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General Information

Introduction

This manual contains information required for installing, operating, and servicing the HP 8711B Option K40 RF Switching Test Set.

Description

The HP 8711B Option K40 RF Switching Test Set is specifically designed for use with the HP 871xA/C Network Analyzer. The HP 8711B Option K40 enables the network analyzer to measure 14 S-Parameters of a four port DUT without disconnecting and reconnecting the DUT.

The HP 8711B Option K40 utilizes the I-Basic capabilities of the HP 871x to control its RF switches. The interface between the HP 871x Network Analyzer and the HP 8711B Option K40 is provided through the parallel port interface. The HP 8711B Option K40 provides a second parallel connector so printer capabilities will not be interrupted or a second switching test set may be added.

Power for the HP 8711B Option K40 is provided by its own internal power supply. A DC output connector is provided on the rear panel to power additional switching test sets.

Accessories

Table 1. HP 8711B Option K40 Accessories Supplied

Description	Quantity	Part Number
Power Cord	1	8120-1348
Type N Jumper Cables	2	8120-4782
Parallel Port Interface Cable	1	08711-60123
HP 8711B Option K40 Operating and Service Manual	1	08711-90153

Specifications

Table 2. HP 8711B Option K40 Specifications

Parameter	Specification
Frequency Range	300 kHz to 1.3 GHz
Insertion Loss	<1.0 dB (Transmission to Port 1, 2, 3, or 4) (Reflection to Port 1, 2, 3, or 4)
Source Match	≥25 dB All Ports
Switch Repeatability	±0.03 dB (Per switch contact)
Impedance	50 Ω (All ports)

Installation

Introduction

This chapter describes how to install the HP 8711B Option K40 Test Set into a measurement system. The topics include initial inspection and preparation for use.

Initial Inspection

Inspect the shipping container (including cushioning material) for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness. The contents of the shipment should be as follows:

- HP 8711B Option K40
- Operating and Service Manual, HP part number 08711-90153
- Power Cord, HP part number 8120-1348
- HP 8711B Option K40 Parallel Port Interface Cable, HP part number 08711-60123
- HP 8711B Option K40 Type N Jumper Cables (2), HP part number 8120-4782
- Front Handle Kit HP p/n 5063-9226

Check the instrument mechanically and electrically. If the instrument is damaged, defective, or incomplete, notify the nearest Hewlett-Packard Sales and Service Office. Keep the shipping material for the carrier's inspection. The HP office will arrange for repair or replacement without waiting for settlement of the claim.

Preparation For Use

Power Requirements

Table 3. Power Requirements

Characteristic	Requirement
Input Voltage	90 V to 250 V
Frequency	48 Hz to 66 Hz
Power	55 VA Max

Line Voltage and Fuse Selection

CAUTION:

To prevent damage to the instrument, make sure that the 3.0 A, 250 V fuse is installed.

Measure the ac line voltage to determine if the line voltage is within the input voltage range specified in Table 3.

A single 3.0 A, 250 V fuse is used over the entire voltage range. This fuse is located in the power-line module on the rear panel of the instrument.

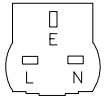
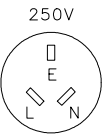
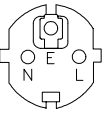
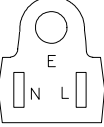
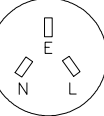
Fuse Replacement

1. Pry out the fuse carrier.
2. Insert the fuse of the proper rating (3.0 A, 250 V).
3. Place the fuse carrier back into the line module.

Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. **Table 4** shows the styles of plugs available on power cables supplied with Hewlett-Packard instruments. The HP part numbers indicated are part numbers for the complete power cable and plug set. The specific type of power cable and plug shipped with the instrument depends upon the country of shipment destination.

Table 4. AC Power Cables Available

PLUG TYPE **	CABLE HP PART NUMBER	PLUG DESCRIPTION	CABLE LENGTH CM (INCHES)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight* BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Great Britain, Cyprus, Nigeria, Singapore, Zimbabwe
250V 	8120-1369 8120-0696	Straight* NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Argentina, Australia, New Zealand, Mainland China
250V 	8120-1689 8120-1692	Straight* CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Central African Republic, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1538	Straight* NEMA5-15P 90°	203 (80) 203 (80)	Black Black	United States Canada, Japan (100 V or 200 V), Brazil, Colombia, Mexico, Phillipines, Saudia Arabia, Taiwan
	8120-1378	Straight* NEMA5-15P	203 (80)	Jade Gray	United States Canada, Japan (100 V or 200 V), Brazil, Colombia, Mexico, Phillipines, Saudia Arabia, Taiwan
	8120-4753	Straight 90°	230 (90)	Jade Gray	
	8120-1521 8120-4754	Straight 90°	203 (80) 230 (90)	Jade Gray Jade Gray	
250V 	8120-5182 8120-5181	Straight* NEMA5-15P 90°	200 (78) 200 (78)	Jade Gray Jade Gray	Israel
<p>* Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug.</p> <p>** E = Earth Ground; L = Line; N = Neutral.</p>					

Positioning the HP 8711B Option K40 Test Set

The HP 8711B Option K40 is designed to be placed under the HP 871x RF Network Analyzer.

Connecting the HP 8711B Option K40 Test Set

The **REFLECTION** connector of the HP 8711B Option K40 connects directly to the **REFLECTION** connector of the HP 871x RF Network Analyzer using a Type N Jumper cable (HP p/n 8120-4782).

