HEWLETT PACKARD

HP 70612D K07
Frequency Translator

Hardware Reference Manual

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Revision 2.0

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Europe:	Hewlett-Packard European Marketing Centre Postbox 999 1180 AZ Amstelveen The Netherlands (31 20) 547 9900
Japan:	Hewlett-Packard Ltd. Measurement Assistance Center 9-1, Takakura-Cho, Hachioji-Shi Tokyo 192, Japan (81) 426 56 7832 (81) 426 56 7840 (FAX)
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Safety and Regulatory Information

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. This product has been designed and tested in accordance with international standards.

WARNING

The WARNING notice denotes a hazard. It calls attention to a procedure, practice, or the like, that, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

CAUTION

The **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

Instrument Markings

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
1SM1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is OFF or in STANDBY position.

⏚ Safety Earth Ground

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Before Applying Power

Verify that the product is configured to match the available main power source as described in the input power configuration instructions in this manual. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Typeface Conventions

Italics

- Used to emphasize important information:
  Use this software *only* with the HP xxxxxX system.
- Used for the title of a publication:
  Refer to the *HP xxxxxX System-Level User's Guide.*
- Used to indicate a variable:
  Type `LOAD BIN` *filename*.

`Instrument Display`

- Used to show on-screen prompts and messages that you will see on the display of an instrument:
  The HP xxxxxX will display the message **`CAL1 SAVED`**.

[Keycap]

- Used for labeled keys on the front panel of an instrument or on a computer keyboard:
  Press **[Return]**.

{Softkey}

- Used for simulated keys that appear on an instrument display:
  Press ***{Prior Menu}***.

`User Entry`

- Used to indicate text that you will enter using the computer keyboard; text shown in this typeface must be typed *exactly* as printed:
  Type `LOAD PARMFILE`
- Used for examples of programming code:

```
#endif // ifndef NO_CLASS
```

`Path Name`

- Used for a subdirectory name or file path:
  Edit the file *`usr/local/bin/sample.txt`*

Computer Display

- Used to show messages, prompts, and window labels that appear on a computer monitor:
  The **Edit Parameters** window will appear on the screen.
- Used for menus, lists, dialog boxes, and button boxes on a computer monitor from which you make selections using the mouse or keyboard:
  Double-click **EXIT** to quit the program.

Contents

Description

The HP 70612D K07 frequency translator, designed for use in the HP 85120A-EB5 and EB9 systems, is a microwave switch matrix that has one input (J1) and one output (J2). The input (17 to 19 GHz) is routed either through a 6 dB attenuator (AT3) and out J2, or it is routed to an amplifier (AR1), a 6 dB attenuator (AT2), limiter/doubler (U1), and programmable attenuator (AT1), which produce double the input frequency (34-38 GHz).

The HP 70612D K07 consists of:

- two SPDT switches
- two 6 dB attenuators
- one 0 to 60 dB attenuator
- one amplifier
- one limiter/doubler

This unit is housed in a 2/8 MMS module with all connectors on the rear panel. Front panel LEDs indicate whether or not the limiter/doubler is in the circuit.

Switch and attenuator drive is by means of J3 (25-pin "D" connector) on the rear panel. To select desired switch positions, refer to the switch/attenuator drive table.

If the MMS host mainframe fails, a relay protection circuit shuts down the amplifier and doubler, stopping air circulation. (+15 Vdc is supplied through J3, and not through the MMS mainframe.) In addition, both the amplifier and the doubler have thermal protection. Their internal voltage regulators will shut down until the temperature falls to acceptable levels.

Accessory List

HP 70612D K07 Hardware Reference Manual, (1)	70612-92046

Specifications

RF Specifications

Frequency range:

13.25 to 20 GHz input

26.5 to 40 GHz output

VSWR:

No specifications; design goal is least possible VSWR.

Insertion loss/gain:

Limiter/doubler out:

Approximately 8 dB loss

Limiter/doubler in:

(With AT1 set to 0 and approximately -1 dBm input power)

Approximately 15 dB gain (+14 dBm output @ 34 to 38 GHz).

(This output power will remain the same over an input range of from at least -5 dBm to +10 dBm.

Environmental Conditions

"for indoor use only" (unless otherwise specified)

Altitude: Up to 15,000 feet (4,572 meters)

Temperature: 0°C to 55°C (unless otherwise specified)

Maximum relative humidity: 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.

Power Consumption

Approximately 30 watts @ 15 Vdc

Dimensions

Height: 5.8 inches (147.2 mm)

Width: 3.7 inches (94.8 mm)

Depth: 18.4 inches (467 mm)

Weight

~ 10 lbs (4.5 kg)

Attenuator and Switch Drive Table

HP70612D K07 DEVICE	ATTEN/SWITCH POSITION	SWITCH DRIVE BOARD IN HP 87130 K26		
		BOARD	COMMAND	CHANNEL
S1 SPDT SW	1 TO C 2 TO C	A2	OPEN CLOSE	221
S2 SPDT SW	1 TO C 2 TO C	A2	OPEN CLOSE	222
AT1 STEP ATTENUATOR	0 dB 10 dB IN	A2	OPEN CLOSE	223
	0 dB 20 dB IN	A2	OPEN CLOSE	224
	0 dB 30 dB IN	A2	OPEN CLOSE	225

Service Information

- There are no adjustable parts in this instrument.
- If your instrument requires service or if you need to remove or replace a component, contact your local HP sales and service office.
- All TORX-drive screws are metric-threaded. All pozidrive screws are inch-threaded.

