8741 data register to clear the output buffer full flag, then issues a RESET command to the Screen Printer Interface Board. If the 8741 status register contains 00H after 1 mS the 8741 executed the reset command and the Reset Response Test passed.

4-20. Echo Data Test Data = 55H. PV software issues an Echo Data command to the SPI Board followed by the data to be echoed back to the mainframe, 55H. The mainframe waits for the Output Buffer Full status from the Board which indicates that it is echoing the data to be read by the mainframe and compared to 55H.

4-21. Echo Data Test Data = AAH. The PV software repeats the previous test using data = AAH to toggle all data lines between the two processors in both high and low states.

Table 4-3. Fails Interprocessor Communication Test

POSSIBLE CAUSES	CONCLUSIONS IF IF THIS IS NOT A PROBLEM
RESET RESPONSE SUBTEST	
Y1 not oscillating U6F pin 12 stuck low U6H pin 3 stuck high or low U6G pin 8 stuck high U6D failure U4C failure	no conclusions
ECHO DATA SUBTEST = 055H	
Y1 not oscillating U6F pins 6 or 12 stuck high U6G pin 8 stuck high U6H pin 3 stuck high or low U6H pin 7 stuck low U6I pins 7,9, or 12 stuck low U6D failure U4C FAILURE	Y1 oscillating U6F pins 6 and 12 ok U6G pin 8 is ok U6H pins 3 and 7 ok U6I pins 7 and 9 ok U4D even pins are ok U4C pins 6,8,9,10,12,14, 16, and 18 ok
ECHO DATA SUBTEST = 0AAH	
U6D failure U4C failure	U6D odd pins are ok U4C pins 13,15,17,19 ok

Screen Printer Performance Verification Board Self Test		
Screen Printer in card slot # 0 Test	# Fail	# Test
Buffer Memory	0	23
Display Controller Connection	0	
Linecounter Hardware	0	
High Speed Counters	0	

Figure 4-3. Board Self Test

4-22. Board Self Test. See Figure 4-3.

4-23. The Self Test command exercises approximately 90% of the hardware on the Screen Printer Interface which returns a status word to the mainframe showing the results of the test. The Self Test contains four subtests and the number of tests performed and failed are tabulated on the CRT display for each test.

4-24. Buffer Memory Test. The Printer Interface uses a 2k x 8 buffer memory to store the display data one row at a time. To test the data bus, buffer memory, memory address counters and read/write circuitry the 8741 performs a write/read/compare, complement/read/compare on the entire 2k x 8 buffer memory.

4-25. Display Controller Connection Test. This tests verifies that the screen Interface Board is receiving the correct signals from the display controller by monitoring the LVRTRC (vertical retrace) signal at the 8741.

4-26. Line counter Hardware Test. This verifies the presence of the line counter inputs from the display controller, the presence of horizontal sync (LHSYNC), and the proper operation of the hardware enable line (HHWEN) and buffer full signal (LBUFFULL).

4-27. High Speed Counter Test. The Self Test enables counters 2E-2G and 3E-3G then monitors the hardware test line, HWTEST, for the correct timing relationship.

Table 4-4. Fails Board Self Test.

POSSIBLE CAUSES	CONCLUSIONS IF IF THIS IS NOT A PROBLEM
BUFFER MEMORY TEST	
U2C pins 5 or 16 stuck high	U2C pins 5 and 16 are ok
U3D pin 7 stuck high	U6E pin 11 is ok
U3E pin 12 stuck high	U6G pin 11 is ok
U4G pin 8 stuck low	U5E is ok
U6E pin 11 stuck high or low	U4E is ok
U6G pin 11 stuck high or low	U4F is ok
U4C pin 35 stuck low	U4C pins 20-25, 27-34, and 35 are ok
U5E failure	
U5F failure	
U4E failure	
U4F failure	
U4C failure	
DISPLAY CONTROLLER CONNECTION TEST	
U2C pin 12 stuck high or low	U2C pin 12 is ok
bad cable	line 8 of cable is ok
U4C failure	U4C pin 1 is ok

Table 4-4 (con't)

POSSIBLE CAUSES	CONCLUSIONS IF IF THIS IS NOT A PROBLEM
LINE COUNTER HARDWARE SUBTEST	
U6I pin 3 stuck high or low	U6I pin 3 is ok
bad cable	lines 22-25 of cable are ok
U2D failure	U2D is ok
U3D failure	U3D is ok
U4C failure	U4C pin 39 is ok
HIGH SPEED COUNTER SUBTEST *	
U2C pin 18 stuck high or low	U2C pin 18 is ok
U4G pins 2,4, or 6 stuck high or low	U4G pins 2,4, and 6 ok
U6G pin 3 stuck high or low	U6G pin 3 is ok
bad cable	line 2 of cable is ok
U4C failure	U4C pin 26 is ok
U2E failure	U2E is ok
U2F failure	U2F is ok
U2G failure	U2G is ok
U3E failure	U3E is ok
U3F failure	U3F is ok
U3G failure	U3G is ok

SEE
TROUBLESHOOTING
TREE
Figure 4-4

* If the Highspeed Counter Subtest fails always troubleshoot that block first. Figure 4-4 is a troubleshooting tree for this block, Figure 4-5 illustrates the waveforms which should be found when following the troubleshooting tree.

