

HP 82937A

HP-IB INTERFACE

SERVICE MANUAL



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General Information

1-1. INTRODUCTION

1-2. This service manual contains information to help you troubleshoot and repair the HP 82937A HP-IB Interface.

1-3. The manual is divided into six sections, which give:

- o A description of the HP-IB interface (section I).
- o A brief description of its main circuits (section II).
- o Information for disassembling and reassembling the interface (section III).
- o Steps for troubleshooting, repairing, and testing the interface (section IV).
- o Lists of replaceable parts (section V).
- o Reference diagrams (section VI).

1-4. Before using this manual in an actual repair, read through sections I and II to learn about the interface and its operation, and sections III through VI to become familiar with the service procedures.

1-5. DESCRIPTION

1-6. The HP 82937A HP-IB Interface Module connects the HP-85 Computer to the Hewlett-Packard Interface Bus. The interface conforms to IEEE Standard 488-1978 and supports a wide variety of operations, permitting the HP-85 to communicate with and control peripheral devices.

1-7. The HP-IB interface requires one of several HP-85 ROMs to perform input-output operations. The type of ROM used determines which operations can be performed by the interface. Available ROMs include:

- o Mass Storage ROM (part number 00085-15001).
- o Plotter/Printer ROM (part number 00085-15002).
- o I/O ROM (part number 00085-15003).

Table 1-1. Specifications

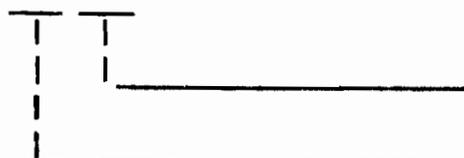
Physical Properties	
o Dimensions:	16.7 x 12.7 x 1.5 cm (6.59 x 5.00 x 0.59 in).
o Cable Length:	2 m (6 ft).
o Weight:	0.5 kg (1.1 lb).
Power Requirements	
o DC Voltages:	+12V, +6V, +5V, -5V provided by HP-85.
Compatibility	
o Plugs into any HP-85 I/O port.	
o Requires use of an interface ROM (refer to paragraph 1-7).	
o Interfaces one HP-IB peripheral (HP 82937A HP-IB Interface alone).	
o Interfaces up to 14 HP-IB peripherals using accessory cables.	
Temperature Limits	
o Operating Temperature:	0 to 55 degrees C (32 to 131 degrees F).
o Storage Temperature:	-40 to 75 degrees C (-40 to 167 degrees F).
o Operating Humidity:	5 to 95 percent relative humidity at 40 degrees C (104 degrees F).

1-8. Specifications for the HP 82937A HP-IB Interface are listed in table 1-1.

1-9. IDENTIFICATION

1-10. The manufacture date of the interface is used for determination of warranty status. The date code is stamped on the printed-circuit board in white ink. Its format is described below.

Y Y W W



Week manufactured.

Year manufactured (years since 1960).

1-11. ACCESSORIES

1-12. Part numbers and descriptions of accessories used with the HP 82937A HP-IB Interface are listed in table 1-2.

Table 1-2. Accessory Descriptions

HP MODEL/PART NUMBER	DESCRIPTION
HP 10833D	Accessory Cable, 1/2 meter
HP 10833A	Accessory Cable, 1 meter
HP 10833B	Accessory Cable, 2 meters
HP 10833C	Accessory Cable, 4 meters
HP 10834A	Adapter (for peripherals not able to accept cable connector)
5060-0138	Conversion Kit (for peripherals requiring American-thread fasteners on cable connector)



Functional Description

2-1. INTRODUCTION

2-2. The HP 82937A HP-IB Interface Module (see figure 2-1) is based on six primary integrated circuits (IC's):

- o The microcomputer IC.
- o The translator IC.
- o The two transceiver IC's.
- o The switch buffer IC.
- o The control latch IC.

2-3. All of these IC's are contained on the interface PCA (printed-circuit assembly). (See figure 6-2 for the schematic diagram of the interface.)

2-4. The HP-IB module connects to the HP-85 by plugging into one of the ports on the HP-85. The connector on the end of the interface cable plugs into the HP-IB receptacle on the peripheral device. Accessory cables are used to connect additional peripherals to the HP-IB.

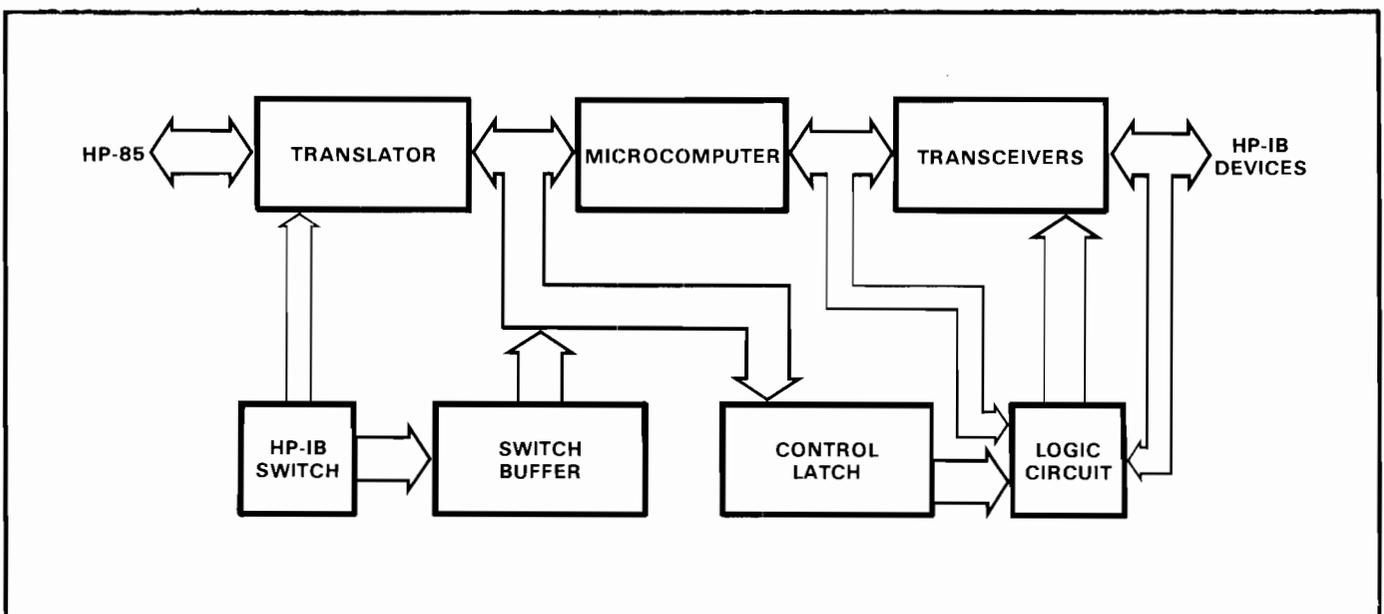


Figure 2-1. HP 82937A HP-IB Interface Block Diagram

2-5. For a detailed description of the operating theory of the interface, refer to the HP 82937A HP-IB Interface Installation and Theory of Operation Manual.

