HP 10751A

Air Sensor

Limited Availability
Used and in Good Condition

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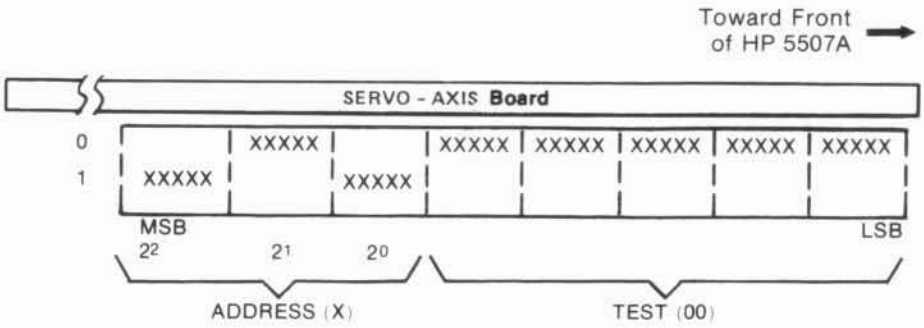


NOTE

The other possible Servo-Axis board switch settings are as follows.

Switch Setting 2^2	2^1	2^0	Corresponding Mnemonic Prefix
0	0	0	S
0	0	1	T
0	1	0	U
0	1	1	V
1	0	0	W
1	0	1	X
1	1	0	Y
1	1	1	Z

Figure 7-5b. Servo-Axis Board Switch Setting

g. Check the address switch (SW1) on the Automatic Compensation board.

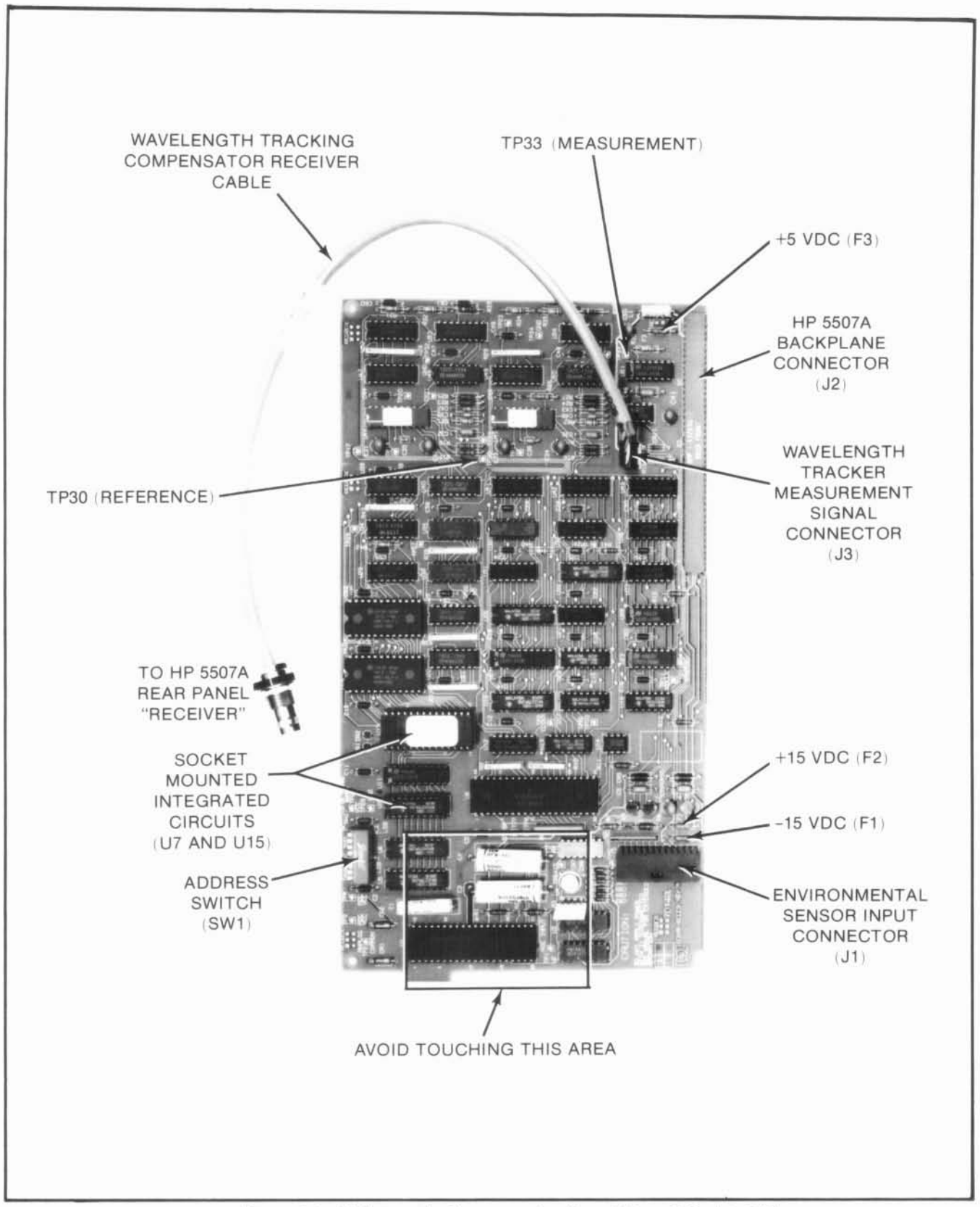
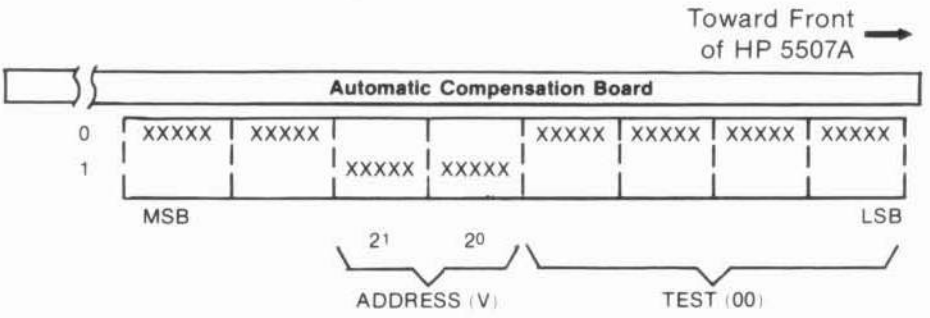


Figure 7-6. A8 Automatic Compensation Board (Part of Option 046)

1. Verify that integrated circuits U7 and U15 are properly installed in their respective sockets.
2. Check the address switch (SW1) on the Automatic Compensation board. Address Switch SW1 TEST switches must be set to zero during normal operation. The ADDRESS switches may be set as desired.



NOTE

The other possible switch settings for the Automatic Compensation board are as follows.

Switch Setting		Corresponding Mnemonic Prefix
2^1	2^2	
0	0	S
0	1	T
1	0	U
1	1	V

Figure 7-8. Automatic Compensation Board Address Switch Setting

CAUTION

The above addresses overlap the Axis board addresses. DO NOT set two boards to the same address.

h. Check the address jumpers (W1 & W2) on the Prototyping board. Address jumpers W1 and W2 are installed in the O (0,0) configuration at manufacture.

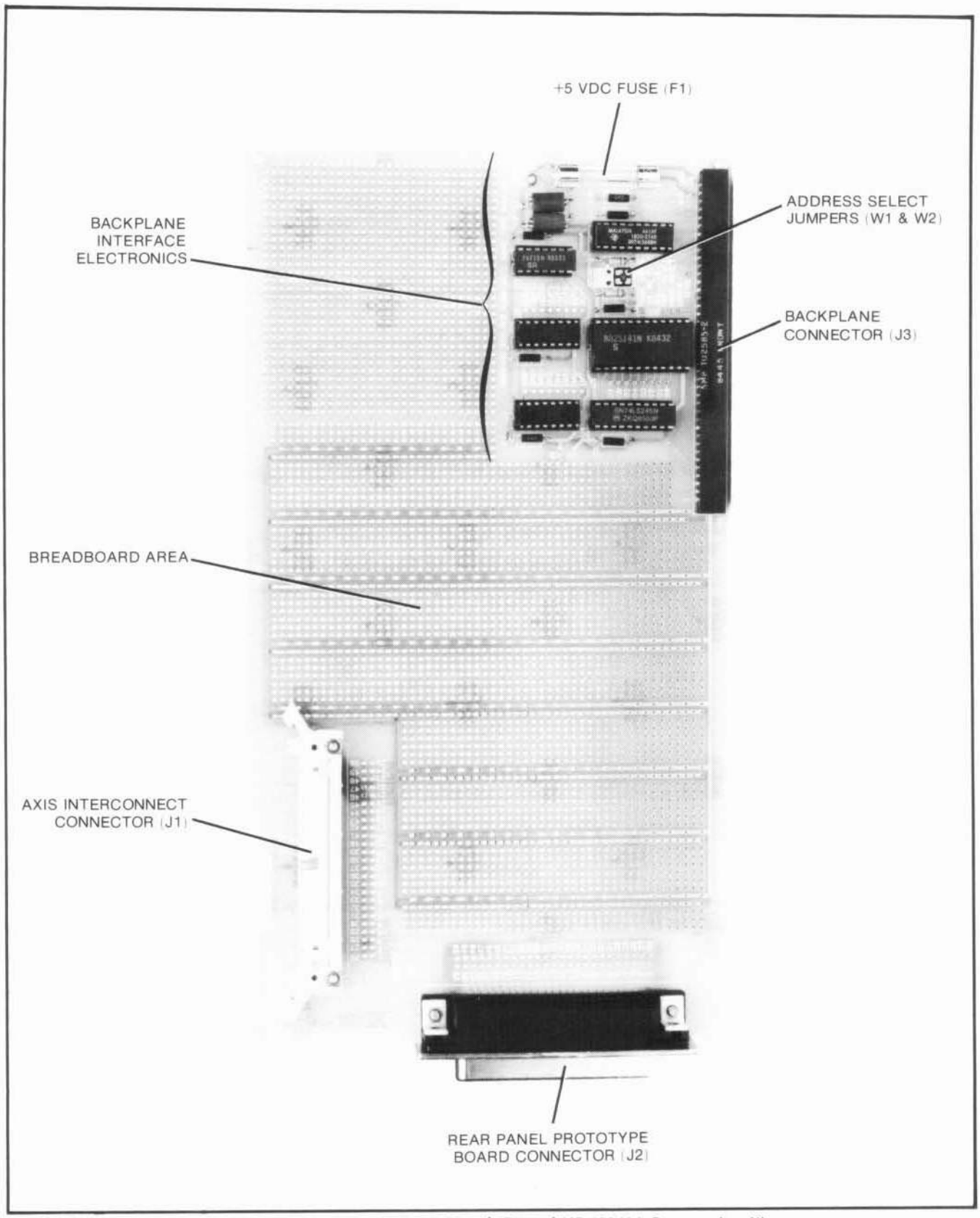
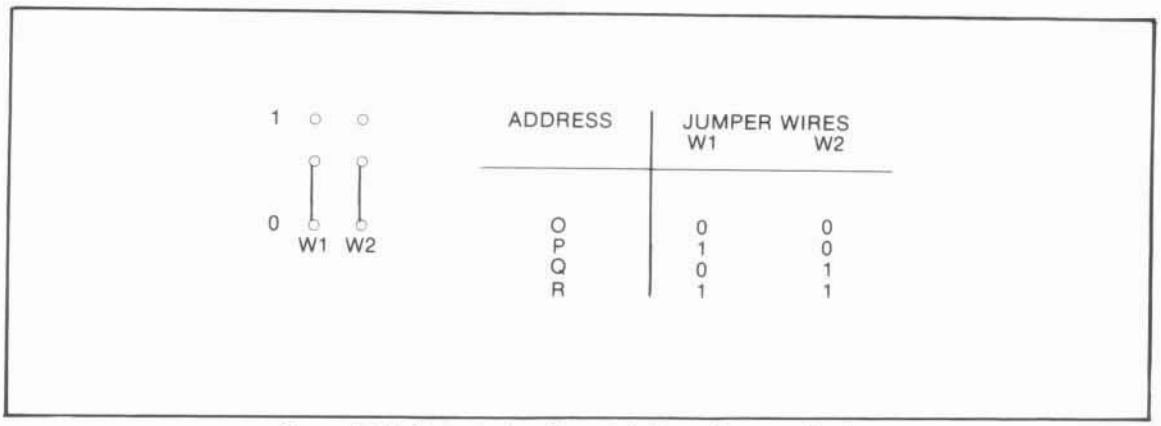


Figure 7-9. A3 Prototyping Board (Part of HP 10941A Prototyping Kit

The other possible address jumper configurations for the Prototyping board are as follows:



ADDRESS	JUMPER WIRES W1	W2
O	0	0
P	1	0
Q	0	1
R	1	1

Figure 7-10. Prototyping Board Address Jumper Setting

HP 5507A FAILURE SYMPTOMS

Look through the symptoms until you see the one which applies to your HP 5507A. The symptoms are listed from "catastrophic" failures to more specific failures. Perform the troubleshooting steps which follow the symptom. The next step after the one you just performed assumes that the previous step did not locate the problem.

NOTE

Power-down the HP 5507A before removing or replacing a board or connector. Check the fuses located on each board to ensure that the fuses are not open or damaged in any way. (See *Table 7-18* for listing of fuse part numbers.) Also try reseating each board in its connector or reconnecting any applicable cables to see if a bad connection caused the problem.

WARNING

DO NOT PERFORM AC LINE MEASUREMENTS OR MEASUREMENTS NEAR THE POWER SUPPLY WITHOUT INSULATED PROBES. DO NOT TOUCH THE AC LINES OR POWER SUPPLY WHEN POWER IS APPLIED. CAPACITORS MOUNTED ON THE A14 POWER SUPPLY ASSEMBLY MAY STILL BE CHARGED EVEN IF THE HP 5507A IS DISCONNECTED FROM ITS AC POWER SOURCE. ANY MAINTENANCE AND REPAIR OF THE OPEN INSTRUMENT WITH VOLTAGE APPLIED SHOULD BE AVOIDED AS MUCH AS POSSIBLE AND, IF NECESSARY, SHOULD BE CARRIED OUT BY A SKILLED PERSON WHO IS AWARE OF THE HAZARDS INVOLVED.

FAILURE SYMPTOM #1

HP 5507A is totally inoperative. Front-panel LEDs and fan do not turn on.

a. Verify that the line voltage selector is set correctly on the rear panel at the power line module.

b. Remove the ac power cord and check the 5A line fuse located in the power line module. If the fuse is blown, use the Signal Flow Diagram (*Figure 7-35*) to check for shorts in the AC line from the Line Module to the power supply.

WARNING

WHEN THE HIGH VOLTAGE SHIELD (MP8) IS REMOVED FROM THE HP 5507A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DO NOT REMOVE THE HIGH VOLTAGE SHIELD UNLESS IT IS NECESSARY AND ONLY AFTER THE FRONT PANEL SWITCH IS SET TO "OFF" POSITION AND THE POWER CABLE (W1) IS FROM THE REAR PANEL AC LINE MODULE.

c. Remove the HP 5507A top cover and high voltage supply shield. Check the fuses on the backplane located next to the power supply connector J2. Replace any blown fuses and check for shorts on that line before reapplying power. Note that the power supply output will be at approximately zero Volts when either a no-load or shorted output condition exists.

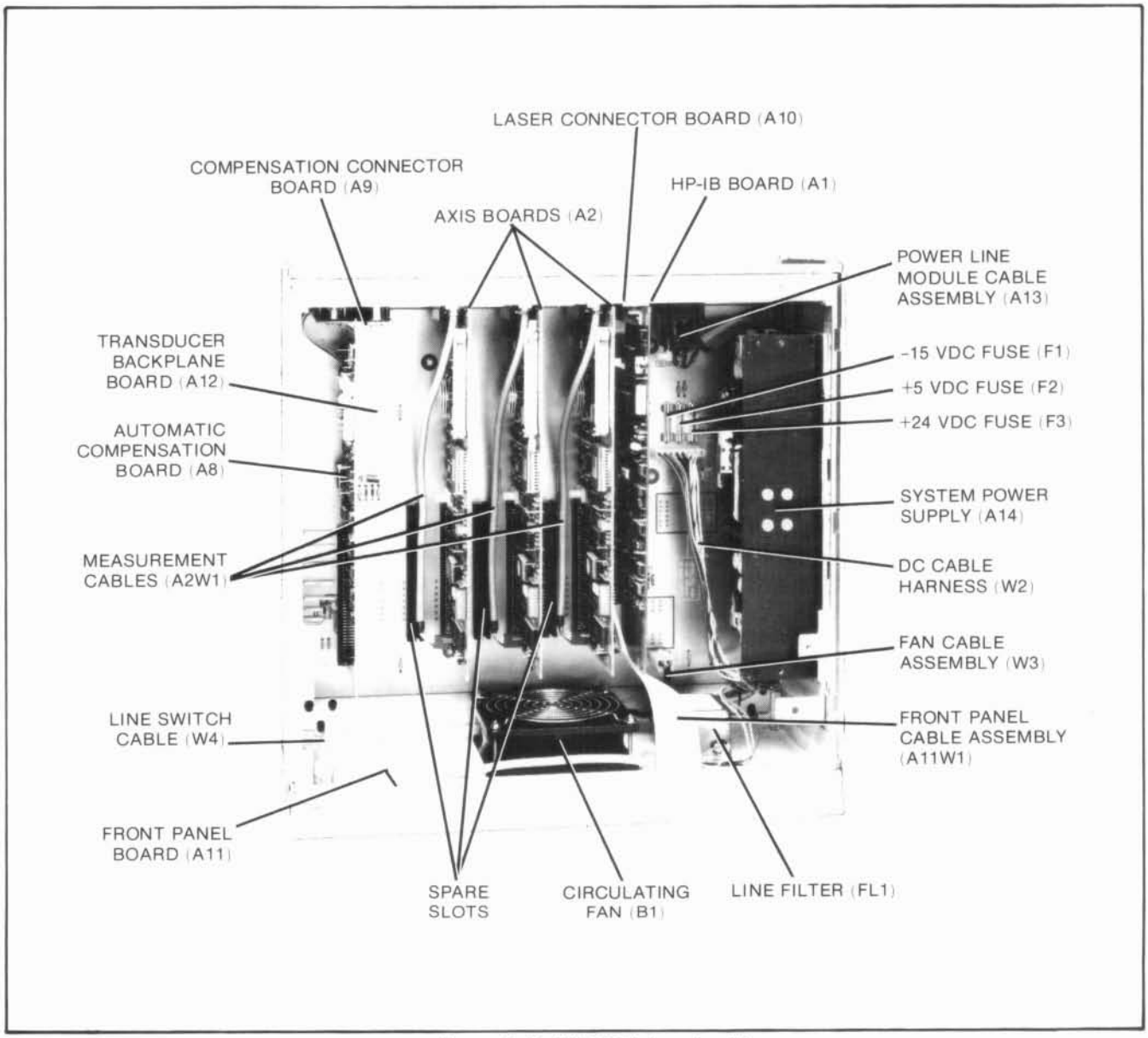


Figure 7-11. HP 5507A Interior View

d. Power up the HP 5507A and measure the output voltages from the power supply at the backplane connector (J2). If all voltages measure at zero Volts, proceed to step e. If some (but not all) of the voltage measurements are OK, proceed to step f. Note that the power supply voltages will be approximately zero Volts when either a no-load or shorted condition exists.

WARNING

STEP E INVOLVES PROBING TERMINALS L AND N OF THE A14 POWER SUPPLY ASSEMBLY WHERE 115- OR 230-VOLTS ARE PRESENT. MAKE ALL VOLTAGE MEASUREMENTS WITH VOLTMETER PROBES THAT ARE INSULATED AND OF SUFFICIENT LENGTH SO AS NOT TO EXPOSE YOURSELF TO HAZARDOUS VOLTAGE LEVELS. IT IS BEST TO REMOVE THE POWER SUPPLY ASSEMBLY WHEN MAKING ALL MEASUREMENTS ON THE A14 POWER SUPPLY ASSEMBLY. REMOVE ALL POWER (FRONT PANEL "LINE" SWITCH SET TO "OFF" AND AC POWER CABLE (W1) DISCONNECTED FROM CHASSIS) WHEN CONNECTING TEST LEADS TO A12 BACKPLANE TEST POINTS.

e. Measure the AC voltage across L (WHT/RED/GRA wire) and N (RED wire) screw terminals located on the power supply. If the voltage is OK, replace the power supply. If the voltage is not OK, check back through the AC line to the power supply using the Signal Flow Diagram (*Figure 7-35*). Check the line filter and power line module.

f. Following the procedures outlined in "HP 5507A Adjustment Procedures" paragraphs, adjust the supply voltages that are out of their specified range to their correct values. If this is not possible, replace the power supply.

FAILURE SYMPTOM #2

The fan turns on, but none of the front panel LEDs light at power-up.

- Remove the HP 5507A top cover and check if the HP-IB board is installed. If it is installed, check if the cable from the HP-IB board to the front panel is installed and installed correctly.