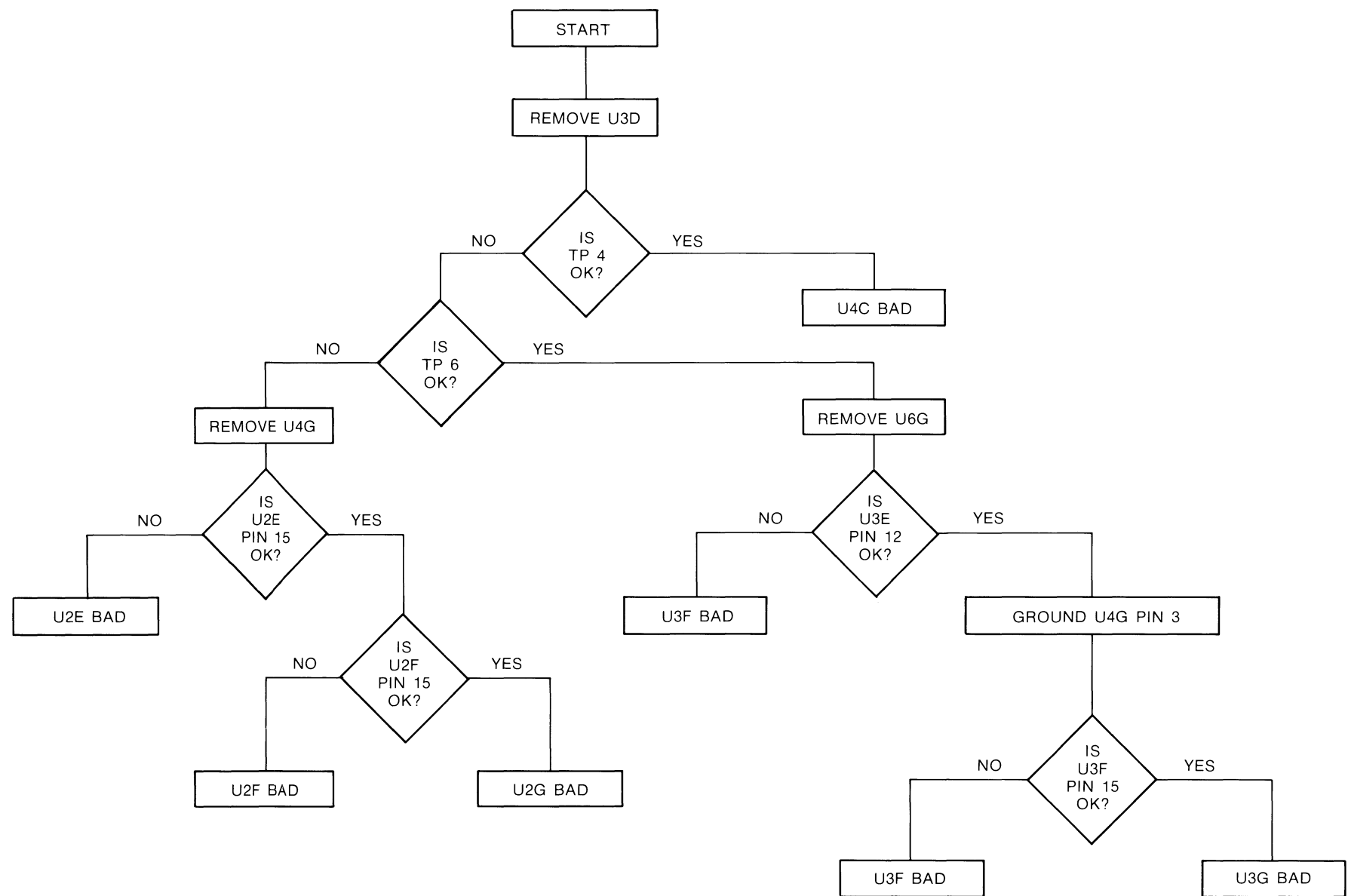


Figure 4-4. Highspeed Hardware Troubleshooting Tree

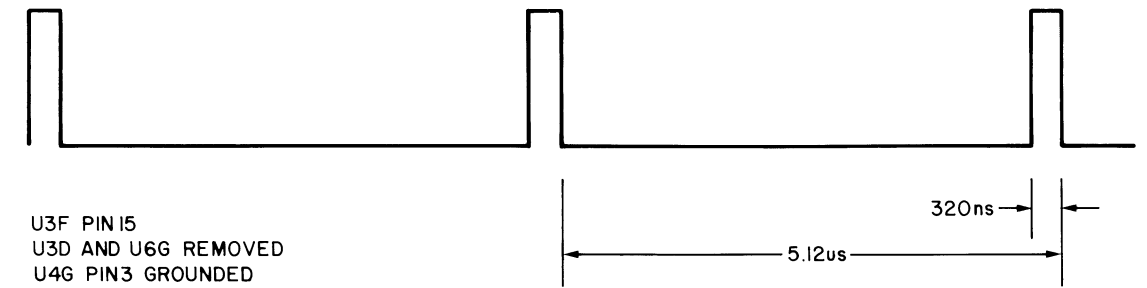
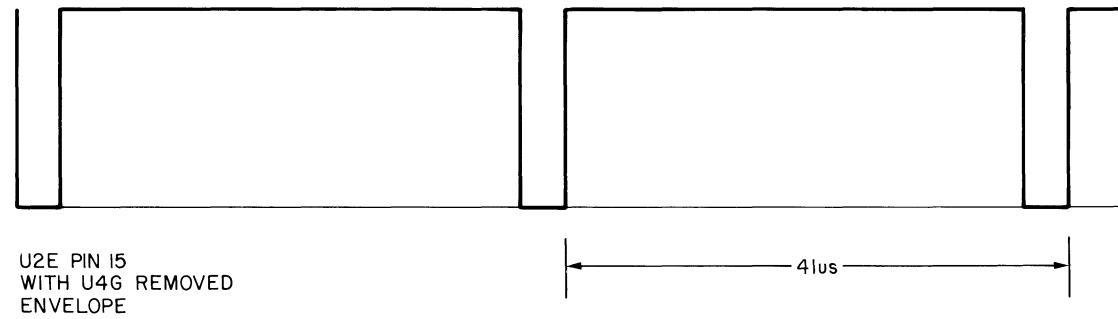
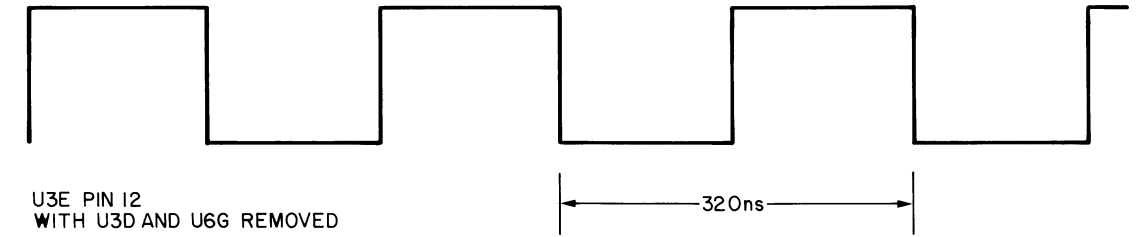
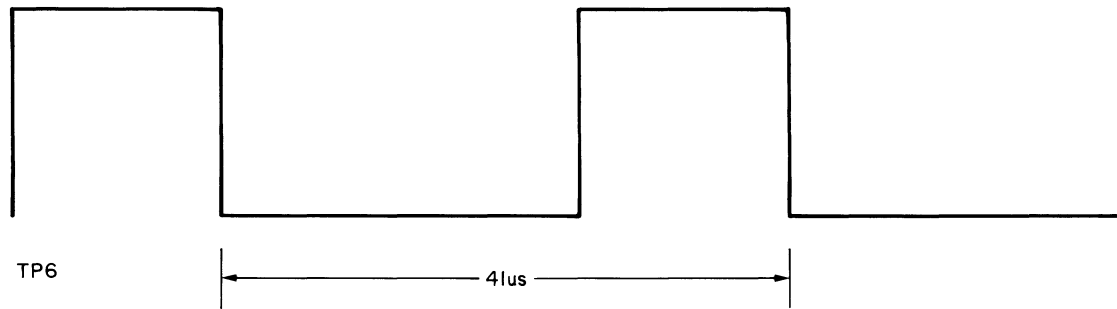
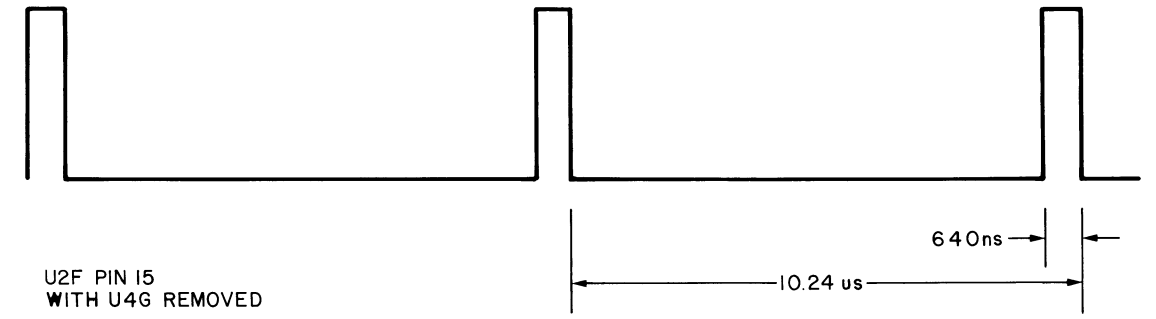
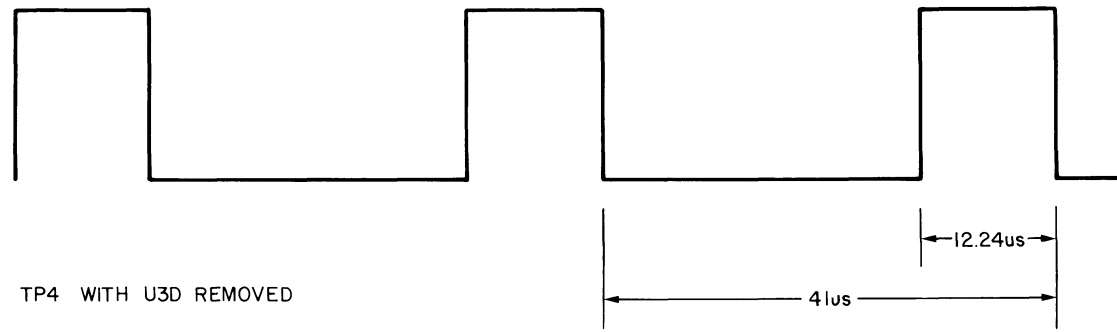