2-6. MICROCOMPUTER

2-7. The microcomputer IC (U2) is the link between the HP-85 and the HP-IB peripherals. It uses its self-contained ROM (read-only memory) to implement the interfacing procedures. The microcomputer responds to instructions from the device that is designated as the system controller. It also responds to interrupt signals from HP-IB devices according to user-programmed conditions. Timing for the microcomputer is determined by an external 11-MHz crystal.

2-8. Contained in the microcomputer are 128 eight-bit registers of RAM (random-access memory). Seven of these registers are status registers, used to store the state of the microcomputer. Another 12 registers are control registers, containing information that defines the operation of the interface. The control registers are accessible to the user via certain operating statements.

2-9. The microcomputer sends and receives information from the HP-85 on eight address/data lines via the translator IC. Eight I/O data lines and eight I/O control lines connect to the peripherals via the transceiver IC's and the HP-IB lines.

2-10. TRANSLATOR

2-11. The translator IC (U1) performs the following functions: transferring data and interrupts between the HP-85 and the microcomputer, transferring command information from the HP-85 to the microcomputer, synchronizing the transfer of data in "Fast Handshake" mode, and sensing the select code switch settings (which identify the HP-IB).

2-12. Another function performed by the translator is interfacing the different logic levels of the HP-85 and the microcomputer. Timing is provided by two of the HP-85 timing signals from the I/O port.

2-13. Four eight-bit registers in the translator provide information to the HP-85 and the microcomputer. The output buffer and input buffer hold data being sent to and from the microcomputer, respectively. The control register defines data (in the output buffer) being sent to the microcomputer. The status register controls the communication of data to the HP-85.

2-14. SWITCH BUFFER

2-15. The switch buffer IC (U4) isolates the talk/listen-address and system-controller switch segments from six address/data lines. The output lines of the switch buffer normally have a high impedance. When the microcomputer is reset, the switch buffer is triggered, providing information about the switch settings.

2-16. CONTROL LATCH

2-17. The control latch IC (U3), when triggered by the microcomputer and translator, sets its six output lines to the same logical states as are present on six of the address/data lines. Its outputs are used to control interfacing operations.

2-18. TRANSCEIVERS

2-19. The two transceiver IC's (U9 and U10) form the link between the microcomputer and the HP-IB lines. Each transceiver has eight signal paths that are enabled to send or receive data according to a direction signal for each path. The 10 direction signals are generated by the control latch IC, the HP-IB system-controller switch setting, and the HP-IB ATN and EOI signals.



Disassembly and Reassembly

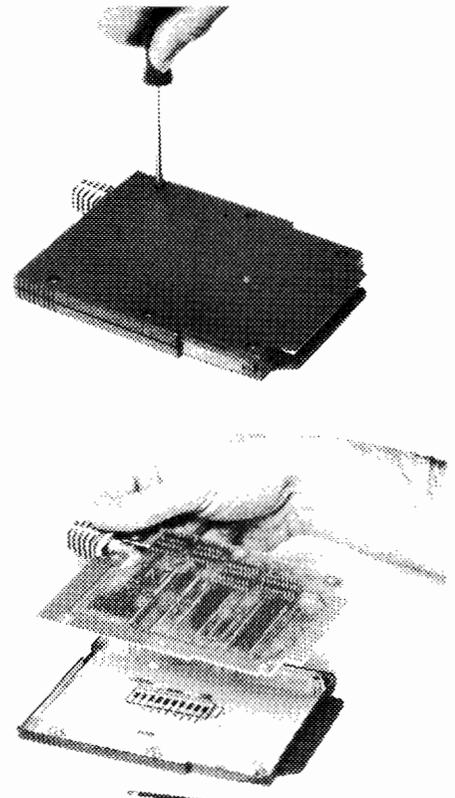
The following procedures describe the steps necessary to disassemble and reassemble the HP 82937A HP-IB Interface in order to replace or repair components that are faulty:

1. Separating the Module.
2. Replacing the PCA and Cable Assembly.
3. Reassembling the Module.

CAUTION

Ensure that adequate precautions are taken regarding electrostatic protection. Work at a bench setup that is electrostatically protected. Otherwise, IC's may be damaged.

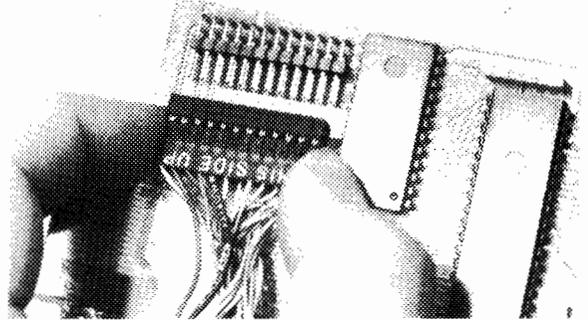
1. SEPARATING THE MODULE
 - a. Remove the six screws holding the bottom case.
 - b. Lift off the bottom case.
 - c. Lift the PCA and ground contact out of the top case.



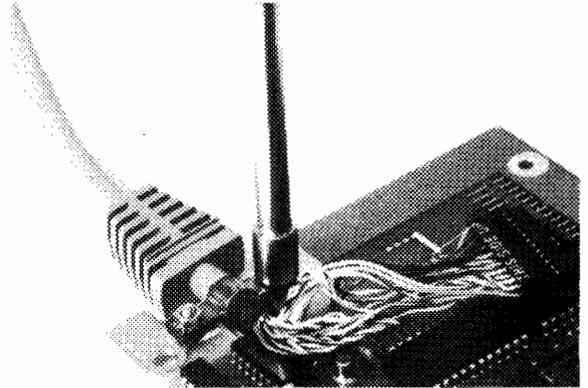
2. REPLACING THE PCA AND CABLE ASSEMBLY

After separating the module (procedure 1):

- a. Unplug the socket from the PCA.



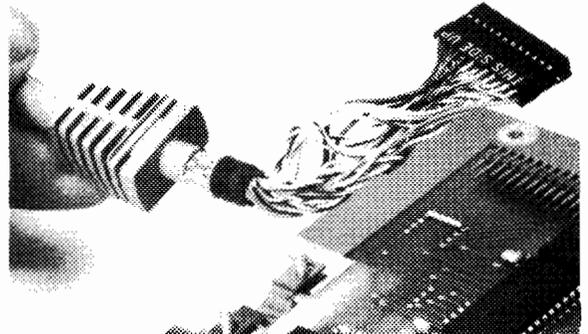
- b. Remove the two locknuts from the cable clamp using a 1/4-inch nut driver.



- c. Remove the top cable clamp.

- d. Separate the PCA and cable assembly.