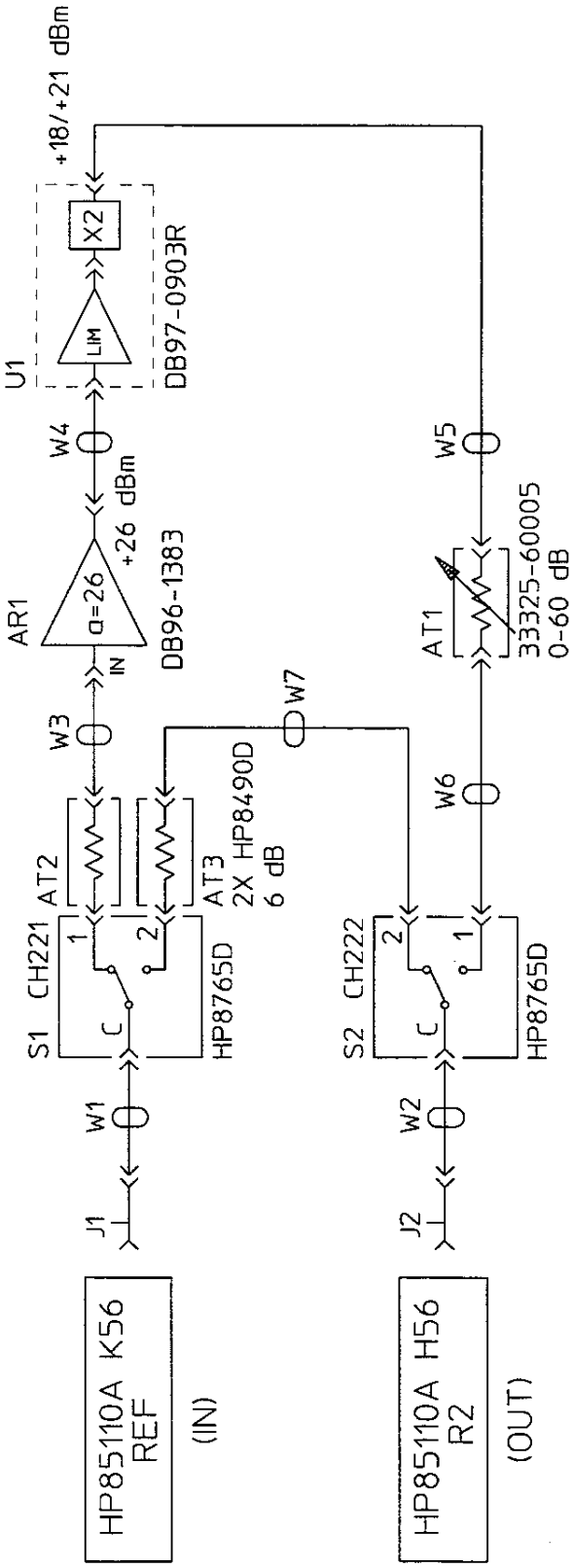
Replaceable Parts

Reference Designation	Part Number	Quantity	Part Description
A1	70612-62064	1	MMS remote power interrupt circuit
A2-A3	08760-60001	2	Relay board
A2J1, J3-J5; A3J1, J3-J5; A4J1, J2	1251-5383	10	Connector body
A2J1, J3-J5; A3J1, J3-J5; A4J1, J2	1251-4052	20	Connector pins
A2J1, J3-J5; A3J1, J3-J5; A4J1, J2	1251-7928	10	Connector body, mating
A2K1, A3K1	70612-82043	2	Relay 4PDT
A4	08760-62051	1	LED board, one section
A4DS1-S2	1990-1131	2	LED green
A4R1, A4R2	0757-0821	2	Resistor, 1.21 Kohm
AR1	70612-82044	1	Amplifier, 17 to 19 GHz, 26 dB Gain, + 26 dBm power with (f) "K" connectors (DBS Microwave, DB96-1383)
AT1	HP 33325-60005	1	Step attenuator, 40 GHz 60 dB 2.4 (f) connectors
AT2-AT3	HP 8490D/Opt 006	2	Fixed attenuator, 50 GHz, 6 dB
CR1	1902-0951	1	Zener diode, 5.1 volts
J1-J2	5062-7243	2	Connector, 2.4 mm bulkhead (f/f)
J3	70612-82048	1	Connector, 26-pin receptacle
J4	70700-60001	1	50-pin cable and MMS (m/f) connector
S1, S2	HP 8765D Opt 15/Opt100	2	SPDT 40 GHz switch, 15 volt, solder terminals
TB1, TB2	0360-1666	2	Terminal board, 5 lug
U1	70612-82049	1	Limiter/Doubler, 19/33 GHz, +10 to +30 dBm in, +18 to +21 dBm out ((DBS Microwave DB97-0903R, order w/two (f) "K" connectors.)
W1	70612-22897	1	RF cable, semirigid
W2	70612-22891	1	RF cable, semirigid
W3	70612-22892	1	RF cable, semirigid
W4	5062-6681		Cable assy, 6" SMA
W5	70612-22894	1	RF cable, semirigid
W6	70612-22895	1	RF cable, semirigid

Reference Designation	Part Number	Quantity	Part Description
W7	70612-22896	1	RF cable, semirigid
	0510-1244	1	Clip
	0900-0012	1	O-ring
	1460-2095	1	Spring
	5001-5835	1	Bar connector
	5001-5840	1	Ground clip
	5022-0051	1	Latch screw
	70611-22201	1	Front frame
	70611-22202	1	Base
	70611-22203	1	Rear frame
	70612-00004	1	Cover, top
	70612-02214	1	Front panel
	70612-02215	1	Rear panel
	70612-02216	1	Deck, vertical
	70612-02217	1	Bottom, panel
	70612-02218	1	Air deflector
	70612-02226	1	Bracket, heat sink
	70612-22782	1	Heat sink
	70700-00004	1	Ferrite bracket
	70700-40002	2	Guide - PC board
	70612-82050	26	Socket (Newark 66F3068)

Schematics and Diagrams

- RF Schematic
- Switch Drive Schematic
- Front Panel
- Rear Panel
- Component Layout



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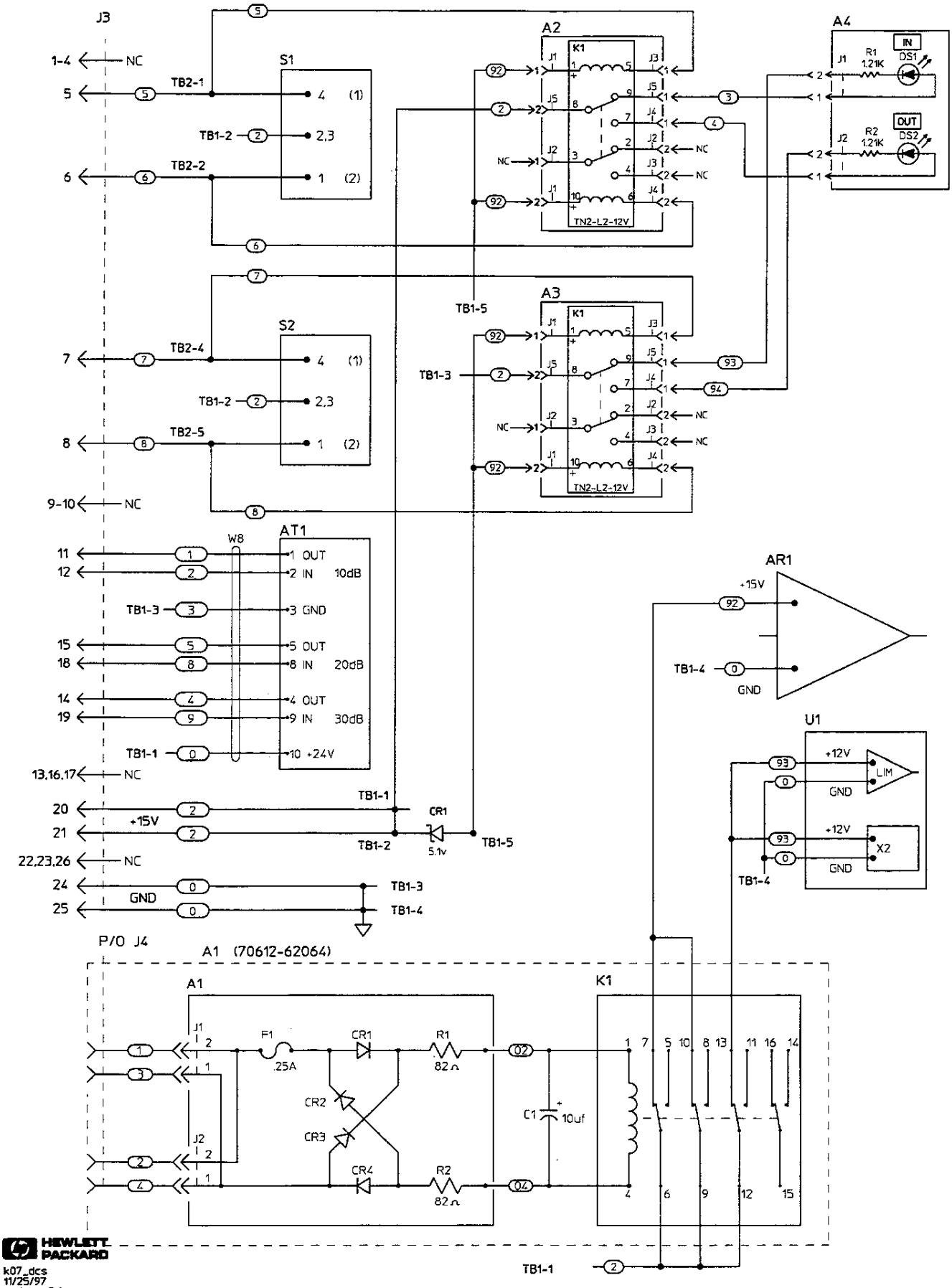
revision x.x