The **TRANSMISSION** connector of the HP 8711B Option K40 connects directly to the **TRANSMISSION** connector of the HP 871x RF Network Analyzer using a Type N Jumper cable (HP p/n 8120-4782).

The **PARALLEL PORT INPUT** of the HP 8711B Option K40 connects directly to the **PARALLEL PORT** of the HP 871x RF Network Analyzer using the Parallel Port Interface Cable (HP p/n 08711-60123).

Operation

Introduction

This chapter describes the front and rear panel features of the HP 8711B Option K40. The I-Basic program example provided in this chapter can be used as an aid in writing a program to control the HP 8711B Option K40.

Front Panel Features

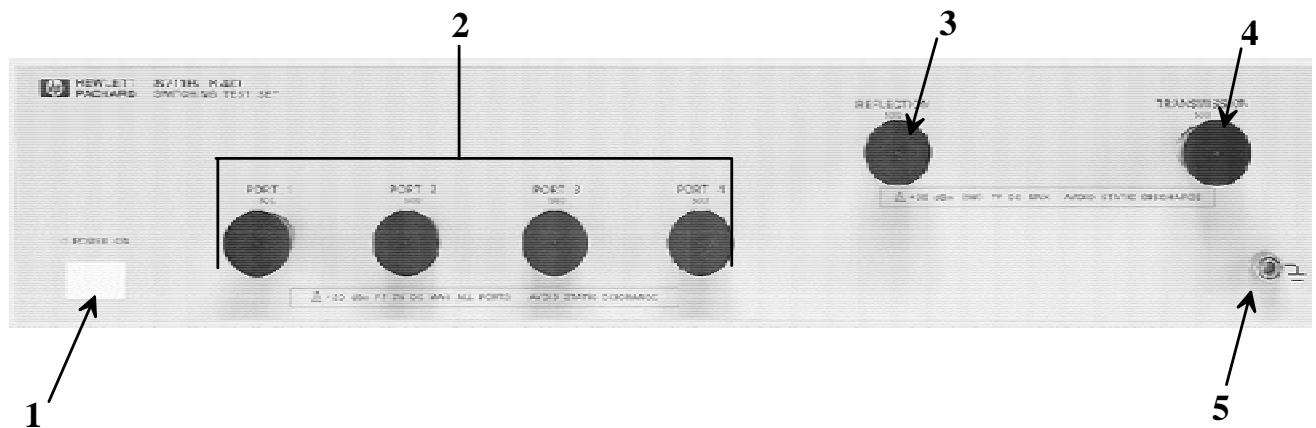


Figure 1. HP 8711B Option K40 Front Panel Features

1. **POWER ON** switch controls the line power to the HP 8711B Option K40.
2. **PORT 1** through **PORT 4** connect to the device under test.

CAUTION:

Do not input more than +20 dBm or 7 Vdc to these ports or damage to the internal RF switches or the HP 871x Network Analyzer will result.

3. **REFLECTION** connector connects directly to the reflection connector on the HP 871x Network Analyzer.

CAUTION:

Do not input more than +30 dBm or 7 Vdc to this connector or damage to the internal RF switches will result.

4. **TRANSMISSION** connector connects directly to the transmission connector on the HP 871x Network Analyzer.

CAUTION:

Do not input more than +30 dBm or 7 Vdc to this connector or damage to the internal RF switches will result.

5. Ground Connector provides a front panel ground connection.

Rear Panel Features

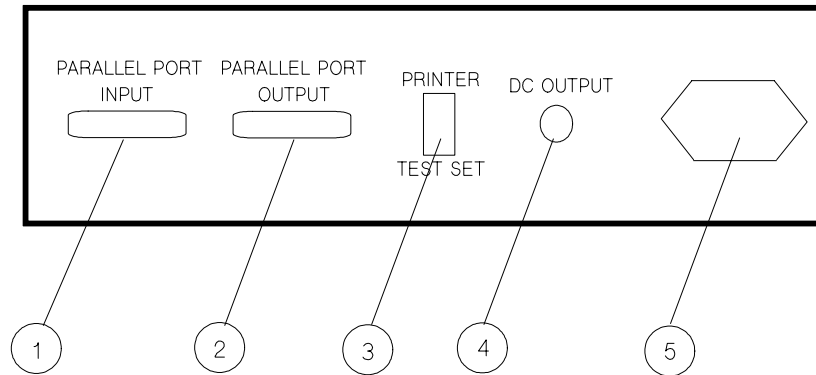


Figure 2. HP 8711B Option K40 Rear Panel Features

1. **PARALLEL PORT INPUT** is a 25-pin subminiature type connector. This connector supplies the control signals to switch the HP 8711B Option K40. In pass through mode, it also accepts signals required to drive a printer.
2. **PARALLEL PORT OUTPUT** is a 25-pin subminiature type connector. This connector supplies the control signals to either control another switching test set or a printer.
3. **PRINTER/TEST SET** switch controls the function of the Parallel Port Output connector. When switched to Printer, a printer can be connected to the Parallel Port Output connector. When this switch is positioned to Test Set, an additional test set can be controlled from the Parallel Port Output connector.
4. **DC OUTPUT** connector provides a +5 V and +24 V output to drive an additional test set (for example, HP 8711A Option K12).
5. **Power Module** is the instrument power receptacle.