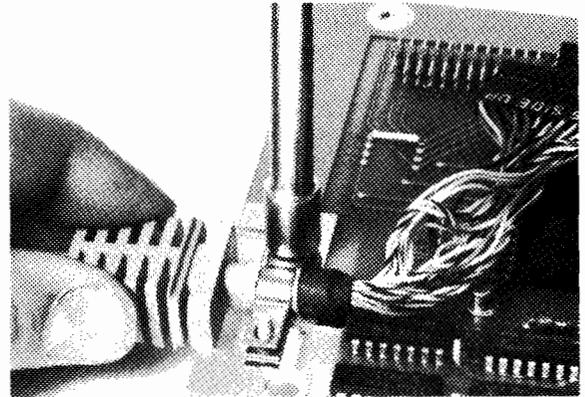
- e. Be sure the bottom cable clamp is in place on the PCA. (The bottom clamp has a larger loop than the top clamp.)



- f. Place the cable assembly onto the bottom cable clamp. Keep the insulation cutout facing away from (but aligned with) the bottom clamp.



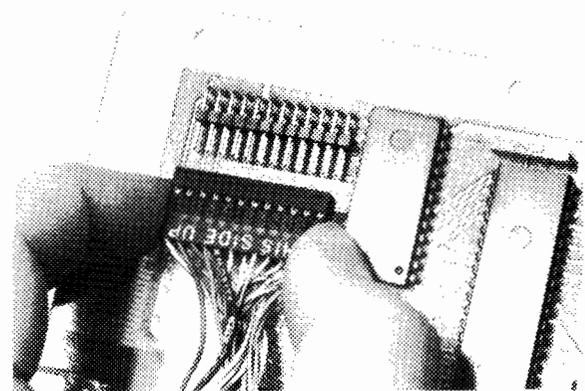
- g. Fasten the cable in place using the top cable clamp and two locknuts. (The top clamp has a smaller loop than the bottom clamp.) The top clamp fits into the insulation cutout and contacts the cable shield.



CAUTION

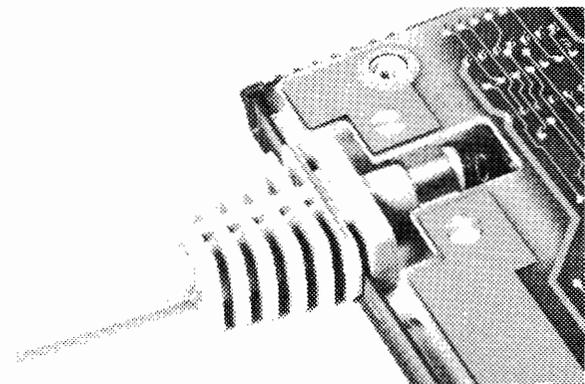
Be sure the printed label on the cable connector faces up. Otherwise, components may be damaged.

- h. Plug the socket into the connector on the PCA. Be sure the label faces up.

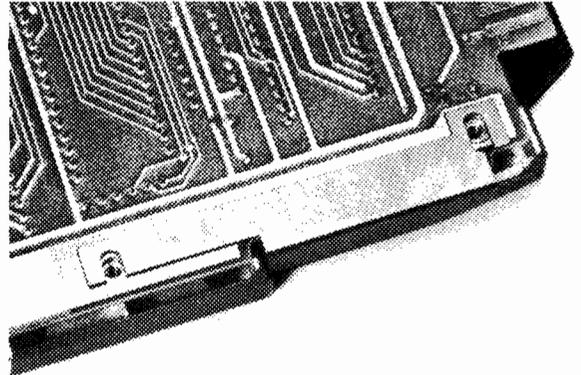


3. REASSEMBLING THE MODULE

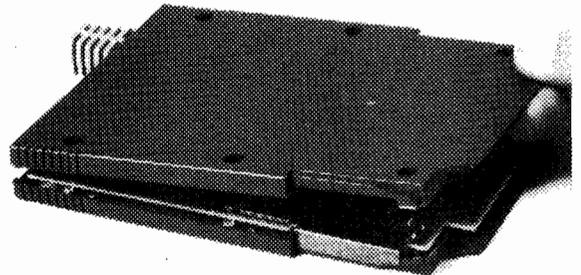
- a. Check the labels inside the case halves. These labels serve as electrical insulators. If either label is damaged, replace the case.
- b. Place the PCA into the top case. Keep the edge of the case between the first and second ribs of the strain relief. Be sure the larger screw holes in the PCA fit around the posts. The components should face into the top case.



- c. Place the ground contact onto the edge of the PCA. The contact should lay along the outside edge of the top case.



- d. Place the bottom case onto the top case and PCA.
- e. Install the six screws. Be sure that the ground contact remains snug against the side of the top case.



Troubleshooting and Testing

4-1. INTRODUCTION

4-2. This section contains the procedures you should follow to isolate the cause of a problem in an HP 82937A HP-IB Interface. The same procedures are used to test an interface. Tools that facilitate service are listed in table 4-1.

CAUTION

Ensure that the bench setup for troubleshooting and repair has adequate electrostatic protection. Otherwise, IC's may be damaged.

4-3. Always begin troubleshooting or testing an HP-IB interface using the procedures described in paragraph 4-13. The troubleshooting and testing procedures make use of a diagnostic test stored on a tape cartridge. An HP-85 Computer, an HP-IB interface that is known to be good, and an HP-85 I/O ROM installed in an HP 82936A ROM Drawer are all required to test an interface.

Table 4-1. Recommended Tools

HP PART/MODEL NUMBER	DESCRIPTION
HP-85	Computer
0960-0062	Continuity Tester
or	or
HP 3469B *	Multimeter
HP 82937A	HP-IB Interface
00085-60946	I/O ROM
8720-0002	Nut Driver, 1/4-inch
ET-12061	Port Extender
82936-60901	ROM Drawer
8710-0899	Screwdriver, #1 Posidriv
00085-60949	Tape Cartridge, test program
* Or equivalent.	

4-4. SAFETY PRECAUTIONS

4-5. Make sure you read and understand the following precautions before you connect or disconnect an interface or peripheral:

Manufacturers of peripheral devices do not all use the same grounding technique. Often, earth ground and logic ground are at different voltage levels. In some instances, this is deliberate in an effort to reduce ground return interference with digital signals.

When the HP 82937A HP-IB Interface is installed in the HP-85, earth ground and logic ground become connected together. Thus, if logic ground on a peripheral is never connected to earth ground or if it is defective, it may have a voltage level considerably different from logic ground on the interface. This potential may be high enough to be hazardous unless peripherals are connected to the bus in an exacting manner.

If you don't know the grounding technique used on a peripheral, check with the manufacturer of the device. After verifying that suitable grounding techniques have been used on the peripheral, follow the installation guidelines below.

WARNING

To avoid personal injury and equipment damage, read and understand the preceding safety precautions and follow the guidelines below.

4-6. Follow these guidelines when connecting or disconnecting the HP-IB interface or peripherals:

- a. Always turn off the HP-85 and all peripherals before installing or removing the interface or any peripherals.
- b. Be sure the HP-85 is plugged into a grounded (three-wire) outlet.
- c. Always have the HP-IB interface module installed in the HP-85 whenever any peripherals are being connected to or removed from the interface.
- d. Be sure that accessory cables remain connected to the interface module as long as peripherals are connected to them.
- e. Turn on the HP-85 and peripherals only after all connections are made. (More than half of the peripherals connected to the HP-IB interface must be turned on for the interface to operate properly.)

