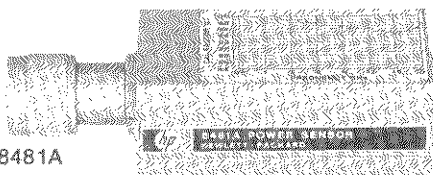


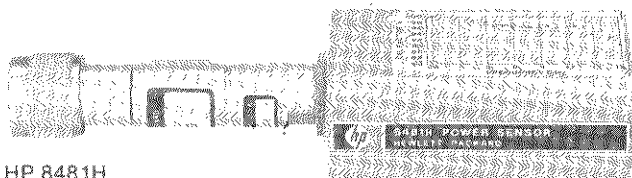
POWER METERS

Power Sensors

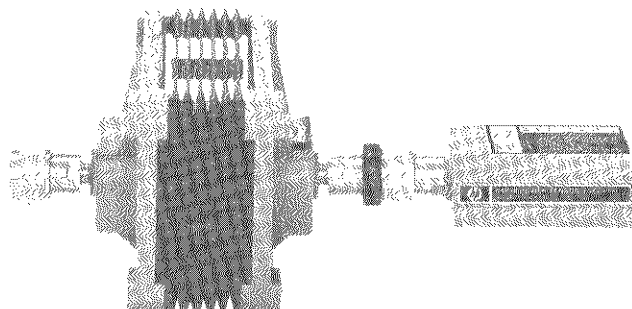
Models 8481A/B, 8481H, 8482A/B, 8482H, 8483A, 8484A, 8485A, R/Q 8486A, 11708A



HP 8481A



HP 8481H



HP 8481B

HP 8480 Series Power Sensors

The HP 8480 series of Power Sensors have been designed for use with the HP 435B, 436A, and 438A Power Meters. They feature wide frequency and power ranges in addition to very low SWR.

The power measurement range of these sensors is from 0.1 nW to 25 watts. With just three sensors a power measurement range of 114 dB can be achieved.

Wide Frequency Range for Many Applications

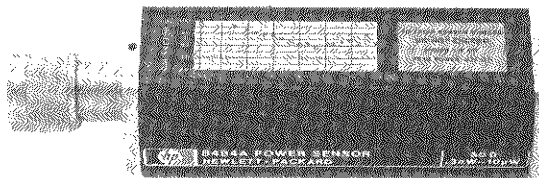
Power measurements can be made over a frequency range of 100 kHz to 50 GHz. The six frequency ranges covered with these units are 10 MHz to 18 GHz, 100 kHz to 4.2 GHz, and 50 MHz to 26.5 GHz, in 50 Ω sensors and 100 kHz to 2 GHz, with the 75-ohm sensor, and 26.5 to 40 GHz and 33 to 50 GHz in Waveguide.

Low SWR for Low Measurement Uncertainty

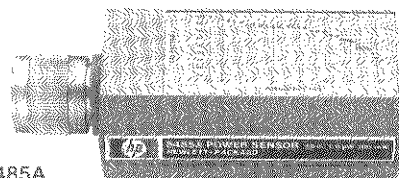
The HP 8481/82/83/85/86 series of sensors use a silicon monolithic thermocouple as the sensing element. The small physical size of the thermocouple enables the sensors to have a very low SWR even at 50 GHz. A low SWR reduces mismatch uncertainty error, typically the largest single source of error in power measurements. The HP 8484A sensor uses a crystal detector for higher sensitivity and low SWR.

Individually Calibrated for More Confidence in Results

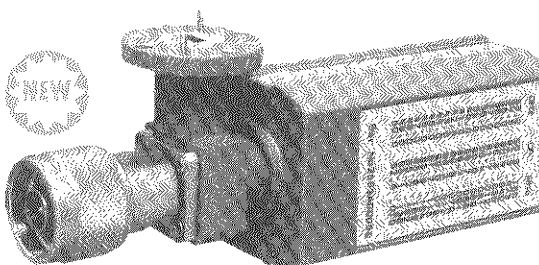
Each sensor is individually calibrated, traceable to the National Bureau of Standards. A control on the meter compensates for power sensor Cal Factor at any frequency. A precise automatic network analyzer printout for Cal Factor and reflection coefficient in magnitude and phase is supplied with the HP 8481A/B/H, 8484A, and 8485A. This means you can significantly reduce mismatch uncertainty by calculating the mismatch error.