Figure 4-5. Highspeed Counter Subtest Waveforms.

Screen Printer Performance Verification		
Screen Printer in card slot # 0 Test	# Fail	# Test
Interprocessor Communication	0	0
Board Self Test	0	0
Serial to Parallel Conversion	0	0

Figure 4-6. Serial to Parallel Conversion Test.

4-28. Serial to Parallel Conversion Test. See Figure 4-6.

4-29. Serial to Parallel Conversion is tested by converting an entire character row (15 scan lines x 720 dots/scan line) of known information on the screen into parallel data and comparing that data to the expected data. The known data is the sixteenth line from the top of the screen and contains the single character "-". The known data is then 10,793 "off" dots and the seven "on" dots corresponding to the seven dots in "-". The screen printer converts the sixteenth line on the display into parallel data and the data it returns to the mainframe is compared to the known parallel data pattern for that line.

Table 4-5. Fails Serial to Parallel Conversion Test

POSSIBLE CAUSES	CONCLUSIONS IF IF THIS IS NOT A PROBLEM
U6G pin 6 is stuck high or low	U6G pin 6 is ok
U5F failure	U5F is ok
U5G failure	U5G is ok

SECTION V
ADJUSTMENTS

The Model 64050A Screen Printer Interface requires no adjustments.

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering parts. Table 6-1 lists abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 contains names and addresses that correspond to the manufacturers' code numbers.

6-3. ABBREVIATIONS.

6-4. Table 6-1 lists abbreviations used in the parts list, the schematics and throughout the manual. In some cases, two forms of the abbreviations are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-5. REPLACEABLE PARTS LIST.

6-6. Table 6-2 is the list of replaceable parts and is organized as follows:

- a. Electrical assemblies and their components in alphanumerical order by reference designation.
- b. Chassis-mounted parts in alphanumerical order by reference designation.
- c. Miscellaneous parts.
- d. Illustrated parts breakdowns, if appropriate.

The information given for each part consists of the following:

- a. The Hewlett-Packard part number.
- b. The total quantity (Qty) in the instrument.
- c. The description of the part.
- d. A typical manufacturer of the part in a five-digit code.
- e. The manufacturer's number for the part.

The total quantity for each part is given only once--at the first appearance of the part number in the list.

6-7. ORDERING INFORMATION.

6-8. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard Office.

6-10. SPARE PARTS KIT.

6-11. At this time no Spare Parts Kit is available for this instrument

6-12. DIRECT MAIL ORDER SYSTEM.

6-13. Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are as follows:

a. Direct ordering and shipment from the HP Parts Center in Mountain View, California.

b. No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local HP office when orders require billing and invoicing).

c. Prepaid transportation (there is a small handling charge for each order).

d. No invoices--to provide these advantages, a check or money order must accompany each order.

6-14. Mail order forms and specific ordering information is available through your local HP office. Addresses and phone numbers are located at the back of this manual.