4-7. SETTING THE HP-IB SWITCH

4-8. The operation of the interface depends upon the settings of the HP-IB switch. This 10-segment switch is located on the PCA inside the interface module. The segments are preset at the factory, but they may have been reset by the customer to a different setting. During the troubleshooting procedure, you may need to change the settings. Use the following procedure to reset the switch.

- a. Separate the case of the module by removing the six screws as described in section 3, procedure 1.
- b. Record the customer's setting of the HP-IB switch so that the interface can be returned to the original setting.
- c. Set the switch segments to the desired positions according to the information in table 4-2. Segment 1 is not used and may be in either position. Segment 2 determines the system controller function (whether or not the HP-85 is the HP-IB controller at turn-on). Segments 3 through 7 determine the talk/listen address. Segments 8 through 10 determine the HP-IB select code.

If the switch is the slide type, the slides should be pushed toward the "0" or "1" printed on the PC board next to the switch. If the switch is the rocker type, the rockers should be pressed down at the end toward the desired setting.

- d. Reassemble the module as described in section 3, procedure 3.

4-9. CHANGING THE PARALLEL POLL JUMPER

4-10. The HP-IB interface responds to a parallel poll command by pulling one of the DIO lines low. The line is selected by a jumper wire on the PCA. The jumper is initially installed between E1 and E2 and selects DIO1 as the response line. To change the response line:

- a. Be sure the interface is disconnected from all devices.
- b. Unplug the cable connector from the PCA connector by prying them apart. Do not pull on the wires.
- c. Unsolder and remove the jumper from the PCA.

Table 4-2. HP-IB Switch Settings

SWITCH SEGMENT →	2	3 4 5 6 7					8 9 10					
	System Controller	Talk/Listen Address	Select Code									
Inactive	0	0	0	0	0	0	0	0	3	0	0	0
Active	1	1	0	0	0	0	0	1	4	0	0	1
		2	0	0	0	1	0		5	0	1	0
		3	0	0	0	1	1		6	0	1	1
		4	0	0	1	0	0		7	1	0	0
		5	0	0	1	0	1		8	1	0	1
		6	0	0	1	1	0		9	1	1	0
		7	0	0	1	1	1		10	1	1	1
		8	0	1	0	0	0					
		9	0	1	0	0	1					
		10	0	1	0	1	0					
		11	0	1	0	1	1					
		12	0	1	1	0	0					
		13	0	1	1	0	1					
		14	0	1	1	1	0					
		15	0	1	1	1	1					
		16	1	0	0	0	0					
		17	1	0	0	0	1					
		18	1	0	0	1	0					
		19	1	0	0	1	1					
		20	1	0	1	0	0					
		21	1	0	1	0	1					
		22	1	0	1	1	0					
		23	1	0	1	1	1					
		24	1	1	0	0	0					
		25	1	1	0	0	1					
		26	1	1	0	1	0					
		27	1	1	0	1	1					
		28	1	1	1	0	0					
		29	1	1	1	0	1					
		30	1	1	1	1	0					

SWITCH CONFIGURATION

- d. Install and solder the jumper in the two holes corresponding to the chosen DIO line. Use table 4-3 to identify the holes.
- e. Reconnect the cable connector. Be sure the printed label on the connector is facing up.

Table 4-3. Placing the Parallel Poll Jumper

PARALLEL POLL RESPONSE LINE	HOLES FOR JUMPER INSTALLATION
DIO1	E1 <-----> E2
DIO2	E3 <-----> E4
DIO3	E5 <-----> E6
DIO4	E7 <-----> E8
DIO5	E9 <-----> E10
DIO6	E11 <-----> E12
DIO7	E13 <-----> E14
DIO8	E15 <-----> E16

4-11. CABLE LENGTH RESTRICTIONS

4-12. In order to ensure proper operation of the interface bus, two rules must be observed regarding the length of interconnecting cables:

- o The total length of cable on one HP 82937A HP-IB Interface must be less than (or equal to) 2 meters times the number of connected HP-IB devices with their power on. The HP-85/HP-IB interface are counted as one device.
- o The total length of cable must not exceed 20 meters.

Both requirements must be met for any installation.

4-13. INITIAL PREPARATION

4-14. Perform the following steps before troubleshooting an HP-IB interface.

- a. Determine the customer's concern, if possible. This information can be helpful in evaluating test results, although you should still follow the recommended procedures.
- b. Turn off the HP-85 and all peripherals.
- c. Disconnect all accessories and peripherals. Be sure to observe the precautions and guidelines described in paragraph 4-4.

- d. Be sure the HP-IB interface to be tested has its switch set as active controller and to talk/listen address 21 (segments 2-7 set to 110101)* with any select code EXCEPT 6. If you open the case to verify the switch setting, do not reassemble it--use the port extender (ET-12061) to install the interface in the next step.

Note: Record the customer's switch setting so that the interface can be returned with the original setting.

- e. Install the HP-IB interface into any HP-85 I/O port. The upper port is recommended so that the port extender can easily be used, if necessary.
- f. Install a known good HP-IB interface into any other HP-85 I/O port.

Note: The good interface must have its switch set as non-controller, to talk/listen address 20, and select code 6 (segments 2-10 set to 010100011).*

- g. Install an I/O ROM and ROM drawer into another HP-85 I/O port.
- h. Connect the two HP-IB interface cables to each other.
- i. Turn on the HP-85.+ (If the HP-85 does not turn on only when the HP-IB interface is installed, replace the interface PCA. Then continue testing.)
- j. Install the tape cartridge containing the test program.+
- k. Execute LOAD"HP-IB" by typing this command into the HP-85.

4-15. DIAGNOSTIC TEST

4-16. Use the following procedure to run the HP-IB diagnostic test and repair the interface. This procedure should also be used to verify that the interface operates properly after repairs are completed.

- a. Press the [RUN] key after the program is loaded and the cursor reappears in the display. This causes the HP-IB test program to begin execution.

* The system controller may be either interface (but not both). If an interface tests good one way, reverse the system controller settings.

+ If these steps are performed in reverse order (that is, the cartridge is inserted before the HP-85 is turned on), the program "Autost" will automatically be executed--and the HP-IB test program can then be selected.

- b. Enter the recommended replies to the program requests. The requests are listed on the left below; the recommended replies are shown on the right.

```

82937A EXERCISER
DO YOU WANT THE OUTPUT PRINTED
AS WELL AS DISPLAYED? (Y/N): ?                Y (for initial tests)
<--- N (for repeated tests)

ENTER SELECT CODE...
?                                               <--- Select Code of HP-IB
ENTER 0 FOR SHORT TEST, OR 1 FOR              being tested
FULL SYSTEM EXERCISER
?                                               <--- 1
ENTER # OF TIMES TO RUN TEST...
?                                               <--- 5
    
```

- c. Observe the output for the names of tests as they are started and error messages as they occur. The test names are listed below; the error messages are listed in table 4-4.