FAILURE SYMPTOM #3

The only front-panel LED that lights at power-up is the LASER ON LED.

a. Remove the HP 5507A top cover and measure the voltage at the +5V test point on the top of the HP-IB board. If the voltage does not measure +4.9 Vdc ±0.15 V, go to (b). If the voltage measurement is OK, go to (c).

b. Remove the power supply's High Voltage Shield and measure the voltage on the +5V line from the power supply at connector J2 (see *Figure 7-11*). BE CAREFUL! USE PROBES WITH LONG INSULATED HANDLES SO THAT YOUR HANDS ARE NOT EXPOSED TO THE POWER SUPPLY CIRCUITRY! If the voltage does not measure +5 Vdc +0.05V or –0.15V, try to adjust the voltage following the procedure outlined in the "Adjustments" paragraphs. If this adjustment is not possible, replace the power supply. If the voltage measures OK, measure the voltage at pins 39 and 79 on the backplane connector (XA1) of the HP-IB board. If the voltage measures +5 Vdc +0.05V or –0.15V, replace the HP-IB board. If the voltage is outside the acceptable range, check the backplane and/or connector.

c. At pin 69 of the HP-IB backplane connector (XA1), check the 6 MHz clock frequency. Does it measure 6 MHz ±60 kHz at TTL voltage level? If not, trace the signal back to its source on the backplane [IC U5 (pin 5)] using the Backplane Schematic Diagram (*Figure 7-36*). If the signal appears OK, replace the HP-IB board.

FAILURE SYMPTOM #4

After power-up, the TALK, LISTEN, and SRQ LEDs either remain off or one or more of them remain on. The HP 5507A front-panel SYSTEM ERROR LED may also be on.

- Remove the HP 5507A top cover and measure the voltage at the +5V test point on the top of the HP-IB board. If the voltage measures +4.9 Vdc ±0.15 V, replace the HP-IB board. If the +5 Vdc is outside the specified range, perform step b of Failure Symptom #3.

FAILURE SYMPTOM #5

After power-up, the SRQ LED flashes constantly with a pause in between a number of flashes. This flashing must not be confused with the normal power-up cycling of the TALK, LISTEN, and SRQ LEDs that indicates the HP 5507A is waiting for the laser head to send a stable reference signal to which the HP-IB board's PLL circuit must lock.

a. Count the number of LED flashes between pauses. Consult *Table 7-5* for the address of the board which corresponds to the number of LED flashes. If the address indicated is an address in use, remove the board with the indicated address and again power up the HP 5507A. See if the instrument passes Self Test.

Table 7-5. SRQ LED Error Indications

NUMBER OF FLASHES BETWEEN PAUSES	ADDRESS OF DEFECTIVE BOARD	BOARD NAME
2	K	Not Used
3	L	Not Used
4	M	Not Used
5	N	Not Used
6	O	Prototyping
7	P	Prototyping
8	Q	Prototyping
9	R	Prototyping
10	S	Axis or Compensation
11	T	Axis or Compensation
12	U	Axis or Compensation
13	V	Axis or Compensation
14	W	Axis
15	X	Axis
16	Y	Axis
17	Z	Axis

b. If the address indicated is not in use, or if removing the the board indicated does not clear the problem, remove each of the other boards (except the HP-IB board) one at a time. Power up the HP 5507A after removing each board and check to see if the problem clears.

c. If the problem has not cleared, replace the HP-IB board.

FAILURE SYMPTOM #6

After power-up, the LISTEN and SRQ LEDs flash constantly. This flashing must not be confused with the normal power-up cycling of the TALK, LISTEN, and SRQ LEDs that indicates the HP 5507A is waiting for the laser head to send a stable reference signal to which the HP-IB board's PLL (Phase-Locked Loop) circuit must lock.

a. Check the Mailbox Busy- line on pin 22 of the backplane connectors (see *Figure 7-36*). Is the signal level at TTL-high? If it is, proceed to step b. If not, turn off power and remove the function and compensation boards connected to the backplane — one at a time. After removing each board, power up the HP 5507A and recheck the Mailbox Busy- line. If the line is now at TTL-high, replace the last board removed from the backplane. If all boards, except the HP-IB board, have been removed from the backplane and the Mailbox Busy- is still low, the problem is in the backplane.

b. Check the Delta Compensation- line at pin 33 of backplane connector XA8 (see *Figure 7-36*). Is the signal level at TTL-high? If so, replace the HP-IB board. If the line is at a low TTL level, turn the HP 5507A off and remove the Automatic Compensation board. Power up and recheck the Delta Compensation- line. If the line is at TTL-high, replace the Automatic Compensation board. If the line has remained at TTL-low, the problem is in the backplane.

FAILURE SYMPTOM #7

The MEASUREMENT SIGNAL ERROR LED turns on after the LASER LOCKED LED turns on.

a. If the system has more than one axis, query the HP 5507A for an explanation of the error (ERRM?). Examine the axis indicated for a blocked beam.

b. Examine the axis indicated for misalignment of the optics.

c. See the "HP 10780A Receiver" or "HP 5518A Laser Head Internal Receiver" troubleshooting paragraphs found in this section for additional information.

FAILURE SYMPTOM #8

The SYSTEM ERROR LED turns on and stays on.

a. Query the HP 5507A for an explanation of the error (ERRM?). Check out the problem indicated by the error message. If the error message returned to the controller is "*__Error-102: Card self-test failure.", where "*" is the address of the board, replace the board indicated by the address.

b. If communication with HP 5507A is impossible, check that the HP-IB board Address Switch S1 test bits are set to zero. Also, ensure that the HP-IB cable is connected firmly to both the HP 5507A and the controller. If the cable is correctly connected, replace the HP-IB board.

FAILURE SYMPTOM #9

The system has a problem but there is no specific indication of a problem from the front-panel indicators (i.e., the power-up sequence was OK).

a. Find out if all the boards that are supposed to be installed are actually installed and working. Do this using the configuration query (CNFG?).

Sample Response: * HP-IB V COMP X AXIS

b. Check the system status using the ISTA? command. See the description for this command in Section IV. (Status byte value is 0 until LASER LOCKED LED illuminates.)

c. Refer to "Individual Board Failure Symptoms" for more information.

INDIVIDUAL BOARD FAILURE SYMPTOMS

If the indicated board has one of the listed symptoms, check the fuses located on each board first (See *Table 7-18* for fuse location and ratings.) Next, check all cable connections to the board in question. Also, reseat the board in its respective backplane connector to ensure that a poor electrical connection has not caused the problem.

The V_{CC} test points on each board should be +4.9 Vdc ±0.15V.

HP-IB Board Failure Symptoms

HP-IB FAILURE SYMPTOM #1

The front-panel LEDs (except for the LASER ON LED) remain off or do not sequence during the power-up cycle.

- Perform procedures outlined in "Failure Symptom #3" in the "HP 5507A Troubleshooting" paragraphs.

HP-IB FAILURE SYMPTOM #2

After power-up, the TALK, LISTEN, and SRQ LEDs either remain off or one or more of them stay on. The HP 5507A front-panel SYSTEM ERROR LED may also be on.

- Perform procedures outlined in "Failure Symptom #4" in the "HP 5507A Troubleshooting" paragraphs.

HP-IB FAILURE SYMPTOM #3

After power-up, the LISTEN and SRQ LEDs flash constantly. This flashing must not be confused with the normal power-up cycling of the TALK, LISTEN, and SRQ LEDs that indicates the HP 5507A is waiting for the laser head to reach operating temperature.

- Perform procedures outlined in "Failure Symptom #6" of the "HP 5507A Troubleshooting" paragraphs.

HP-IB FAILURE SYMPTOM #4

No HP-IB communication.

a. Ensure that the HP-IB board Address Switch SW1 test bits are set to zero.

b. Ensure that the HP-IB cable is connected correctly.

c. If a and b are OK, the HP-IB board is the problem. Replace it.

HP-IB FAILURE SYMPTOM #5

The response to a CNFG? query is incorrect.

a. If one board responds incorrectly, replace that board.

b. If all functional boards connected to the backplane respond incorrectly, the HP-IB board and the backplane address lines could be at fault. Check the address lines for shorts and continuity. If they are OK, replace the HP-IB board.

HP-IB FAILURE SYMPTOM #6

The response to a ISTA? query and the LASER LOCKED LED shows that the PLL on the HP-IB board has not locked onto the reference signal although the laser head is generating a good TTL reference signal. This signal should be a square wave with a low at 0V and a high at +2.5 to +5 Volts.

- Using the *Figures 7-35* and *7-36*, trace the reference signal from laser head input to the HP-IB board via the backplane. If the signal path checks OK, replace the HP-IB board.

HP-IB FAILURE SYMPTOM #7

The LASER LOCKED LED is off and the ISTA? query response indicates that the HP-IB board's Phase-locked Loop (PLL) has lost lock on the reference signal.

a. Check pins 35 and 37 of the HP-IB board's backplane connector (XA1). Is the reference signal present? If so, proceed to step b. If not, trace the reference signal line from the HP-IB board backplane connector to the laser head. *Figures 7-35* and *7-36*, the HP 5507A/B Signal Flow Diagram and Backplane Schematic Diagram respectively, will prove helpful.

b. Check the quality of the reference signal. It should be a TTL-level signal having the frequency shown below for the Laser Head you are using.

HP 5501A/B:	1.5 to 2.0 MHz
HP 5517A:	1.5 to 2.0 MHz
HP 5517B:	1.9 to 2.4 MHz
HP 5517C:	2.4 to 3.0 MHz
HP 5518A	
(Serial below 2532A02139):	1.5 to 2.0 MHz
(Serial 2532A02139 and above):	1.7 to 2.4 MHz

HP-IB FAILURE SYMPTOM #8

The HP-IB board does not recognize backplane Error- line transitions, or the front-panel SYSTEM ERROR LED is not working, or errors are not reset properly by the HP-IB board.

a. If the HP-IB board fails to detect the backplane Error- line transitions, probe pin 60 of backplane connector XA1. Use a logic probe such as the HP 545A. Continue to monitor this line as you induce a system error and subsequently reset it. An error can be induced by sending an illegal mnemonic to a board. An example is sending mnemonic *NUL13 to an Axis board. Reset the error by issuing a "soft reset" to the system. This can be accomplished simply by depressing the front-panel RESET switch. The Error- line should toggle from high to low when the error is induced and from low to high when cleared. If the Error- line remains high regardless of the error induced, then the Error- line may be shorted. If the Error- line does not toggle from low to high after resetting the error, proceed to step c. If the Error- line functions as it should but "Bit five" of the instrument status byte does not respond to the induced error conditions, replace the HP-IB board. The instrument current status byte can be displayed by the controller by sending mnemonic ISTA?. Refer to "HP 5507A Status Bytes" on page 4B-18 for more details.

b. If the front-panel SYSTEM ERROR LED is not working in step with the status byte changes, force an error by sending the mnemonic *NUL13 to the Axis board while probing pin 60 of backplane connector XA1 (Error- line). This line toggles from high to low when an error is detected in the system. Probe the A1J3 pin 5 (flat-ribbon cable that connects the HP-IB board and the front-panel board) or Axis board IC A1U24(Pin 10). This signal should be high. If the signal is low, replace the HP-IB board. If the signal is high, repair the front panel board.

c. If performing a "hard reset" by power cycling the HP 5507A/B or issuing the BOOT command, or performing a "soft reset" by depressing the front-panel RESET switch or issuing the ERST command does not the clear the error condition, replace the HP-IB board.

Axis Board Failure Symptoms

If any of the following conditions exist, replace the Axis board.

a. LEDs on the board stay continuously on or either one continues to flash after the board self test has completed, or one or both of the LEDs never turn on.

b. The Axis board does not appear in the CNFG? configuration response or the response is erroneous.

c. The front-panel SYSTEM ERROR LED is on, while the SRQ LED flashes a defined number of times, followed by a pause, then a repeat of the flashes. The number of SRQ LED flashes corresponds to an Axis board's address as outlined in *Table 7-5* ("SRQ LED Error Indications").

d. The insertion of a particular Axis board causes an error indication. If the response to an ERRM? query is "-100: No cards found during boot", check the backplane-mounted and Axis board-mounted fuse(s) before replacing the Axis board.

e. The analog velocity output scaling is incorrect.

f. The measurement PLL will not indicate a loss of lock. This is indicated when the MEASUREMENT SIGNAL ERROR LED remains off when the path of the laser beam is blocked.

g. The position counter output is unstable.

h. The resolution extension bits are not counting up and down properly with 11.25° steps in the measurement phase.

i. The position counter bits do not work. Position information (*POS) is incorrect.

j. The position counter over/underflow does not work.

k. The External Sample- input does not work.

l. The Drive Enable- signal is not turning on or off properly.

m. The rear-panel hardware Position Error outputs are not working correctly.

n. The Two's Complement Position Error output mode does not work.

o. The rear-panel Error Hold- input does not work.

p. The Position Error Clip does not work.

q. The Position Null does not work.

r. The Backplane Error-, Path Error-, Sampled-, or Position Null- lines are not working properly.

s. The measurement PLL test signal (*TST) does not work or is at the wrong frequency.

t. An Axis board appears twice in the CNFG? response.

Servo-Axis Board Failure Symptoms

If any of the following conditions exist, replace the Servo-Axis board.

a. LEDs on the board stay continuously on or either one continues to flash after the board self test has completed, or one or both of the LEDs never turn on.

b. The Servo-Axis board does not appear in the CNFG? configuration response or the response is erroneous.

c. The front-panel SYSTEM ERROR LED is on, while the SRQ LED flashes a defined number of times, followed by a pause, then a repeat of the flashes. The number of SRQ LED flashes corresponds to a Servo-Axis board's address as outlined in *Table 7-5* ("SRQ LED Error Indications").

d. The insertion of a particular Servo-Axis board causes an error indication. If the response to an ERRM? query is "-00: No cards found during boot", check the backplane-mounted and Servo-Axis board-mounted fuse(s) before replacing the Servo-Axis board.

e. The measurement PLL will not indicate a loss of lock. This is indicated when the MEASUREMENT SIGNAL ERROR LED remains off when the path of the laser beam is blocked. (if GREEN LED on receiver stays on, then adjust its gain first).

f. The resolution extension bits are not counting up and down properly with 11.25 degree steps in the measurement phase.

g. The position counter bits do not work. Position information (*POS) is incorrect (verify sample mode first).

h. The position counter over/underflow does not work.

i. The External Sample- input does not work (check sample mode first).

j. The Drive Enable- signal is not turning on or off properly.

k. The Threshold or Window Output does not work.

l. The backplane Error-, Path Error-, Sampled-, or Position Null- lines are not working properly.

m. The measurement PLL test signal (*TST) does not work or is at the wrong frequency.

n. A Servo-Axis board appears twice in the CNFG? response.

o. Binary interface does not transfer data (check handshake timing first).

p. No output from DAC OUT line (check coefficient, *OUT and *DRE values first).

q. No output from Pulse up- or Pulse down- lines (check coefficient, *OUT and *DRE values first).

r. Limit switch inputs do not stop travel (check polarity and direction sense first).

s. Master axis does not move (check board setup first).

t. Slave axis does not move (check board setup and Inter-servo cable first).

A-Quad-B Axis Board Failure Symptoms

If any of the following conditions exist, replace the A-Quad-B Axis board.

a. LEDs on the board stay continuously on or either one continues to flash after the board self test has completed, or one or both of the LEDs never turn on. (Check backplane and board mounted fuses before replacing board.)

b. The A-Quad-B Axis board does not appear in the CNFG? configuration response or the response is erroneous.

c. The front-panel SYSTEM ERROR LED is on, while the SRQ LED flashes a defined number of times, followed by a pause, then a repeat of the flashes. The number of SRQ LED flashes corresponds to a A-Quad-B Axis board's address as outlined in *Table 7-5* ("SRQ LED Error Indications").

d. The insertion of a particular A-Quad-B Axis board causes an error indication. If the response to an ERRM? query is "-100: No cards found during boot", check the backplane- mounted and A-Quad-B Axis board-mounted fuse(s) before replacing the A-Quad-B Axis board.

e. The measurement PLL will not indicate a loss of lock. This is indicated when the MEASUREMENT SIGNAL ERROR LED remains off when the path of the laser beam is blocked. (if GREEN LED on receiver stays on, then adjust its gain first).

f. The resolution extension bits (the five LSBs of *RLP) are not counting up and down properly with 11.25 degree steps in the measurement phase.

g. The position counter bits do not work. Position information (*RLP, *POS, or *MUL) is incorrect (verify sample mode first).

h. The position counter over/underflow does not work.

i. The External Sample- inputs do not work (check sample mode first).

j. The Start-, Stop-, Axis Init-, Comp Update-, or Preset Enable- inputs do not work. (Check voltage setting first.)

k. The READY, SYSTEM ERROR-, or AXIS ERROR- outputs do not work.

l. The backplane Error-, Path Error-, or Sampled- lines are not working properly.

m. The measurement PLL test signal (*TST) does not work or is at the wrong frequency.

n. An A-Quad-B Axis board appears twice in the CNFG? response.

o. Parallel interface does not transfer data (Check handshake timing and address lines first).

p. The Serial interfaces do not transfer data (Check baud rates, connections and CTS - RTS lines first.).

q. No output from A/Up, A/Up-, B/Dn, B/Dn- lines (Verify READY output is true first.).

r. No output from Marker or Marker- lines.

Automatic Compensation Board Failure Symptoms

If any of the following conditions exist, replace the Automatic Compensation board.

a. LEDs on the board stay on continuously or either one continues to flash after the board self test has completed, or one or both of the LEDs never turn on.

b. The front-panel SYSTEM ERROR LED is on, while the SRQ LED flashes a defined number of times, followed by a pause, then a repeat of the flashes. The number of SRQ LED flashes corresponds to the Automatic Compensation board's address (either 10, 11, 12, or 13) as outlined in *Table 7-5* ("SRQ LED Error Indications").

(Continued on page 7-35.)

c. The Automatic Compensation board does not appear in the CNFG? response or the response is erroneous.

d. After power-up, the front-panel LISTEN and SRQ LEDs are both flashing. (This could also be indicating a problem with the HP-IB board).

PROTOTYPING BOARD/BACKPLANE TROUBLESHOOTING

The HP 10941A Prototyping Kit allows custom circuitry to be designed into the HP 5507A Laser Position Transducer Electronics. The following procedure will help isolate possible faults that may occur. The schematic diagram, *Figure 3-19*, may be referenced during the troubleshooting process. Before proceeding with any troubleshooting, refer to Section I, "Limitation of Warranty", for HP 10941A Prototyping Kit.

NOTE

The backplane interface ICs are socket mounted. This makes it convenient to replace (or swap) a suspected defective IC. If the interface electronics ICs are readily available, it will probably be most cost effective to replace the suspect IC as opposed to analyzing signals.

a. Check fuse F1 on the Prototyping board for continuity.

b. Visually examine both sides of the PC board for contaminants, foreign materials, and broken IC or socket pins. Contaminants, such as dirt or oxidation on socket or edge connectors, can be removed by cleaning them with a 50/50 solution of isopropyl alcohol and de-ionized water, applied with a lint-free cotton cloth. Foreign materials, such as broken wire strands and solder splashes, should be removed carefully so as not to damage the board surface.

c. Check +5 Volts (V_{CC}) and ground (GND) pins on each IC. Refer to "Table of Active Elements" provided in *Figure 3-19* for IC V_{CC} and GND pin numbers. V_{CC} should measure 4.9 Vdc ±0.15V.

d. If a V_{CC} (+5 Vdc) problem is detected:

   1. Check fuse F1. Measure the voltage on both line and load side of fuse. Check for +5 Volts on the backplane connector (pin 39 or 79). If voltage differences are detected, disconnect power to the HP 5507A, give the Prototyping board +5 Volt traces a visual inspection, and check for continuity between each IC and the backplane connector (pin 39 or 79).

   2. Check for continuity to ground between each IC ground pin and the HP 5507A backplane (pins 40 or 80). (Disconnect power to the HP 5507A if an ohmmeter is used to check continuity.)

e. If an address jumper (W1 or W2) has been removed or its position changed, check for continuity to ground from appropriate pin of IC U6 when either address jumper is installed.

f. Query the HP 5507A with a CNFG? command. Is the board listed? If not, proceed to step g. If it is listed but the address is wrong, check continuity of address jumpers W1 and W2 as in step e. If W1 and W2 check OK, replace U6. Query the HP 5507A again (i.e., send mnemonic CNFG?). If board is listed, proceed to step i.

g. Replace ICs U3, U4, and U6. If the board is still not listed (in response to the CNFG? command), change IC U5. If the problem still persists, check for continuity between the ICs and between the ICs and the backplane [see schematic (*Figure 3-19*)].

h. Query the HP 5507A by sending command INST?. Check the mnemonics list returned to the controller. If the list is OK, proceed to step i. If not, replace IC U5.

i. Exchange ICs U1 and U2 with each other. If the problem still exists, check control and address signal lines to these ICs. If these signal lines are OK, then the user-supplied circuitry is suspect.

HP 5527A System Power Supply Current Limitations

The HP 5507A Laser Position Transducer Electronics contains a power supply that provides power to the entire transducer system. Custom-designed function boards can also be powered by this supply, provided the supply's ratings are not exceeded.