Operating Theory

The HP 8711B Option K40 Switching Test Set is comprised of four mechanical RF switches, a controller board, and a power supply.

The RF switches are controlled by the I-Basic capabilities of the HP 871x Network Analyzer. The HP 871x RF Network Analyzer's Parallel Port output connector is utilized for an interface to control the 8711B Option K40.

The following description illustrates how the HP 8711B Option K40 expands the capabilities of the HP 871x RF Network Analyzer from a single port analyzer to a four port analyzer.

The reflection path and transmission path first encounter RF switch S4 (refer to the HP 8711B Option K40 block diagram in Figure 6). The switch is a transfer switch which changes the function of the reflection and transmission paths to both being reflection/transmission paths. These two RF paths lead to RF switch S1 and S3. RF switch S1 divides this path into Port 1 and Port 2 connections. RF switch S3 divides this path into RF switch S1 and S2. S2 further divides the path into Port 3 and Port 4. This RF diagram provides a means to make 14 different S-Parameter measurements on a single four port device.

Programming the HP 8711B Option K40

In order to control the RF switches in the HP 8711B Option K40, an I-Basic program must be written. Below is an example of a program selecting an RF path from the transmission connector to the Port 1 connector. Refer to **Table 5** showing the necessary switch positions for each of the ten possible paths along with the appropriate I-Basic command.

The HP 8711B Option K40/K12 requires additional memory space for storing instrument state and calibration data. The HP 8711A provides 46 kilobytes of nonvolatile memory for instrument state and calibration data. A new SCPI command has been set up to provide up to 1.5 Mbytes of memory space for storing instrument state, calibration data, and I-BASIC programs in I-BASIC memory.

Following are two example programs demonstrating how to use the capabilities for learn strings less than 32,767 bytes long, and for learn strings greater than 32,767 bytes not exceeding 80,000 bytes long. Also following is an example program demonstrating how to save the instrument state and calibration data from I-BASIC memory to disk and back to I-BASIC memory.

For additional programming assistance, refer to Section 9, of the standard Operating and Programming Manual.

NOTE:

HP 8711A instruments with serial numbers below 3325A01275 require special Option H02 or upgraded to firmware Rev. 2.10.

Front Panel Control of the Switching Test Set

Firmware Requirements

Firmware revision required to use the front panel control is A.03.50 for the HP 8711A (or B.03.50 for the HP 8711B). If you have an earlier firmware revision, you may want to install revision 3.50, and use the built-in [**Test Set Control**] menu.

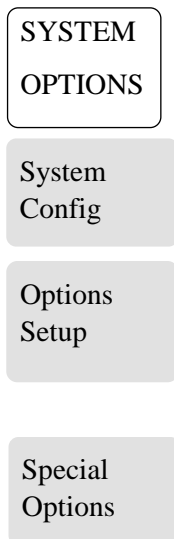
To upgrade the firmware to revision 3.50, refer to your HP 871x Service Manual. See the chapter titled "*Correction Constants and Firmware*".

NOTE:

Be sure to save your correction constants when upgrading firmware.

Enabling the Test Set Control Menu

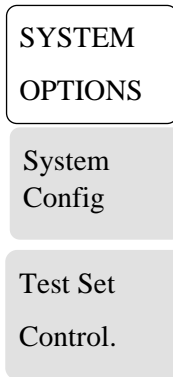
If you have the firmware revision A.03.50 installed you can enable the [**Test Set Control**] menu, press the following keys:



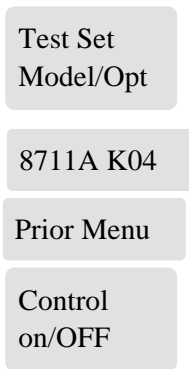
and enter the work **BEARS** (case does not matter). A message will appear saying "Control of Special Handling Switching Test Set now enabled"

Test Set Control Menu

Press the following keys to enter the [**Test Set Control**] menu (this menu is disabled by default, but can be enabled by a keyword, as described above).

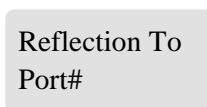


Use the softkeys to select **8711A K04** as the model of your switching test set.



When set to "**ON**", the analyzer will write to the test set to configure the connections. Writing is done when you recall an instrument state, turn on power, or change a test set setting.

Select the test set port that you want to use as the reflection port (RF OUT)



or, select the test set port that you want to use as the transmission port (RF IN).



Programming Considerations

The design of the controller board is configured such that it has two latches for each RF switch driver. Since an RF switch could end up straddling the different latch inputs, an RF switch could be driven in two different directions at the same time. In order to prevent this from happening, it is recommended that the latches be cleared prior to changing their positions. Refer to lines 730 to 750. It is also advisable to clear the latches after all switch positions have been completed. This will prevent current flow in RF S4 which does not have a current interrupt circuit in it. Refer to lines 810 to 830. Wait statements between each switch command are necessary to assure that proper switching occurs. Refer to line 780.