1. CHECKING SWITCH SETTINGS AND HANDSHAKE
2. STATUS TEST
3. CONTROL LINES TEST
4. CHECKING DATA TRANSMITTERS
5. PASS CONTROL
6. 2ND CONTROL LINES TEST
7. CHECKING DATA RECEIVERS
8. RECEIVE CONTROL
9. CHECK TALK AND LISTEN CAPABILITY
10. DATA TRANSMIT TEST
11. DATA RECEIVE TEST
12. SERVICE REQUEST & INTERRUPT TEST
13. EXTERNAL ADDRESS TEST
14. TESTING SERVICE REQUEST AND SERIAL POLLS
15. PARALLEL POLL TEST
16. RESET TEST

- o If only the test names are displayed followed by TEST COMPLETE , the HP-IB interface is operating properly. The absence of any error messages indicates that no error conditions were detected.
- o If any error message is displayed, the test program has detected an improper or unexpected condition. For most error messages, the program will display TEST ABORT and stop. Take whatever action is indicated in table 4-4 next to the specified error message. (If the program did not stop at the error message, check the conditions indicated for that error after the program stops.) After checking or repairing the interface, repeat the diagnostic test to verify proper operation.

Table 4-4. Repair Procedures

Use this table to determine what to do when an error message is displayed by the diagnostic test. For each displayed message, take action as indicated in the order shown. Then repeat the diagnostic test.

ERROR MESSAGE	ACTION
General Error Messages	
<ul style="list-style-type: none"> ○ GREATER THAN 10 DATA ERRORS 	<p>Check continuity of HP-IB cables, either between PCA connectors or from PCA connector to HP-IB connector. Replace cable assembly if bad.</p> <p>Replace PCA, repeat test.</p>
<ul style="list-style-type: none"> ○ NON RECOVERABLE TIMEOUT ON PASS CONTROL 	<p>Replace PCA, repeat test.</p>
<ul style="list-style-type: none"> ○ TIMEOUT OCCURRED 	<p>Replace PCA, repeat test.</p>
<ul style="list-style-type: none"> ○ INTERFACE CARD FAILED SELF TEST, PROBABLE PROCESSOR FAILURE 	<p>Replace PCA, repeat test.</p>
<ul style="list-style-type: none"> ○ INTERFACE CARD AT SELECT CODE nn DID NOT RESPOND AT POWER ON CHECK SELECT CODE AND CONNECTIONS 	<p>Check select code setting and installation. Repeat test.</p> <p>Replace PCA, repeat test.</p>
<ul style="list-style-type: none"> ○ ERROR OCCURRED IN ROM OTHER THAN I/O ROM ERROR mmm IN LINE nnnn 	<p>Remove all devices except those specified in paragraph 4-13. Repeat test.</p> <p>Replace PCA, repeat test.</p>
<ul style="list-style-type: none"> ○ ERROR mmm IN LINE nnnn 	<p>Replace PCA, repeat test.</p>
<ul style="list-style-type: none"> ○ ERROR OCCURRED IN INTERFACE CARD NOT UNDER TEST ERROR mmm IN LINE nnnn WITH SELECT CODE ss 	<p>Remove or replace indicated interface module. Repeat test.</p>

Table 4-4. Repair Procedures (Continued)

ERROR MESSAGE	ACTION
General Error Messages (Continued)	
o ERROR 110 : I/O CARD	Replace PCA, repeat test.
o ERROR nnn : "label"	Remove devices from I/O ports one at a time to determine the cause of the error. Replace the HP-IB PCA if the interface causes the error.
1. CHECKING SWITCH SETTINGS AND HANDSHAKE	
o HANDSHAKE FAILURE OR INTERFACE NOT LOGGED IN CHECK THAT SWITCHES ARE SET TO SELECT CODE n NON RECOVERABLE ERROR	Move switches back and forth, then reset to proper select code. Replace PCA, repeat test.
o XLATOR IB NOT CLEAR WHEN EXPECTED	Replace PCA, repeat test.
o SWITCHES DIDN'T READ AS EXPECTED ie CONTROL BIT AND ADDRESS '21' SETTING SHOULD READ AS 110101 SWITCHES (2-7) READ AS nnnnn	Check switch settings. Switches must be set to 110101. Replace PCA, repeat test.
2. STATUS TEST	
o STATUS ERROR	Replace PCA, repeat test.
o STATUS ERROR STATUS BYTE 3= nnn THIS MAY BE CAUSED IF A PERIPHERAL IS CONNECTED DURING THE TEST. IF TRUE, DISCONNECT THE DEVICE AND RERUN THE TEST. OTHERWISE TEST FAILED	Disconnect peripheral device, if present. Replace PCA, repeat test.

Table 4-4. Repair Procedures (Continued)

ERROR MESSAGE	ACTION
<p>3. CONTROL LINES TEST</p> <ul style="list-style-type: none"> ○ CONTROL LINE ERROR IUT CONTROL BYTE= nnn ○ CONTROL LINE ERROR IAT CONTROL BYTE= nnn 	<p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p>
<p>4. CHECKING DATA TRANSMITTERS</p> <ul style="list-style-type: none"> ○ DATA ERROR-NO HANDSHAKE DATA SENT mmm DATA RCVD nnn ○ DATA ERROR-NO HANDSHAKE DATA SENT SHOULD BE mmm IAT RECEIVED nnn 	<p>For one occurrence, repeat test to verify no more occurrences. For several occurrences, check continuity of HP-IB cables, either between PCA connectors or from PCA connector to HP-IB connector. Replace cable assembly if bad. Repeat test. Replace PCA, repeat test.</p> <p>For one occurrence, repeat test to verify no more occurrences. For several occurrences, check continuity of HP-IB cables, either between PCA connectors or from PCA connector to HP-IB connector. Replace cable assembly if bad. Repeat test. Replace PCA, repeat test.</p>
<p>5. PASS CONTROL</p> <ul style="list-style-type: none"> ○ PASS CONTROL ERROR IUT DIDN'T GIVE UP CONTROL ○ PASS CONTROL ERROR IAT DID NOT RECEIVE CONTROL 	<p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p>

Table 4-4. Repair Procedures (Continued)

ERROR MESSAGE	ACTION
<p>6. 2ND CONTROL LINES TEST</p> <ul style="list-style-type: none"> ○ CONTROL LINE ERROR IUT CONTROL BYTE= nnn ○ CONTROL LINE ERROR IAT CONTROL BYTE= nnn 	<p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p>
<p>7. CHECKING DATA RECEIVERS</p> <ul style="list-style-type: none"> ○ DATA ERROR- NO HANDSHAKE DATA SENT TO IUT mmm IUT RCVD nnn 	<p>Replace PCA, repeat test.</p>
<p>8. RECEIVE CONTROL</p> <ul style="list-style-type: none"> ○ PASS CONTROL ERROR IUT DID NOT RECEIVE CONTROL 	<p>Replace PCA, repeat test.</p>
<p>9. CHECK TALK AND LISTEN CAPABILITY</p> <ul style="list-style-type: none"> ○ TALK ADDRESSING ERROR ○ INTERFACE DIDN'T PROPERLY UNCONFIGURE ON UNTALK ○ LISTEN ADDRESSING ERROR ○ INTERFACE DIDN'T PROPERLY UNCONFIGURE ON UNLISTEN 	<p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p>