HP 70612D K07 RF Schematic



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k07_dcs
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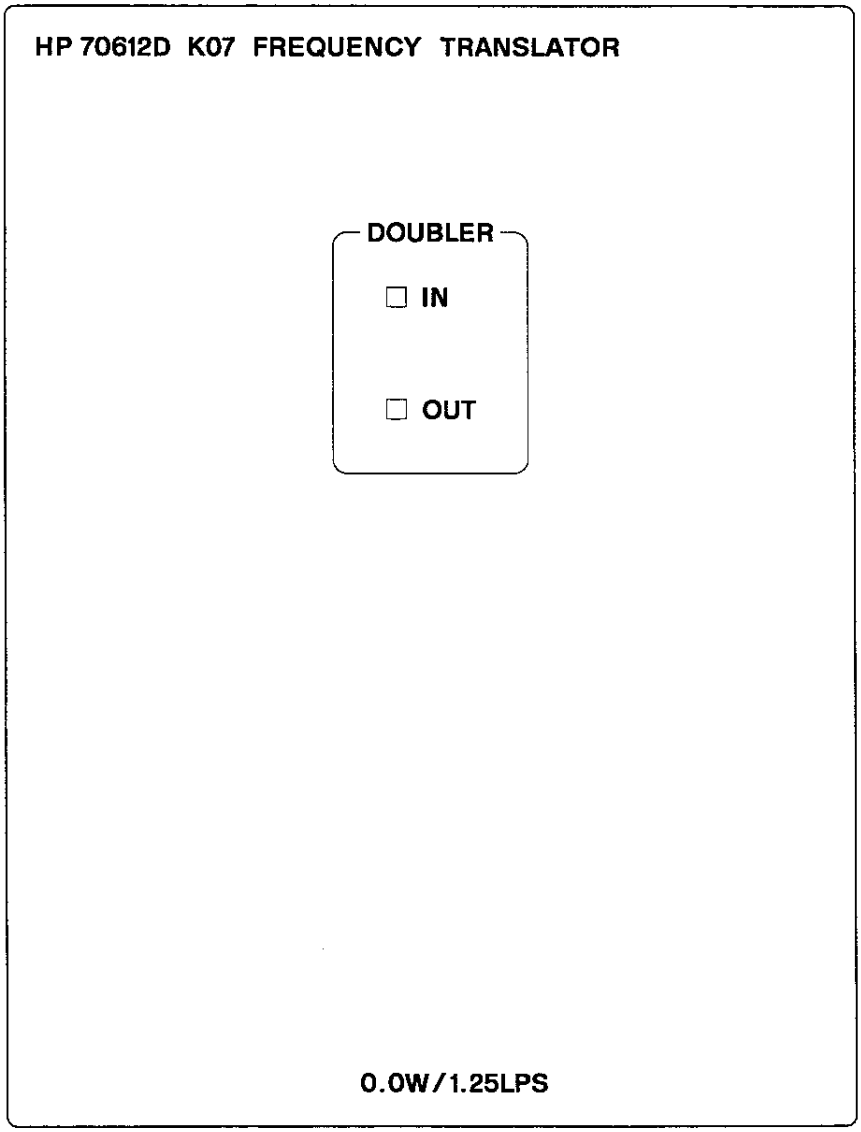
HP 70612D K07 DC Schematic



Front View

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k07_fp
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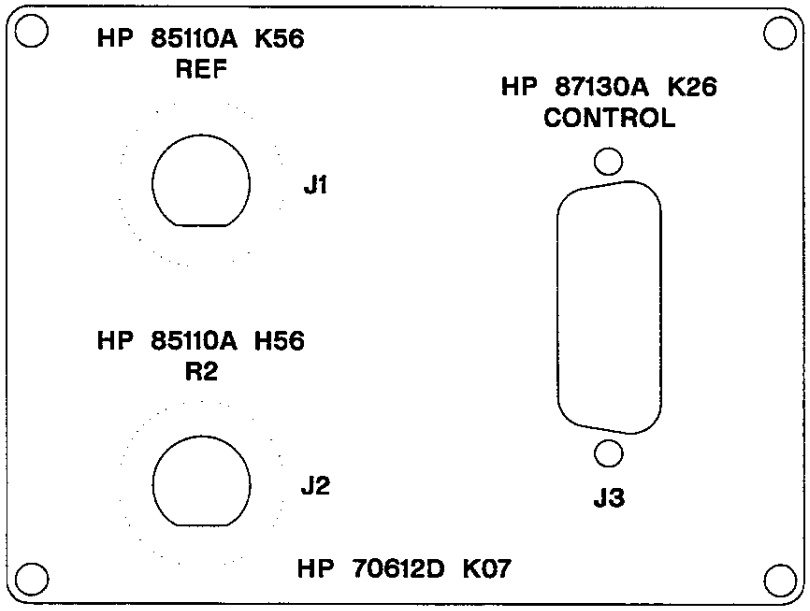

Rear View

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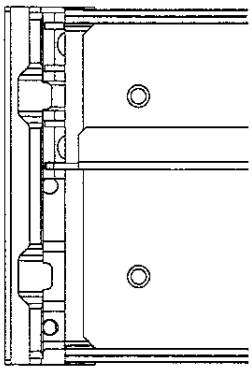
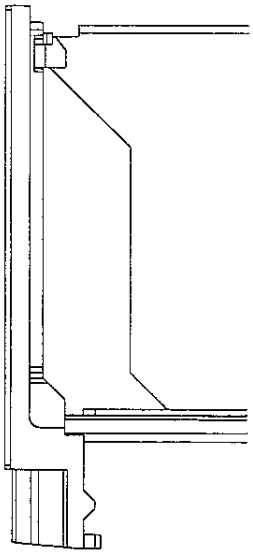
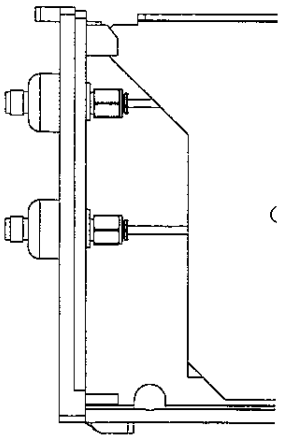
k07_rp
03/07/97
revision 1.0



Rear



Rear



Front

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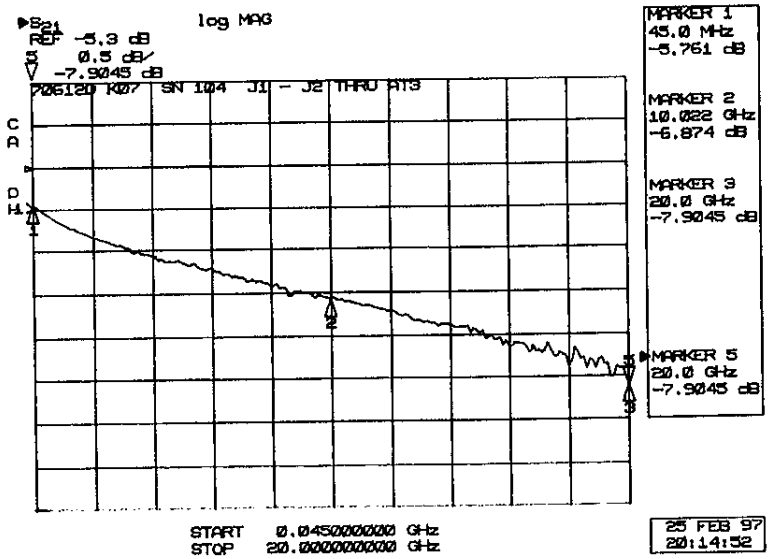
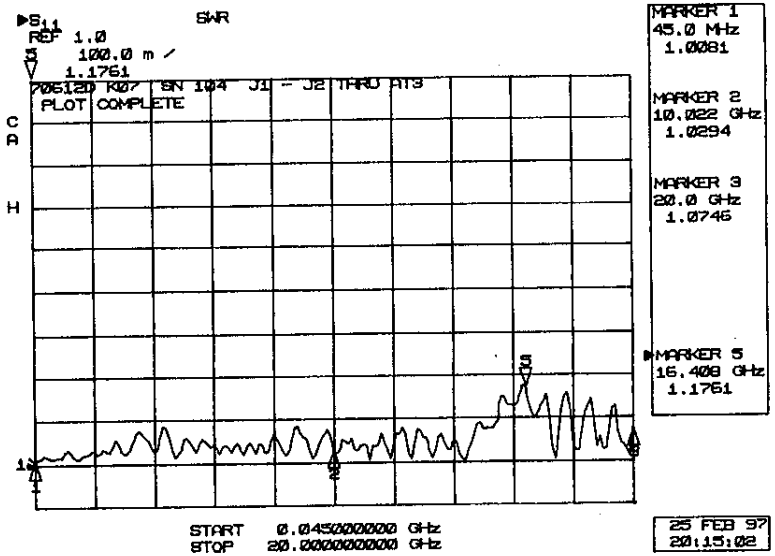
k07_clayout2
11/06/97
revision 3.0