Table 5. RF Path/Switch Positions

RF PATH Connector	RF SWITCH POSITION							
	S4		S3		S2		S1	
From - To	Conn	Command	Conn	Command	Conn	Command	Conn	Command
Trans - Port 1	J2-J1	WRITEIO 15,3;2	--	--	--	--	1-2	WRITEIO 15,3;34
Trans - Port 2	J2-J1	WRITEIO 15,3;2	--	--	--	--	3-2	WRITEIO 15,3;36
Trans - Port 2	J3-J1	WRITEIO 15,3;1	1-C	WRITEIO 15,3;4	--	--	3-4	WRITEIO 15,3;34
Trans - Port 3	J3-J1	WRITEIO 15,3;1	2-C	WRITEIO 15,3;8	1-C	WRITEIO 15,3;16	--	--
Trans - Port 4	J3-J1	WRITEIO 15,3;1	2-C	WRITEIO 15,3;8	2-C	WRITEIO 15,3;33	--	--
Refl - Port 1	J2-J4	WRITEIO 15,3;1	--	--	--	--	1-2	WRITEIO 15,3;34
Refl - Port 2	J2-J4	WRITEIO 15,3;1	--	--	--	--	3-2	WRITEIO 15,3;36
Refl - Port 2	J3-J4	WRITEIO 15,3;2	1-C	WRITEIO 15,3;4	--	--	3-4	WRITEIO 15,3;34
Refl - Port 3	J3-J4	WRITEIO 15,3;2	2-C	WRITEIO 15,3;8	1-C	WRITEIO 15,3;16	--	--
Refl - Port 4	J3-J4	WRITEIO 15,3;2	2-C	WRITEIO 15,3;8	2-C	WRITEIO 15,3;33	--	--

Selecting RF Path Trans to Port 1

```
700 Setup1: !  
710 DISP "RF Path Trans to Port 1 (S4, S1)"  
720 OUTPUT 800;"diag:cpu:mem 33554694,-1"  
  
730 FOR I=0 TO 224 STEP 32  
  
740 WRITEIO 15,3;I  
750 NEXT I  
760 WAIT .03  
770 WRITEIO 15,3;2  
780 WAIT .03  
790 WRITEIO 15,3;34  
800 WAIT .03  
810 FOR I=0 TO 224 STEP 32  
  
820 WRITEIO 15,3;I  
830 NEXT I  
840 OUTPUT 800;"diag:cpu:mem 33554694,0"  
  
850 RETURN
```

Displays RF path.

Selects test set.
(-1 = Test Set)
(0 = Printer)

*Lines 730, 740, and 750
clear latches prior to
inputting new data.*

Switches RF Switch S4.

Switches RF Switch S1.

*Lines 810, 820, and 830
clear latches, remove
current from RF switches.*

Selects printer.
(-1 = Test Set)
(0 = Printer)

Saving Instrument State and CAL <32,767 Bytes Long

10	DIM	Mem1\$[20000]	<i>Allocate 20 Kbytes per memory.</i>
20	DIM	Mem2\$[20000]	
		...	
50	OUTPUT	@Hp8711;"MMEM:STOR:STAT:CORR ON"	<i>Send Cal Data when storing Mem1\$.</i>
60	OUTPUT	@Hp8711;"SYSTEM:SET:LRNLong?"	<i>Read instrument state and cal data into Mem1\$.</i>
70	ENTER	@Hp8711 USING "-K"; Mem1\$	<i>Read memory 1 from the analyzer.</i>
		...	
160	OUTPUT	@Hp8711;Mem1\$	<i>Put Mem1\$ back into the instrument.</i>

Saving Instrument State and CAL >32,767 Bytes Long

10	DIM	Mem1\$ (1:4) [20000]	<i>Allocate 80 Kbytes per memory.</i>
20	DIM	Mem2\$ (1:4) [20000]	
		...	
50	OUTPUT	@Hp8711;"MMEM:STOR:STAT:CORR ON"	<i>Send Cal Data when storing Mem1\$.</i>
60	OUTPUT	@Hp8711;"SYSTEM:SET:LRNLong?"	<i>Read instrument state and cal data into Mem1\$.</i>
70	ENTER	@Hp8711 USING "%,-K"; Mem1\$(*)	<i>Read memory 1 from the analyzer.</i>
		...	
160	OUTPUT	@Hp8711;Mem1\$(*)	<i>Put Mem1\$ back into the instrument.</i>

Saving Instrument State and CAL from I-BASIC to Disk

10	ASSIGN @Hp8711 to 800	
20	DIM Mem1\$(20000)	<i>Allocate 20 Kbytes per memory.</i>
30	DIM Mem2\$(20000)	
40	OUTPUT @Hp8711;"MMEM:STOR:STAT:CORR ON"	<i>Send Cal Data when storing Mem1\$.</i>
50	OUTPUT @Hp8711;"SYSTEM:SET:LRNLong?"	<i>Read instrument state and cal data into Mem1\$.</i>
60	ENTER @Hp8711 USING "-K"; Mem1\$	<i>Read memory 1 from the analyzer.</i>
70	OUTPUT @Hp8711;Mem1\$	<i>Put Mem1\$ back into the instrument.</i>
80	CREATE "MEMFILE1",20000	<i>Create a file if it does not exist.</i>
90	ASSIGN @File TO "MEMFILE1";FORMAT ON	<i>Assign IO to file.</i>
100	OUTPUT @File;Mem1\$	<i>Store this array to disk.</i>
110	ASSIGN @File TO *	<i>Close the file.</i>
120	PAUSE	

Recalling Instrument State and CAL From Disk to I-BASIC Memory

130	ASSIGN @File TO "MEMFILE1";FORMAT ON	<i>Assign IO to file.</i>
140	ENTER @File USING "-K"; Mem2\$	<i>Read file into Mem 2.</i>
150	ASSIGN @File TO *	<i>Close the file.</i>
160	OUTPUT @Hp8711;Mem2\$	<i>Restore instrument state and cal into instrument.</i>
170	END	

Performance Tests

There are no performance tests for this instrument.