Table 4-4. Repair Procedures (Continued)

ERROR MESSAGE	ACTION
<p>10. DATA TRANSMIT TEST</p> <ul style="list-style-type: none"> ○ DATA XMIT ERROR IUT DATA SENT WAS mmm IAT RCVD nnn ○ HANDSHAKE TIMEOUT ERROR 	<p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p>
<p>11. DATA RECEIVE TEST</p> <ul style="list-style-type: none"> ○ DATA RCV ERROR IAT SENT mmm IUT RCVD nnn 	<p>Replace PCA, repeat test.</p>
<p>12. SERVICE REQUEST & INTERRUPT TEST</p> <ul style="list-style-type: none"> ○ RECEIVED WRONG INTERRUPT CAUSE- EXPECTED mmm RCVD nnn ○ INCORRECT SERIAL POLL RCVD EXPECTED 255; RECEIVED nnn ○ INTERRUPT ERR-INT DID NOT OCCUR WHEN EXPECTED INTERRUPT MASK= nnn 	<p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p>
<p>13. EXTERNAL ADDRESS TEST</p> <ul style="list-style-type: none"> ○ IUT DID NOT RECOGNIZE ITS ADDRESS ○ INTERRUPT ERR-INT DID NOT OCCUR WHEN EXPECTED INTERRUPT MASK= nnn ○ INTERRUPT STATUS REG DIDN'T MATCH INTERRUPT MASK STATUS REG WAS mmm SHOULD BE nnn 	<p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p> <p>Replace PCA, repeat test.</p>

Table 4-4. Repair Procedures (Continued)

ERROR MESSAGE	ACTION																		
<p>14. TESTING SERVICE REQUEST AND SERIAL POLLS</p> <ul style="list-style-type: none"> <li style="margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>○ IUT DID NOT CORRECTLY RESPOND TO A SERIAL POLL EXPECTED RESPONSE 255 RECEIVED nnn</p> </div> <div style="width: 50%;"> <p>Replace PCA, repeat test.</p> </div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>○ INTERRUPT ERR-INT DID NOT OCCUR WHEN EXPECTED INTERRUPT MASK= 8</p> </div> <div style="width: 50%;"> <p>Replace PCA, repeat test.</p> </div> </div> 																			
<p>15. PARALLEL POLL TEST</p> <ul style="list-style-type: none"> <li style="margin-bottom: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>○ PARALLEL POLL ERROR A PARALLEL POLL ERROR OCCURRED AT THIS POINT IN THE TEST. THIS MAY NOT BE AN ERROR IN THE HP-IB THE TEST EXPECTS THE PARALLEL POLL JUMPER TO BE IN THE PRESET CONFIGURATION OF E1 TO E2 (DIO1) IF THIS HAS BEEN CHANGED, AN ERROR WILL OCCUR IN THE TEST. THE TEST CONTINUES AFTER THIS ERROR SINCE IT MAY NOT BE AN ERROR IN THE HP-IB.</p> <p>THE PARALLEL POLL RESPONSE RECEIVED WAS nnn</p> </div> <div style="width: 50%;"> <p>Check the installation of the parallel poll jumper. If the indicated response agrees with the response shown in the table below for the actual position of the jumper, the interface is good. If the indicated response is incorrect for the jumper position, replace the PCA, repeat the test.</p> </div> </div> 																			
<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%; text-align: center;">JUMPER POSITION</th> <th style="width: 40%; text-align: center;">PROPER RESPONSE</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">E1 <--> E2</td><td style="text-align: center;">1</td></tr> <tr><td style="text-align: center;">E3 <--> E4</td><td style="text-align: center;">2</td></tr> <tr><td style="text-align: center;">E5 <--> E6</td><td style="text-align: center;">4</td></tr> <tr><td style="text-align: center;">E7 <--> E8</td><td style="text-align: center;">8</td></tr> <tr><td style="text-align: center;">E9 <--> E10</td><td style="text-align: center;">16</td></tr> <tr><td style="text-align: center;">E11 <--> E12</td><td style="text-align: center;">32</td></tr> <tr><td style="text-align: center;">E13 <--> E14</td><td style="text-align: center;">64</td></tr> <tr><td style="text-align: center;">E15 <--> E16</td><td style="text-align: center;">128</td></tr> </tbody> </table>		JUMPER POSITION	PROPER RESPONSE	E1 <--> E2	1	E3 <--> E4	2	E5 <--> E6	4	E7 <--> E8	8	E9 <--> E10	16	E11 <--> E12	32	E13 <--> E14	64	E15 <--> E16	128
JUMPER POSITION	PROPER RESPONSE																		
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E3 <--> E4	2																		
E5 <--> E6	4																		
E7 <--> E8	8																		
E9 <--> E10	16																		
E11 <--> E12	32																		
E13 <--> E14	64																		
E15 <--> E16	128																		

Table 4-4. Repair Procedures (Continued)

ERROR MESSAGE	ACTION
<p>16. RESET TEST</p> <ul style="list-style-type: none"> <li data-bbox="196 485 1271 552">○ IUT DID NOT RECEIVE CONTROL BACK ON RESET Replace PCA, repeat test. <li data-bbox="196 598 1271 665">○ IAT DID NOT RECEIVE IFC FROM IUT ON RESET OF IUT Replace PCA, repeat test. 	

d. Turn off the system.

e. Remove the HP-IB interface.

f. If necessary, reset the HP-IB switch to the customer's original setting and reassemble the case.

Replaceable Parts

5-1. INTRODUCTION

5-2. This section lists the replaceable parts for the HP 82937A HP-IB Interface.

5-3. Parts descriptions, HP part numbers, and quantities for the interface are listed in table 5-1. (The HP 82937A HP-IB Interface is illustrated in figure 5-1.) Parts information, including reference designations, for the PCA is given in table 5-2. (The PCA component location diagram is shown in figure 6-1.)

5-4. ORDERING INFORMATION

5-5. To order replacement parts or assemblies, address your order or inquiry to your authorized HP dealer, to the nearest Hewlett-Packard sales and service facility, or to Corporate Parts Center or Parts Center Europe. Specify the following information for each part ordered:

- a. Interface model.
- b. HP part number.
- c. Part description.
- d. Complete reference designation (if applicable).