If the power supply voltage ratings fall outside the limits listed in *Table 7-6*, refer to the "HP 5527A Power Supply Adjustments" paragraphs in this section for assistance.

Table 7-6. HP 5507A Power Supply Limitations

POWER SUPPLY OUTPUT AT BACKPLANE	VOLTAGE LIMITS (In Vdc)
+5 Volts	+4.85V to +5.05V
+15 Volts	+14.5V to +15.5V
-15 Volts	-14.5V to -15.5V

Many times power supply problems are caused by an excessive load being placed across its output. A characteristic of such overloading is the inability to adjust the supply voltage to within its specified output voltage. The following information provides maximum output current and nominal current requirements for each voltage supplied to each assembly connected to the HP 5527A Laser Position Transducer system (e.g., HP 5507A subassemblies, laser head, receivers, and sensors).

If adjustment problems are encountered, measure current at the power supply outputs. If the measured current exceeds the recommended limits, sequentially remove the sensors and/or laser head. Measure the current again after each assembly is disconnected. Is the current reading now within specified limits? If so, replace or repair the assembly that was removed last.

Nominal power requirements of the laser heads, environmental sensors, and receivers, are listed by power supply voltage in *Table 7-7*. These nominal current values should be used for indication only.

Table 7-7. HP 5527A/B Nominal Power Requirements (See Note 1)

SUPPLY	LASER HEADS				SENSORS		RECEIVER
	5501A	5517A	5517B/C	5518A	10751A/B	10757A/B/C	10780B/C/F
+5V	—	—	—	—	—	—	—
+15V	800mA	2.5A (–1) 1.5A (2)	2.2A (–1) 1.5A (2)	2.5A (–1) 1.5A (2)	53mA	7mA	136 mA
–15V	700mA	20mA	20mA	17mA (–1) 11mA (2)	53mA	7mA	
+24V	—	—	—	—	—	—	—

(1) Maximum value when laser heater is active (peak during warm-up).
(2) Typical value when heater is off (peak after warm-up).

Table 7-8 lists typical current measurements for the function boards contained within the HP 5507A/B Laser Position Transducer Electronics.

Table 7-8. Typical HP 5507A/B Assembly Current Measurements

ASSEMBLY	VOLTAGE (dc volts)	CURRENT (Amps)
10932A/B Axis Board	+5 +15 –15 +24	2 0.006 0.003 Not Used
10934A A-Quad-B Axis Board	+5 +15 –15 +24	2.5 0.040 0.045 Not Used
10936A/B Servo-Axis Board	+5 +15 –15 +24	2.5 0.030 0.045 Not Used
10946B/C Automatic Compensation Board(1)	+5 +15 –15 +24	1.75 0.018 0.009 Not Used
HP-IB Interface Board and Front Panel	+5 +15 –15 +24	1.1 0.014 0.012 Not Used
Backplane Board	+5 +15 –15 +24	0.120 Not Used Not Used 0.240(2)

(1) Current requirements for the Automatic Compensation board do not include other current draws available at the rear panel via the Compensation Connector board. Additional current may be supplied to the compensation sensor input and the HP 10780 Receiver associated with the Wavelength Tracking Compensator.

(2) The BI Circulation fan is the only component connected to +24 Vdc.

DISASSEMBLY AND REASSEMBLY OF THE HP 5507A

Tools Required:

(1) Pozidriv Screwdrivers:
Small — 3" long shaft, for use on Pozidriv screws up to size 4 (HP Part No. 8710-0899)
Large — 4" long shaft, for use on Pozidriv screws of size 6 and above (HP Part No. 8710-0900)

(2) 9/16" Hex Nut Driver (0.75" deep)

(3) 7 mm Hex Nut Driver

(4) Slotted screw driver

WARNING

MAINTENANCE DESCRIBED HEREIN IS PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT, AND PROTECTIVE COVERS REMOVED. 100 VOLTS/240 VOLTS AC MAY BE PRESENT IN THE HP 5507A EVEN WHEN THE FRONT PANEL SWITCH IS SET TO OFF. MAINTENANCE SHOULD BE PERFORMED ONLY BY SERVICE-TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED (e.g., FIRE AND ELECTRIC SHOCK). WHERE MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER CORD SHOULD BE REMOVED. CONTACT WITH PRIMARY POWER VOLTAGE COULD CAUSE SERIOUS PERSONAL INJURY.

CAUTION

The HP 5507A must be turned off prior to inserting or removing any pc board. Expensive damage to both the instrument and the pc board may result if power is left on.

CAUTION

Some circuits on the HP 5507A plug-in boards are susceptible to damage from electrostatic discharge. Use an anti-static work station and ground straps when handling printed circuit assemblies during assembly or disassembly.

Prior to performing disassembly and reassembly procedures, perform the following:

a. Set front-panel LINE switch to off.

b. Disconnect the AC power from the rear panel.

TOP COVER REMOVAL

To remove the top cover, proceed as follows:

a. Place HP 5507A with top cover (MP14, *Figure 7-13*) facing up.

b. At the top rear of instrument, remove recessed Pozidriv screw. The screw is retained with the cover and therefore can not be fully removed from the cover. Loosen screw only until the cover can be removed. Slide the top cover to the rear of the instrument and lift off.

c. The replacement procedure is essentially the reverse of the removal procedure.

BOTTOM COVER REMOVAL

To remove the bottom cover, proceed as follows:

a. Turn the instrument upside-down and loosen the recessed Pozidriv screw located in the rear edge of the bottom cover (MP15, *Figure 7-13*). The screw is retained with the bottom cover and therefore cannot be fully removed. Loosen screw only until the cover can be removed.

b. Slide the cover to the rear of the instrument until it can be lifted off.

c. The replacement procedure is essentially the reverse of the removal procedure.

SIDE COVER REMOVAL

To remove each side cover, proceed as follows:

a. Remove top and bottom covers (MP14 and MP15) as previously outlined.

b. Loosen the recessed Pozidriv screw located in the rear edge of the the side cover (MP16, *Figure 7-13*). The screw is retained with with the side cover and therefore cannot be removed. Loosen screw only until the cover can be removed.

c. Slide the cover to the rear of the instrument until it can be lifted off.

d. The replacement procedure is essentially the reverse of the removal procedure.

FAN REMOVAL AND INSTALLATION

There are two reasons for having to remove the fan; to replace a defective fan or to reverse the direction of air flow into the HP 5507A.The HP 5507A air flow is reversed to facilitate the HP 5507A being mounted in a pressurized cabinet. The fan can be removed and/or air flow reversed as follows:

a. Remove instrument top cover (MP14, *Figure 7-13*).

b. Disconnect fan cable assembly (W3) from backplane connector J1.

c. Remove front-panel grille assembly (MP23, *Figure 7-15*).

   1. Remove two retaining screws (H21, *Figure 7-15*).

   2. Swing bottom part of grille away from instrument and lower grille, removing retaining tabs from slots in front panel.

d. Remove air filter (MP22) by disengaging hook and loop retaining mechanisms (H22, *Figure 7-15*).

e. Remove four screws and nuts (H16 and H17, *Figure 7-15*) that secure the fan to the front panel assembly.

f. Remove fan grille (MP24, *Figure 7-15*).

g. Reinstall fan so that air is now forced out through the front panel (counterclockwise rotation as viewed from inside the HP 5507A). If a defective fan is being replaced, install new fan so that the blades rotate clockwise (as viewed from inside the HP 5507A). This will draw air in through the front panel. Ensure fan is positioned so that fan cable exits fan body from the top-right corner as viewed from the front of the HP 5507A. This will prevent the cable from interfering with the installation of the HP 5507A bottom cover.

h. Reposition fan grille (MP24, *Figure 7-15*) and tighten four screws (H16).

i. If airflow is being reversed, do not reinstall the fan filter (MP22, *Figure 7-15*). If a defective fan is being replaced, reinstall filter.

j. Install front-panel grille (MP23) and its two retaining screws (H21).

k. Plug fan cable assembly (W3) into backplane connector J1.

POWER SUPPLY ASSEMBLY REPLACEMENT

a. Remove top and bottom instrument covers (MP14 and MP15, *Figure 7-13*) as previously described.

b. Remove pc board retainer (MP10, *Figure 7-13*), held in place by two screws (H6, *Figure 7-13*) located at each side of the instrument.

c. Remove High Voltage Shield (MP8, *Figure 7-16*) by removing two screws (H10, *Figure 7-16*).

WARNING

WHEN THE HIGH VOLTAGE SHIELD (MP8) IS REMOVED FROM THE HP 5507A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DO NOT REMOVE THE HIGH VOLTAGE SHIELD UNLESS IT IS NECESSARY AND ONLY WHEN THE UNIT IS DISCONNECTED FROM THE POWER MAINS.

d. Remove right side cover (as viewed from HP 5507A front panel) by removing recessed Pozidriv screw located at the rear edge of the side cover (MP16, *Figure 7-13*).

e. Disconnect dc power cable assembly (W2, *Figure 7-13*) from A12 Transducer Backplane connector J2.

f. Disconnect the two BLK/RED wires from the A14 power module as shown in *Figure 7-12* (View B).

g. Disconnect the WHT/RED/GRA, GRA, and GRN wires from the power supply's terminal block (pins 1-3), using a slotted screw driver.

h. Remove four screws (H12, *Figure 7-16*) that secure the power supply to the two side struts (MP7). Note out of which holes in the struts the four screws were removed. For each strut, a screw is located in the fifth hole from the instruments front panel and the fourth hole from the rear panel of the instrument.

i. Remove four screws (H11, *Figure 7-16*) that secure power supply to the power supply bracket (MP6, *Figure 7-16*).

j. The replacement procedure for the power supply (A14) is essentially the reverse of the removal procedure.

CAUTION

Refer to Figures 7-12 (View B) and 7-35 when reconnecting the two BLA/RED wires or the DC power cabling to the A14 Power Supply Assembly. These figures document the correct wiring scheme.

POWER LINE MODULE CABLE ASSEMBLY REPLACEMENT

a. Remove top and bottom instrument covers (MP14 and MP15, *Figure 7-13*) as previously described.

b. Remove pc board retainer (MP10, *Figure 7-13*), held in place by two screws (H6, Figure 7-13) located at each side of the instrument.

c. Remove High Voltage Shield (MP8, *Figure 7-16*) by removing two screws (H10, *Figure 7-16*).

WARNING

WHEN THE HIGH VOLTAGE SHIELD (MP8) IS REMOVED FROM THE 5507A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DO NOT REMOVE THE HIGH VOLTAGE SHIELD UNLESS IT IS NECESSARY AND ONLY WHEN THE UNIT IS DISCONNECTED FROM THE POWER MAINS.

d. Remove right side cover (as viewed from HP 5507A front panel) by removing recessed Pozidriv screw located at the rear edge of the side cover (MP16, *Figure 7-13*).

e. Disconnect DC power cable assembly (W2, *Figure 7-13*) from A12 Transducer Backplane connector J2.

f. Disconnect the two BLK/RED wires from the A14 power module as shown in *Figure 7-12* (View B).

g. Disconnect BLK/RED and BLK/GRN wires from spade connector of line filter FL1. [See *Figure 7-15* (View A) for FL1 wiring scheme.]

h. Remove cable from the two backplane-mounted cable clamps.

i. Unsolder GRN/YEL wire from solder lug riveted to HP 5507A rear panel. NOTE: During reinstallation of the GRN/YEL wire, ensure wire lead passes through the eye of the lug, wraps around three adjacent sides of the lug, and is then crimped in place (i.e., GRN/YEL wire is mechanically secure before soldering). Such mechanical securing shall prevent motion between parts of a joint during the resoldering operation.

j. Remove two screws (H6, *Figure 7-17*) that secure line module to the HP 5507A rear panel.

k. From inside the HP 5507A, press down and out on the top of module at the two parallel plastic retainers that keep the retainer secure in the 5507A rear panel assembly. Repeat this operation at the bottom of the module. (See *Figure 7-12* (View A.)

l. Remove A13 Power Line Module Cable Assembly from HP 5507A.

m. The A13 Power Line Module Cable Assembly installation procedure is essentially the reverse of the removal procedure. When the Power Line Module Cable Assembly (HP Part No. 05507-60101) is ordered, it is delivered to the customer prewired and ready for installation.

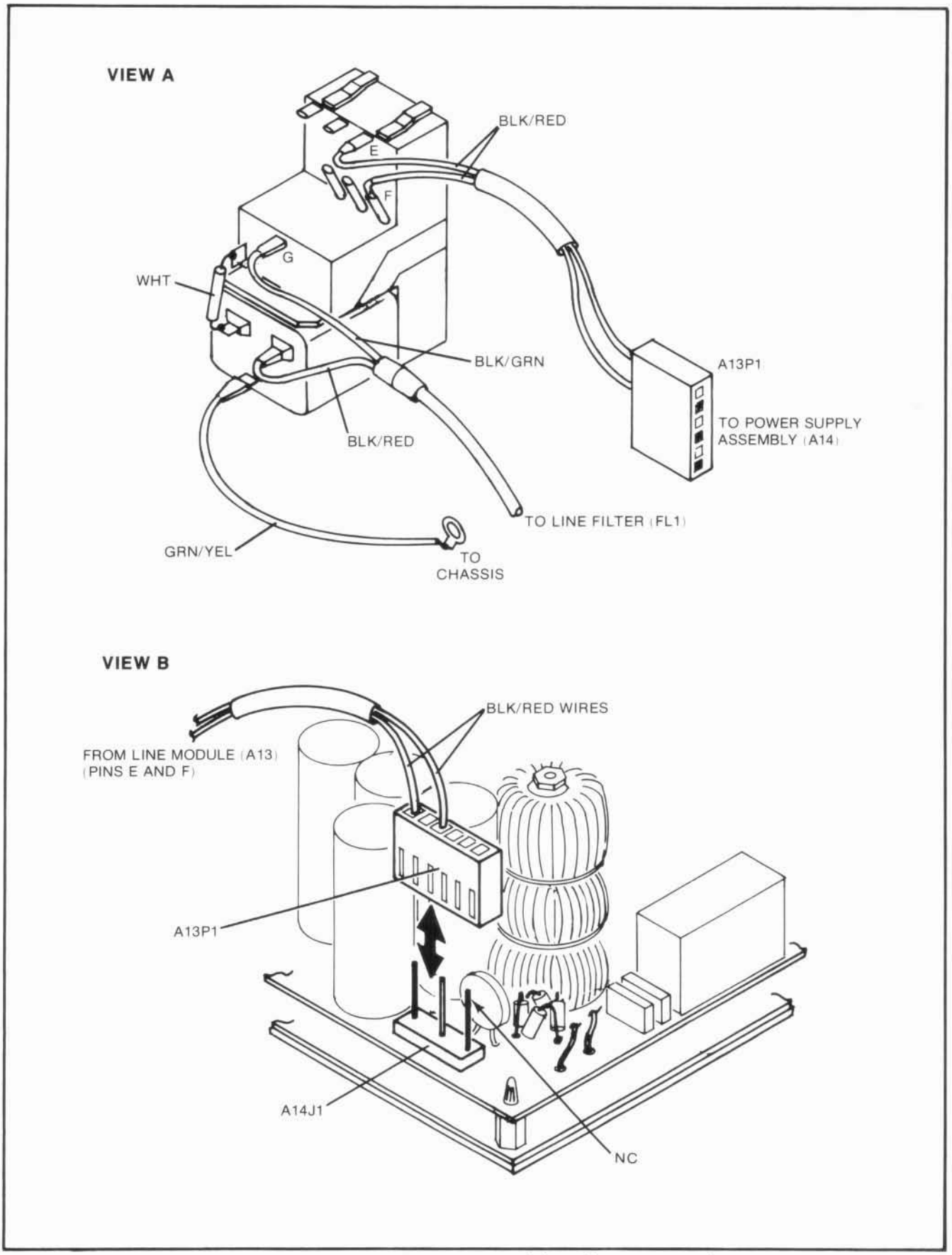


Figure 7-12. A13 Power Line Module Cable (View A) and A14 Power Supply (View B) Assembly Removal/Installation

Printed Circuit Board Replacement

HP-IB Interface Board Replacement

a. Remove HP 5507A top cover (MP14, *Figure 7-13*) following procedures previously outlined.

b. Remove pc board retainer (MP10, *Figure 7-13*), held in place by two screws (H6, *Figure 7-13*) located at each side of the instrument.

c. Disconnect front-panel cable assembly (A11W1, *Figure 7-11*) from HP-IB board connector J3 (*Figure 7-2*)..

d. Remove two hex-head fasteners (H5, *Figure 7-17*) located at HP 5507A rear panel HP-IB connector. (Use a 7 mm hex socket to remove fasteners.) Note that the 24-pin connector adapter (MP4, *Figure 7-17*) is mounted on the external surface of the HP 5507A rear panel.

e. Gently remove the HP-IB board from backplane connector XA1. Note that the HP-IB connector shield (A1MP1, *Figure 7-17*) is mounted on HP-IB rear-panel connector (J1) and is located on the internal side of the HP 5507A rear panel.

f. The HP-IB board installation procedure is essentially the reverse of the removal the procedure.

g. Following the installation of the HP-IB board and before applying power to the HP 5507A, check the HP-IB board's address switch to ensure proper setting.

CAUTION

Each board must be set to a unique address. Failure to do so will result in improper operation or circuit damage.

Axis Board Replacement (Option 032)

a. Remove HP 5507A top cover (MP14, *Figure 7-13*) following procedures previously outlined.

b. Remove pc board retainer (MP10, *Figure 7-13*), held in place by two screws (H6, *Figure 7-13*) located at each side of the instrument.

c. Disconnect receiver cable assembly (A2W1, *Figure 7-17*) from Axis board connector J4.

d. Remove two hex-head fasteners (H5, *Figure 7-17*) located at HP 5507A rear-panel Axis board connector. Note that the 50-pin connector adapter (MP3, *Figure 7-17*) is mounted on the external surface of the HP 5507A rear panel.

e. Gently remove the Axis board from backplane connector XA2, XA4, XA6, or applicable slot. Note that the HP-IB connector shield (A1MP1, *Figure 7-17*) is mounted on HP-IB rear-panel connector (J1) and is located on the internal side of the HP 5507A rear panel.

f. The Axis board installation procedure is essentially the reverse of the removal procedure. (See *Figure 6-5* for reference.)

g. Following the installation of the Axis board and before applying power to the HP 5507A, check the Axis board's address switch to ensure proper setting.

CAUTION

Each board must be set to a unique address. Failure to do so will result in improper operation or circuit damage.

Automatic Compensation Board Replacement (Option 046)

NOTE

Avoid handling the Automatic Compensation PC board near integrated circuit A8U1.

a. Remove HP 5507A top and bottom covers (MP14 and MP15, *Figure 7-13*) following procedures previously outlined.

b. Remove pc board retainer (MP10, *Figure 7-13*), held in place by two screws (H6, *Figure 7-13*) located at each side of the instrument.

c. Remove left-side cover (MP16, *Figure 7-13*) as viewed from the front panel of the HP 5507A.

d. Disconnect Compensator Connector board cable assembly (A9W1, *Figure 7-17*) from Automatic Compensation board connector J1.

e. Disconnect Wavelength Tracking Compensator receiver cable (A8W1, *Figure 7-17*) from the Automatic Compensation board 4-pin connector A8J3.

f. Gently remove the Automatic Compensation board from backplane connector XA8.

g. The Automatic Compensation board installation procedure is essentially the reverse of the removal procedure.

NOTE

The A9 Compensation Connector Board (mounted on the 5507A rear panel) is slotted. When installing the A8 Automatic Compensation Board, the protruding section of the A8 printed circuit board must pass through the slot in the A9 printed circuit board. Also, the base of the A8 board must engage the card guide mounted on the A12 Backplane Transducer board.

h. Following the installation of the Automatic Compensation board and before applying power to the HP 5507A, check the Automatic Compensation board's address switch to ensure proper setting.

CAUTION

Each board must be set to a unique address. Failure to do do so will result in improper operation or circuit damage.

Compensation Connector Board Replacement (Option 046)

a. Remove Automatic Compensation board as previously outlined.

b. Remove three hex nuts (H4, *Figure 7-17*) from respective BNC connectors located on 5507A rear panel. (Use 9/16" hex nut driver to remove the hex nuts.)

c. Remove six machine screws (H9, *Figure 7-17*) that secure the three twist-lock receptacles located at the rear panel.

d. Remove the Compensation Connector board from the instrument.

e. The Compensation Connector board installation procedure is essentially the reverse of the removal procedure.