Adjustments

There are no adjustments for this instrument.

Replaceable Parts

Introduction

This chapter provides replaceable parts and ordering information.

Replaceable Parts List

The replaceable parts list is arranged in alpha-numerical order by reference designator and consists of the following information:

- a. Reference designator
- b. Total quantity (Qty) in the instrument
- c. Description of the part
- d. Hewlett-Packard part number

Ordering Parts

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

To request information on a part that is not listed in the replaceable parts table, include the instrument model number, instrument identification number, and a description of the part and its function. Address the inquiry to the nearest Hewlett-Packard office.

Table 6. Replaceable Parts (1 of 2)

Reference Designator	Qty	Description	Part Number
A1	1	CONTROLLER/DRIVER BD	08711-60125
A2	1	POWER SUPPLY	0950-2252
DS1	1	LED-YELLOW	1990-0858
F1	2	FUSE 3 A 250 V F	2110-0780
F2, F3	2	FUSE 3 A 250 V F	2110-0003
J7	1	CONNECTOR DC 3-PIN	1251-6781
J1-J6	6	TYPE N BULKHEAD CONN	5061-5386
W2,W4	2	RF CABLE	08711-20158*
W1,W3	2	RF CABLE	08711-20157*
W5	1	RF CABLE	08711-20119*
W6,W15,W16	3	RF CABLE	08711-20120*
W7	1	RF CABLE	08711-20121*
W8	1	RF CABLE	08711-20141*
W9,W10	2	RF CABLE	08711-20123*
W11	1	RF SWITCH CABLE ASSY	08711-60128*
W12	1	PRINTER/TEST SET SWITCH ASSY	08711-60129
W13	1	DC CABLE ASSY	08711-60127*
W14	1	AC LINE CABLE ASSY	87130-60007
S1	1	RF SWITCH, TRANSFER	33312-60004
S2,S3	2	RF SWITCH, SPDT	70612-60003
S4A	1	RF SWITCH, SPDT	08711-60157
S4B	1	RF SWITCH, TRANSFER	33313-60001
S5	1	ROCKER SWITCH	3101-3008
	2	TRIM-SIDE (NOT SHOWN)	5041-9170
	1	FRAME-REAR	5021-5802
	2	STRUT-SIDE	5021-5887
	1	FRAME-FRONT	5022-1187
	4	STDF REAR PANEL (NOT SHOWN)	5041-9188

Table 6. Replaceable Parts (2 of 2)

Reference Designator	Qty	Description	Part Number
	4	FOOT-FM .5M (NOT SHOWN)	5041-9167
	1	TRM STRIP (NOT SHOWN)	5041-9176
	1	CAP-FRONT (NOT SHOWN)	5041-9186
	1	CAP-REAR (NOT SHOWN)	5041-9187
	1	STRAP ASSY	5063-9210
	1	COVER TOP (NOT SHOWN)	5002-1047
	1	COVER BOTTOM (NOT SHOWN)	5002-1088
	1	COVER-SIDE W/O RH (NOT SHOWN)	5002-3913
	1	COVER-SIDE W RH (NOT SHOWN)	5002-3736
	1	FRONT HANDLE KIT (NOT SHOWN)	5063-9226
	2	TYPE N JUMPER CABLES (NOT SHOWN)	8120-4782
	1	REAR-PANEL	08711-00053*
	1	DECK	08711-00054*
	1	INTERFACE CABLE (NOT SHOWN)	08711-60123
	1	FRONT-PANEL DRESS	08711-00077*
	1	FRONT-PANEL SUB	08711-00076*
	1	BRACKET, RF SWITCH	08711-00063*

NOTE:

The part numbers indicated (*) are unique to this special option. To order these replacement parts, please contact NA MID Support Group with the part number, module/model number and option number. If ordering parts through your local HP Sales and Service Office, specify that asterisk parts are ordered through the NA MID Support Group.

NOTE:

Special Options are built to order, therefore long lead times may be encountered when ordering replacement parts.