Table 6-1. Reference Designators and Abbreviations

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

Table 6-2. Replaceable Parts List

Reference Designator	HP Part Number	C D	Qty	Description	Mfr Code
C1-2,5-21	0160-5512	9	19	CAPACITOR FIXED	28480
C3	0180-0328	8	1	CF 1A 22 UF 15 V	56289
C4	0160-2055	9	2	CF CE .10 UF 100 V	51406
C22	0160-2055	9		CF CE .10 UF 100 V	28480
TP1-10	0360-0535	0	10	TERM-TEST POINT	46819
Y1	0210-1393	7	1	CRYSTAL 8.0 MHZ	28480
R1	0757-0280	3	1	RF .12 MF 1K	24546
XU5E	1200-0541	1	1	SOCKET 24 PIN	76381
XU4C	1200-0654	7	1	SOCKET IC 40 PIN	28480
RP1	1810-1280	8	1	RES NET 10K X 9	28480
U2C	1820-1624	7	2	IC 74S241	01295
U2D	1820-1419	8	1	IC 74LS85	01295
U2E-G	1820-1942	2	6	IC 74S163J	01295
U2D	1820-1419	8	1	IC 74LS85	01295
U2E-G	1820-1942	2	6	IC 74S163J	01295
U2D	1820-1419	8	1	IC 74LS85	01295
U2E-G	1820-1942	2	6	IC 74S163J	0129528
U4C	64050-80001	9	1	IC 8741A	28480
U4E-F	1820-1989	7	2	IC 74LS393	07263
U4C	1820-0683	6	1	IC 74S04	01295
U5E	1818-1611	7	1	IC HM6116P-3	01295
U5F	1820-1677	0	1	IC 74S374	01295
U5G	1820-1457	4	1	IC 74S299	01295
U6D	1820-2206	3	1	IC 74LS640	01295
U6E	1820-1448	3	1	IC 74S09	01295
U6F	1820-1202	7	1	IC 74LS10	01295
U6G	1820-0681	4	1	IC 74S00	01295
U6H	1820-1917	1	1	IC 74LS240	07263
U6I	1820-1624	7	1	IC 74S241	01295
MP1	64050-85001	9	1	EXTRACTOR PC BD	28480
MP2	64050-85002	0	1	EXTRACTOR PC BD	28480
W1	64050-61601	5	1	CABLE ASSEMBLY	28480
W2	64050-61602	6	1	CABLE ASSEMBLY	28480

Table 6-3. List of Manufacturers' Codes

Mfr. No.	Manufacturer Name	Address
00779 76381 07263 51406 46819 24546 28480	AMP INC 3M CO FAIRCHILD SEMICONDUCTOR MURATA CORP OF AMERICA OVERLAND PRODUCTS CO CORNING GLASS WORKS HEWLETT-PACKARD CO CORPORATE HQ	HARRISBURG PA ST PAUL MINN ROBERTSVILLE CA MARIETTA GA FRENCH CREEK CA BRADFORD PA PAID ALTO CA

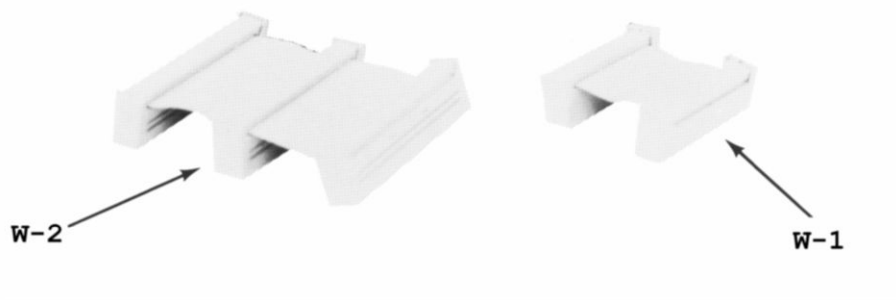
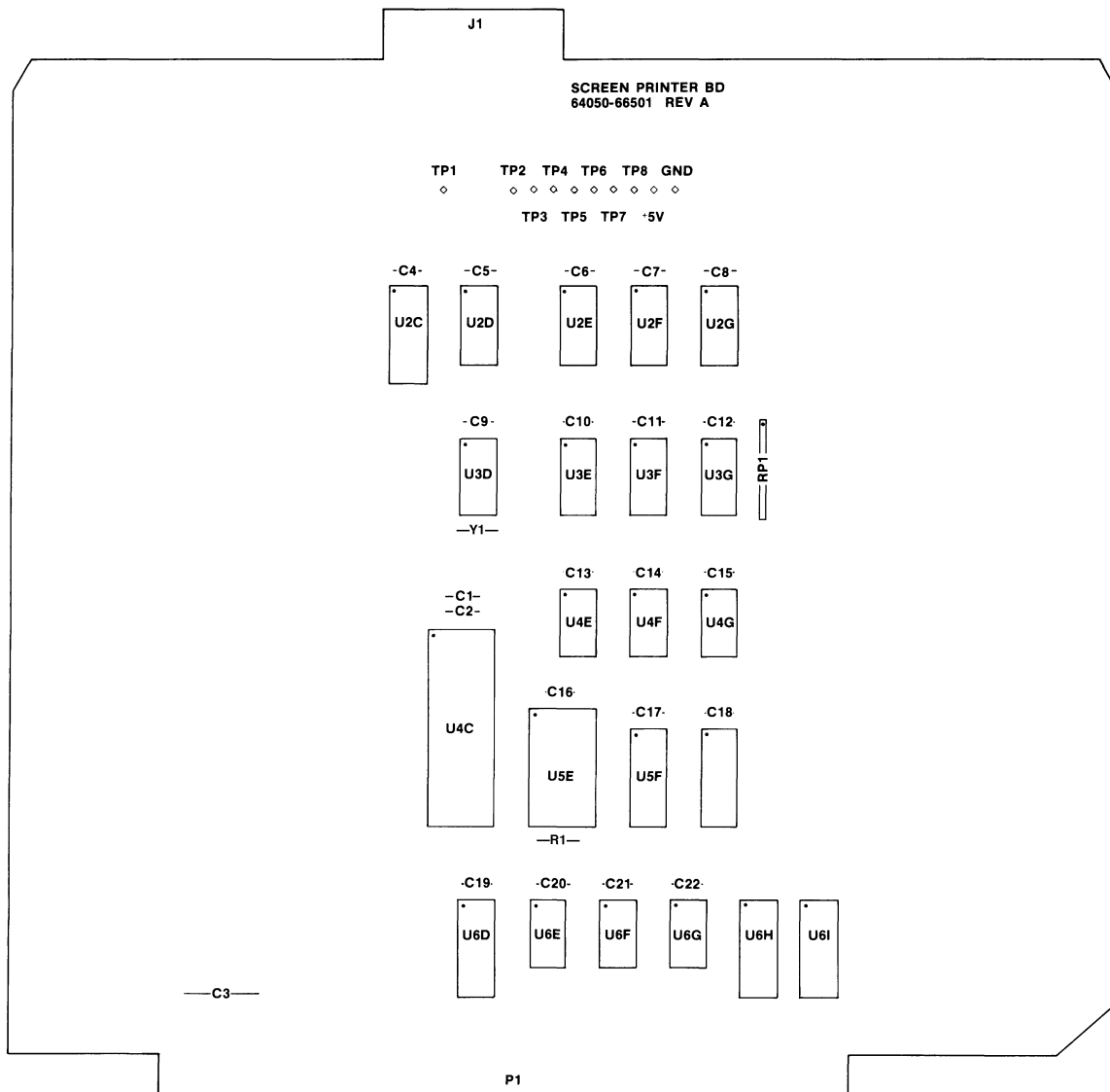


Figure 6-1. Replaceable Parts Locator

SECTION VII

MANUAL CHANGES

This section normally contains information for backdating this manual for models with repair numbers prior to the one shown on the title page. Because this edition includes the information for the first repair number there is no backdating material.