Table 5-1. HP 82937A HP-IB Interface Replaceable Parts

INDEX NUMBER, FIGURE 5-1	HP PART NUMBER	DESCRIPTION	QUANTITY
1	82937-60004	ASSEMBLY, cable	1
2	82937-60901	ASSEMBLY, printed-circuit	1
3	82937-60902	ASSEMBLY, top/bottom case, service	1
4	1400-1064	CLAMP, cable, bottom	1
5	1400-1063	CLAMP, cable, top	1
6	0363-0174	CONTACT, ground	1
7	0590-0199	NUT, locking	2
8	2200-0143	SCREW, 4-40	6

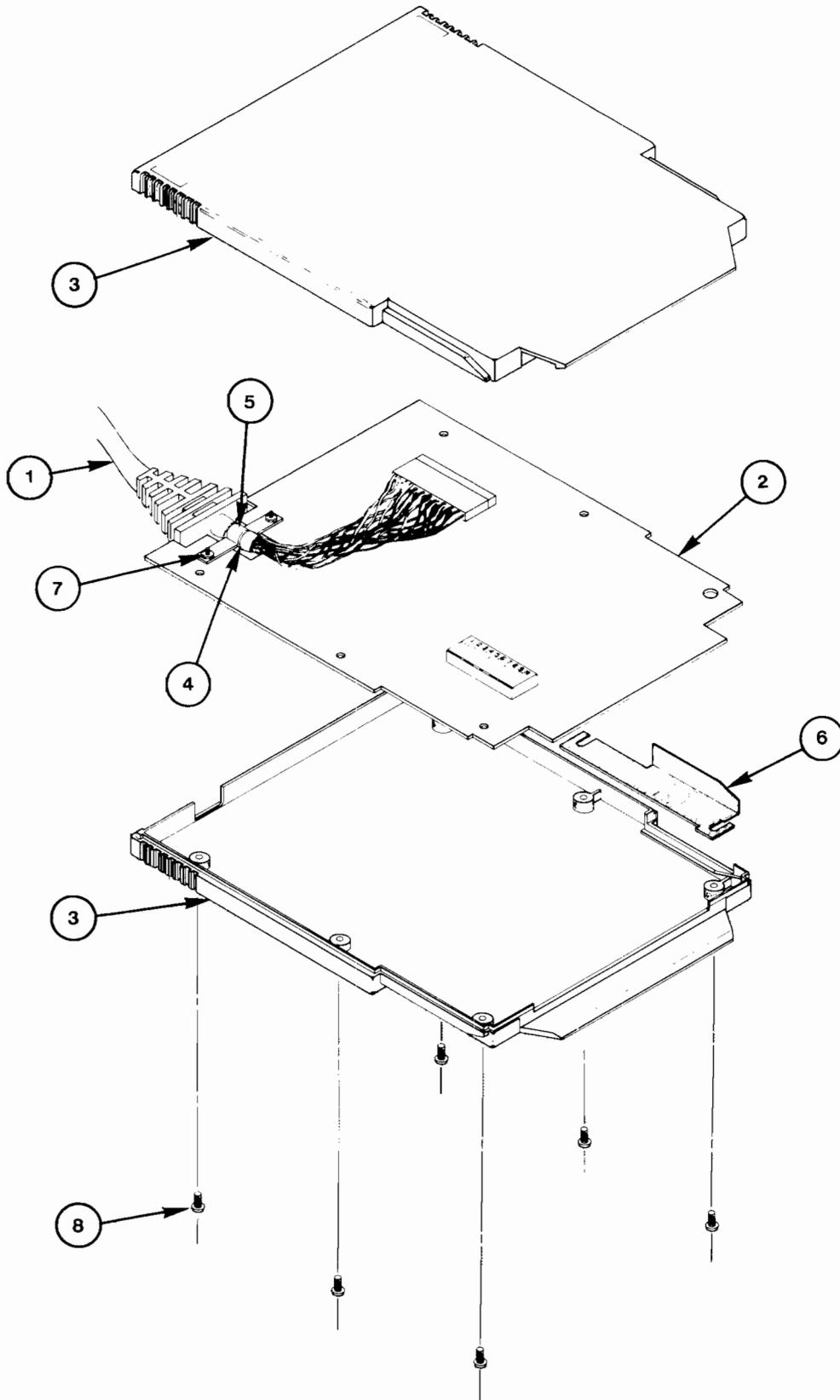


Figure 5-1. HP 82937A HP-IB Interface Exploded View

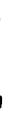
Table 5-2. Interface PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	QUANTITY
C1,C2	0180-0228	CAPACITOR, 22 uF, 15V	2
C3-C13,C15	0160-0576	CAPACITOR, 0.1 uF, 50V	12
C14	0160-4767	CAPACITOR, 20 pF, 200V	1
J1	1251-5266	CONNECTOR, 24-pin	1
Y1	0410-1222	CRYSTAL, 11-MHz	1
MP1	0340-0883	INSULATOR, transistor Q1	1
U3	1820-1466	INTEGRATED CIRCUIT, control latch	1
U11	1820-1112	INTEGRATED CIRCUIT, flip-flop, quad	1
U2	1820-2437	INTEGRATED CIRCUIT, microcomputer	1
U7	1820-1197	INTEGRATED CIRCUIT, NAND, quad	1
U5	1820-1198	INTEGRATED CIRCUIT, NAND, quad	1
U8	1820-1144	INTEGRATED CIRCUIT, NOR, quad	1
U6	1820-1416	INTEGRATED CIRCUIT, Schmitt inverter, hex	1
U4	1820-1402	INTEGRATED CIRCUIT, switch buffer	1
U9,U10	1820-2424	INTEGRATED CIRCUIT, transceiver	2
U1	1MB5-0101	INTEGRATED CIRCUIT, translator	1
W1	8150-3773	JUMPER	1
R1	0683-1035	RESISTOR, 10K, 5%, 1/4W	1
R2,R3	0683-2225	RESISTOR, 2.2K, 5%, 1/4W	2
R4	0683-1025	RESISTOR, 1K, 5%, 1/4W	1
R7	1810-0367	RESISTOR NETWORK, 4.7K, 2%, 1.2W	1
R5,R6	1810-0278	RESISTOR NETWORK, 3.3K, 2%, 1.2W	2
S1	3101-0491	SWITCH, 10-segment SPDT	1
Q1	1854-0019	TRANSISTOR, NPN	1

Reference Diagrams

6-1. This section includes reference diagrams for the HP 82937A HP-IB Interface.

6-2. The component location diagram for the PCA is shown in figure 6-1. The interface schematic diagram is shown in figure 6-2.