HP 70612D K07 Component Layout

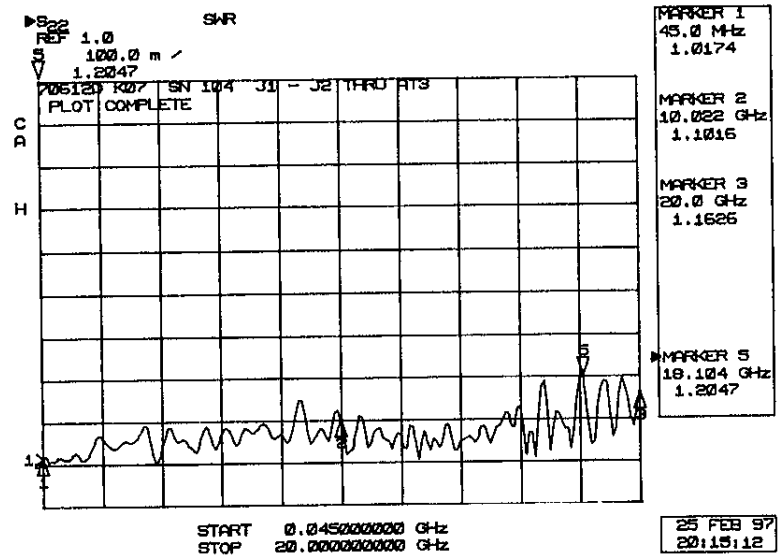
Appendix A/Test Data

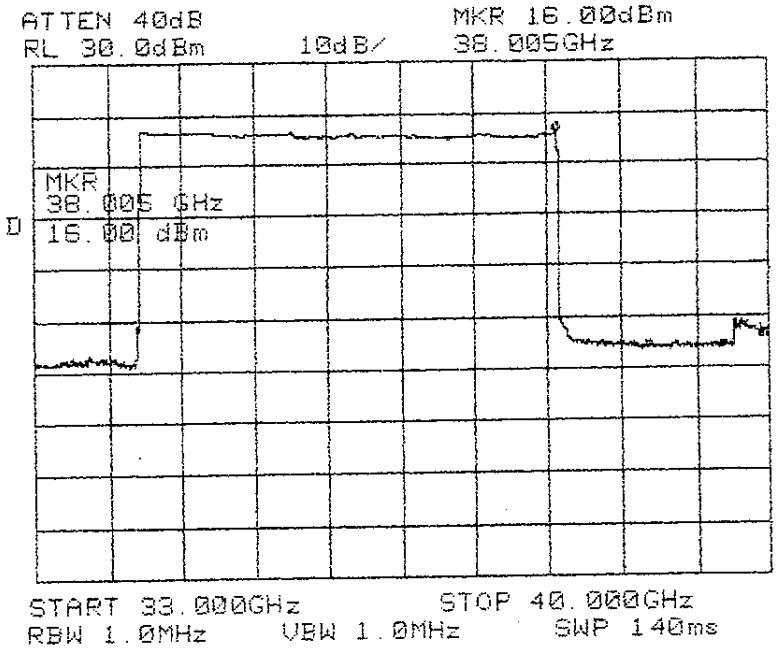
The graphs in this section show typical insertion loss, isolation, phase match, and VSWR for this instrument. The S-parameter reference line value, scale, and value at marker are above the graph. Start and stop frequencies are shown below each graph. The reference line is marked by >.


log MAG
S21
REF -5.3 dB
0.5 dB/
-7.9045 dB
706120 R07 SN 104 J1 - J2 THRU AT3
MARKER 1
45.0 MHz
-5.761 dB
MARKER 2
10.022 GHz
-6.874 dB
MARKER 3
20.0 GHz
-7.9045 dB
MARKER 5
20.0 GHz
-7.9045 dB
START 0.045000000 GHz
STOP 20.000000000 GHz
25 FEB 97
20:14:52


SWR
S11
REF 1.0
100.0 m
1.1761
706120 R07 SN 104 J1 - J2 THRU AT3
PLOT COMPLETE
MARKER 1
45.0 MHz
1.0081
MARKER 2
10.022 GHz
1.0294
MARKER 3
20.0 GHz
1.0746
MARKER 5
16.408 GHz
1.1761
START 0.045000000 GHz
STOP 20.000000000 GHz
25 FEB 97
20:15:02

U1, AR1 OUT

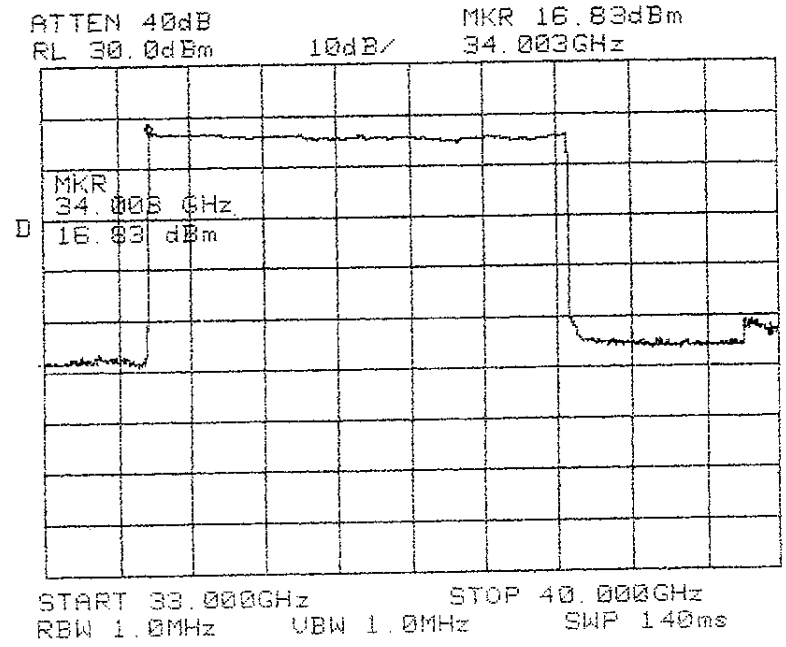

SWR
S22
REF 1.0
100.0 m
1.2047
706120 R07 SN 104 J1 - J2 THRU AT3
PLOT COMPLETE
MARKER 1
45.0 MHz
1.0174
MARKER 2
10.022 GHz
1.1016
MARKER 3
20.0 GHz
1.1626
MARKER 5
18.104 GHz
1.2047
START 0.045000000 GHz
STOP 20.000000000 GHz
25 FEB 97
20:15:12



J1 - J2 thru AR1 & U1

Marker @ Stop Frequency

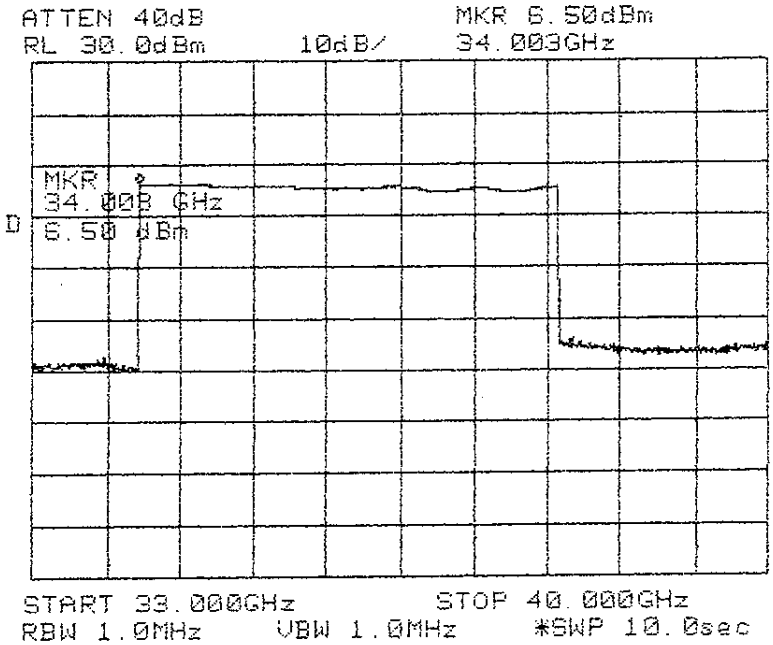
-1 dBm applied at 17 - 19 GHz to J1



J1 - J2 thru AR1 & U1

Marker @ Start Frequency

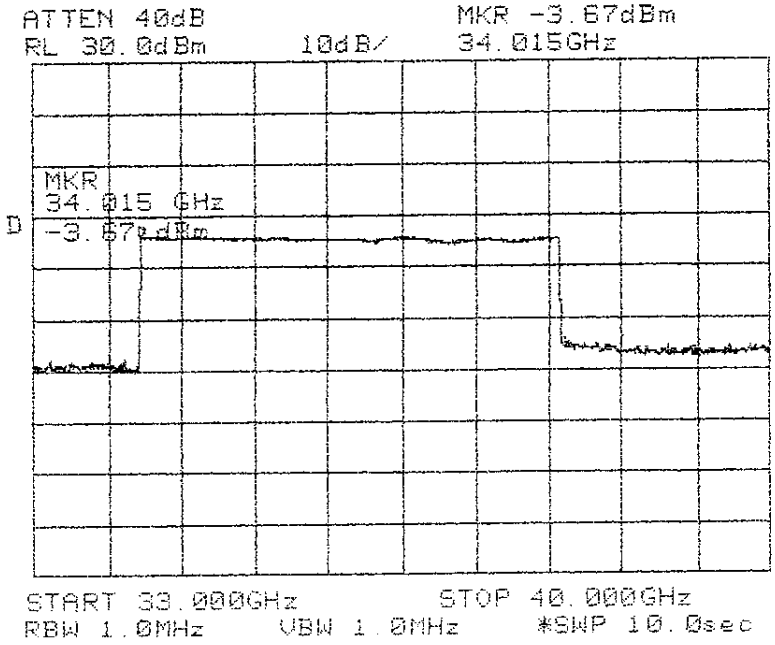
-1 dBm applied at 17 - 19 GHz to J1



J1 - J2 AT1 (10dB)