SECTION VIII

THEORY AND SCHEMATICS

8-1. INTRODUCTION.

8-2. This section contains block and component level theory and schematics for the 64050A Screen Printer Interface. The block diagram, schematic, component locator, and other service information are provided in foldout service sheets to help in servicing the Screen Printer Interface. Figure 8-1 illustrates some of the terms used in the discussion of Printer Interface Theory (8-7).

8-3. LOGIC CONVENTIONS. The positive logic convention is used for logic variables and circuits within the 64050A. Positive logic defines a "1" as the more positive voltage (high) and a "0" as the more negative logic (low).

8-4. LOGIC LEVELS. TTL high +2.0 volts; low +0.8 volts

8-5. POWER SUPPLIES. The mainframe supplies +5 volts to the Screen Printer Interface.

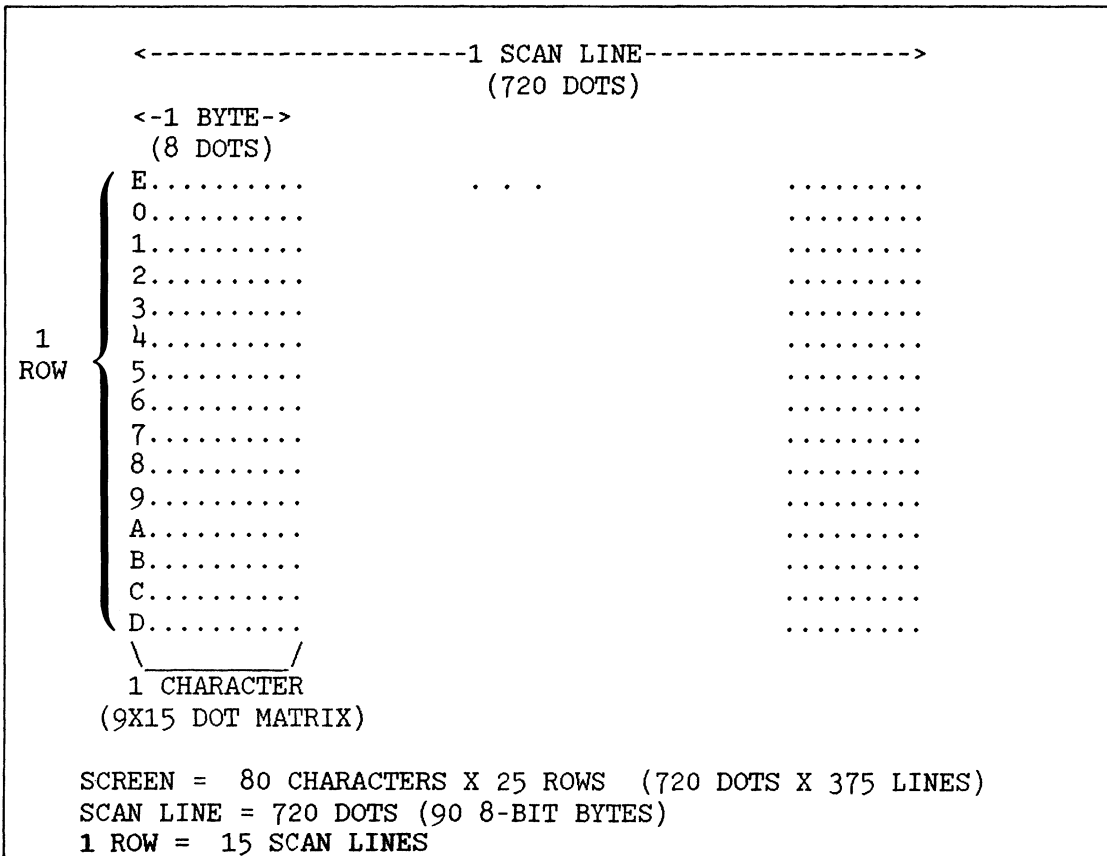


Figure 8-1. Definitions of Graphic Display Terms

8-6. THEORY.

8-7. OVERVIEW. During the following description please refer to the block diagram illustrated in Figure 8-2. The basic function of the Screen Printer Interface is to receive serial data bits from the display control board and convert them to parallel data configured in bytes to be transferred to the mainframe processor. The high speed hardware block converts 8 bits of serial data to 1 byte of parallel data which is then stored in the buffered memory. 1350 of these data bytes are stored sequentially in the buffered memory (90bytes/scan line x 15 scan lines/row). This row of data is transferred to the mainframe processor, the next row of data to be converted is identified by the 8741 processor, the hardware is reset and the process is repeated.

8-8. THEORY. During the following discussion please refer to Service Sheet 1. The keys to understanding the Screen Printer Interface are the signals received from the display controller and the mainframe processor which the printer interface uses to control the timing of the high speed hardware section.

8-9. LHSYNC and DOTCLK provide timing for the highspeed hardware. LHSYNC, the horizontal synchronization signal, defines the beginning of a scanline of data. DOTCLK defines the period of time for each dot. LLC 0-3, received from the display controller, provides a continuous count of the number of scan lines in each row.

8-10. U2E through U2G, High Speed Counters, are configured as a self-stopping 12-bit counter which enables Byte Clock, U3E, a preset number of dot clocks after LHSYNC. This signal disables acquisition while the display is retracing from the right side of the screen back to the left. When the screen has completed its retrace, the hardware is enabled to read in the next line.

8-11. DOTCLK clocks U3E, the Byte Clock, a divide by 8 counter which clocks data into the parallel data latch on the rising edge of BYTECLK and into the buffer memory on the falling edge of BYTECLK.

8-12. U3F and U3G, the Byte Counters, count 90 bytes after the Byte Clock, U3E, is enabled and then disable the Byte Clock.

8-13. U5G is a shift left register clocked by DOTCLK. When a byte of data has been clocked into the shift register, the BYTECLK latches it into data latch U5F. Data is latched out of U5F and into buffer memory on the opposite edge of BYTECLK.

8-14. The data is written into buffer memory byte by byte. The addresses are sequentially incremented by the address counters U4E and U4F. When the buffer memory is full (one entire row of data) the microprocessor is triggered by LBUFFUL to reset and increment the address counters to read the data out of buffer memory.