Servo-Axis Board Replacement

a. Remove HP 5507A/B top cover (MP14, *Figure 7-13*) following procedures previously outlined.

b. Remove pc board retainer (MP10, *Figure 7-13*), held in place by two screws (H6, *Figure 7-13*) located at each side of the instrument.

c. If installed, remove the interconnect cables to the Servo-Axis boards.

d. Remove two hex-head fasteners (H5, *Figure 7-17*) located at HP 5507A/B rear-panel Servo-Axis board connector. Note that the 50-pin connector adapter (MP3, *Figure 7-17*) is mounted on the external surface of the HP 5507A/B rear panel.

e. Gently remove the Servo-Axis board from backplane connector XA2, XA4, XA6, or applicable slot. Note that the shield (A2MP1, *Figure 7-17*) is located on the internal side of the HP 5507A/B rear panel.

f. Disconnect receiver cable assembly (A2W1, *Figure 7-17*) from Servo-Axis board cable clamp and connector A15J4 (*Figure 7-5.1*).

g. The Servo-Axis board installation procedure is essentially the reverse of the removal procedure. (See *Figure 6-5* for reference.)

h. Following installation of the Servo-Axis board and before applying power to the HP 5507A/B, check the board's address switch to ensure proper setting.

NOTE

Each board must be set to a unique address. Failure to do so will result in improper operation or circuit damage.

A-Quad-B Axis Board Replacement

a. Remove HP 5507A/B top cover (MP14, *Figure 7-13*) following procedures previously outlined.

b. Remove pc board retainer (MP10, *Figure 7-13*), held in place by two screws (H6, *Figure 7-13*) located at each side of the instrument.

c. If installed, remove the interconnect cables to the A-Quad-B Axis boards.

d. Remove two hex-head fasteners (H5, *Figure 7-17*) located at HP 5507A/B rear-panel A-Quad-B Axis board connector. Note that the 50-pin connector adapter (MP3, *Figure 7-17*) is mounted on the external surface of the HP 5507A/B rear panel.

e. Gently remove the A-Quad-B Axis board from backplane connector XA2, XA4, XA6, or applicable slot. Note that the shield (A2MP1, *Figure 7-17*) is located on the internal side of the HP 5507A/B rear panel.

f. Disconnect receiver cable assembly (A2W1, *Figure 7-17*) from the A-Quad-B Axis board cable clamp and connector A16J4.

g. The A-Quad-B Axis board installation procedure is essentially the reverse of the removal procedure. (See *Figure 6-5* for reference.)

h. Following installation of the A-Quad-B Axis board and before applying power to the HP 5507A/B, check the board's address switch to ensure proper setting.

NOTE

Each board must be set to a unique address. Failure to do so will result in improper operation or circuit damage.

Laser Connector Board Replacement

a. Remove top cover (MP14, *Figure 7-13*) of 5507A as previously described.

b. Remove HP-IB board as previously described.

c. Disconnect Laser Connector board cable assembly (A10W1, *Figure 7-17*) from backplane connector J3.

d. Remove the two retaining screws (H9, *Figure 7-17*) located at LASER HEAD twist-lock connector on the 5507A rear panel.

e. Remove Laser Connector board (A10, *Figure 7-17*).

f. The Laser Connector board installation procedure is essentially the reverse of the removal procedure.

Front Panel Board Replacement

a. Remove instrument top cover as previously described.

b. Disconnect front-panel cable assembly (A11W1, *Figure 7-11*) from HP-IB board connector J3 (*Figure 7-2*).

c. Remove front panel (MP20, *Figure 7-15*) by removing three Pozidriv machine screws (H7, *Figure 7-15*).

d. Remove five machine screws (H13, *Figure 7-15*) to free PC Board.

e. The front panel board installation procedure is essentially the reverse of the removal procedure.

Transducer Backplane Board Replacement

WARNING

WHEN THE HIGH VOLTAGE SHIELD (MP8) IS REMOVED FROM THE 5507A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DO NOT REMOVE THE HIGH VOLTAGE SHIELD UNLESS IT IS NECESSARY AND ONLY WHEN THE UNIT IS DISCONNECTED FROM THE POWER MAINS.

a. Remove top, bottom, and side covers of 5507A as previously described.

b. Remove all PC boards that plug into the Backplane board as previously described (i.e., HP-IB Interface, Axis, Prototyping, Automatic Compensation, etc.).

c. Disconnect all cables that plug into the Backplane board (i.e., fan power, dc power, and Laser Connector board cables).

d. Disengage power line module cable from backplane-mounted cable clamps.

e. Remove lower-right hand strut (as viewed from the 5507A front panel) by removing four screws (H18, *Figure 7-18*).

f. Remove A12 Backplane board.

g. The Backplane board installation procedure is essentially the reverse of the removal procedure. *Figure 7-18* is is helpful reference when installing the board. Note that when installed properly, the board is free to move in the strut grooves from the front to the rear of the instrument.

LINE SWITCH ACCESS AND REPLACEMENT

To gain access to the LINE switch retaining screws:

a. Remove front sub-panel (MP21, *Figure 7-15*) from the front frame (MP17, *Figure 7-15*) by removing six machine screws located on top and bottom of front frame.

b. Gently ease the front sub-panel forward to gain access to the two retaining screws.

c. Remove two Pozidriv retaining screws (H14, *Figure 7-15*).

d. The installation procedure is essentially the reverse of the removal procedure.

REFERENCE DESIGNATOR	DESCRIPTION	HP PART NUMBER
H6	FLATHEAD SCREW M3.0 × 0.5 6MM-LG 90-DEG	0515-0890
MP9	PART OF RACK MOUNT KIT (OPT. 908)	5061-9678
MP10	PC BOARD RETAINER BRACKET	05507-00005
MP11	SIDE TRIM	5001-0440
MP12	FOOT	5040-7201
MP13	TOP TRIM	5040-7202
MP14	TOP COVER	5061-9434
MP15	BOTTOM COVER	5061-9446
MP16	SIDE COVER	5061-9461
MP25	PC BOARD RETAINER BRACKET	05507-00007

Part of Figure 7-13. HP 5507A Cabinet Parts

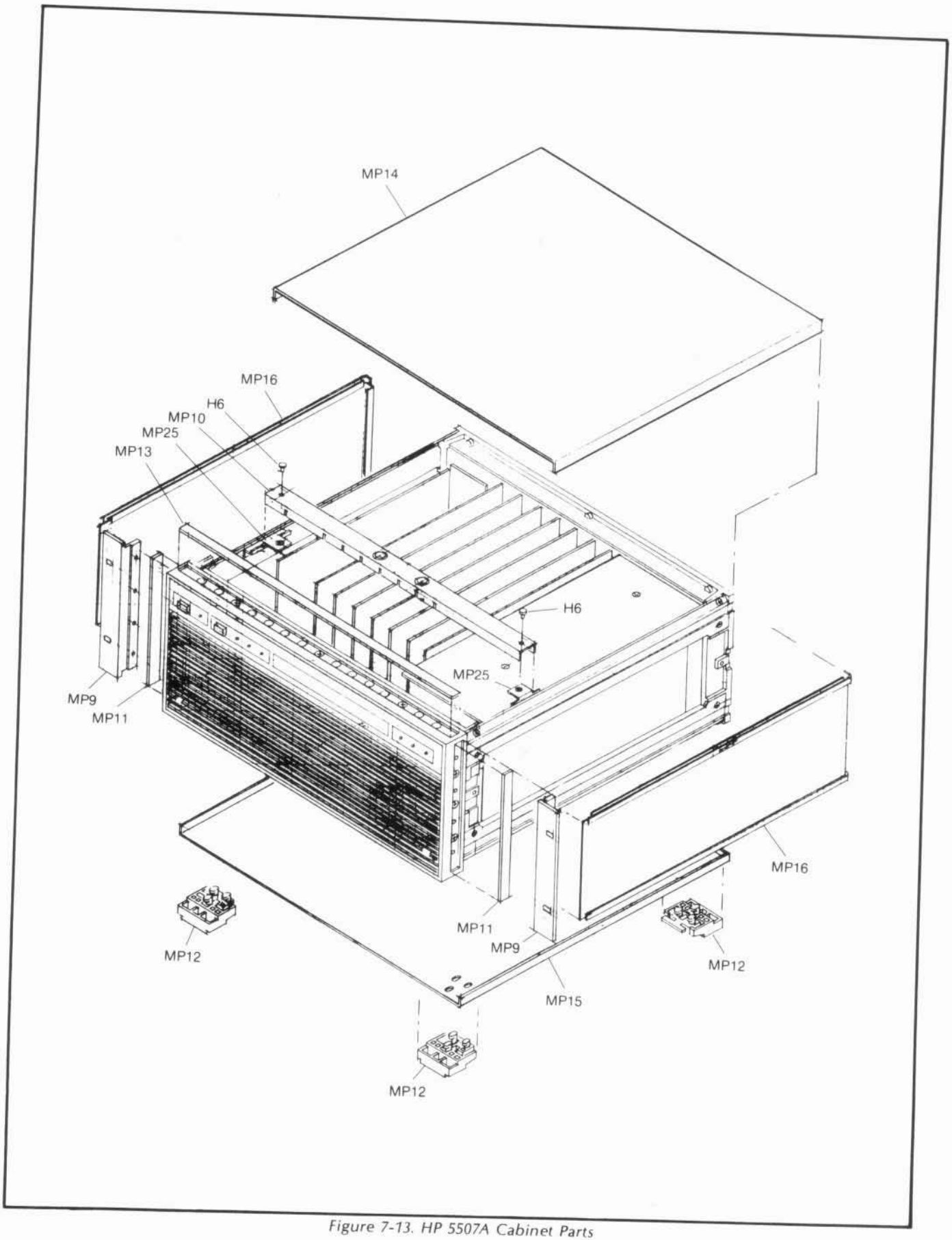


Figure 7-13. HP 5507A Cabinet Parts

REFERENCE DESIGNATOR LOCATIONS	DESCRIPTION	HP PART NO.	QTY	BACKPLANE SLOT
A1	HP-IB INTERFACE BOARD ASSEMBLY	05507-60002	1	XA1 ONLY
A2	AXIS BOARD ASSEMBLY (PART OF OPTION 032)	10932-60002	UP TO 6*	XA2 THROUGH XA7
A3	PROTOTYPING BOARD ASSEMBLY (PART OF PROTOTYPING KIT)	10941-60001	UP TO 4*	SLOTS XA2 THROUGH XA7
A8	AUTOMATIC COMPENSATION ASSY (PART OF OPTION 046)	10946-60004	XA8 ONLY	
A9	COMPENSATION CONNECTOR BOARD ASSEMBLY (PART OF OPTION 046)	10946-60002	1	—
A10	LASER CONNECTOR BOARD ASSEMBLY	05507-60003	1	—
A11	FRONT PANEL BOARD ASSEMBLY	05507-60001	1	—
A12	TRANSDUCER BACKPLANE ASSEMBLY	05507-60004	1	—
A13	POWER LINE MODULE CABLE ASSY	05507-60101	1	—
A14	POWER SUPPLY	0950-2077	1	—
A15**	SERVO-AXIS BOARD ASSEMBLY (PART OF OPTION 036)	10936-60002	UP TO 6*	XA2 THROUGH XA7
A16***	A-QUAD-B AXIS BOARD ASSEMBLY (PART OF OPTION 034)	10934-60001	UP TO 6*	XA2 THROUGH XA7

* The HP5507A/B accommodates six function boards in addition to the HP-IB board and the Automatic Compensation board. Six backplane slots are available for any combination of Axis, A-Quad-B, Servo-Axis, and Prototyping boards; XA2 through XA7. The 5507A/B performs a self-configuration during power-up. The HP-IB board recognizes which compensation and function boards are in place, thus accommodating any system configuration.

** When installing more than one Servo-Axis Board, locate the additional Servo-Axis board in an adjacent slot to allow for inter-servo cable connections.

*** When installing more than one A-Quad-B Axis board, locate the boards close enough together to allow for the internal busing of the parallel port (HP 10934A cable options 002, 003, 004, and 006).

Part of Figure 7-14. HP 5507A/B Printed Circuit Board Location

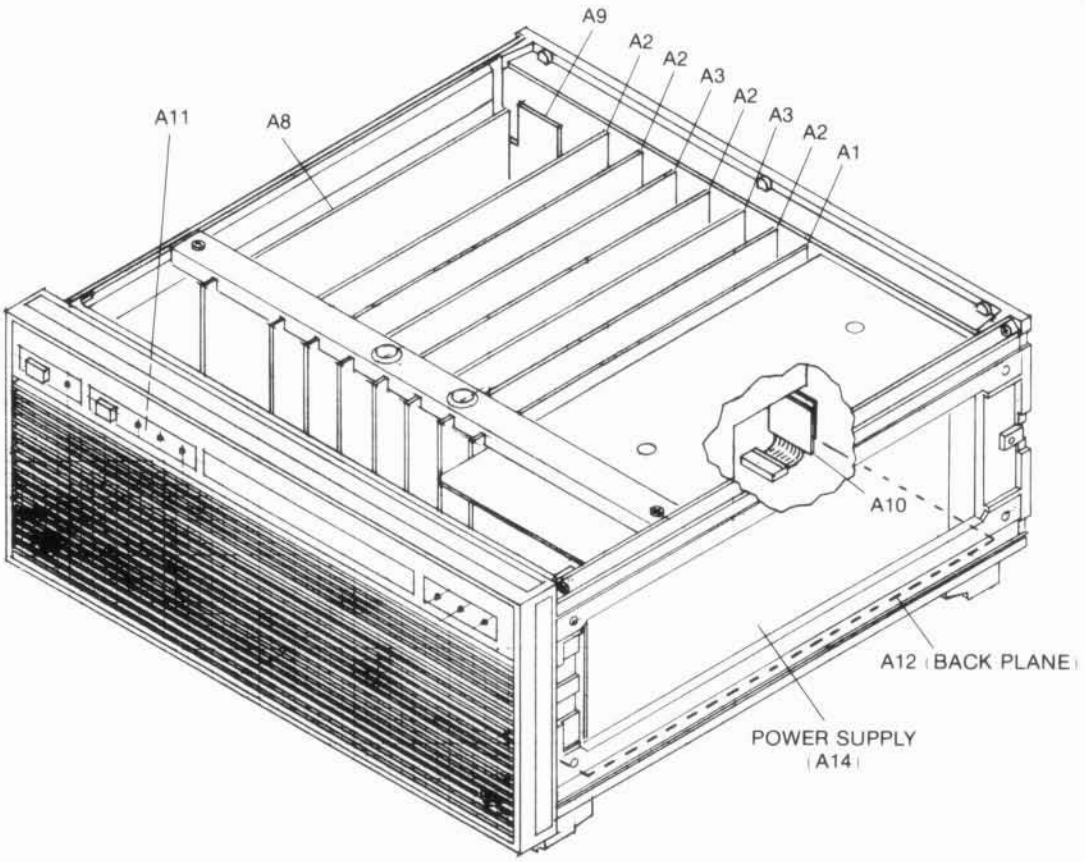


Figure 7-14. HP 5507A Printed Circuit Board Location

REFERENCE DESIGNATOR	DESCRIPTION	HP PART NUMBER
A11	FRONT PANEL BOARD ASSEMBLY	05507-60001
A11W1	FRONT PANEL CABLE ASSEMBLY	8120-4766
B1	FAN (24 VDC)	3160-0471
FL1	LINE FILTER	9135-0291
H7	MACHINE SCREW M3.5 × 0.6 6MM-LG PAN-HD	0515-0887
H13	MACHINE SCREW M2.5 × 0.45 4MM-LG PAN-HD	0515-0402
H14	MACHINE SCREW M2 × 0.4 4MM-LG PAN-HD	0515-0834
H15	MACHINE SCREW M4 × 0.7 6MM-LG PAN-HD	0515-0889
H16	MACHINE SCREW M3.5 × 0.6 47MM-LG PAN-HD	0515-1286
H17	HEX NUT DBL-CHAM M3.5 × 0.6 2.8MM-THK	0535-0007
H21	MACHINE SCREW 5 × 0.8	0515-1520
H22	HOOK & LOOP LOCK	0510-0656
H23	CABLE CLAMP	1400-1231
MP17	FRONT FRAME	5021-5805
MP18	"LINE" KEY CAP	5041-1682
MP19	"RESET" KEY CAP	5041-2054
MP20	FRONT PANEL	05507-00001
MP21	FRONT SUB-PANEL	05507-00002
MP22	FAN FILTER	4208-0297
MP23	GRILLE	4040-1518
MP24	FAN GRILLE	3160-0099
W4	LINE SWITCH CABLE ASSEMBLY	05507-60104
W3	FAN CABLE ASSEMBLY	05507-60103

Part of Figure 7-15. HP 5507A Front Panel Assembly

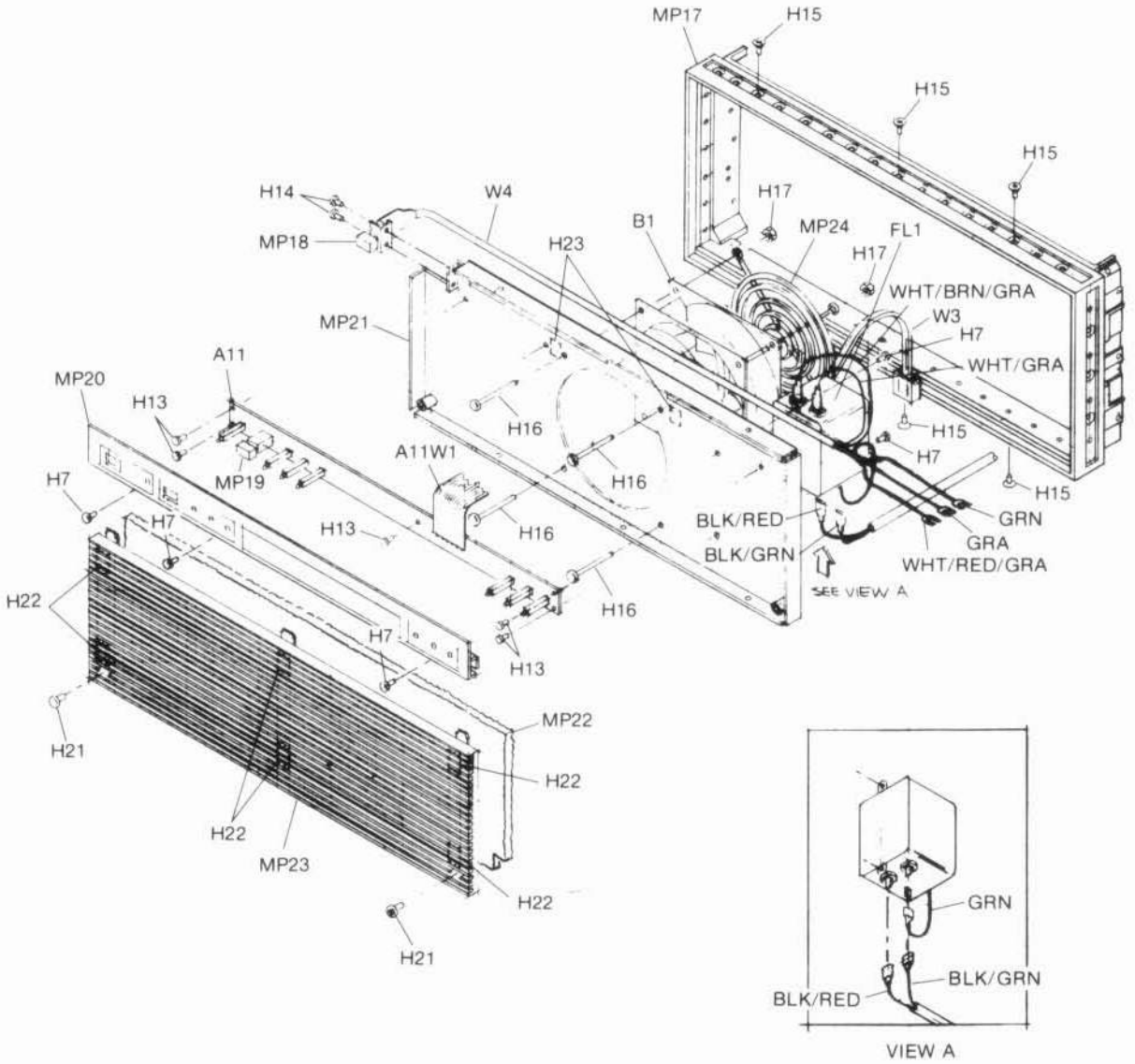


Figure 7-15. HP 5507A Front Panel Assembly

REFERENCE DESIGNATOR	DESCRIPTION	HP PART NUMBER
A14	POWER SUPPLY	0950-1660
H10	MACHINE SCREW 8-32 .375 IN-LG PAN-HD POZI	2510-0045
H11	MACHINE SCREW 8-32 .375 IN-LG 82 DEG	2510-0121
H12	MACHINE SCREW M4 × 0.7 6MM-LG HPAN-HD	0515-0898
MP6	POWER SUPPLY BRACKET	05507-00004
MP7	STRUT	5021-5836
MP8	HIGH VOLTAGE SHIELD	05507-00010
W2	DC CABLE HARNESS	05507-60102