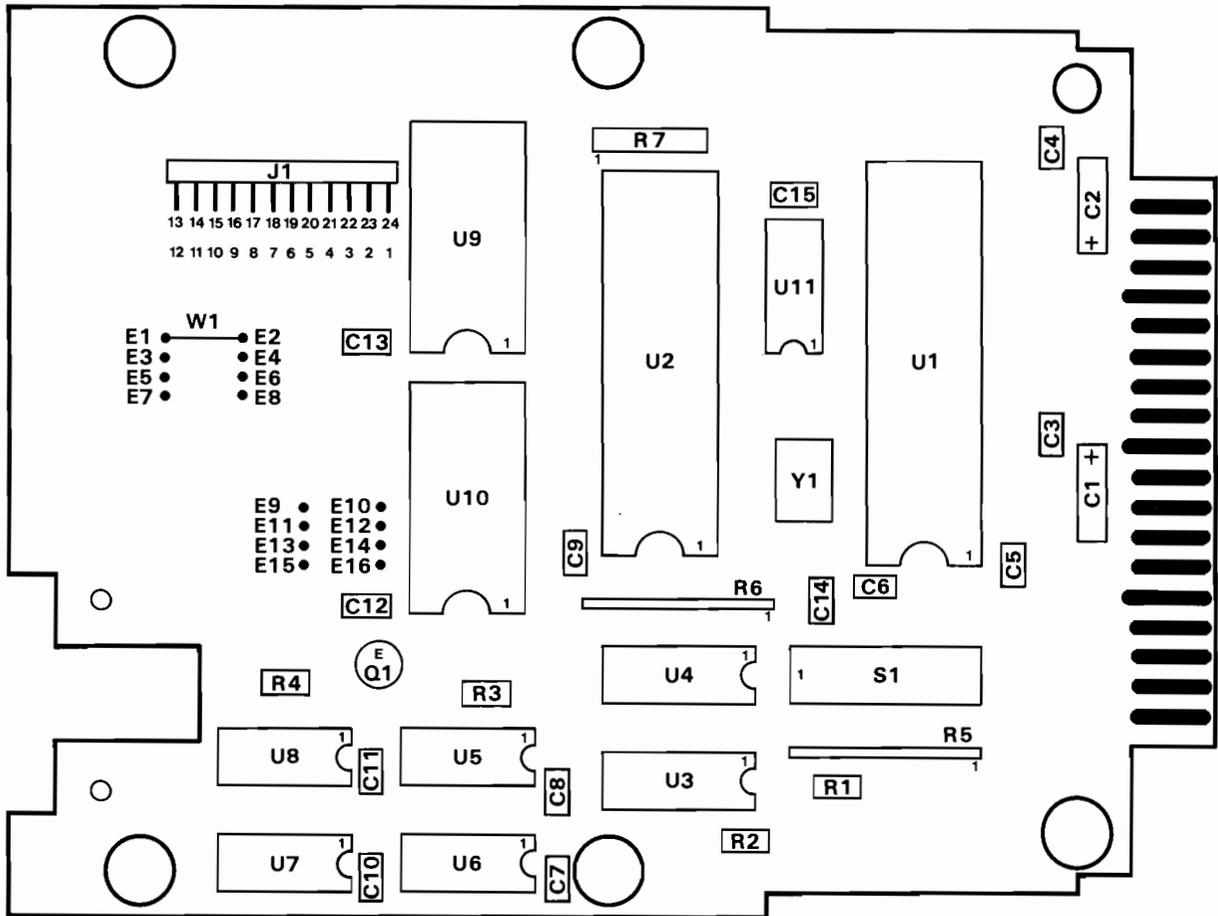


Figure 6-1. PCA Component Location Diagram

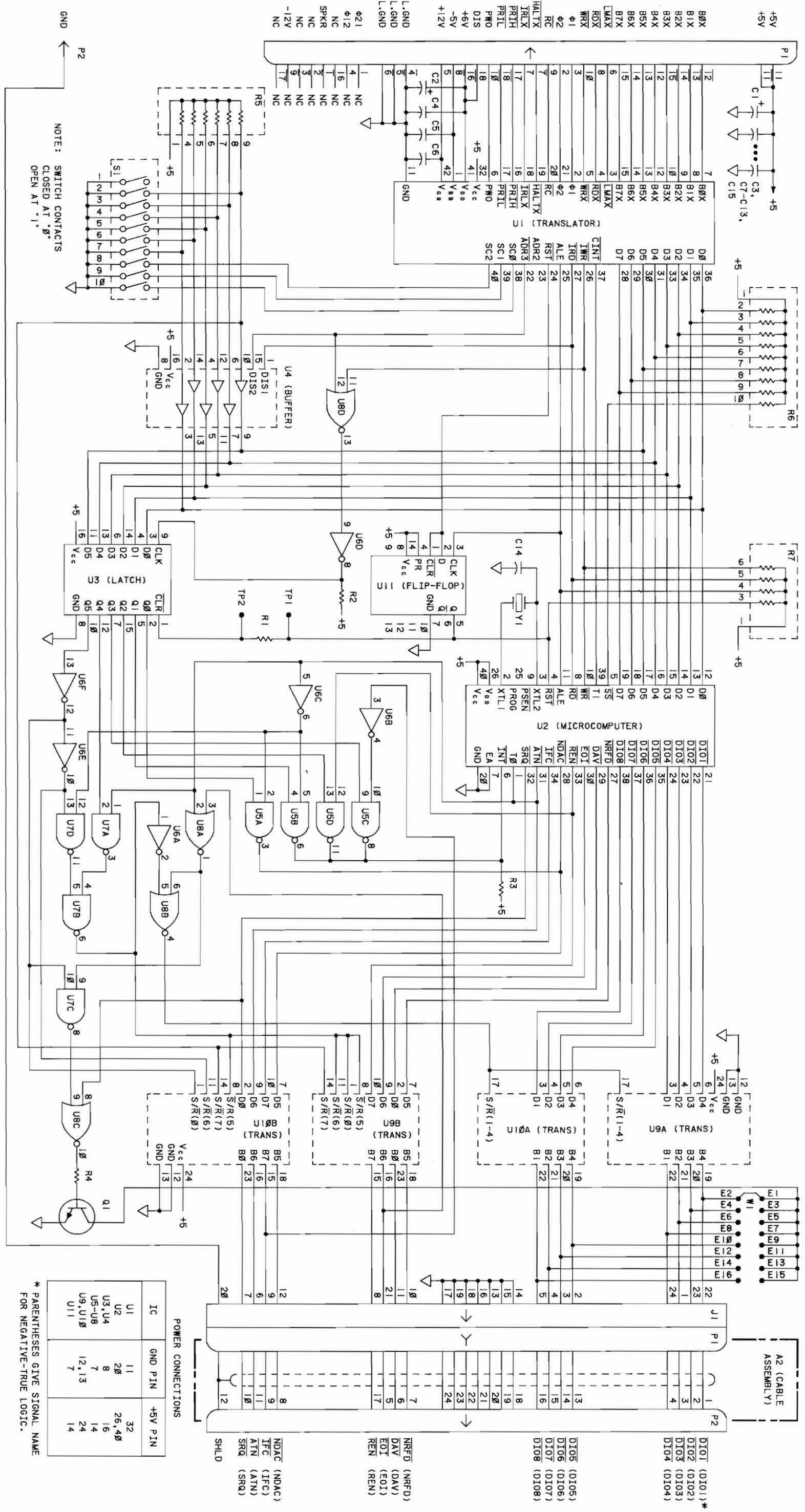


Figure 6-2. HP 82937A HP-IB Interface Schematic Diagram