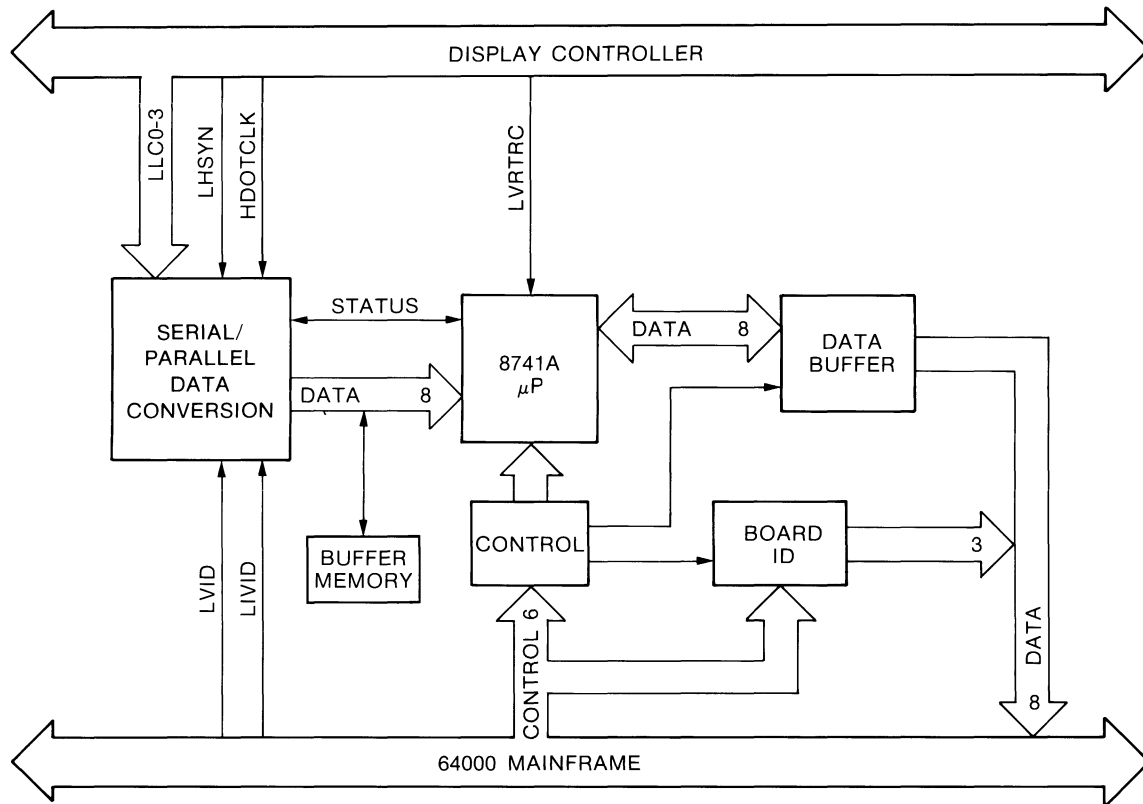


Figure 8-2. Screen Printer Interface Block Diagram

8-15. The mainframe processor programs the 8741 to select rows of data from the display for conversion from serial to parallel data. The convert instruction which the 8741 receives is a two part command: the number of the first row to be converted, and the number of rows to be converted. The 8741 monitors LVRTRC (low vertical retrace) to identify the row which is to be converted. LVRTRC pulses low once each time the entire screen has been scanned (once every 405 lines). The 8741 uses its internal timer to delay enabling the hardware until the beginning of the row to be converted which will occur a predefined time period after LVRTRC.

8-16. LLC0-3 are counting the fifteen scan lines per row of data continuously and being compared to "D" (hex) by U2D. When U4C (8741) identifies a row which needs to be captured it presets U3D with a high on HHWEN. As soon as U2D counts to "D" (indicating that a new row is about to begin) it pulses high. At the beginning of the next line LHSYNC clocks that high into U3DB. The high output from U3DB clocks U3DA, which toggles and enables the Byte Clock Counter. LBUFFUL stays high and U3DA remains preset until the beginning of the next row when U3DA toggles again, LBUFFUL notifies the 8741 to pull HHWEN low, and HHWEN disables the Byte Clock.

8-17. The remainder of the circuitry consists of an I/O data buffer and control circuitry for chip select, read/write, and reset in addition to A0 which is used as a command line. The Printer Interface ID code, 1003H, is generated here as well.

8-18. MNEMONICS.

8-19. Signals in the 64050A have been assigned mnemonics which describe the active state and function of the signal line. A prefix letter (H, L, P, or N) indicates the active state of the signal and the remaining letters indicate its function. An H prefix indicates that the function is active in the high state; an L prefix indicates that it is active in the low state. For devices that are edge sensitive the prefix "P" indicates that the function is active on the positive going edge; the prefix "N" indicates that the device is active on the negative going edge.

Table 8-1. Mnemonics

TO/FROM MAINFRAME	
LA0	LOW ADDRESS 0. Address input to 8741 which indicates whether the byte transfer is data or command.
LD0-7	LOW DATA 0-7. Data bus which carries all transfer of data, status or commands between the screen printer interface and the host system.
LD12	LOW DATA 12. LD0,LD1 and LD12 are pulled low to generate the model 64050 ID code 1003H.
LHSYNC	LOW HORIZONTAL SYNC. This signal which is received from the mainframe is defined by the 41 uS for scan and retrace.
LVID	LOW VIDEO. This signal is low when a full bright video dot is on.
LIVID	LOW INVERSE VIDEO. This signal is low when a half-bright video dot is on.
LSTSB	LOW STROBE. LSTB is a signal from the motherboard which indicates that data is being read to or written from the bus. High indicates that data is available on the bus.
LWRT	LOW WRITE. This input from mainframe processor is used to read or write data and status from the 8741.
LID	LOW ID. This signal must be active to enable the board ID code on to the data bus.