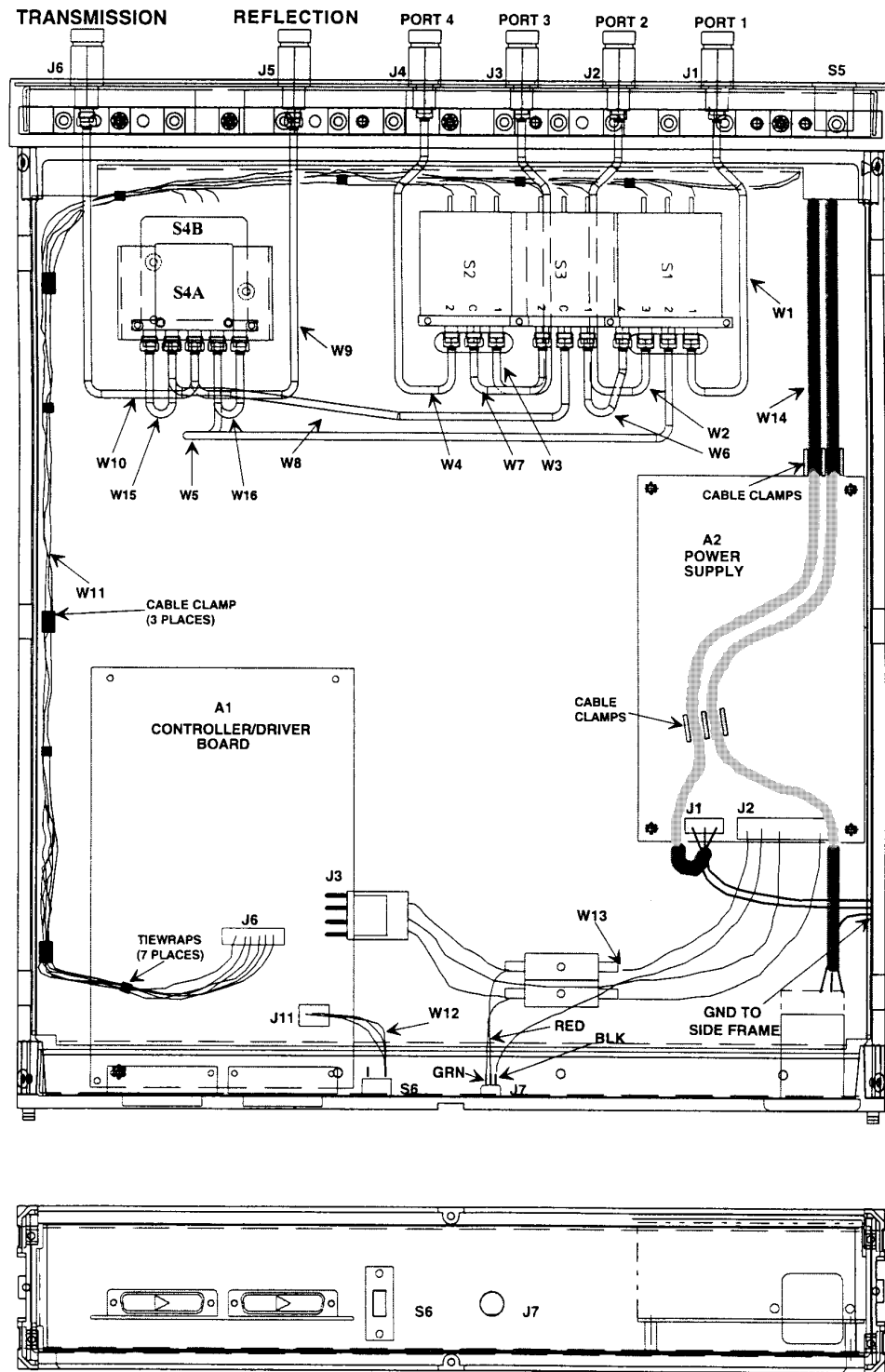


Figure 3. Major Component Locations

Manual Backdating Changes

This manual has been written for and applies directly to all HP 8711B Option K40 Test Sets. However, because there are no earlier versions of this instrument, this chapter contains no applicable information.

Service

This chapter provides a schematic, RF switch wiring diagram, and a block diagram of the assemblies in the HP 8711B Option K40 Test Set. Schematic diagrams of the power supply are not available at this time.