Marker @ Start Frequency

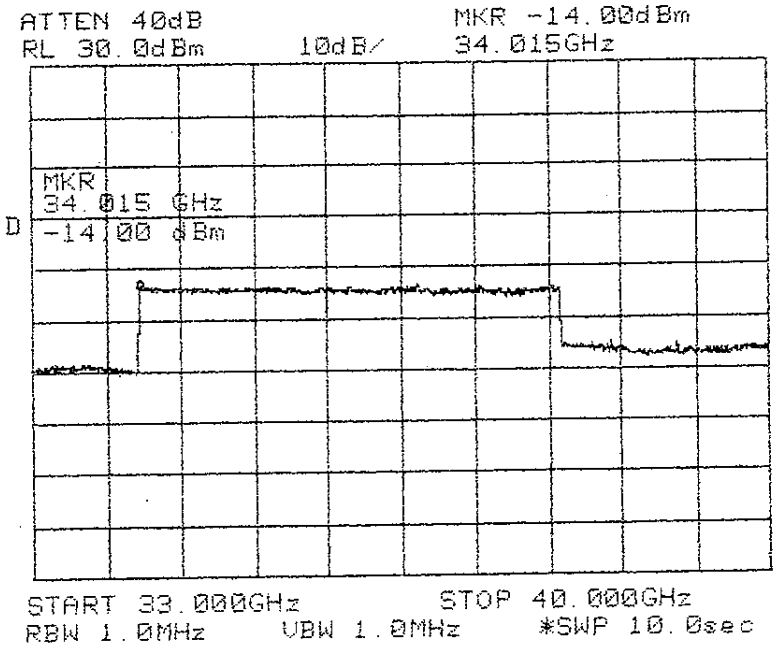
-1 dBm applied at 17 - 19 GHz to J1



J1 - J2 AT1 (20dB)

Marker @ Start Frequency

-1 dBm applied at 17 - 19 GHz to J1



J1 - J2 AT1 (30dB)

Marker @ Start Frequency

-1 dBm applied at 17 - 19 GHz to J1

Appendix B/Technical Data Sheets

- HP 33325 Step Attenuator
- HP 8490D Fixed Attenuator
- HP 8765D SPDT Switch

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USER SPECIFICATIONS

33325-60004 50 GHz, 60 dB
Programmable Step Attenuator
5 Volt Coils, 2.4mm Connectors
(33325-60005 = 15 VOLT)
(File: USE25604.WP1)

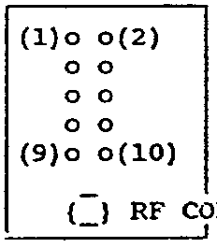
ELECTRICAL CHARACTERISTIC	MINIMUM	NOMINAL	MAXIMUM
FREQUENCY RANGE (GHz)	DC		50
INSERTION LOSS (dB+dB/GHz): DC - 40 GHz (dB) 40 - 50 GHz (dB)			 0.6 + .03/GHz 2.5
VSWR: DC - 12.4 GHz 12.4 - 34 GHz 34 - 40 GHz 40 - 50 GHz			 1.25 1.50 1.70 2.10
REPEATABILITY (dB)			0.03
SWITCHING SPEED (ms)			20
LIFETIME (cycles)	2M		
SWITCHING VOLTAGE (V)	4.5	5	7
COIL RESISTANCE (Ohms/Section)	14	15.5	17
RF INPUT POWER: Avg (Watts) Peak (Watts) (10 microsecs max pulse width)			0.1 50

				MODEL	STK. NO. 33325-60004
				USER SPECIFICATIONS	
A	DNA	T.H.	11-27-91	BY TOM HORTON/gm	DATE NOV. 27, 1991
LTR	PC NO.	APPROVED	DATE	APPD	SHEET NO. OF

HEWLETT PACKARD

ATTENUATION ACCURACY (± dB from nominal)		
Step (dB)	DC-40 GHz	40-50 GHz
10	0.5	0.6
20	0.6	0.7
30	0.7	1.0
40	1.0	1.1
50	1.2	1.3
60	1.6	1.7

ATTENUATOR SWITCHING PINOUT:



SECTION:	Section 1		Section 2		Section 3	
	THRU LINE	ATTN CARD	THRU LINE	ATTN CARD	THRU LINE	ATTN CARD
Actuation (dB):	0	10	0	20	0	30
Actuating Pin:	1	2	5	8	4	9

Pin 10 is +5 Volts, common to all coils.

To select the desired section, ground the pin indicated.

			MODEL	STK. NO. 33325-60004
			USER SPECIFICATIONS	
SEE PG. 1			BY TOM HORTON/gm	DATE NOV. 27, 1991

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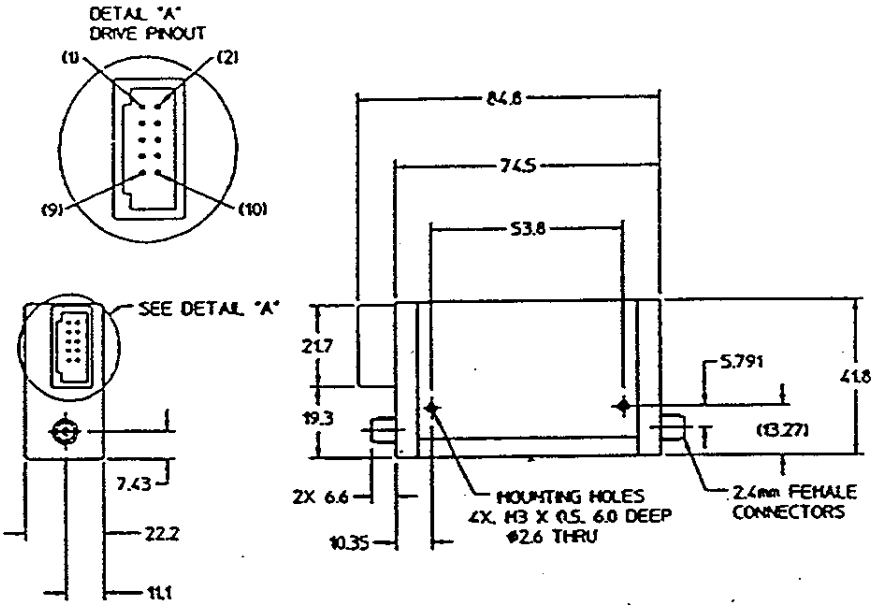
SWITCHING NOTES:

Pins relate to 10 pin attenuator header as shown, NOT to terminating connector on any attached drive cable.

Solenoids are magnetic latching type; drive voltage may be removed after switching. Current is self-interrupting in less than 20 ms.

DESIGNER NOTE:

Though not presently required, it is recommended that drive pin #3 be connected to ground in anticipation of future drive circuitry options.



DIMENSIONS IN MILLIMETRES

Figure 1

				MODEL	STK. NO. 33325-60004
				USER SPECIFICATIONS	
	SEE PG. 1			BY TOM HORTON/gm	DATE NOV. 27, 1991
LTR	PC. NO.	APPROVED	DATE	APPD.	SHEET NO. 3 OF 3
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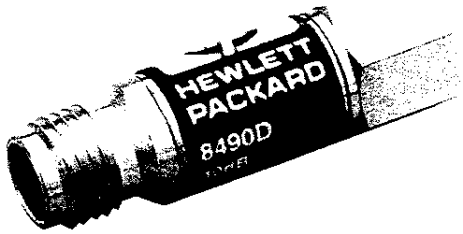
9320-2801/LJ

HEWLETT PACKARD

HP 8490 D
Coaxial Attenuators

dc – 50 GHz
2.4 mm connectors

Technical Data



The HP 8490D family is a line of precision fixed coaxial attenuators with performance specified up to 50 GHz. These attenuators use the 2.4 mm coaxial connector, which exhibits excellent performance from dc to 50 GHz. The HP 8490D family has attenuation values of 3, 6, 10, 20, 30, and 40 dB.