Table 8-1 (con't)

LSEL	LOW SELECT. An active low select enables the 8741 chip select and the data bus buffer U6D.
LPOP	LOW POWER ON PULSE. This signal is used to reset 8741 status flipflops and to initialize program counter to zero at power up.
INTRA SCHEMATIC MNEMONICS	
BYTECLK	BYTE CLOCK. This signal is generated from LHSYNC and HDOTCLK to latch a byte of data out of the serial-parallel converter and write it into the buffer memory.
DB0-7	BUFFERED DATA 0-7. Buffered data bus between U5F, the data latch; U5E, the buffer memory; and U4C, the 8741.
LBUFFUL	LOW BUFFER FULL. This signal generated by U3DA when a complete row of data has been acquired by the screen printer interface causes the 8741 to disable U3DA.
HHWEN	HIGHSPEED HARDWARE ENABLE. HHWEN is a signal generated by the 8741 which goes high to preset U3DA and goes low to disable it.
LMEMIN	LOW MEMORY IN. This signal is generated by the 8741 to enable the output of the parallel latch for inputting data to the buffer memory.
HWTEST	HARDWARE TEST. Used to check counter output during self test.
ADDRCLR	ADDRESS CLEAR. This signal generated by the 8741 is used to clear the sequential address counters U4E and U4F.
ADDRINC	ADDRESS INCREMENT. This signal generated by the 8741 enables the counters which increment the addresses being read out of memory.
LBDSEL	LOW BOARD SELECT. This signal selects the 8741 and the interface data buffer.
LIDSEL	LOW ID SELECT. This line must be active to enable the board ID code onto the data bus.

Table 8-1 (con't)

TO/FROM DISPLAY CONTROLLER	
LVRTRC	LOW VERTICAL RETRACE. This signal pulses low once each time the display screen has been scanned (once every 405 lines.)
HDOTCLK	HIGH DOT CLOCK. This signal defines the period of time for each dot (40 nS).
LLC0-3	LOW LINE COUNT 0-3. These signals provide a count for the 15 scan lines required to form a character row.

NOTES

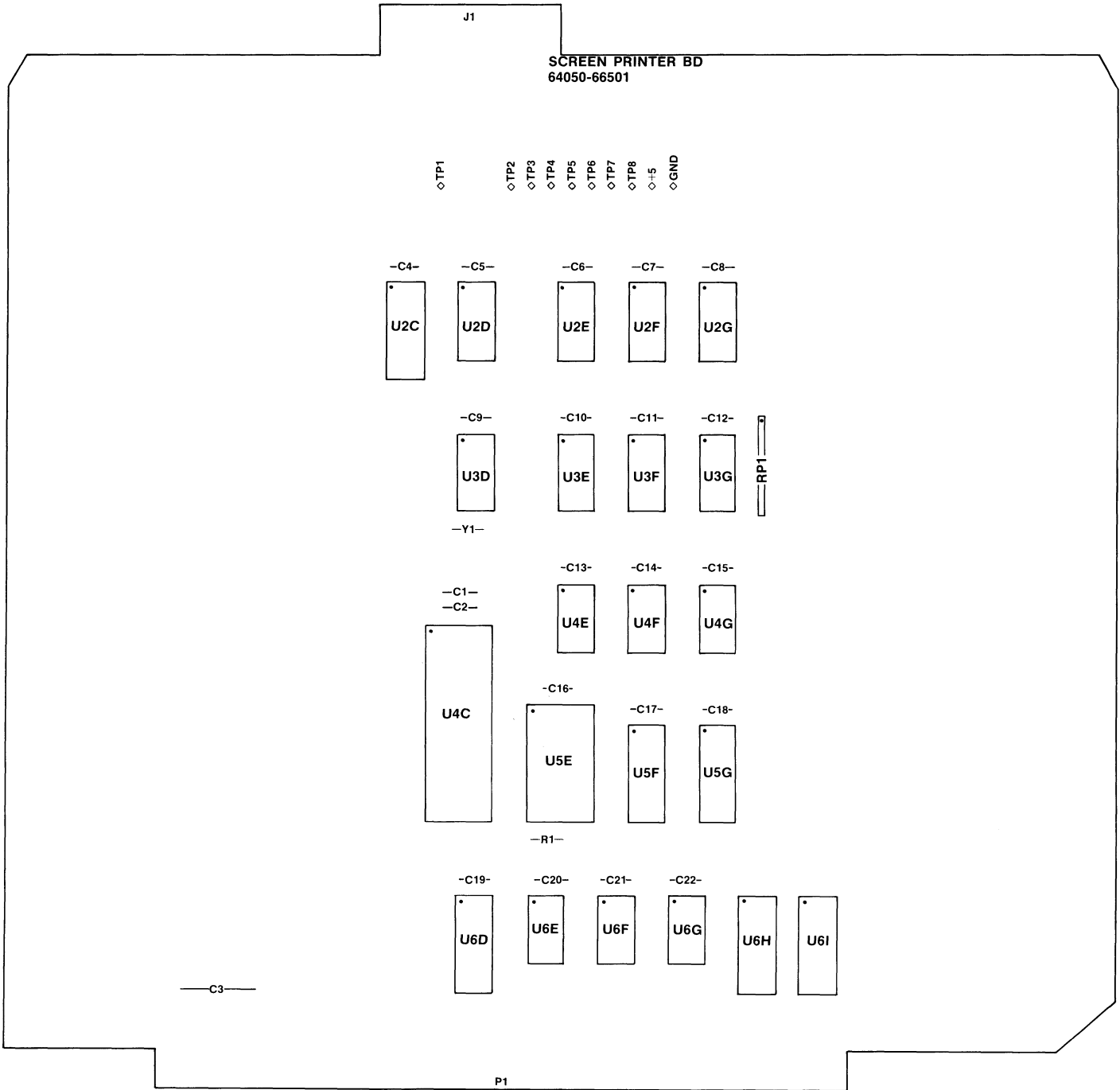
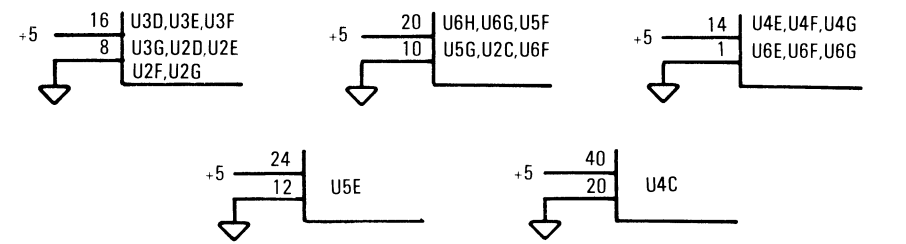
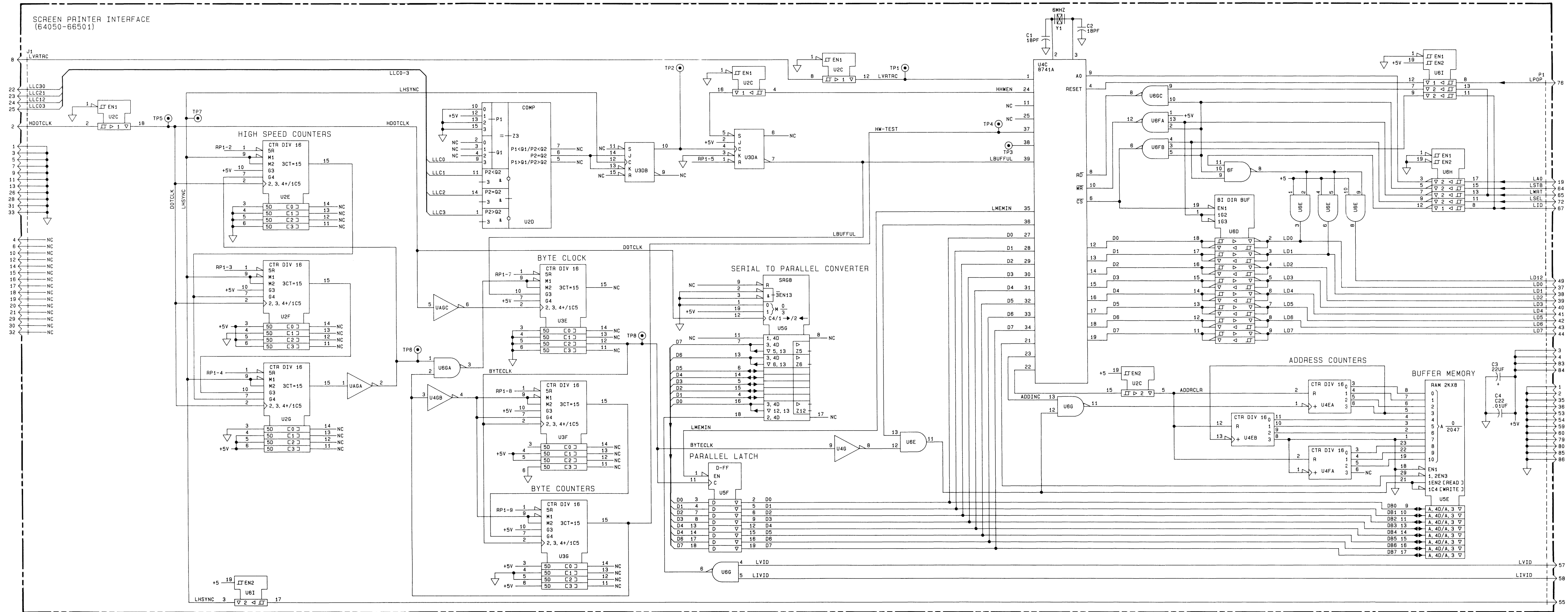