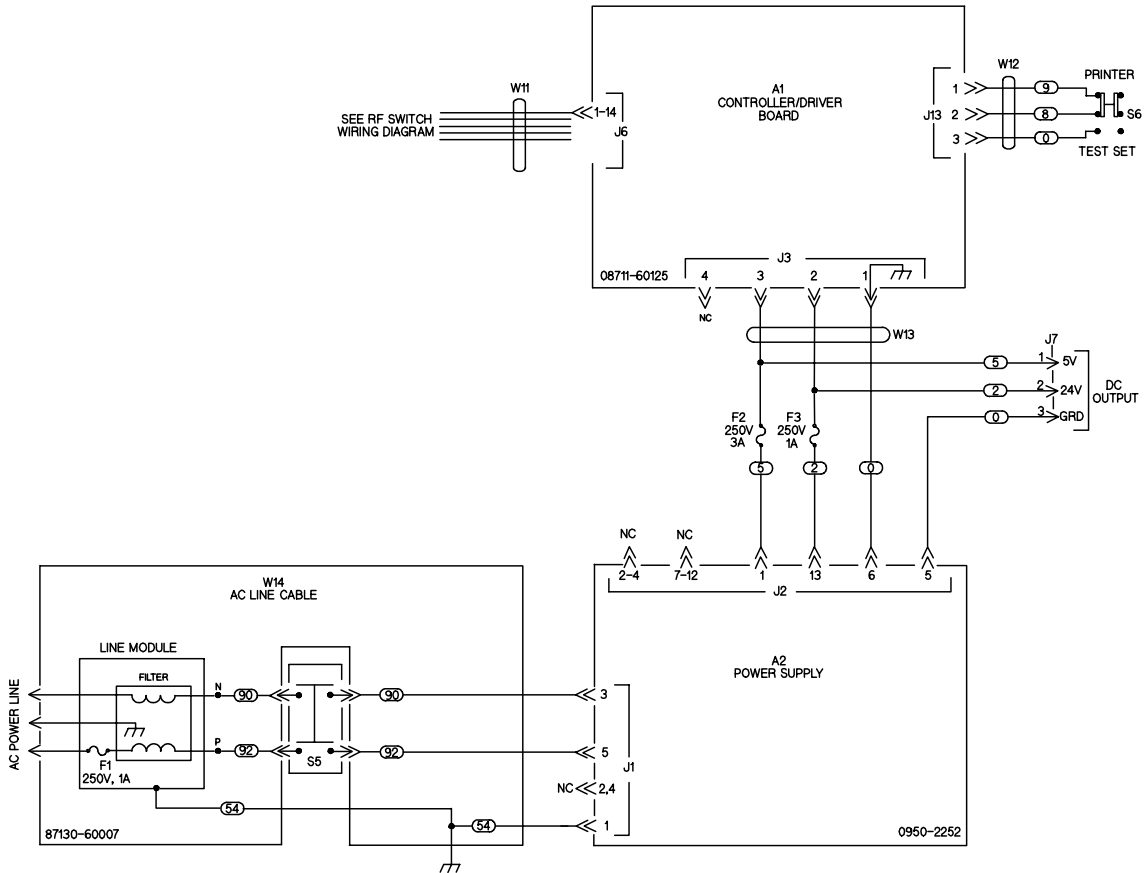


Figure 4. HP 8711B Option K40 Overall Schematic Diagram

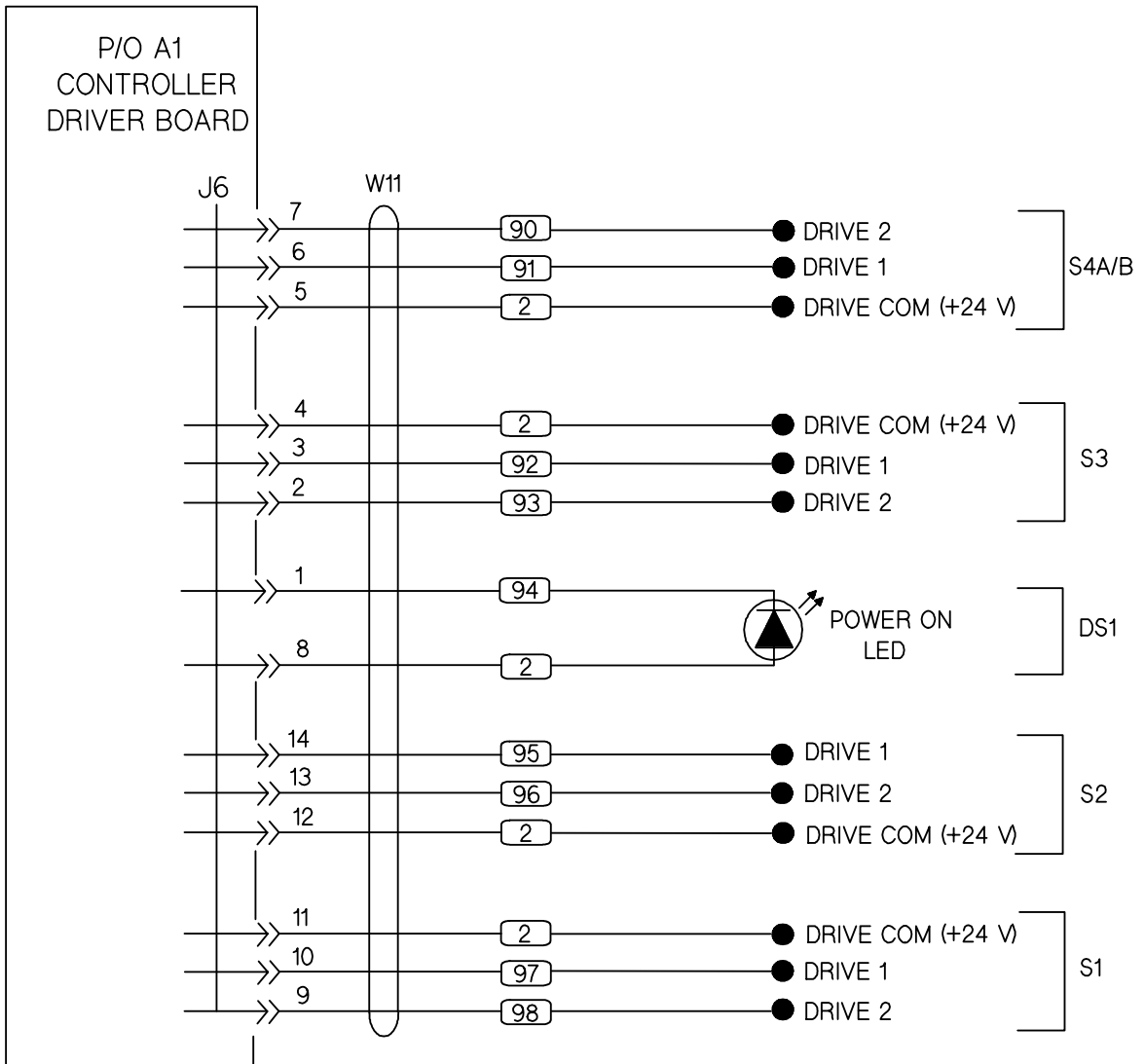


Figure 5. RF Switch Wiring Diagram