Part of Figure 7-16. HP 5507A Power Supply Assembly

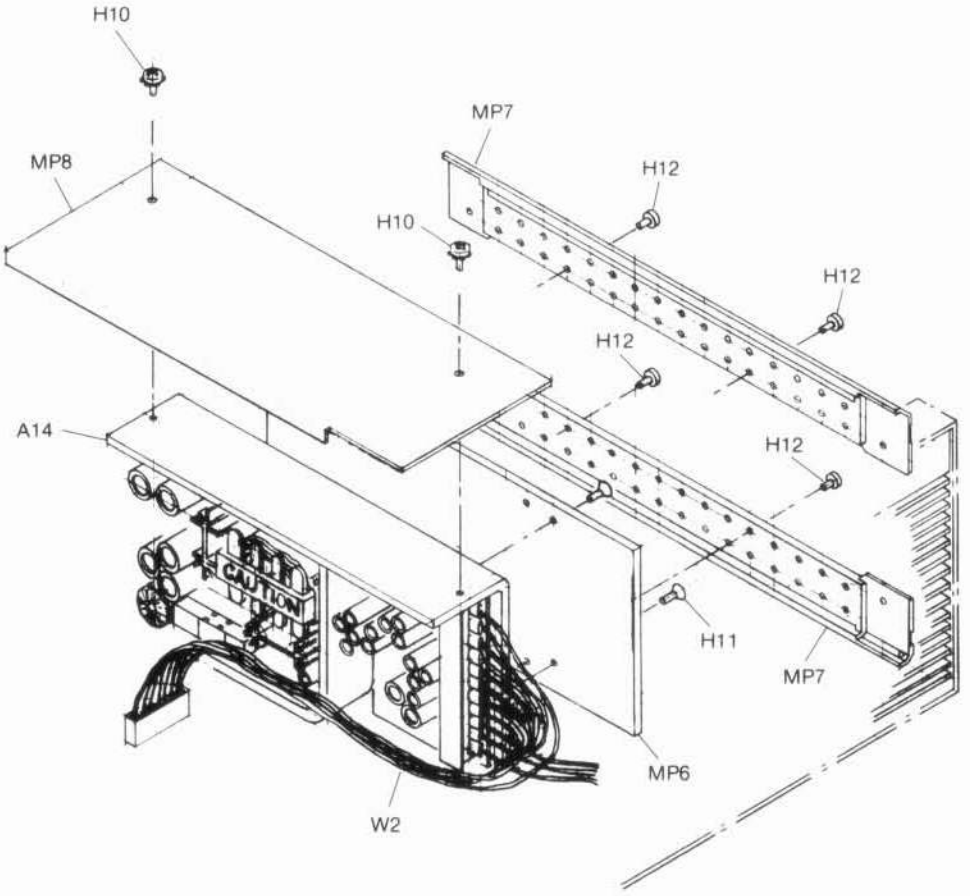


Figure 7-16. HP 5507A Power Supply Assembly

REFERENCE DESIGNATOR	DESCRIPTION	HP PART NUMBER
A1MP1	HP-IB CONNECTOR SHIELD	1251-7773
A2MP1	AXIS/PROTOTYPING CONNECTOR SHIELD (PART OF A2J1 AND A3J2 CONNECTOR ASSEMBLY)	1252-0558
A2W1	MEASUREMENT AXIS RECEIVER CABLE ASSY	10932-60101
A8W1	WAVELENGTH TRACKING COMPENSATOR RECEIVER CABLE ASSEMBLY	10932-60101
A9	COMPENSATION CONNECTOR BOARD ASSEMBLY	10946-60002
A9W1	COMPENSATION CONNECTOR BOARD CABLE ASSY	8120-4765
A10	LASER CONNECTOR BOARD ASSEMBLY	05507-60003
A10W1	LASER CONNECTOR BOARD CABLE ASSY	8120-4764
A13	POWER LINE MODULE CABLE ASSEMBLY	05507-60101
H1	HOLE PLUG	6960-0002
H2	HOLE PLUG	6960-0046
H3	HOLE PLUG	6960-0013
H4	HEX NUT DBL CHAM 15/32 32-THD	2950-0035
H5	HP-IB STAND OFF	0380-1523
H6	FLAT HEAD SCREW M3 × 0.5 6MM-LG 90-DEG	0515-0890
H7	MACHINE SCREW M3.5 × 0.6 6MM-LG PAN-HD	0515-0887
H8	LOCK WASHER INTL T 15/32 IN .472-IN-ID	2190-0102
H9	MACHINE SCREW 4-40 .25-IN-LG PAN-HD POZI	2200-0103
H18	MACHINE SCREW M4 X 0.7 THD; 6	0515-1331
H19	LOCK WASHER INTL T 1/2 IN .505-IN-ID	2190-0068
H20	HEX NUT DBL CHAM 15/32-28-THD .125-IN-THK	2950-0054
MP1	REAR PANEL	05507-00003
MP2	PATCH PLATE	05507-00006
MP3	50 PIN CONNECTOR ADAPTER	05507-00008
MP4	24 PIN CONNECTOR ADAPTER	05507-00009
MP5	REAR FRAME	5021-5806
W1	POWER CORD CABLE	8120-1378

Part of Figure 7-17. Rear Panel Assembly

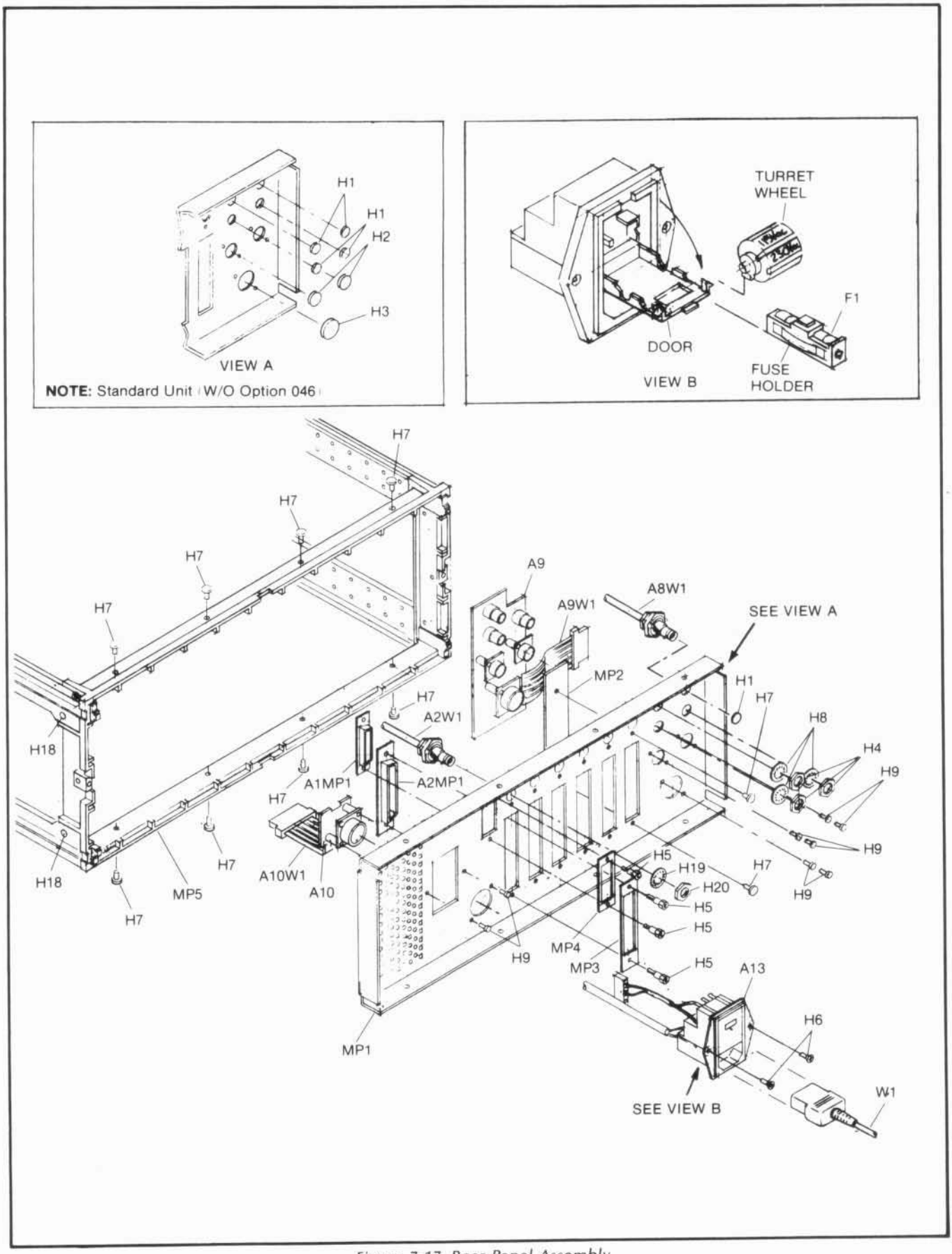


Figure 7-17. Rear Panel Assembly

REFERENCE DESIGNATOR	DESCRIPTION	HP PART NUMBER
A12	TRANSDUCER BACKPLANE ASSEMBLY	05507-60004
H18	MACHINE SCREW M4 × 0.7 THD; 6	0515-1331
MP7	STRUT	5021-5836

Part of Figure 7-18. HP 5507A Backplane Removal/Installation

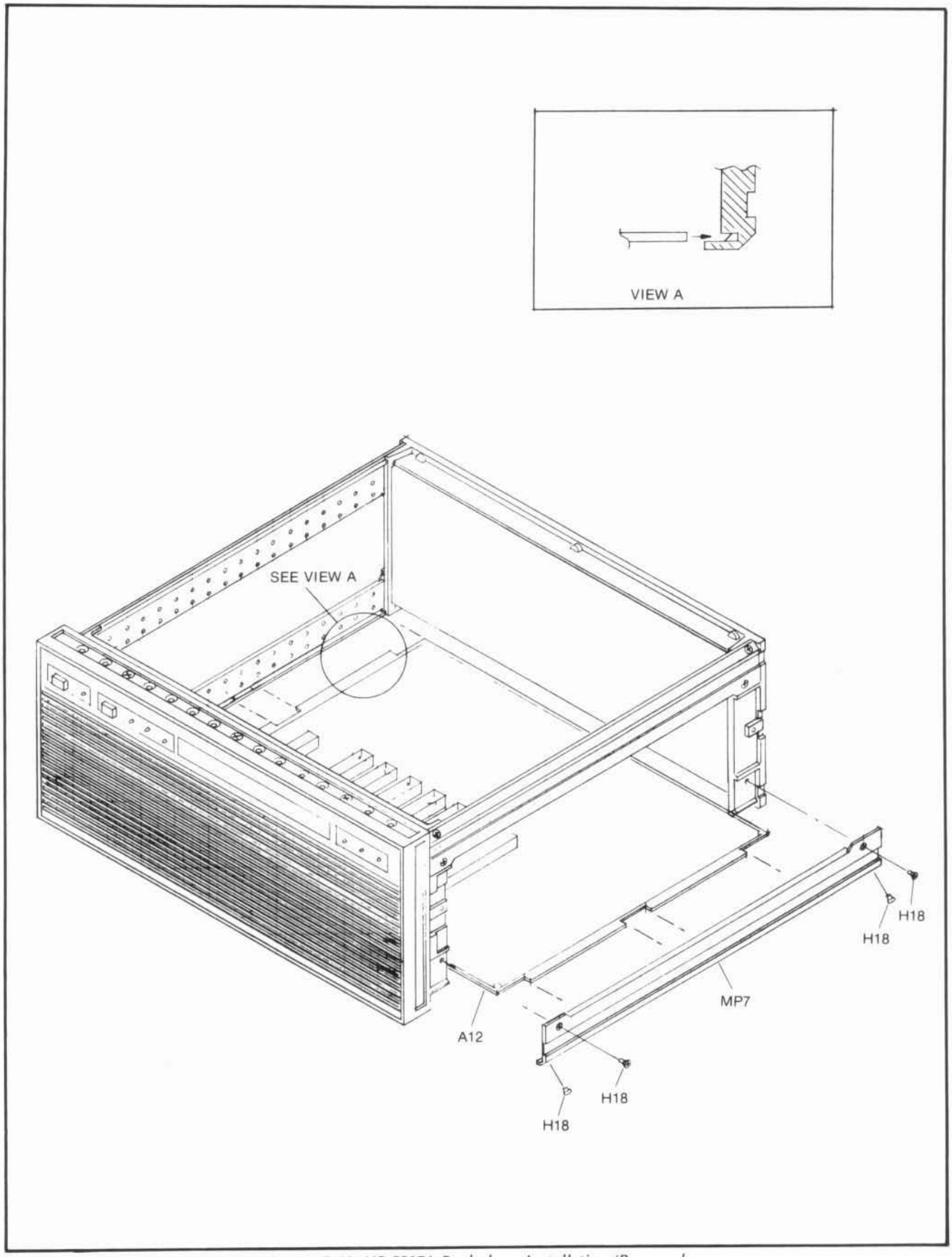


Figure 7-18. HP 5507A Backplane Installation/Removal

HP 10751A/B AIR AND 10757A/B/C MATERIAL TEMPERATURE ASSEMBLY-LEVEL SENSOR TROUBLESHOOTING

Failures occurring in the HP 10751A/B Air Sensor or the HP 10757A/B/C Material Temperature Sensors are verified by checking the accuracy of each sensor's measurements. The HP 10946A Automatic Compensation board should be calibrated before checking sensor operation. The calibration procedure for the HP 10946A can be found in "HP 10946A Automatic Compensation Board Calibration" paragraphs of this section. Proper sensor operation can be verified by reading the appropriate variable using the mnemonics found in *Table 4-K1* ("Troubleshooting Mnemonics").

NOTE

The compensation number should not be used until five minutes after system power-up. This will allow an adequate warm-up period for the HP 10751A/B Air Sensor.

Temperature Measurements

The HP 10751A/B and the 10757A/B/C provide a voltage signal that decreases linearly with increasing temperature. The voltage is bipolar and centered (0 volts) at approximately 25°C (77°F). An error message is indicated if a temperature signal exceeds the ±1V range of the HP 10946A analog-to-digital converter. The temperature measurements require +15V and -15V supplies from the HP 10946A to generate the temperature signals. In addition, the HP 10751A/B Air Sensor requires the +10 V_{ref} voltage. Note that the sensors are calibrated for 0°C to 40°C operation which does not require the full ±1 Volt range of the A to D.

Pressure Measurement

The HP 10751A/B also measures air pressure. The air pressure signal is a dc voltage that decreases linearly with increasing air pressure. An error message is indicated if the air pressure signals exceed the ±1 Volt range of the HP 10946A analog-to-digital converter. +10 V_{ref} is not used for the air pressure measurement. The HP 10751A/B pressure measurement requires only +15V and -15V power supplies.

Humidity Switch

The humidity switch is used to send one of three voltages to the HP 5507A:

Table 7-9. Humidity Switch Settings

SWITCH SETTING	HUMIDITY RANGE	VOLTAGE SENT TO HP 5507A
75%	62.5 to 95%	0.7V (approximate)
50%	37.5 to 62.5%	0.0V
25%	0 to 37.5%	-0.7V (approximate)

Unused HP 10751A/B and 10757A/B/C Connectors

Connectors are provided on the HP 5507A rear panel for the HP 10751A/B and the 10757A/B/C. When connectors are not used, the corresponding A to D input channels on the HP 10946A pull themselves up to approximately +1.1 Volts. This is outside the range of the A/D Converter. At power-up, the HP 10946A interprets this channel as inactive (unused). The HP 10751A/B uses three input channels and each HP 10757A/B/C uses one. If any of the three HP 10751A/B input channels is interpreted as unused, the 10751A/B is ignored by the HP 5507A.

HP 10751A/B Air Sensor Assembly Isolation

Air Sensor measurement failures can be isolated using the following procedure. Failures can be caused by the Automatic Compensation board (A8), the Compensation Connector board (A9), or the HP 10751A/B Air Sensor. If the Air Sensor is attached to the HP 5507A and the outputs cannot be read over the HP-IB by using the appropriate mnemonics, then one of the three signals (air temperature, air pressure, or relative humidity) has exceeded +1.1 Volts.

a. Disconnect the Air Sensor from the HP 5507A and verify the open connector resistances and voltages at the HP 5507A rear panel according to *Table 7-11*.

b. If the connector checks out OK, the HP 10946A board passes self tests and has been calibrated recently, and does not exhibit any of the symptoms listed in "Automatic Compensation Board Failure Symptoms", the failure is probably in the HP 10751A/B.

c. For additional confidence in the HP 5507A Air Sensor connector and the three associated A to D converter input channels, perform the following:

   1. Ground pins A, G, and H of the Air Sensor connector to the HP 5507A rear panel. (See *Figure 7-19*.)
   2. Set the English/Metric output to Metric using the command mnemonic *MET. Default selection at power-up is Metric units.
   3. Enable Air Sensor A/D channels as follows:
      (a) Air Pressure Channel — send mnemonic *CEB1
      (b) Air Temperature Channel — send mnemonic *CEB2
      (c) Air Humidity Channel — send mnemonic *CEB16, or
      (d) Enable all three of the above channels by sending mnemonic *CEB19.

d. Read each Air Sensor A/D channel by issuing the following mnemonics:

   1. Air Pressure Channel — *APV?
   2. Air Temperature — *ATV?
   3. Air Humidity — *AHV?

   The three Air Sensor Channels should read:

   Air Temperature: 25.36°C ±0.3°C
   Air Pressure: 760.2 ±3.5 mm Hg
   Air Humidity: 50%

HP 10757A/B/C Material Temperature Sensor Assembly Isolation

Material temperature measurement failures can be isolated using the following procedures. Failures can be caused by either the HP 10946A or the HP 10757A/B/C.

a. If a Material Temperature Sensor works on one but not all rear panel connectors, the failure is in the corresponding HP 10946A analog-to-digital converter input channel or the rear-panel Compensation Connector board (A9).

b. Disconnect the individual Material Temperature Sensors and verify the open connector resistances and voltages at the HP 5507A rear panel connector according to *Table 7-12*.

c. If the connector pins check out, the HP 10946A passes its self tests, and the sensor does not work properly on any of the Material Temperature Sensor connectors on the HP 5507A rear panel, the failure is probably located in the HP 10757A/B/C.

*Preceding the mnemonic denotes the current address of the board, which can "S", "T", "U", or "V".

d. For additional confidence in the HP 5507A Material Temperature connectors and corresponding A-to-D converter input channels, perform the following:

1. Ground pin F of the open connector in question. This simulates a temperature signal corresponding to approximately 25°C.
2. Set the English/Metric output to Metric using the command mnemonic *MET. Default selection at power-up is Metric units.
3. Enable Material Temperature A/D channels as follows:
   (a) MT1 Channel — send mnemonic *CEB4
   (b) MT2 Channel — send mnemonic *CEB8, or
   (c) Enable both channels by sending mnemonic *CEB12
4. Read each Material Temperature A/D channel by issuing the following mnemonics:
   (a) MT1 Channel — *MT1?
   (b) MT2 Channel — *MT2?

Read the material temperature value to verify the A-to-D converter and input channel. The temperature read by the HP 5507A for the corresponding input channel should be 25.36°C ±0.3°C.

Connectors and Cables

The HP 5507A rear panel sensor connector pin-outs are shown in *Figure 7-19*, HP 5507A Rear Panel Sensor Connectors.Pin designation letters on the figure correspond to those stenciled on the connector. Connector pin function and open connector measurement values are provided for reference in *Tables 7-10, 7-11,* and *7-12*. Open connector (no instrument connected) measurement values listed in the tables can be used for initial tests. Good probe contact is required to verify resistance measurements that are given for some of the connector pins. The cable pins are 0.04 inch in diameter.

An HP 3456A Digital Voltmeter is required for resistance and voltage measurements. For resistance measurements, be sure to zero the meter to eliminate test lead resistance.

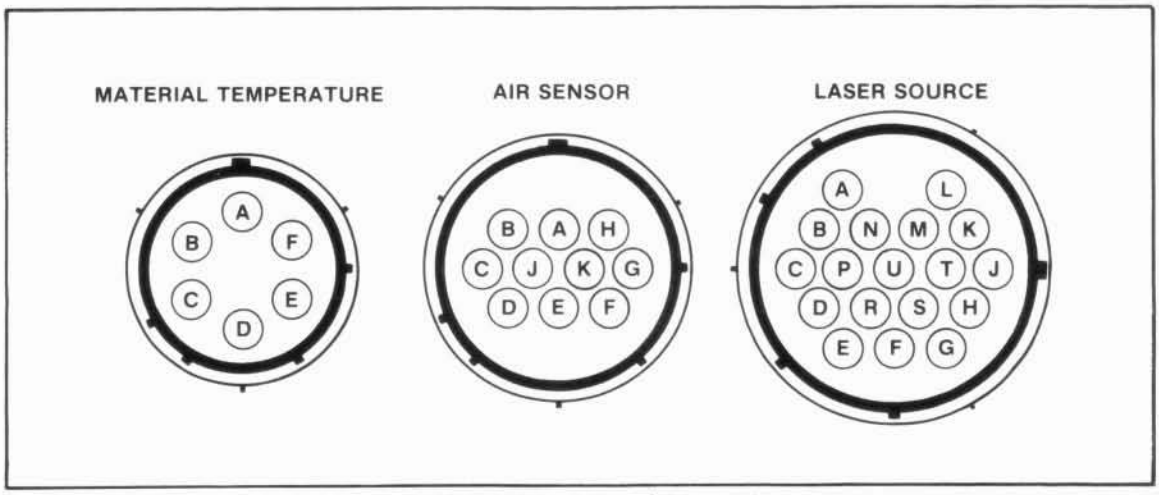


Figure 7-19. HP 5507A Rear Panel Sensor Connectors

*Preceding the mnemonic denotes the current address of the board, which can "S", "T", "U", or "V".