Figure 8-3. Model 64050A Component Locator



ICs ON THIS SCHEMATIC

Ref Des	HP Part No.	Mfr Part No.
U2C	1820-1624	74S241
U2D	1820-1419	74LS85
U2E-G	1820-1942	74LS163J
U3D	1820-1282	74LS109
U3E-G	1820-1942	74LS163J
U4C	64050-90901	8741A
U4E-F	1820-1989	74LS393N
U4G	1820-0683	74S04
U5E	1818-1611	HM6116P-3
U5F	1820-1677	74S374
U5G	1820-1457	74S299
U6E	1820-1448	74S09
U6F	1820-1202	74LS10
U6G	1820-0681	74S00
U6H	1820-1917	74LS240N
U6I	1820-1624	74S241

PARTS ON THIS SCHEMATIC

- C1-2
- C3
- C4-22
- TP1-10
- Y1
- R1
- XU5E
- XU4C
- RP1

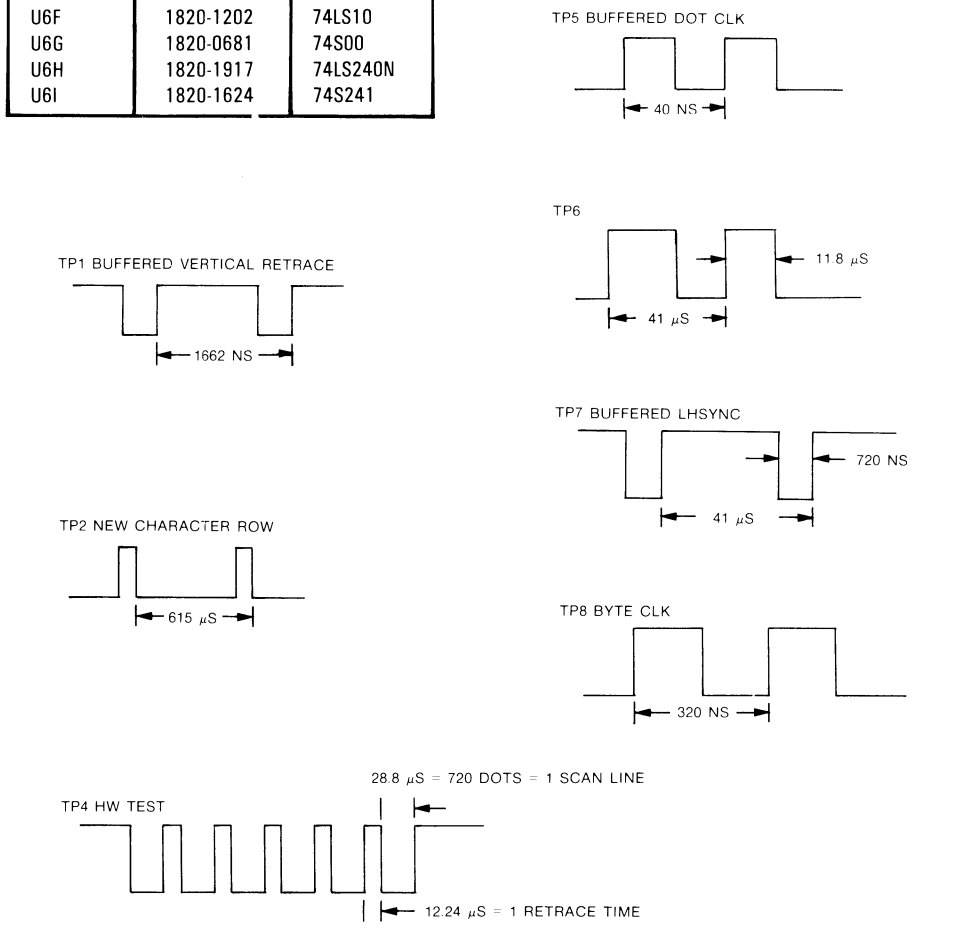


Figure 8-4.
Service Sheet 1
8-9

SALES & SUPPORT OFFICES

Arranged alphabetically by country



Product Line Sales/Support Key

Key Product Line

A Analytical

CM Components

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CS Computer Systems Software Sales and Services

E Electronic Instruments & Measurement Systems

M Medical Products

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Photo & Cine Equipment
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W.J. Towell Computer Services
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