The HP 8490D family of 2.4 mm fixed coaxial attenuators is assembled and tested with the same meticulous care as their lower frequency counterparts: HP 8491s, 8492s, and the 8493s. These attenuators are all tested on Hewlett-Packard Automatic Network Analyzers to assure specifications over the full frequency range.

Applications

Ruggedness, reliability, and small size make these attenuators useful both on the bench and in systems applications. With their accuracy and low SWR they are ideally suited for extending the range of sensitive power meters for higher power measurements. The same characteristics lend themselves to applications such as calibration standards and RF substitution measurements. With their broad dc to 50 GHz frequency range and reasonable cost, general applications such as the reduction of power level to sensitive components and instrumentation systems are attractive and appropriate uses for these attenuators.

Optional Calibration Data

Use of calibration data is an effective means of reducing measurement uncertainty at RF and microwave frequencies. This data is available for the HP 8490D as Option 890. Data is generated by an automatic network analyzer and is supplied as a tabulated list of attenuation and SWR at every 400 MHz from 400 MHz to 50 GHz. Measurements are directly traceable to NIST standards, and feature very low uncertainties.

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HP 8490D Specifications

Frequency Range: dc – 50 GHz

Impedance (Nominal): 50 Ω

Connector: 2.4 mm

	Attenuation (dB)			SWR (Maximum)			Atten. Data Uncert. (dB)
Opt.	Min. (GHz) 0 –50	Max. (GHz) 0 – 26.5	Max. (GHz) 26.5 – 50	(GHz) 0 – 26.5	(GHz) 26.5 – 40	(GHz) 40 – 50	(GHz) 0.4 – 50
003	2.5	3.9	4.8	1.15	1.25	1.45	±0.6
006	5.4	6.9	7.8	1.15	1.25	1.45	±0.6
010	9.4	10.9	11.3	1.15	1.25	1.45	±0.6
020	19.2	21.3	21.7	1.15	1.25	1.45	±0.6
030	29.2	31.3	31.7	1.15	1.25	1.45	±0.8
040	38.2	42.5	42.5	1.08	1.15	1.25	±1.7

Power (Maximum): 1W average; 100W peak

Environmental:

Temperature, Operating: –5°C to +50°C

Non-Operating: –55°C to +75°C

Altitude, Operating: 15,000 ft

Non-Opeating: 50,000 ft

Humidity: Cycling, 5 days, +40°·C @ 95% R.H.

Vibration: 0.015 in., 5-55-5 Hz, 14 min., 3 axes

Shock: 100 g, 1-2 ms, 3 times, 3 planes

Ordering Information: HP 8490D*

Options: 003, 006, 010, 020, 030, 040, 890

*Must be ordered with one of Option 003 through 040

For more information, call your local HP sales office listed in the telephone directory white pages. Ask for the Test and Measurement Department, or write to Hewlett-Packard:

United States:
Hewlett-Packard Company
4 Choke Cherry Road
Rockville, MD 20850
(301) 670-4300

Hewlett-Packard Company
5201 Tollview Drive
Rolling Meadows, IL 60008
(708) 255-9800

Hewlett-Packard Company
5161 Lankershim Blvd.
No. Hollywood, CA 91601
(818) 505-5600

Hewlett-Packard Company
2015 South Park Place
Atlanta, GA 30339
(404) 955-1500

Canada:
Hewlett-Packard Ltd.
6877 Goreway Drive
Mississauga, Ontario L4V1M8
(416) 678-9430

Japan:
Yokogawa-Hewlett-Packard Ltd.
15-7, Nishi Shinjuku 4 Chome
Shinjuki-ku
Tokyo 160, Japan
(03) 5371-1351

Latin America:
Hewlett-Packard
Latin American Region Headquarters
Monte Pelvoux No. 11
Lomas de Chapultepec
11000 Mexico, D.F. Mexico
(525) 202-0155

Australia/New Zealand:
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
Melbourne, Australia
(03) 895-2895

Europe/Africa/Middle East:
Hewlett-Packard S.A.
Central Mailing Department
P.O. Box 529
1180 AM Amstelveen
The Netherlands
(020) 547-66698

Far East:
Hewlett-Packard Asia Ltd.
22-30/F., West Tower
Bond Centre
89 Queensway
Central, Hong Kong
8487777

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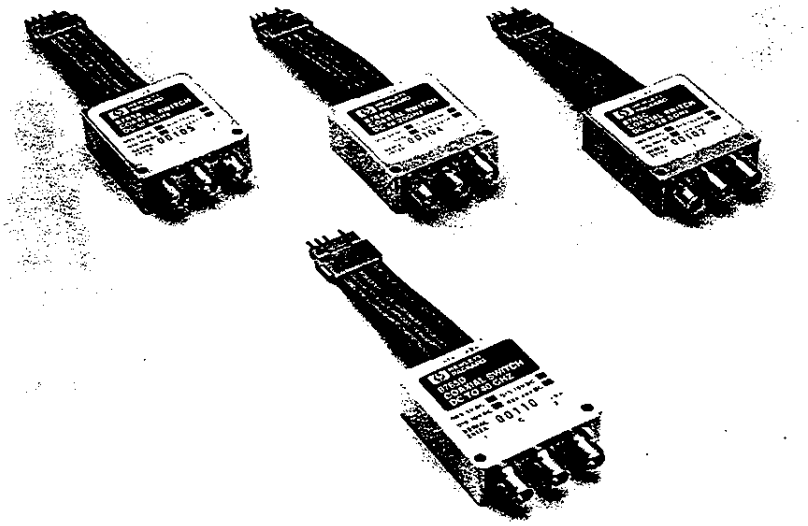
HEWLETT PACKARD

HP 8765A/B/C/D
Microwave SPDT Switches

DC - 4, 20, 26.5, 40 GHz

Technical Data



Features and Description

- High isolation
- Exceptional reliability, long life
- Excellent repeatability
- Unterminated

The HP 8765 family of switches is designed for microwave instrumentation and ATE systems and features excellent electrical and mechanical performance.

The HP 8765A and HP 8765B are equipped with SMA connectors and operate from dc to 4 and 20 GHz respectively. The higher performance HP 8765C and D switches operate from dc to 26.5 GHz with 3.5 mm connectors, and 40 GHz with 2.4 mm connectors. For applications that call for 2.92 mm connectors, Option 292 can be ordered with the HP 8765D. All the switches are available with voltage options covering any drive voltage between 4.5 volts and 32 volts dc. Where performance data are required, Option 890 includes a print out of test results.

This family of switches was designed from the ground up for maximum dependability and performance. The switches are all designed to operate within their specifications for more than 10,000,000 cycles. In precision measurement and monitoring applications where insertion loss repeatability is critical, all the HP 8765s will operate in excess of 5,000,000 cycles with better than 0.03 dB of insertion loss repeatability at 25°C.

Driving the HP 8765A/B/C/D

The HP 8765 Switch family is available with two methods for connecting to the dc control circuitry. The standard switch comes with a ribbon cable terminated with a single in-line five position male connector with one pin removed. The user has the option of ordering solder terminals (Option 100) where they are required (figure 3). The HP 8765 Switches have both sides of the switching solenoids available to the user. Typically, as is the case with the HP 8762 switches, the switching solenoids will have a common positive terminal or a common ground. By making both sides of each coil available, users can select the dc drive method that best suits their needs. The suggested methods are:

1) Common Negative Drive
2) Common Positive Drive
3) Polarity Reversal Drive

Regardless of which method is chosen for switching, two conditions will always apply: 1) the switch is positive latching and 2) since there are no dc current interrupts, the supply may be continuous or may be switched off after the 15 ms switching time.