Table 7-10. LASER HEAD Connector Pinouts

CONNECTOR	PIN	FUNCTION	OPEN CONNECTOR MEASUREMENT VALUES
LASER HEAD	A	No Connection	———
	B	MEASurement FREQuency Signal	140 to 150 ohm (HP 5507A Power Off)
	C	MEASurement FREQuency Signal	140 to 150 ohm (HP 5507A Power Off)
	D	Measurement Shield	0.02 to 0.2 ohm (HP 5507A Power Off)
	E	REFerence FREQuency Signal	80 to 90 ohms (HP 5507A Power Off)
	F	REFerence FREQuency Signal	80 to 90 ohms (HP 5507A Power Off)
	G	Power Ground	0.02 to 0.2 ohm (HP 5507A Power Off)
	H	Power Ground	0.02 to 0.2 ohm (HP 5507A Power Off)
	J	+15V	+14.5 to +15.5V
	K	+15V	+14.5 to +15.5V
	L	-15V	-15.5 to -14.5V
	M	+15V	+14.5 to +15.5V
	N	Ground—Cable Shield	0.02 to 0.2 ohm (HP 5507A Power Off)
	P	Ground—Cable Shield	0.02 to 0.2 ohm (HP 5507A Power Off)
	R	Reference Shield	0.02 to 0.2 ohm (HP 5507A Power Off)
	S	Power Ground	0.02 to 0.2 ohm (HP 5507A Power Off)
	T	+15V	+14.5 to +15.5V
	U	Ground—Cable Shield	0.02 to 0.2 ohm (HP 5507A Power Off)

All measurement values with respect to chassis (earth) ground.

Table 7-11. AIR SENSOR Connector Pinouts

CONNECTOR	PIN	FUNCTION	OPEN CONNECTOR MEASUREMENT VALUES
AIR SENSOR	A	Air Pressure Signal (AP)	+1.1V
	B	+10 V_{ref}	+9.99 to +10.01V
	C	Ground—Cable Shield	0.02 to 0.2 ohm (HP 5507A Power Off)
	D	Analog Ground	0.02 to 0.3 ohm (HP 5507A Power Off)
	E	+15V	+14.5 to +15.5V
	F	-15V	-15.5 to -14.5V
	G	Humidity Switch Signal (AH)	+1.1V
	H	Air Temperature Signal (AT)	+1.1V
	J	Ground—Cable Shield	0.02 to 0.2 ohm (HP 5507A Power Off)
	K	Ground—Cable Shield	0.02 to 0.2 ohm (HP 5507A Power Off)

All measurement values with respect to chassis (earth) ground.

Table 7-12. MATERIAL TEMPERATURE SENSOR Connector Pinouts

CONNECTOR	PIN	FUNCTION	OPEN CONNECTOR MEASUREMENT VALUES
MATERIAL TEMPERATURE SENSOR 1 or 2	A	Ground—Cable Shield	0.02 to 0.2 ohms (HP 5507A Power Off)
	B	No Connection	———
	C	+15V	+14.5 to +15.5V
	D	Analog Ground (Not used by HP 10757X)	0.02 to 0.2 ohm (HP 5507A Power Off)
	E	-15V	-15.5 to -14.5V
	F	MTX (X = 1 or 2)	+1.1V

All measurement values with respect to chassis (earth) ground.

HP 10751A/B AIR SENSOR BOARD-LEVEL TROUBLESHOOTING INFORMATION

The following paragraphs contain board-level theory, troubleshooting and repair information, and replaceable parts lists for the HP 10751A/B Air Sensor. The schematic diagram, component locator, and assembly illustrated parts breakdown are located at the back of Section VII.

The schematic diagram for the HP 10751A/B is shown in *Figure 7-38*. The schematic has functional blocks that are labeled alphabetically with circled letters. These labels correspond to the letters in the text for the circuit theory.

HP 10751A/B Air Sensor Circuit Theory

The HP 10751A/B Air Sensor measures air pressure and air temperature and has provision for entering one of three values of ambient humidity; "high", "low", or "normal". Pressure, temperature, and humidity information is supplied to the HP 5507A in signal form, AP, AT, and AH. They are used to compensate for the dependence of laser wavelength on the permittivity of air.

AIR PRESSURE

Pressure Signal Offset Circuitry Ⓐ Ⓓ Ⓖ

The offset adjustment circuits consist of +10V offset U5-Q2, -10V offset U4, and offset calibration network R7. The -10V offset is derived from the +10V offset by means of U4 which has a gain of -1. Resistors R19A and B are precision resistors and R18 is the bias current compensating resistor. S1 allows for either positive or negative offset adjustments and is used only during calibration.

The ±10V at the output of S1 is divided to ±74.4 mV by R12 and R11 and applied to jumpers S10-S17. The jumpers can apply either ±74.4 mV or ground to the R/2R network. The information applied to R7 by the jumpers is treated as a binary integer B (where $0 \leq B \leq 255$). The jumpers are set during the calibration procedures and thereafter should not be changed. The output of the R/2R network (pin 16) is:

$$V_{out} = (B/256) \times V_{in}$$

Example: $V_{out} = (51/256) \times 74.4 \text{ mV}$

$$V_{out} = 14.8 \text{ mV}$$

U1 amplifies the output of R7 (pin 16) by a factor of two and sums it with the pressure signal from U3 to form AP. This gives a maximum AP offset of ± (74.4 mV × 2) = 148.8 mV. Full-scale output is 0.95 Volts. The resultant adjustment range is nominally ±16%. The air pressure characteristics are shown in *Figure 7-20*.

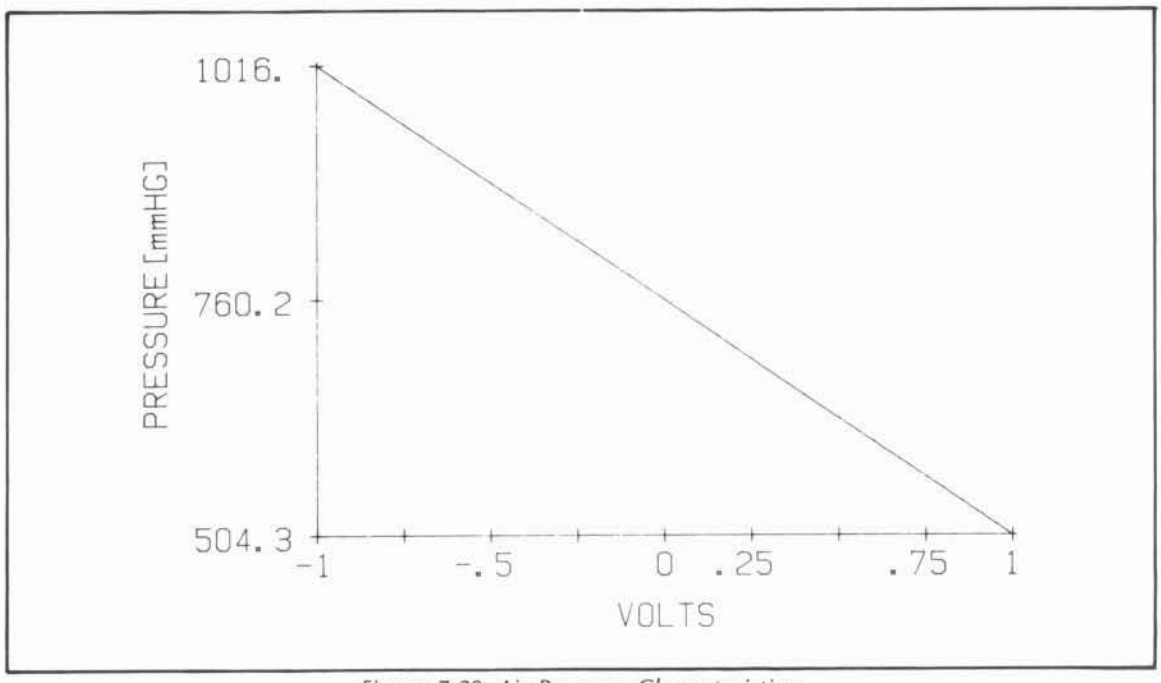


Figure 7-20. Air Pressure Characteristics

Pressure Signal Gain Circuitry Ⓔ Ⓗ Ⓙ Ⓚ

The block diagram for the Commutating Auto-Zero (CAZ) Instrumentation Amplifier U3 is shown in *Figure 7-21*. U3 provides amplification of the pressure transducer output (30 mV) with an accuracy of 0.1% full scale. The commutation of the differential to single-ended voltage converter allows the instrumentation amplifier to have a frequency response from dc to 10 Hz. Capacitors C10 and C11 are alternately connected to the differential inputs, then to the + input the CAZ operational amplifier and ground.

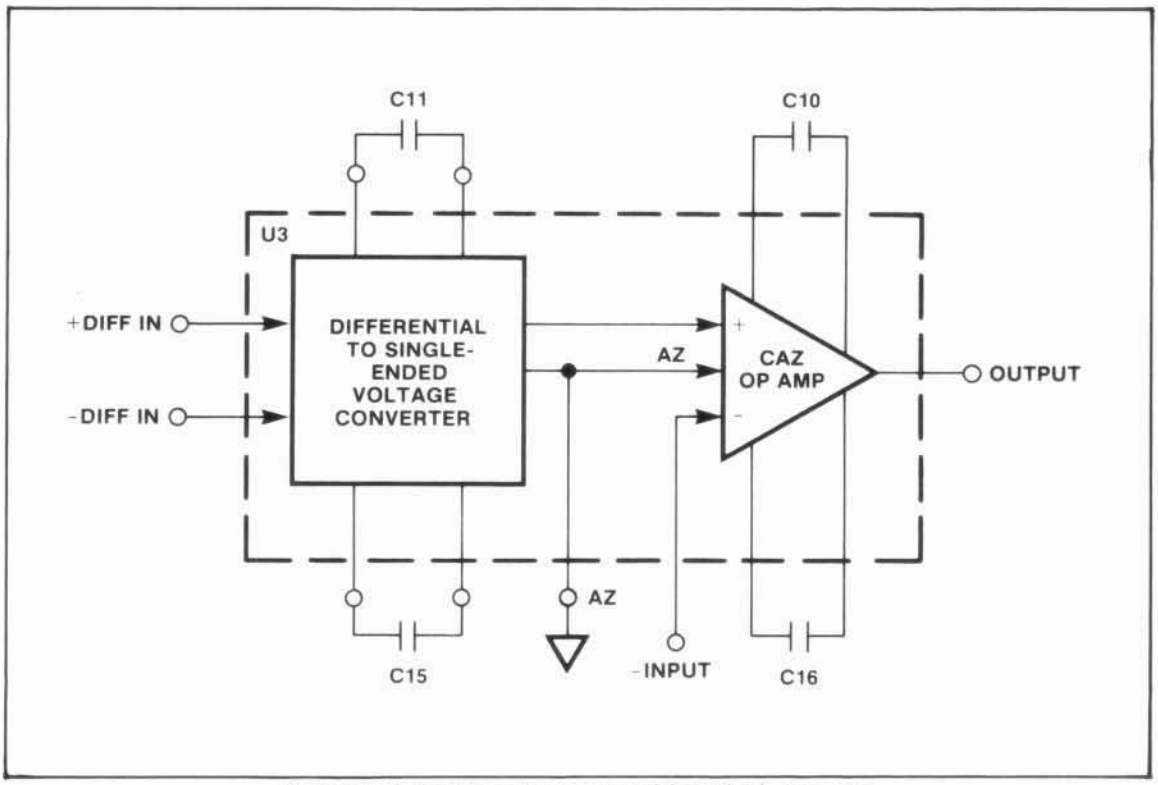


Figure 7-21. Instrumentation Amplifier Block Diagram

The CAZ op amp section of the amplifier contains two op amps whose functions alternate to provide the auto zeroing feature. Referring to *Figure 7-22*, the CAZ op amp has a third input terminal, AZ. The voltage on the AZ input is the level to which each of the internal op amps is auto-zeroed. In Mode A, op amp number 2 is configured in a unity gain mode by integrated switches and charges C16 to a voltage equal to the input offset voltage of the amplifier. While C16 is charging, op amp number 1 passes the input signal with its input compensated by C10. In Mode B, the functions of the internal op amps are switched.

NOTE

The voltages of C10, C16, C11, C15 cannot be measured without affecting amplifier output.

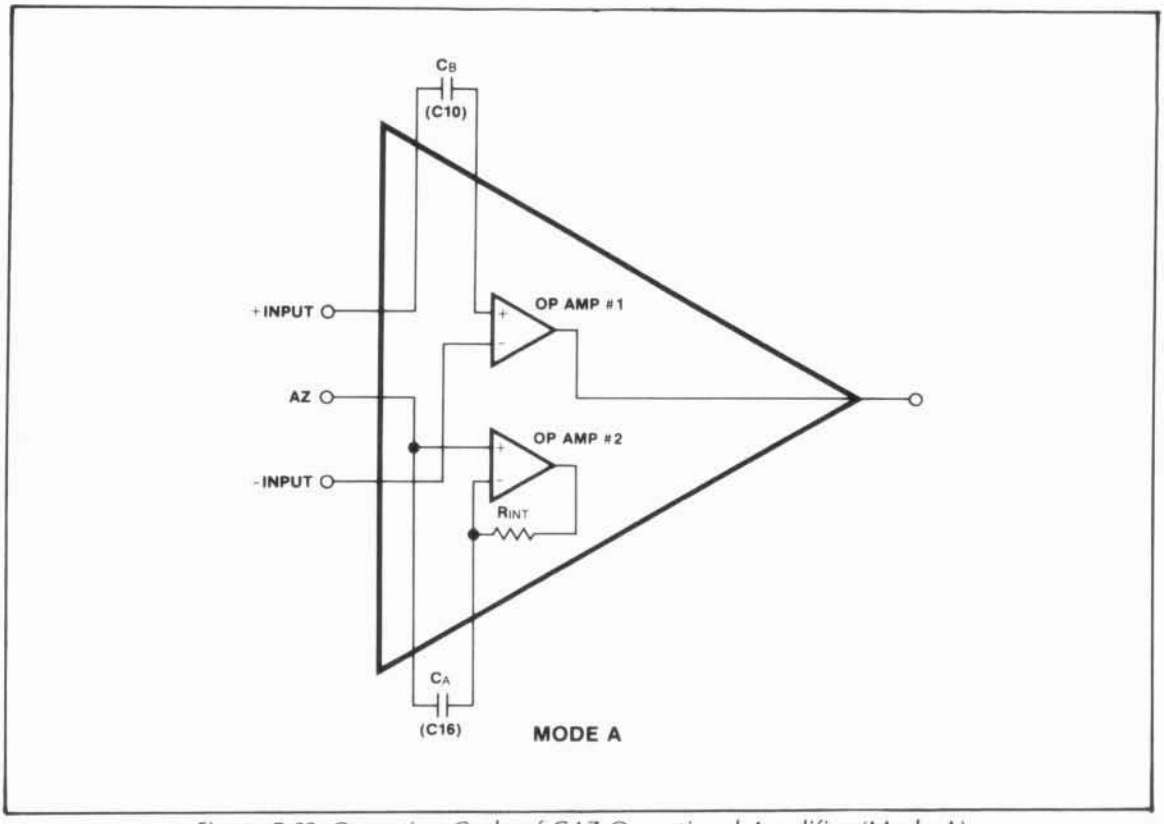


Figure 7-22. Operation Cycle of CAZ Operational Amplifier (Mode A)

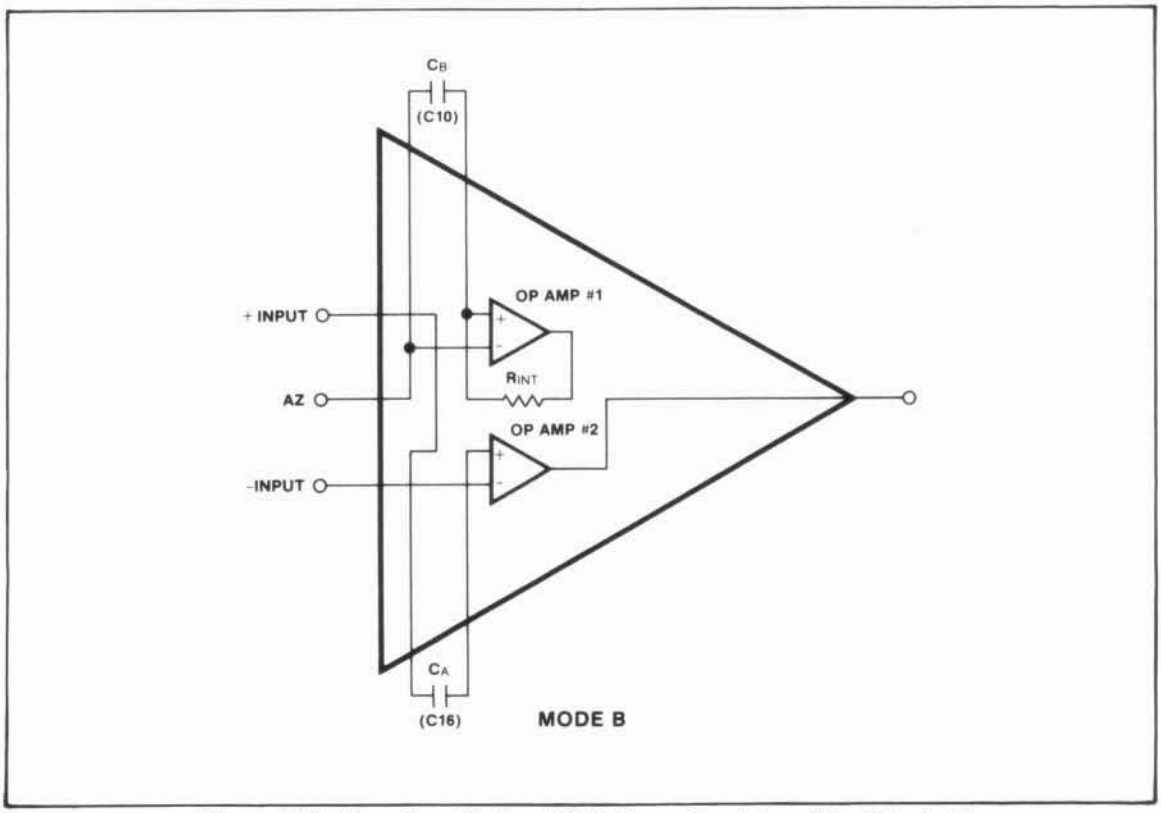


Figure 7-23. Operation Cycle of CAZ Operational Amplifier (Mode B)

The op amps inside U3 are CMOS and have an output impedance of 50 kohms. Since these are driving approximately 20 kohms, there is some loss of open loop gain. Most of this loading is due to the R/2R network R16. The circuit is susceptible to oscillation when a capacitive load is connected to the output at U3 pin 9. As a result of this limitation, connecting a X10 scope probe to the output of the amplifier will cause a small (~100 mV) oscillation at about 100 kHz. Connecting a voltmeter to this node may result in an oscillation at full output (~8V p-p) and make all measurements invalid.

R/2R Network R16 (H)

The pressure transducer is a strain-gauge bridge that has a differential output between approximately 25 and 38 mV at 30.54 inches of mercury (775.72 mm Hg). Since the HP 10946A A/D converter has a 0.95V full scale range for unipolar input to minimize quantization error, amplification up to this level is required. This translates into a gain that is adjustable between approximately 89 and 117. The R/2R network R16 is used as a voltage divider. Assuming a gain of zero (all jumpers = 0), the gain of feedback network R9 is 4.66k/554.66k = 1/119, giving a forward gain 1/f = 118. Assuming the gain of the R/2R is 1 (all jumpers = 1, gives a gain of 255/256 ~ 1), the two 550 kohm resistors are in parallel which gives f = 4.66k/359.5k = 1/77, gain = 77. The R/2R network jumpers S2 through S9 are set during calibration and should not be changed.

Potentiometer R8 allows finer resolution since the R/2R adjustment resolution is limited to 8 bits. With a potentiometer accuracy of 1% (limited by shock and vibration), the combination of digital and potentiometer adjustment provides adjustment accuracy of 0.006%.

Output Buffer U1 (J)

U1 performs three functions. First, it buffers the high impedance output of U3 providing a low impedance source capable of driving the Air Sensor cable and the input impedance of the HP 5507A rear-panel AIR SENSOR inputs. Second, a low pass filter configuration is used to remove the commutation spikes from U3's output. Third, the offset adjustment developed by R7 is summed into AP.

The low pass filter configuration is a 2nd order filter with poles at 0.3 and 2.1 Hz, a precise dc gain of 1 for the signal from U6, and a gain of 2 for the offset signal from R7. Precision resistor network R15 determines the gain. R6 affects ac gain only. R5 is a bias current compensation resistor.