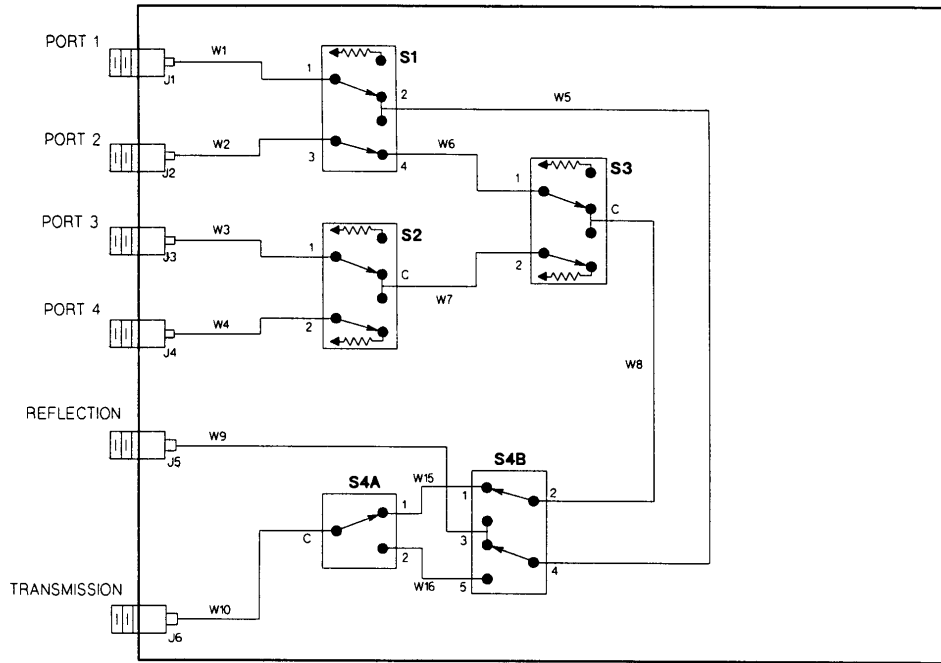


Figure 6. HP 8711B Option K40 Block Diagram

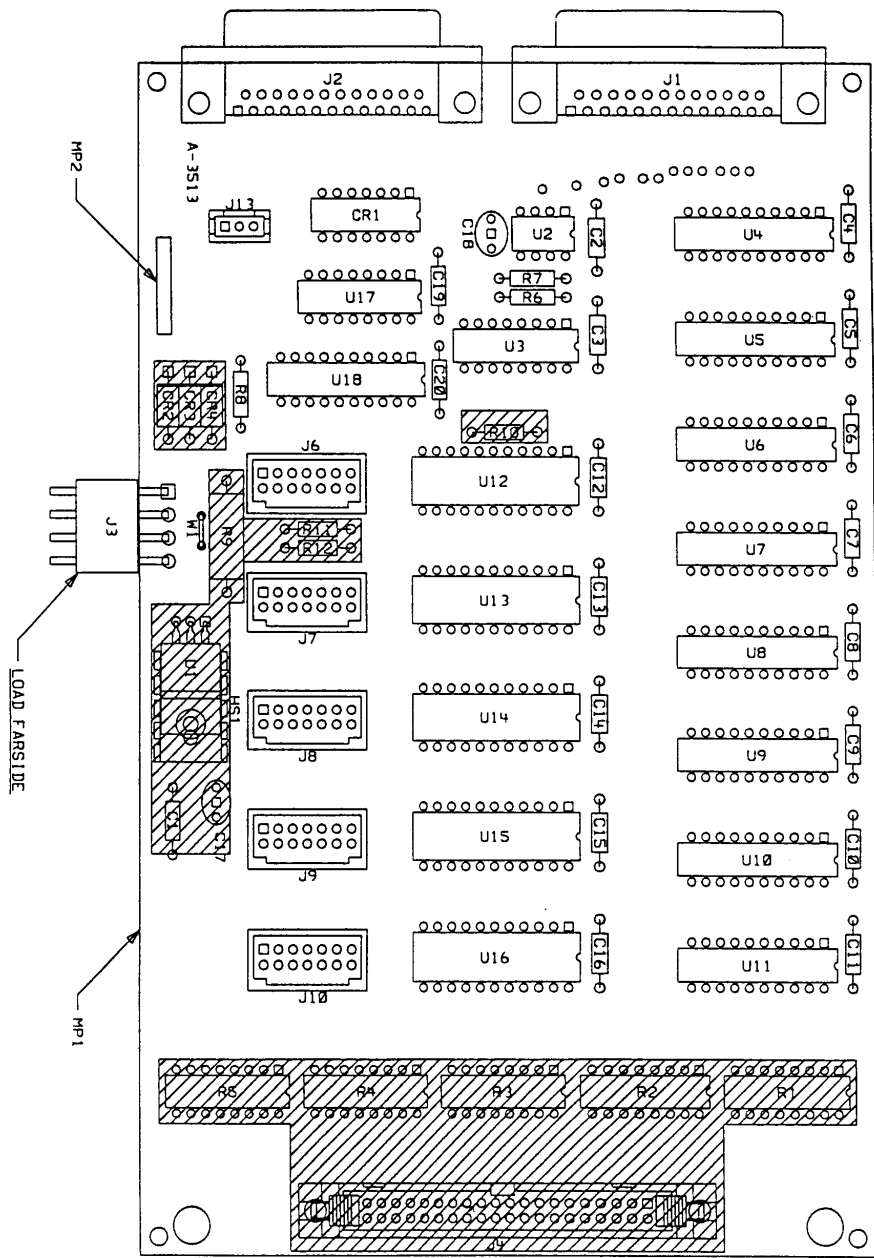


Figure 7. AI Controller / Driver Board Component Locations Diagram