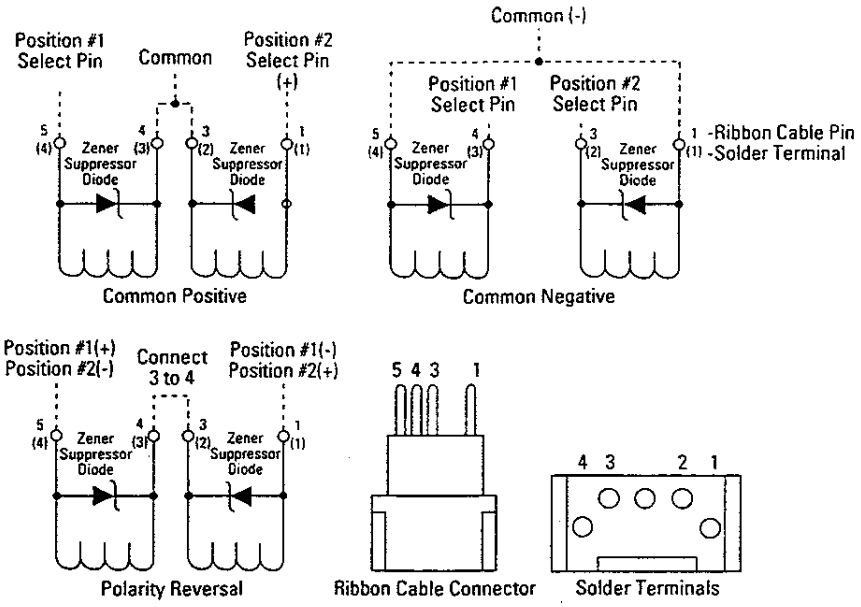


Figure 1a.
DC Control Circuit Configurations.

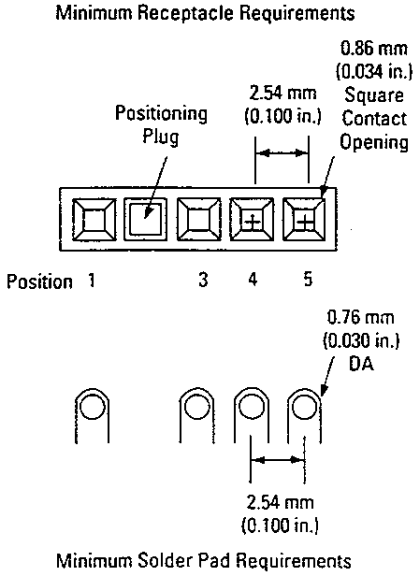


Figure 1b.
Suggested Receptacle Dimensions.

Common Negative Drive

With the common negative drive method, the two outside pins on the ribbon cable or the two outside terminals on the solder block are connected together to form a common negative or ground. Switching is then accomplished by applying the appropriate positive voltage to either of the inner pins or terminals (figure 1a).

Common Positive Drive

To drive the switch with a common positive arrangement, the two inner pins or terminals are tied together and then to a positive voltage. To effect switching, one of the two outer pins or terminals is brought to ground (figure 1a).

Polarity Reversal Drive

To drive the switch using a po larity reversal scheme, the two inner pins or terminals are tied together. The switch will complete a circuit between the two RF contacts on the side of the switch to which the negative or ground potential has been connected (figure 1a).

Interfacing the HP 8765

The HP 8765 family of switches is available with two dc control connection options. The standard switch is connected to the dc drive circuitry via a ribbon cable. Option 100 allows soldering wires between the control circuitry and the switch.

Ribbon Cable

The kapton flex circuit ribbon cable on the standard switch is terminated to a single in-line male polarized connector with

four 0.64 mm (0.025 in.) square pin posts on 2.54 mm (0.100 in.) centers. Position number 2 has been removed to facilitate polarization of the plug and receptacle (figure 1a). To assist you in connecting your drive circuit to the switch's ribbon cable connector, a six foot long four wire cable is included with every standard switch. The cable is terminated on one end with a 0.64 mm (0.025 in.) square pin receptacle. The five position receptacle is polarized to mate with the switch's ribbon cable connector. The opposite end of the cable is left unterminated for connecting to your control circuits.

The six foot cable provides a quick and convenient way of connecting the switch to your control circuits for evaluation and low volume production. For high volume production a more convenient or more permanent connection may be suggested. Soldering the ribbon cable connector into a circuit board provides a reliable and rugged connection. Mating the ribbon cable connector to a PC board connector provides a quick to install and remove connection. The suggestions below are intended to provide minimum connection requirements. These suggestions are not endorsements or recommendations of one method over another. It is the responsibility of the user to determine the suitability for use of any interconnect method for a particular application.

PC Board Connectors

PC board connectors are available in surface mount and solder pin styles and in horizontal and vertical orientations. This type of connector makes connection to and disconnection from the dc circuit quick and convenient. The connectors should be a minimum of five positions wide, and depending upon the number of switches to be connected can be any multiple of five positions (ie. 10, 15, 25, etc.). Single row or double row configurations can also be used to increase connector density. The contacts should accept 0.64 mm (0.025 in.) square pins set on 2.54 mm (0.100 in.) centers and up to 5.84 mm (0.230 in.) long. Use of a polarizing plug in the second position of each switch connection is recommended to help ensure proper orientation. Figure 1b shows a suggested receptacle dimension.

Soldered Connections

The ends of the switch ribbon cable can also be soldered directly to a PC board. This method provides a semi-permanent connection that can withstand higher vibration environments than can the PC board connectors. Connection and disconnection of the switches requires soldering requiring more time and equipment than do PC board connectors. The PC board hole pattern should have the center lines of the through holes along a single axis separated by 2.54 mm ± 0.08mm. (0.100 in. ±0.003 in.). The suggested hole diameter for a 0.64 mm (0.025 in.) pin is 1.00 mm ±0.076 mm (0.040 in. ± 0.003 in.).

Omission of position 2 in the PC hole pattern is suggested to help prevent soldering the connector in the wrong orientation.

Optional Ribbon Connector Extension Cables

Optional extension cables for the switch ribbon cable connector are available as Option 108 for an 8 inch extension and Option 116 for a 16 inch extension. The cables have male and female ends configured as indicated in figure 1a "Ribbon Cable Connector" and figure 1b "Minimum Receptacle Requirements." These ribbon cables can be connected to the dc control circuitry with the same methods suggested above.

Optional Solder Terminals

Solder terminals in place of the ribbon cable for connecting to the dc control circuitry are available as Option 100. The four solder terminals provide access to both sides of each of the solenoids.

Easy HP-IB Programmability

The HP 8765 switch family can be easily used in ATE systems with HP-IB control using the HP 11713A Attenuator/Switch Driver. The HP 11713A provides manual and programmable control of up to 10 24 V switches or solenoids. Connecting between the HP 11713A and four HP 8765 A/B/C/D Option 024 switches is made easy via the HP 11761A cable/adapter. The HP 11713A provides 24 Vdc and 0.65A continuously or 1.3A peak (up to 1 second). The non-interrupting HP 8765 Option 024 draws 120 mA continuously, allowing the HP 11713A to drive up to five of these switches at a time. Five more dc circuit interrupting HP 8762/3/4s or up to five sections of step attenuators or multiport switches can be driven simultaneously.

Specifications

HP Model:	HP 8765A	HP 8765B	HP 8765C	HP 8765D
Frequency Range:	dc - 4 GHz	dc - 20 GHz	dc - 26.5 GHz	dc - 40 GHz
Insertion loss (dB): (f is frequency in GHz)	0.2 + 0.025f	0.2 + 0.025f	0.25 + 0.027f	0.25 + 0.027f
*Typical insertion loss:	0.2 @ 4 GHz	0.2 @ 4 GHz 0.5 @ 20 GHz	0.2 @ 4 GHz 0.5 @ 20 GHz 0.7 @ 26.5 GHz	0.2 @ 4 GHz 0.5 @ 20 GHz 0.7 @ 26.5 GHz 1.0 @ 40 GHz
Isolation (dB): (f is frequency in GHz)	120 - 2.25f	120 - 2.25f	120 - 2.6f	120 - 2.6f
*Typical isolation:	120 @ 4 GHz	120 @ 4 GHz 90 @ 20 GHz	120 @ 4 GHz 90 @ 20 GHz 60 @ 26.5 GHz	120 @ 4 GHz 90 @ 20 GHz 60 @ 26.5 GHz 50 @ 40 GHz
SWR:	<1.2 dc - 4 GHz	<1.2 dc - 4 GHz <1.35 4 - 12.4 GHz <1.45 12.4 - 18 GHz <1.7 18 - 20 GHz	<1.25 dc - 4 GHz <1.45 4 - 18 GHz <1.7 18 - 26.5 GHz	<1.25 dc - 4 GHz <1.45 4 - 18 GHz <1.7 18 - 40 GHz
*Typical SWR:	<1.15 dc - 4 GHz	<1.15 dc - 4 GHz <1.3 4 - 12.4 GHz <1.4 12.4 - 20 GHz	<1.15 dc - 4 GHz <1.3 4 - 12.4 GHz <1.4 12.4 - 26.5 GHz	<1.15 dc - 4 GHz <1.3 4 - 12.4 GHz <1.4 12.4 - 40 GHz
Connectors: Standard	SMA (f)	SMA (f)	3.5 mm (f)	2.4 mm (f)
Options				2.92 mm (f) (Option 292)
Repeatability: (Up to 5,000,000 Cycles measured at 25°C)	<0.03 dB	<0.03 dB	<0.03 dB	<0.03 dB

*Specifications describe the instrument's warranted performance. Supplemental and typical characteristics are intended to provide information useful in applying the instrument by giving typical, but not warranted performance parameters.