HP 8484A



HP 8485A



HP Q8486A

High Power Sensors to 25 Watts

The HP 8481B and 8482B High Power Sensors both have a power range of 1 mW to 25 watts. The HP 8481B covers a frequency range of 10 MHz to 18 GHz and the HP 8482B has a frequency range of 100 kHz to 4.2 GHz.

Previous methods of measuring high power levels usually required adding a separate attenuator in front of a low power sensor. With the HP 8481/82B power sensors, the attenuator and sensor are combined into one unit. This reduces mismatch uncertainty error and improves accuracy by including the attenuator in the measured Calibration Factor curves. In addition, light-weight, heat-dissipating fins on the attenuator prevent burns.

Medium Power Sensors to 3 Watts

The HP 8481H measures power from 100 μ W to 3 watts over a frequency range of 10 MHz to 18 GHz. The HP 8482H measures power from 30 μ W to 3 watts over a frequency range of 100 kHz to 4.2 GHz.

Standard Sensors to 100 mW

The HP 8481A, 8482A, 8483A, and 8485A Power Sensors all measure power over a range of 1 μ W to 100 mW. The HP 8481A is a 50-ohm sensor with a frequency range of 10 MHz to 18 GHz. The HP 8482A is a 50-ohm sensor with a frequency range of 100 kHz to 4.2 GHz. The HP 8483A is a 50-ohm sensor with a frequency range of 50 MHz to 26.5 GHz. The HP 8485A is a 75-ohm sensor and covers a frequency range of 100 kHz to 2 GHz.

High Sensitivity Sensors

The HP 8484A measures power from 0.1 nW to 10 μ W over a frequency range of 10 MHz to 18 GHz. It is furnished with the HP 11708A 50 MHz reference attenuator for precise calibration with 1 mW power meter reference oscillator. Noise and drift have been reduced to less than 5% of full scale on the 300 pW range (only 15 pW) when it is used with the HP 435B power meter. Noise and drift are even less with the HP 436A and 438A power meters.

Millimeter-Wave Power Sensors

The HP R8486A and Q8486A Thermocouple Waveguide Power Sensors measure true, average power from 1 μ W to 100 mW over the frequency ranges of 26.5 to 40 GHz (R-band) and 33 to 50 GHz (Q-band).