AIR TEMPERATURE (I)

The air temperature measurement is identical to the temperature measurement of the material temperature sensors with the exception that the Air Sensor temperature transducer AT is mounted on a heatsink in free air.

The air transducer is an absolute temperature sensor which outputs 1 microampere per degree Kelvin. Operational amplifier U2 provides current to voltage conversion with a trans-resistance gain of 33.5 kohm (33.5 kohm = R1 + R3). The input range of the A/D converter in the HP 5507A is $-1V \leq V_{in} \leq +1V$. +10 V_{ref} is applied to the positive input of U2 to provide the necessary offset. At 25.36°C, the op amp output, AT, equals 0 Volts. It has a slope of -33.5 mV/°C over the entire operating temperature range. Resistor R2 is a bias current compensation resistor. C2 eliminates noise from the temperature signal (MT) which is essentially dc, and A2C1 and A2C2 provide EMI rejection.

AIR HUMIDITY (F)

Humidity has very little effect on the speed of light in air. For example, it exerts only 0.1 ppm error on a distance measurement for 10% humidity error. For this reason, only three humidity selections are provided; 25%, 50% and 75%. These ranges are selected by a switch on the Air Sensor. If the switch is optimally set*, the maximum humidity error is 15% yielding 0.15 ppm measurement error. The signal AH is either ground, ~0.7V, or ~–0.7V. The HP 5507A uses thresholds at ±0.5V for this measurement, if AH is above +0.5V, RH = 75% below –0.5V, RH = 25%, and between –0.5V and +0.5V, RH = 50%.

$$\text{low} < \frac{50 + 25}{2} = 37.5\%$$

$$\text{high} > \frac{75 + 50}{2} = 62.5\%$$

ANALOG GROUND

The HP 10751A/B Air Sensor is an analog circuit, whose outputs are measured by the HP 10946A A/D converter with respect to true ground (HP 5507A chassis). Ignoring U6, it is not feasible to have a low-current ground line to which AT and AP could be referenced. All of the connections tied to the ⏚ symbol on the schematic must be referred to true ground. Unfortunately, this would feed too much current back on the ground lead causing between 1.5 mV to 7 mV of ground (drop depending on the resistance of the grounds wire).

U6, Q1, and R17 are used to provide an alternate path for the air sensor ground current. U6 measures and replicates analog ground with a maximum offset of 150 μV and diverts the ground current from all Air Sensor ⏚ symbols into the ±15V supplies. Analog ground is the same as the HP 5507A chassis potential and connects to the + input of U6. The replicated ground exists at the output of U6. CR3 protects the circuitry should the ground buffer fail, and resistor R3 protects Q1 against the loss of the analog ground signal. R17 lessens the current load on Q1 to reduce its power dissipation.

10751A/B Air Sensor Troubleshooting

CAUTION

Do not connect test instrument ground leads to analog ground if they are true grounded (third prong); or referred to ground anywhere in the HP 5507A.

If you wish to accurately measure a voltage that is referred to ⏚, it can be measured differentially, referred to ⏚ using a voltmeter with floating inputs (e.g., HP 3456A). Note that the inputs to the HP 5005A Signature Multimeter (recommended service equipment) are NOT floating; the (N) lead is connected to true ground.

Alternatively, you can ground the test instrument probes to the shield ground but remember that some small dc offset will exist between the probe ground and the ground inside the air sensor.

*Optimal switch setting (Operator selected) for low and high

CAUTION

CMOS IC's, such as U3, are susceptible to static when removed from a circuit board. U3 is also subject to SCR latchup when either the air sensor is plugged into the HP 5507A after power-up, or when the ±5V supplies are shorted. If you suspect that any of the power supplies have momentarily shorted, feel U3. If hot to the touch, turn off power, allow sufficient time to cool, then reapply power. If U3 heats up again within a minute or so, either U3 is bad, or a circuit fault exists which is causing SCR latchup.

Be sure to turn off the HP 5507A when opening the HP 10751A/B housing. The inside of the housing is conductive and catastrophic short circuits may occur.

CAUTION

The pressure transducer, 10751-60303, in the air probe senses pressure on its front face. This face is a stainless steel diaphragm which can be easily deformed by touching or applying undue pressure. If it is necessary to touch the transducer, avoid touching the diaphragm.

CAUTION

Static electricity can result in permanent degradation or catastrophic failure of the instrument or assemblies removed from the instrument.

All work performed on assemblies or instruments with covers removed must be at a static safe work station that provides proper grounding for the operator.

Always store and transport assemblies in a static shielding bag.

Proper operation of the HP 10751A/B can be verified when the unit is connected to an HP 5507A electronics unit. All measurements can be read over HP-IB using the proper programming mnemonics. The information in "HP 10751A/B Air and 10757A/B/C Material Temperature Sensor Assembly-level Troubleshooting" paragraphs should be used to verify that a problem exists in the HP 10751A/B before consulting the troubleshooting information in this section. Should troubleshooting be required, the "HP 10751A/B Air Sensor Circuit Theory" paragraphs provide the necessary background for applying the "HP 10751A/B Air Sensor Troubleshooting" procedures.

If an HP 10751A/B fails, it is recommended that the unit be returned to Hewlett-Packard. Most repairs require recalibration. The "HP 10751A/B Calibration Procedure" can be found in this section. Field repair is limited to replacing boards A1 and A2, the Pressure Transducer, cables, and mechanical parts.

AIR SENSOR ERRORS

Temperature Measurements

The HP 10751A/B produces a voltage level, AT, that decreases linearly with increasing temperature. This signal is bipolar and centered about 0 volts at approximately 25°C (77°F). The SYSTEM ERROR LED on the HP 5507A front panel turns on if a temperature signal exceeds the ±1V range of the Analog-to-Digital converter. The temperature measurements require +15V and -15V supplies and +10 V_{ref} from the HP 5507A. Note that the temperature sensor is calibrated for 0 to 40°C operation which does not require the full ±1 Volt range of the HP 10946A A/D converter.

Pressure Measurements

The HP 10751A/B also measures air pressure by supplying a dc voltage, AP, that decreases linearly with increasing air pressure. The SYSTEM ERROR LED on the HP 5507A front panel turns on if the air pressure signals exceed ±1 Volt. The air pressure signal is bipolar and centered about 0 Volts at 760.2 mm Hg (29.93 inches Hg). +10 V_{ref} is not used for the air pressure measurement, only the +15V and –15V power supplies are required.

Humidity Switch

The humidity switch sends one of three voltages to the HP 5507A:

Switch Setting	Voltage (Nominal)
75%	0.7V (approximately)
50%	0.0V
25%	–0.7V (approximately)

HP 10946A A/D conversion errors or faulty probes can cause probe errors to be indicated by the HP 5507A. Inaccurate readings, which do not cause error indications, can also occur. Probe data, in English or Metric units, can be observed directly by reading the appropriate mnemonic.

HUMIDITY INDICATOR TROUBLESHOOTING

The humidity circuit consists of two resistors and a switch. Refer to Analog Ground troubleshooting, "Analog Ground", before replacing A1.

Switch Position	AH Value (Nominal)
HI	0.7V
NORM	0.0V
LOW	–0.7V

AIR TEMPERATURE TROUBLESHOOTING

a. Verify that +15V, –15V and +10 V_{ref} are within tolerances given in the "Connectors and Cables" paragraphs.

b. Verify +10 V_{ref} on both sides of R3. Voltage drops of more than 1 mV across R3 may indicate a failure of U2. Replace A1.

c. Measure voltage on pin 2 of U2. If it is within 1 mV of +10 V_{ref}, verify feedback resistor values before replacing A2. If pin 2 is outside this 1 mV range, disconnect the temperature sensor board from the main board. If pin 2 is now within 1 mV of +10 V_{ref}, replace A2. Otherwise replace A1. U2 output should rise to 10V with the temperature sensor disconnected.

AIR PRESSURE TROUBLESHOOTING

a. Verify that +15 and –15V are within tolerances given in the "Connectors and Cables" paragraphs.

b. Check Pressure Transducer output. See *Figure 7-20* ("Air Pressure Characteristics"). If improper, replace Pressure Transducer. If OK, replace A2.

HP 10751A/B Replaceable Parts

The following paragraphs contain information required for ordering parts for the HP 10751A/B Air Sensor. Part numbers are provided in either illustrated breakdown form or tabulated listing form depending on the type of part. Purchase Order and Direct Mail Order information is also provided.

Table 7-13 shows how the parts lists and illustrated parts breakdowns (IPB) are organized. *Table 7-14* gives abbreviations used in the parts lists. *Tables 7-15* and *7-16* list the replaceable parts that are mounted on PC board assemblies. *Table 7-17* contains the names and addresses that correspond to the manufacturers code number given in *Tables 7-15* and *7-16*. *Figure 7-39* is the illustrated parts breakdown showing the chassis mounted parts and assemblies for the HP 10751A/B.

Table 7-13. HP 10751A/B Replaceable Parts, Tables, and Figures

Assemblies, Mechanical Parts and Case Mounted Electrical Parts	*Figure 7-39* HP 10751A/B Exploded Views (Two Sheets)
Parts Mounted on A1 PC Board Assembly	*Table 7-15* 10751-60001 PC Board Assembly Replaceable Parts
Parts Mounted on A2 PC Board Assembly	*Table 7-16* 10751-60002 PC Board Assembly Replaceable Parts

Table 7-14 lists abbreviations used in the parts list and schematic diagram. In some cases, two forms of the abbreviates are used, one in capital letters, and one partial or no capital letters. This occurs because the abbreviations in the parts list are always all capital letters. However, in the schematic, other abbreviated forms are used with both upper or lower case letters.

To order a part listed in the replaceable parts tables or figures, quote the Hewlett-Packard part number, the check digit, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

To order a part that is not listed in the following tables, 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.

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

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 the orders require billing and invoicing).

c. Prepaid transportation.

d. No invoices — to provide these advantages, a check or money order must accompany each order. Payment may be made using Visa or Mastercard by supplying credit card number, expiration date, and authorized signature.

e. Mail order forms and specific ordering information is available through your local HP office.

Table 7-14. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

- A = assembly
- AT = attenuator; isolator; termination
- B = fan; motor
- BT = battery
- C = capacitor
- CP = coupler
- CR = diode; diode thyristor; varactor
- DC = directional coupler
- DL = delay line
- DS = annunciator; signaling device (audible or visual); lamp; LED
- E = miscellaneous electrical part
- F = fuse
- FL = filter
- H = hardware
- HY = circulator
- J = electrical connector (stationary portion); jack
- K = relay
- L = coil; inductor
- M = metre
- MP = miscellaneous mechanical part
- P = electrical connector (movable portion); plug
- Q = transistor; SCR; triode thyristor
- R = resistor
- RT = thermistor
- S = switch
- T = transformer
- TB = terminal board
- TC = thermocouple
- TP = test point
- U = integrated circuit; microcircuit
- V = electron tube
- VR = voltage regulator; breakdown diode
- W = cable; transmission path; wire
- X = socket
- Y = crystal unit-piezo-electric
- Z = tuned cavity; tuned circuit

ABBREVIATIONS

- A = ampere
- ac = alternating current
- ACCESS = accessory
- ADJ = adjustment
- A/D = analog-to-digital
- AF = audio frequency
- AFC = automatic frequency control
- AGC = automatic gain control
- AL = aluminum
- ALC = automatic level control
- AM = amplitude modulation
- AMPL = amplifier
- APC = automatic phase control
- ASSY = assembly
- AUX = auxiliary
- AVG = average
- AWG = american wire gauge
- BAL = balance
- BCD = binary coded decimal
- BD = board
- BE CU = beryllium copper
- BFO = beat frequency oscillator
- BH = binder head
- BKDN = breakdown
- BP = bandpass
- BPF = bandpass filter
- BRS = brass
- BWO = backward-wave oscillator
- CAL = calibrate
- ccw = counterclockwise
- CER = ceramic
- CHAN = channel
- cm = centimeter
- CMO = coaxial
- COEF = coefficient
- COM = common
- COMP = composition
- COMPL = complete
- CONN = connector
- CP = cadmium plate
- CRT = cathode-ray tube
- CTL = complementary transistor logic
- CW = continuous wave
- cw = clockwise
- D/A = digital-to-analog
- dB = decibel
- dBm = decibel referred to 1 mW
- dc = direct current
- deg = degree (temperature interval or difference)
- ° = degree (plane angle)
- °C = degree Celsius (centrigrade)
- °F = degree Fahrenheit
- °K = degree Kelvin
- DEPC = deposited carbon
- DET = detector
- diam = diameter
- DIA = diameter (used in parts list)
- DIFF AMPL = differential amplifier
- div = division
- DPDT = double-pole, double-throw
- DR = drive
- DSB = double sideband
- DTL = diode transistor logic
- DVM = digital voltmeter
- ECL = emitter coupled logic
- EMF = electromotive force
- EDP = electronic data processing
- ELECT = electrolytic
- ENCAP = encapsulated
- EXT = external
- F = farad
- FET = field-effect transistor
- F/F = flip-flop
- FH = flat head
- FOL H = fillister head
- FM = frequency modulation
- FP = front panel
- FREQ = frequency
- FXD = fixed
- g = gram
- GE = germanium
- GHz = gigahertz
- GL = glass
- GND = ground(ed)
- H = henry
- h = hour
- HET = heterodyne
- HEX = hexagonal
- HD = head
- HDW = hardware
- HF = high frequency
- HG = mercury
- HI = high
- HP = Hewlett-Packard
- HPF = high pass filter
- HR = hour (used in parts list)
- HV = high voltage
- Hz = hertz
- IC = integrated circuit
- ID = inside diameter
- IF = intermediate frequency
- IMPG = impregnated
- in = inch
- INCD = incandescent
- INCL = include(s)
- INP = input
- INS = insulation
- INT = internal
- kg = kilogram
- kHz = kilohertz
- kΩ = kilohm
- kV = kilovolt
- lb = pound
- LC = inductance-capacitance
- LED = light-emitting diode
- LF = low frequency
- LG = long
- LH = left hand
- LIM = limit
- LIN = linear taper (used in parts list)
- lin = linear
- LK WASH = lockwasher
- LO = low; local oscillator
- LOG = logarithmic taper (used in parts list)
- log = logarithm(ic)
- LPF = low pass filter
- LV = low voltage
- m = metre (distance)
- mA = milliampere
- MAX = maximum
- MΩ = megohm
- MEG = meg (10⁶) (used in parts list)
- MET FLM = metal film
- MET OX = metal oxide
- MF = medium frequency; microfarad (used in parts list)
- MFR = manufacturer
- mg = milligram
- MHz = megahertz
- mH = millihenry
- mho = conductance
- MIN = minimum
- min = minute (time)
- ′ = minute (plane angle)
- MINAT = miniature
- mm = millimetre
- MOD = modulator
- MOM = momentary
- MOS = metal-oxide semiconductor
- ms = millisecond
- MTG = mounting
- MTR = meter (indicating device)
- mV = millivolt
- mVac = millivolt, ac
- mVdc = millivolt, dc
- mVpk = millivolt, peak
- mVp-p = millivolt, peak-to-peak
- mVrms = millivolt, rms
- mW = milliwatt
- MUX = multiplex
- MY = mylar
- μA = microampere
- μF = microfarad
- μH = microhenry
- μmho = micromho
- μs = microsecond
- μV = microvolt
- μVac = microvolt, ac
- μVdc = microvolt, dc
- μVpk = microvolt, peak
- μVp-p = microvolt, peak-to-peak
- μVrms = microvolt, rms
- μW = microwatt
- nA = nanoampere
- NC = no connection
- N/C = normally closed
- NE = neon
- NEG = negative
- nF = nanofarad
- NI PL = nickel plate
- N/O = normally open
- NOM = nominal
- NORM = normal
- NPN = negative-positive-negative
- NPO = negative-positive zero (zero temperature coefficient)
- NRFR = not recommended for field replacement
- ns = nanosecond
- NSR = not separately replaceable
- nW = nanowatt
- OBD = order by description
- OD = outside diameter
- OH = oval head
- OP AMPL = operational amplifier
- OPT = option
- OSC = oscillator
- OX = oxide
- oz = ounce
- Ω = ohm
- P = peak (used in parts list)
- PAM = pulse-amplitude modulation
- PC = printed circuit
- PCM = pulse-code modulation; pulse-count modulation
- PDM = pulse-duration modulation
- pF = picofarad
- PH BRZ = phosphor bronze
- PHL = phillips
- PIN = positive-intrinsic-negative
- PIV = peak inverse voltage
- pk = peak
- PL = phase lock
- PLO = phase lock oscillator
- PM = phase modulation
- PNP = positive-negative-positive
- P/O = part of
- POLY = polystyrene
- PORC = porcelain
- POS = positive; position(s) (used in parts list)
- POSN = position
- POT = potentiometer
- p-p = peak-to-peak
- PP = peak-to-peak (used in parts list)
- PPM = pulse-position modulation
- PREAMPL = preamplifier
- PRF = pulse-repetition frequency
- PRR = pulse repetition rate
- ps = picosecond
- PT = point
- PTM = pulse-time modulation
- PWM = pulse-width modulation
- PWV = peak working voltage
- RC = resistance capacitance
- RECT = rectifier
- REF = reference
- REG = regulated
- REPL = replaceable
- RF = radio frequency
- RFI = radio frequency interference
- RH = round head; right hand
- RLC = resistance-inductance-capacitance
- RMO = rack mount only
- rms = root-mean-square
- RND = round
- ROM = read-only memory
- R&P = rack and panel
- RWV = reverse working voltage
- S = scattering parameter
- s = second (time)
- ″ = second (plane angle)
- S-B = slow-blow fuse (used in parts list)
- SCR = silicon controlled rectifier; screw
- SE = selenium
- SECT = sections
- SEMICON = semiconductor
- SHF = superhigh frequency
- SI = silicon
- SIL = silver
- SL = slide
- SNR = signal-to-noise ratio
- SPDT = single-pole, double-throw
- SPG = spring
- SR = split ring
- SPST = single-pole, single-throw
- SSB = single sideband
- SST = stainless steel
- STL = steel
- SQ = square
- SWR = standing-wave ratio
- SYNC = synchronize
- T = timed (slow-blow fuse)
- TA = tantalum
- TC = temperature compensating
- TD = time delay
- TERM = terminal
- TFT = thin-film transistor
- TGL = toggle
- THD = thread
- THRU = through
- TI = titanium
- TOL = tolerance
- TRIM = trimmer
- TSTR = transistor
- TTL = transistor-transistor logic
- TV = television
- TVI = television interference
- TWT = traveling wave tube
- U = micro (10⁻⁶) used in parts list)
- UF = microfarad (used in parts list)
- UHF = ultrahigh frequency
- UNREG = unregulated
- V = volt
- VA = voltampere
- Vac = volts ac
- VAR = variable
- VCO = voltage-controlled oscillator
- Vdc = volts dc
- VDCW = volts, dc, working (used in parts list)
- V(F) = volts, filtered
- VFO = variable-frequency oscillator
- VHF = very-high frequency
- Vpk = volts peak
- Vp-p = volts peak-to-peak
- Vrms = volts rms
- VSWR = voltage standing wave ratio
- VTO = voltage-tuned oscillator
- VTVM = vacuum-tube voltmeter
- V(X) = volts, switched
- W = watt
- W/ = with
- WIV = working inverse voltage
- WW = wirewound
- W/O = without
- YIG = yttrium-iron-garnet
- Zo = characteristic impedance

NOTE

All abbreviations in the parts list will be in upper case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