General Operating Data

Maximum Power Rating:
2 Watt average for switching with power applied.
100 Watt peak, non-switching
Life: 10,000,000 cycles
Switching Speed: 15 ms maximum

Solenoid Electrical Specifications and Switching Voltage Options

Option	Voltage	Current	Impedance
005	5 (4.5 - 7) Vdc	385 mA @ 5 Vdc	13 Ω, 8 mH
010	10 (7 - 12) Vdc	300 mA @ 10 Vdc	33 Ω, 25 mH
015	15 (12 - 20) Vdc	200 mA @ 15 Vdc	75 Ω, 55 mH
024	24 (20 - 30) Vdc	120 mA @ 24 Vdc	200 Ω, 135 mH

HP Model	Calibration Frequencies for Option 890 Calibration Data	
8765A	200 to 4000 MHz every 200 MHz	20 Points
8765B	200 to 18000 MHz every 200 MHz	90 Points
8765C	1500 to 26500 MHz every 250 MHz	101 Points
8765D	1500 to 40000 MHz every 250 MHz	155 Points

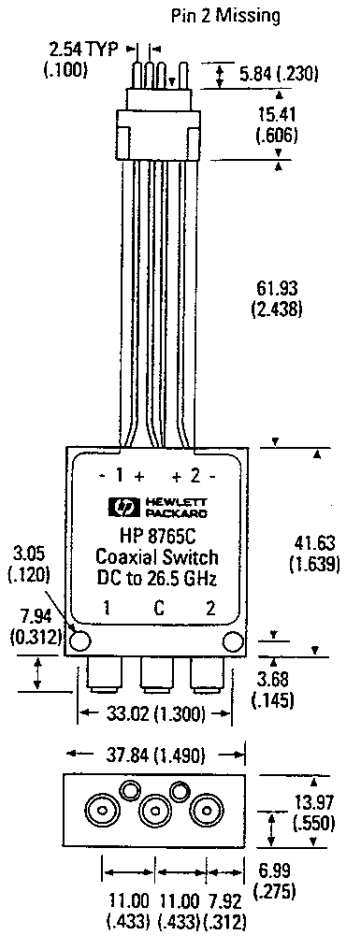


Figure 2. Standard unit part dimensions in millimeters and (inches).

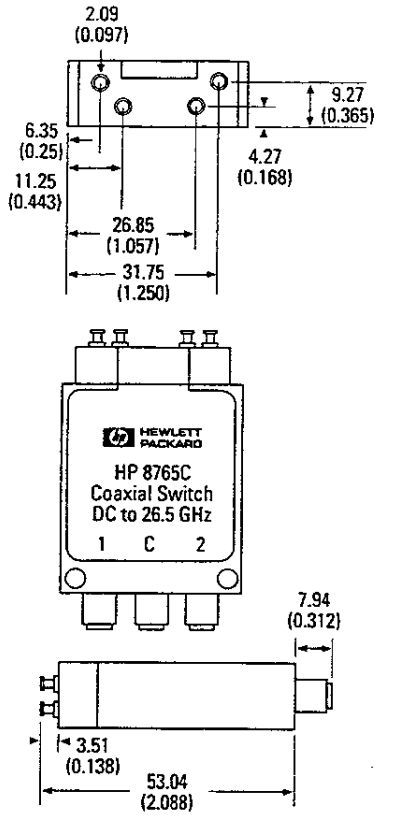


Figure 3. Option 100 with solder terminals part dimensions in millimeters and (inches).

Environmental

Operating Temperature
–25°C to 75°C

Storage Temperature
–55°C to 85°C

Temperature Cycling:
–55°C to 85°C, 10 cycles per MIL-STD 202F, Method 107D, Condition A (Modified)

Vibration:
Operating:
7g's: 5 - 2000 Hz @ 0.25" p-p
Survival:
20 g's: 20 - 2000 Hz @ 0.06" p-p, 4 min/cycle, 4 cycles/axis
Random: Survival:
2.41 g(rms) 10 min/axis

Shock:
Half Sine: 500 g's @ 0.5ms, 3 drops/direction, 18 total
Operating: 50 g's @ 6 ms, 6 directions

Moisture Resistance:
65°C, 95% RH, 10 days per MIL-STD-202F, Method 106E

Altitude Storage:
50,000 ft (15,240 meters) per MIL-STD-202F, Method 105C, Condition B

RFI:
Per MIL-STD-461C, RE02, Part 4

Electrostatic Discharge:
25 kV max

Abuse:
2W, CW, 1 kW peak pulse (10 uS), 2 minute duration.

Operating Life:
To meet 0.03dB IL repeatability: 5 Million cycles
To meet specifications: 10 Million cycles

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Ordering Information

All switches must be ordered with a voltage option to be valid. Standard switches are equipped with ribbon cables terminated to a single in-line connector (see information inside data sheet for application information). All standard switches come with a six foot cable with mating connector on one end to facilitate connection to the user's control circuitry.

Solder Terminal

A solder terminal may be specified in place of the standard ribbon cable. The solder terminal option does not include the extension cable and is not compatible with Option 108 and 116.

Extension Cables

These are extension cables to mate to the ribbon cable on the standard switch. Option 108 is 8 inches long. Option 116 is 16 inches long

Connectors

The HP 8765D may be ordered with optional 2.92 mm connectors in place of the 2.4 mm connectors. 2.92 mm connectors can mate with 3.5 mm connectors.

Calibration Data

Option 890 includes a print out of the SWR (reflection) and insertion loss data for the switch as measured on the automatic network analyzer. The network analyzer's measurement uncertainties have been minimized and all measurements are directly traceable to NIST standards.

Accessories

The HP 11761A Cable/Adapter is available for directly connecting the ribbon cables of up to four HP 8765 switches to the HP 11713A Attenuator/Switch Driver.

The HP 11713A Attenuator/ Switch driver is designed to provide manual and HP-IB control of switches and attenuators. The HP 11713A can drive up to five HP 8765 series switches and five self-interrupting switches, such as the HP 8762, 3 or 4, or step attenuator sections. Option 024 switches (24V) must be ordered for use with the HP 11713A.

HP 8765A/B/C/D Options and Accessories

Solenoid Voltage Options (Specify one)

Opt. 005	5 Vdc
Opt. 010	10 Vdc
Opt. 015	15 Vdc
Opt. 024	24 Vdc

Other Options and Accessories

Opt. 100	Solder Terminal
Opt. 108	8 inch extension cable
Opt. 116	16 inch extension cable
Opt. 292	2.92 mm connectors
Opt. 890	Calibration Data
HP 11761A	Cable/Adapter
HP 11713A	Attenuator/Switch Driver

For more information, call your local HP sales office listed in the telephone directory white pages. Ask for the Test and Measurement Department, or write to Hewlett-Packard:

United States
Hewlett-Packard Company
5201 Tollview Drive
Rolling Meadows, IL 60008
(708) 255-9800

Hewlett-Packard Company
5161 Lankershim Blvd.
No. Hollywood, CA 91601
(818) 505-5600

Hewlett-Packard Company
2015 South Park Place
Atlanta, GA 30339
(404) 955-1500

Hewlett-Packard Company
4 Choke Cherry Road
Rockville, MD 20850
(301) 670-4300

Canada
Hewlett-Packard Ltd.
6877 Goreway Drive
Mississauga, Ontario L4V1M8
(416) 678-9430

Far East
Hewlett-Packard Asia Ltd.
22/F Bond Centre
West Tower
89 Queensway
Central, Hong Kong

Japan
Yokogawa-Hewlett-Packard Ltd.
29-21, Takaido-Higashi 3-chome
Suginami-ku, Tokyo 168
(81) 03-331-6111

Elsewhere in the world:
Hewlett-Packard
Intercontinental Headquarters
3495 Deer Creek Road
Palo Alto, CA 94304-1393
USA
(415) 857-5027

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