HP 8480 Series Specifications

HP Model (Nominal Impedance)	Frequency Range	Power Range	Maximum Power	Power Linearity ²	Maximum SWR (Reflection Coefficient)	Size mm (in.)	RF Connector
						Shipping Weight kg (lb)	
8481A (50 Ω)	10 MHz-18 GHz	1 μ W to 100 mW	300 mW avg. 15 W peak 30 W $\bullet$ μ s (per pulse)	+10 to +20 dBm ± 2 , -4%	10 MHz - 30 MHz: 1.40 (0.166) 30 MHz - 50 MHz: 1.18 (0.083) 50 MHz - 2 GHz: 1.10 (0.048) 2 - 12.4 GHz: 1.18 (0.083) 12.4 - 18 GHz: 1.28 (0.123)	30 x 38 x 105 (1.2 x 1.5 x 4.1)	N(m)
Option 001						0.5 (1)	APC-7
8481B (50 Ω)	10 MHz-18 GHz	0-35°C: 1 mW-25 W; 35°C-55°C: 1 mW-20 W	0-35°C: 30 W avg. 1 35°C-55°C: 25 W avg. 10 MHz-5.8 GHz 500 W peak 5.8-18 GHz 125 W peak 500 W $\bullet$ μ s (per pulse)	+35 to +44 dBm ± 4 %	10 MHz - 2 GHz: 1.10 (0.048) 2-12.4 GHz: 1.18 (0.083) 12.4-18 GHz: 1.28 (0.123)	83 x 114 x 248 (3.25 x 4.5 x 9.75)	N(m)
8481H (50 Ω)	10 MHz-18 GHz	100 μ W to 3 W	3.5 W avg. 100 W peak 100 W $\bullet$ μ s (per pulse)	+25 to +35 dBm ± 5 %	10 MHz - 8 GHz: 1.20 (0.091) 8-12.4 GHz: 1.25 (0.110) 12.4 - 18 GHz: 1.30 (0.130)	30 x 38 x 149 (1.2 x 1.5 x 5.9)	N(m)
8482A (50 Ω)	100 kHz-4.2 GHz	1.0 μ W to 100 mW	300 mW avg. 15 W peak 30 W $\bullet$ μ s (per pulse)	+10 to +20 dBm ± 2 , -4%	100-300 kHz: 1.60 (0.231) 300 kHz - 1 MHz: 1.20 (0.091) 1 MHz - 2 GHz: 1.10 (0.048) 2-4.2 GHz: 1.30 (0.130)	30 x 38 x 105 (1.2 x 1.5 x 4.1)	N(m)
8482B (50 Ω)	100 kHz-4.2 GHz	0-35°C: 1 mW-25 W; 35°C-55°C: 1 mW-20 W	0-35°C: 30 W avg. 1 35°C-55°C: 25 W avg. 500 W peak 500 W $\bullet$ μ s (per pulse)	+35 to +44 dBm ± 4 %	100 kHz - 2 GHz: 1.10 (0.048) 2 GHz - 4.2 GHz: 1.18 (0.083)	83 x 114 x 248 (3.2 x 4.5 x 9.7)	N(m)
8482H (50 Ω)	100 kHz-4.2 GHz	100 μ W to 3 W	3.5 W avg. 100 W peak 100 W $\bullet$ μ s (per pulse)	+25 to +35 dBm ± 5 %	100 kHz-4.2 GHz: 1.20 (0.091)	30 x 38 x 149 (1.2 x 1.5 x 5.9)	N(m)
8483A ³ (75 Ω)	100 kHz-2 GHz	1.0 μ W to 100 mW	300 mW avg. 10 W peak 30 W $\bullet$ μ s (per pulse)	+10 to +20 dBm ± 2 , -4%	100-600 kHz: 1.80 (0.286) 600 kHz - 2 GHz: 1.18 (0.083)	30 x 38 x 105 (1.2 x 1.5 x 4.1)	N(m) 75 Ω
8484A ⁴ (50 Ω)	10 MHz-18 GHz	0.1 nW to 10 μ W	200 mW avg. 200 mW peak	-30 to -20 dBm ± 1 %	10-30 MHz: 1.40 (0.166) 30 MHz - 4 GHz: 1.15 (0.070) 4-10 GHz: 1.20 (0.091) 10-15 GHz: 1.30 (0.130) 15-18 GHz: 1.35 (0.149)	36 x 44 x 133 (1.4 x 1.7 x 5.2)	N(m)
8485A (50 Ω)	50 MHz-26.5 GHz	1 μ W to 100 mW	300 mW avg. 15 W peak 30 W $\bullet$ μ s (per pulse)	+10 to +20 dBm ± 2 , -4%	50 MHz-100 MHz: 1.15 (0.070) 100 MHz-2 GHz: 1.10 (0.048) 2-12.4 GHz: 1.15 (0.070) 12.4-18 GHz: 1.20 (0.091) 18-26.5 GHz: 1.25 (0.111)	30 x 38 x 95 (1.2 x 1.5 x 3.7)	APC-3.5(m)
R8486A (Waveguide)	26.5-40 GHz	1 μ W to 100 mW	300 mW avg. 15 W peak 30 W $\bullet$ μ s pulse	+10 to +20 dBm ± 2 , -4%	1.4 (0.167)	30 x 38 x 126 (1.2 x 1.5 x 5.0)	Waveguide Flange UG-599/U
Q8486A (Waveguide)	33-50 GHz	1 μ W to 100 mW	300 mW avg. 15 W peak 30 W $\bullet$ μ s pulse	+10 to +20 dBm ± 2 , -4%	1.5 61(0.200)	30 x 38 x 126 (1.2 x 1.5 x 5.0)	Waveguide Flange UG-383/U