Table 7-15. 10751-60001 P.C. Board Assembly Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	**10751-60001**	**2**	**1**	**A1 P.C. BOARD ASSEMBLY (SERIES 2452)**	**28480**	**10751-60001**
A1C1	0160-4557	0	10	CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C2	0160-4554	7	8	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C3	0160-3072	2	6	CAPACITOR-FXD 1UF +-10% 100VDC MET-POLYE	28480	0160-3072
A1C4	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C5	0160-3072	2		CAPACITOR-FXD 1UF +-10% 100VDC MET-POLYE	28480	0160-3072
A1C6	0180-3573	0	2	CAPACITOR-FXD 10UF +-10% 35WVDC TA	56289	152D106X9035B2
A1C7	0180-3573	0		CAPACITOR-FXD 10UF +-10% 35WVDC TA	56289	152D106X9035B2
A1C8	0160-4554	7		CAPACITOR-FXD .01UF +-20% 35WVDC CER	28480	0160-4554
A1C9	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C10	0160-3072	2		CAPACITOR-FXD 1UF +-10% 100VDC MET-POLYE	28480	0160-3072
A1C11	0160-3072	2		CAPACITOR-FXD 1UF +-10% 100VDC MET-POLYE	28480	0160-3072
A1C12	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C13	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C14	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C15	0160-3072	2		CAPACITOR-FXD 1UF +-10% 100VDC MET-POLYE	28480	0160-3072
A1C16	0160-3072	2		CAPACITOR-FXD 1UF +-10% 100VDC MET-POLYE	28480	0160-3072
A1C17	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C18	0160-4809	5	1	CAPACITOR-FXD 390PF +-5% 100VDC CER	28480	0160-4809
A1C19	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C20	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C21	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C22	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1C23	0160-4554	7		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-4554
A1C24	0160-4557	0		CAPACITOR-FXD .1UF +-20% 50VDC CER	16299	CAC04X7R104M050A
A1CR1	1902-0032	3	1	DIODE-ZNR 5.49V 5% DO-35 PD=.4W	28480	1902-0032
A1CR2	1902-3070	5	1	DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1902-3070
A1CR3	1901-0050	3	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A1J1	1251-4989	6	1	CONNECTOR 5-PIN M POST TYPE	28480	1251-4989
A1J2	1251-6778	5	1	CONNECTOR 4-PIN F POST TYPE	28480	1251-6778
A1J3	1251-6855	9	1	CONNECTOR 8-PIN M POST TYPE	28480	1251-6855
A1Q1	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1Q2	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1R1	2100-3876	0	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 17-TRN	28480	2100-3876
A1R2	0698-3158	4	2	RESISTOR 23.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2372-F
A1R3	0699-0811	2	2	RESISTOR 33K .1% .125W F TC=0+-5	28480	0699-0811
A1R4	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1R5	0698-3455	4	1	RESISTOR 261K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2613-F
A1R6	0757-0472	5	1	RESISTOR 200K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2003-F
A1R7	1810-0504	9	2	NETWORK-RES 16-DIP MULTI-VALUE	28480	1810-0504
A1R8	2100-3875	9	1	RESISTOR-TRMR 2K 10% C TOP-ADJ 17-TRN	28480	2100-3875
A1R9	1810-0599	2	1	RESISTIVE NETWORK- 8P3R 3 VAL 1WF	28480	1810-0599
A1R10	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A1R11	0698-8005	0	1	RESISTOR 75 .1% .1W F TC=0+-15	07716	MAR5-1/10-T10-75R0-B
A1R12	0699-0642	7	1	RESISTOR 10K .1% .1W F TC=0+-5	28480	0699-0642
A1R13	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R14	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R15	1810-0598	1	1	RESISTIVE NETWORK- 4P2R 3 VAL 1WF	28480	1810-0598
A1R16	1810-0504	9		NETWORK-RES 16-DIP MULTI-VALUE	28480	1810-0504
A1R17	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R18	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R19	1810-0597	0	1	RESISTIVE NETWORK- 4P2R 10K OHM 1WF	28480	1810-0597
A1R20	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R21	0757-0407	6	1	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A1S1-A1S17	1251-4682	6	17	CONNECTOR 3-PIN M POST TYPE	28480	1251-4682
A1S18	3101-1782	6	1	SWITCH-TGL SUBMIN SPDT 2A 250VAC PC	28480	3101-1782
A1TP1	0360-0124	3	5	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1TP5	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1U1	1826-0543	9	5	IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-07CJ
A1U2	1826-0543	9		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-07CJ
A1U3	1826-0761	3	1	IC INSTM AMPL 14-DIP-C PKG	32293	ICL7605CJN
A1U4	1826-0543	9		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-07CJ
A1U5	1826-0965	9	1	IC-AD 584KH	28480	1826-0965
A1U6	1826-0543	9		IC OP AMP LOW-DRIFT TO-99 PKG	06665	OP-07CJ
				MISCELLANEOUS A1 PARTS		
	1258-0141	8	17	JUMPER-REM	28480	1258-0141

Table 7-16. 10751-60002 Temperature Transducer Assembly Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description		Mfr Code	Mfr Part Number
A2	**10751-60002**	**3**	**1**	**A2 AIR TEMP TRANSDUCER ASSEMBLY**		**28480**	**10751-60002**
A2C1	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER		28480	0160-3879
A2C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	ER	28480	0160-3879
A2P2	1251-5394	9	1	CONNECTOR 4-PIN M POST TYPE	ER	28480	1251-5394
A2U1				**MISCELLANEOUS A2 PARTS**			
	0380-1539	8	2	STANDOFF-NYLON 8L M 3.0		28480	0380-1539
	0515-0753	3	4	SCREW-NYLON M3 X 5		28480	0515-0753
	10751-20003	0	1	HEAT SINK		28480	10751-20003

Table 7-17. Manufacturer's Code List

MFR. NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
04713	Motorola Semiconductor Products	Phoenix, AZ	85008
06665	Precision Monolithics	Santa Clara, CA	95050
07716	TRW Incorporated, Burlington Division	Burlington, IA	52601
16299	Corning Glass Works, Component Division	Raleigh, NC	27604
24546	Corning Glass Works (Bradford)	Bradford, PA	16701
28480	Hewlett-Packard Company, Corporate HQ	Palo Alto, CA	94304
32293	Intersil Incorporated	Cupertino, CA	95014

HP 5507A OPERATOR'S MAINTENANCE

Operator's maintenance consists of selecting operating voltage, replacing defective fuses, cleaning the measurement optics, and cleaning the air filter. These items are discussed in the following paragraphs.

Line Voltage Selection

The HP 5507A is equipped with an ac power module that contains a turret wheel voltage selector to select either 115- or 230-Volt operation. Before applying power, the voltage selector must be set to the correct position and the correct fuse must be installed. To convert from one line voltage to another, perform the following procedure (see *Figure 7-24*):

a. Remove ac power cord from rear panel to gain access to the fuse compartment.

b. Using a small, slot-type screwdriver, open the power module door to gain access to the fuse and turret wheel.

c. REMOVE the turret wheel before rotating to desired voltage. DO NOT turn turret wheel while it is installed in the module. Push wheel firmly into module.

d. To change or install fuse, follow procedures outlined in "AC Line Fuse Replacement" paragraphs.

e. Close the power module door. The door must snap shut. The operating voltage selected is shown in module window.

f. Reconnect ac power cord.

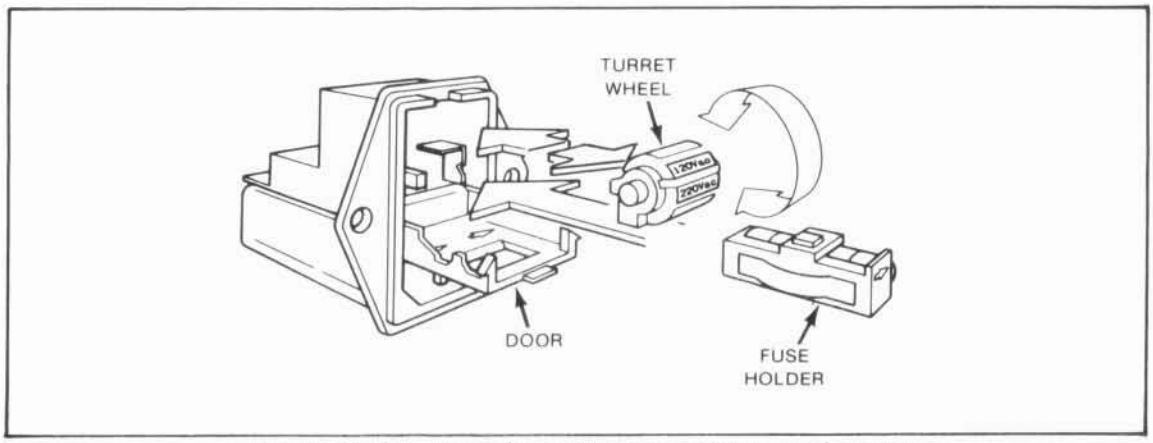


Figure 7-24. AC Line Voltage Selection and Fuse Replacement

Fuses

There are five fuses in the standard HP 5507A package: one power line fuse, three fuses located on the backplane, and one located on the HP-IB Interface Board. In addition, the functional boards and the Automatic Compensation board are individually fused directly on the printed circuit board. Details on fuse replacement are covered in the following paragraphs.

AC LINE FUSE REPLACEMENT

The power line fuse is contained in the Power Line Module on the rear panel of the HP 5507A (see *Figure 7-24*). Replacement of this fuse is described below.

a. Remove ac power cord from rear panel to gain access to the fuse compartment.

b. Using a small common-blade (slot) screwdriver, carefully open the fuse compartment access door.

c. Pull the fuse cartridge out of the module and replace the fuse with one of the same voltage and current rating. For a 115 Vac supply source, use a 5 Amp line fuse, and for a 230 Vac supply source, use a 3.0 Amp fuse (HP Part No.'s 2110-0010 and 2110-0003, respectively).

d. Insert the fuse cartridge in the right fuse compartment making sure the arrow points to your right ("⇨").

e. Snap the fuse compartment access door shut.

f. Reconnect ac power cord.

INTERNAL DC POWER FUSES

Backplane Fuses

Access to the dc power fuses inside the HP 5507A requires removing the instrument top cover and High Voltage Shield. The internal fuses should only be replaced with the ac power cable removed.

WARNING

WHEN THE HIGH VOLTAGE SHIELD (MP8) IS REMOVED FROM THE HP 5507A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DO NOT REMOVE THE HIGH VOLTAGE SHIELD UNLESS IT IS NECESSARY AND ONLY WHEN THE UNIT IS DISCONNECTED FROM THE POWER MAINS.

a. Turn HP 5507A front-panel ac LINE switch off.

b. Remove ac line cable (W1, *Figure 7-17*) from ac Power Line Module.

c. Remove top cover (MP14, *Figure 7-13*) from HP 5507A following the procedures outlined in the "Top Cover Removal" paragraphs.

d. Remove High Voltage Shield (MP8, *Figure 7-16*).

e. Replace defective fuse with one of same voltage and current rating. *Table 7-18* lists part numbers for the appropriate fuse replacement.

f. Replace High Voltage Shield (MP8, *Figure 7-16*).

g. Replace HP 5507A top cover (MP14, *Figure 7-13*).

h. Reconnect ac power cable (W1) to instrument.

Printed Circuit Board Fuses

HP Part Numbers for pc board-mounted fuses for the HP-IB, Automatic Compensation, Transducer Backplane, and the remaining function boards are found in *Table 7-18*.

Table 7-18. Internal Fuse Ratings

LOCATION	REFERENCE DESIGNATOR	CURRENT RATING	HP PART NO.	BUS PROTECTED
HP-IB Board	A1F1	3 Amp*	2110-0447	HP-IB +5 Vdc
Axis Board	A2F1	3 Amp*	2110-0447	Axis Board +5 Vdc
Prototyping Board	A3F1	2 Amp	2110-0002	Prototyping +5 Vdc
Automatic Compensation Board	A8F1 A8F2 A8F3	1 Amp* 1 Amp* 3 Amp*	2110-0665 2110-0665 2110-0688	Auto Comp +15 Vdc Auto Comp -15 Vdc Auto Comp +5 Vdc
Backplane Board	A12F1 A12F2 A12F3	3 Amp 5 Amp 3 Amp	2110-0003 2110-0010 2110-0003	Backplane -15 Vdc Backplane +15 Vdc Backplane +24 Vdc

*Soldering station required. If RMA-P2 (Rosin, Mildly Active) solder is used to install a fuse in the above pc boards, HP recommends that you do not remove the flux from the soldered area.

Procedures for Cleaning Measurement Optics

WARNING

THE FOLLOWING OPTICAL CLEANING PROCEDURES DO NOT APPLY TO THE OPTICS OF THE LASER HEAD. CLEANING OF THE LASER HEAD OPTICS IS RARELY REQUIRED AND REQUIRES ACCESS TO THE INTERIOR OF THE INSTRUMENT WHERE HIGH VOLTAGES CAN BE PRESENT. ALL LASER HEAD MAINTENANCE SHOULD BE PERFORMED BY A QUALIFIED HP TECHNICIAN WHO IS AWARE OF THE HAZARDS INVOLVED.

If an optical instrument is visibly dirty on its optical surfaces, the following cleaning procedures should be used.

The optics should be handled with care so that nothing comes in contact with the exposed glass surfaces. Fingerprints will collect dust and dirt which will attenuate and disperse the laser beam. Cleaning the optics should be avoided unless the signal intensity of the beam is noticeably reduced.

If cleaning of the optics is required, be careful to avoid rubbing particles into the coated surfaces. Permanent reduction of signal density could result. If particles are observed on the optics surface, remove by blowing off with clean pressurized air or preferably dry nitrogen. If unavailable, commercially available products such as Kodak Laboratory Sprayer or Micro Duster TX 600 from the Texwipe Company may be used.

Each optical instrument is shipped with a package of lens tissue which is made specifically for cleaning optics. Use these tissues (or equivalent) with a pure industrial grade methanol in the following manner:

a. Fold the tissue into an approximate 1-inch square.

b. Wet the tissue with methanol (do not saturate) and gently wipe across optical surfaces. Use only enough pressure to remove the contaminate.

c. Do not reuse the tissue.

d. For additional cleaning, repeat the process using a new tissue.

For optical surfaces that are hard to reach, the tissue may be held with a clamping tweezer such as a hemostatic forcep. However, care must be taken not to scratch the coated surface. Do not scrub the surface with a dry tissue.

Avoid alcohol contamination with the following precautions:

a. Use only new, previously unopened containers. Alcohol absorbs water if left exposed to air. This will result in water spots when the alcohol evaporates.

b. Transfer the alcohol to a squeeze bottle that can be capped and made airtight.

c. Never transfer alcohol back into the original container.

Air Filter Cleaning

The air filter is located at the front of the HP 5507A and should be cleaned periodically or when it has collected excessive dirt. To clean proceed as follows:

a. Remove ac power cord from HP 5507A rear panel.

b. On the front panel of the HP 5507A, remove the two Pozidriv screws (H21, *Figure 7-15*) located on either side of the grille (MP23, *Figure 7-15*). Swing bottom part of grille away from the instrument and lower grille, removing retaining tabs from slots in front panel. Gently remove the filter element (MP22, *Figure 7-15*) which is held in place by six hook-and-loop lock pads. It may be replaced by ordering HP Part No. 4208-0297.

c. Clean the filter by blowing compressed air through it from the inside out. If the filter is too dirty to clean with air, wash the filter element in hot water and a mild detergent. Dry the filter before reinstalling.

HP 5527A SYSTEM CALIBRATION PROCEDURES

In order to maintain the accuracy of the HP 5527A Laser Position Transducer system, the following assemblies must be calibrated on a yearly basis:

- HP 10751A/B Air Sensor
- HP 10757A/B/C Material Temperature Sensor
- HP 10946B Automatic Compensation Board (Option 046) when used with either the HP 10751A/B Air Sensor or HP 10757A/B/C Material Temperature Sensor (or both). The Automatic Compensation board requires NO calibration when used only with the HP 10717A Wavelength Tracker.

Due to the complexity of the calibration procedures and the test equipment required, it is recommended that both environmental sensors (i.e., air and material temperature sensors) be returned to HP for calibration. If calibration of the compensator's two voltage references and A/D converter is attempted, use only the specified test equipment or its equivalent.

HP 5507A Laser Position Transducer Electronics

The only calibration required for the HP 5507A is that of the HP 10946B Automatic Compensation Board's +10 and +0.5 voltage references (V_{ref}) when used with either the HP 10751A/B Air Sensor or HP 10757A/B/C Material Temperature Sensor (or both). This calibration should be performed at 12 month intervals. Calibration should also be performed after repair is made to any of the HP 5507A assemblies. The HP 10946B requires NO calibration when used only with the HP 10717A Wavelength Tracker.

HP 10946B AUTOMATIC COMPENSATION BOARD CALIBRATION

The compensator uses two voltage references. One reference, $+10V_{ref}$, is used by the HP 10751A as an offset in air temperature signal conditioning. The other voltage reference, $+0.5V_{ref}$, is the A/D converter reference voltage. The A/D converter compares channel voltages to this reference and has a dynamic range of $\pm 2 \times 0.5V_{ref}$ or approximately ±1 Volt.

The compensator is calibrated by measuring the reference voltages at the HP 5507A rear panel BNC connectors and writing the reference voltages to the Compensator using mnemonics *RVA and *RVB for +10 and +0.5 respectively. The Compensator will store these values into non-volatile RAM when the calibrate enable command (mnemonic *CRE) and calibrate command (mnemonic *CRC) are sent.

NOTE

The "*" preceding the mnemonic denotes the current address of the Automatic Compensator board.

Calibration Procedure

A Note on Extended Operation

If at any time the Automatic Compensation board is placed on a board extender connect analog ground (Test Point 2) on the PC board to the HP 5507A chassis rear panel.

a. Disable all sensors by setting the Channel Enable Byte to 0 (send mnemonic *CEB0).

b. Measure +10 V_{ref} and +0.5 V_{ref} at the HP 5507A rear panel BNCs. Use an HP 3456A DVM. +10 V_{ref} should be measured with 10's of microvolts resolution and +0.5 V_{ref} should be measured with microvolt resolution. Measured values should be within the the following limits:

Table 7-19. V_{ref} Voltage Calibration Limits

MEASUREMENT POINT (Rear Panel BNC's)	LIMITS (In Vdc)
+10 V_{ref}	+9.99V ≤ V(measured) ≤ +10.01V
+0.5 V_{ref}	+0.49875V ≤ V(measured) ≤ +0.50125V

If either of the measured voltages are outside of their respective limits, measure the voltage at TP5 (+15V) located on the Automatic Compensator board. The test limits are; +14.5V ≤ V(measured) ≥ +15.5V. If the +15V measurement is outside this range, perform the adjustment outlined in "Power Supply Adjustment Procedure" paragraphs in this section. The power supply assembly must be replaced if this adjustment is not possible.

c. Enable the Air Sensor A/D channels by sending mnemonic *CEB19.

d. Use mnemonics *RVA and *RVB, where "*" is the board address, to enter the exact measured values of +10 V_{ref} and +0.5 V_{ref} respectively. To keep track of the measurements made, the date the measurements were made, and the date the next measurement should be made, fill out the "Compensator Calibration" label (HP Part No. 10946-80001) and place on instrument's rear panel where indicated.

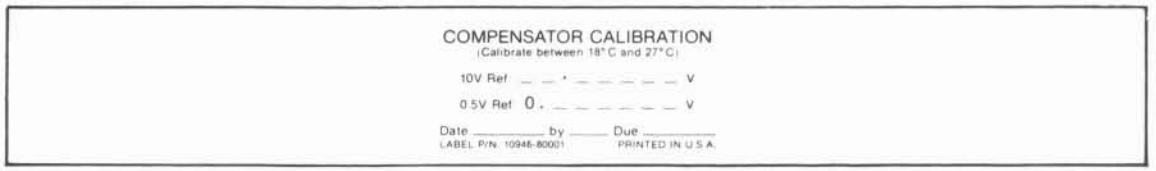


Figure 7-25. "Compensator Calibrator" Label

e. Send the Calibrate Reference Enable command mnemonic *CRE.

f. Send the Calibrate References Command mnemonic *CRC.

g. Verify the data entered by reading both calibration values as follows:

1. +10 Vref — send mnemonic *RVA?
2. +0.5 Vref — send mnemonic *RVB?

HP 10751A/B Calibration Procedure

Due to the complexity of the calibration procedures and the test equipment required, it is recommended that the HP 10751A/B be returned to Hewlett-Packard for calibration.

The HP 10751A/B Pressure and Temperature circuitry both require a 12-month calibration cycle. Also, calibration should be performed after repair is made to any of the 10751A/B circuits except the humidity switch.

Equipment Required. Refer to *Table 7-20* for a list of test equipment required for the HP 10751A/B calibration procedures. In addition, the procedures require the HP 5507A and the HP 3456A Digital Voltmeter. Also for convenience, the following additional equipment is recommended:

Accessories for Temperature Calibration

*Extender Cable, (10751-60201/60202 to 10751-60001)
*Extender Cable, (10751-60001 to 10751-60002)

Accessories for Pressure Calibration

*Extender Cable, (10751-60201/60202 to 10751-60001)
*Adapter, (¼ inch I.D. Pneumatic Hose to 10751A/B Pressure Transducer

Table 7-20. Recommended Test Equipment (Note 1)

INSTRUMENT	USE* (Note 2)	SPECIFICATIONS	RECOMMENDED EQUIPMENT
Quartz Thermometer with Probe	51,57	Range: 0-50°C Accuracy: ±0.04°C	HP 2804A and HP 18120A Laboratory Probe
Temperature Bath	51,57	Volume: 15 Liters Uniformity: ±0.01°C	Benco Grant Model SP15
Refrigeration Unit for Temperature Bath	51,57		Benco Grant Model CC-15
Dielectric Liquid for Temperature Bath	51, 57		Flourinet FC-40 3M Company
Precision Pressure Controller	51	Range: 22-31 in. Hg (minimum) (558.8-800 mm Hg) Accuracy: ±0.0125% of reading	Texas Instruments Model 156-02
Calibration Accessories	51, 52	Extender Cables and Adapter	See Note 3

Note 1: This equipment not required if both HP 10751A/B and 10757A/B/C are returned to Hewlett-Packard for periodic calibration.

Note 2: 51 = HP 10751A/B Calibration
57 = HP 10757A/B/C Calibration

Note 3: Contact the nearest Hewlett-Packard Sales and Support Office for assistance in ordering the any calibration accessories.

*These items are available from HP. Contact your local HP Sales and Support Office for ordering instructions.