¹For pulses greater than 30 W the maximum average power (Pa) is limited by the energy per pulse (E) in W $\bullet$ μ s according to $P_a = 30 - 0.02E$.

²Negligible deviation except for those power ranges noted.

³Includes HP 1250-0597 adapter from 75 Ω type N to 50 Ω type N for calibration.

⁴The HP 11708A 30 dB attenuator for calibrating against a 0 dBm, 50 MHz power reference is shipped with the HP 8484A.

Uncertainty of Calibration Factor Data for
HP 8482A and 8483A

Frequency (MHz)	Sum of Uncertainties (%) ¹				Probable Uncertainties (%) ²			
	HP Model				HP Model			
	8482A	8482B	8482H	8483A	8482A	8482B	8482H	8483A
0.1	± 2.3	± 5.7	± 3.3	± 2.6	± 1.3	± 2.8	± 1.6	± 1.5
0.3	2.2	5.7	3.2	2.5	1.2	2.8	1.6	1.4
1.0	2.2	5.7	3.2	2.5	1.2	2.8	1.6	1.4
3.0	2.2	5.7	3.2	2.5	1.2	2.8	1.6	1.4
10.0	2.5	5.7	3.5	3.0	1.3	2.8	1.6	1.6
30.0	2.6	5.7	3.6	3.1	1.4	2.8	1.7	1.6
50.0	0(ref)	2.7	0(ref)	0(ref)	0(ref)	2.7	0(ref)	0(ref)
100.0	3.1	5.6	4.1	3.9	1.6	3.3	1.9	2.0
300.0	3.1	5.6	4.1	3.9	1.6	3.3	1.9	2.0
1000.0	2.7	5.7	3.7	3.7	1.4	3.3	1.7	2.0
2000.0	2.7	5.5	3.7	3.9	1.4	3.1	1.7	2.1
4000.0	2.8	5.5	3.8	—	1.5	3.1	1.8	—

Uncertainty of Calibration Factor Data for
HP 8481A/B, 8484A 8485A³

Frequency (GHz)	Sum of Uncertainties (%) ¹				Probable Uncertainties (%) ²			
	HP Model				HP Model			
	8481A	8481B	8481H	8484A	8485A	8481A	8481B	8484A
0.1	± 3.1	± 6.4	± 4.1	± 4.4	—	± 1.6	± 3.0	± 1.9
2	2.7	5.8	3.7	4.0	± 3.6	1.4	3.1	1.7
4	2.8	5.8	3.8	4.1	—	1.5	3.1	1.8
6	2.8	5.8	3.8	4.1	4.0	1.5	3.1	1.8
8	3.2	6.0	4.2	4.6	—	1.7	3.2	2.0
10	3.6	6.2	4.6	5.1	4.7	1.9	3.3	2.2
12	3.9	7.8	4.9	6.5	—	2.1	4.1	2.2
14	4.8	7.9	5.8	7.4	5.6	2.6	4.1	2.8
16	5.2	8.0	6.2	7.8	—	2.9	4.2	3.0
18	5.8	8.3	6.8	8.4	5.9	3.2	4.3	3.4
22	—	—	—	—	6.8	—	—	—
26.5	—	—	—	—	7.3	—	—	—

¹Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NBS.

²Square root of sum of the individual uncertainties squared (RSS).

³For R/Q8486A uncertainty data see the data sheet (5953-6482).