

POWER METERS

Power Meter

Model 436A



HP 436A



HP 436A Power Meter

The HP 436A Power Meter is a general purpose digital power meter intended for manual and automatic RF and microwave power measurements. It is compatible with the entire series of HP 8480 Power Sensors. Depending on which power sensor is used, the HP 436A can measure power from -70 dBm (100 pW) to $+44$ dBm (25W) at frequencies up to 50 GHz.

The logically organized and uncluttered front panel, and the convenience of push-button operation and digital display make the HP 436A both easy to interpret and easy to use in any application. The auto ranging capability allows for "hands-off" operation.

The HP 436A measures either absolute or relative power. It displays absolute power in either watts or dBm, and relative power in dB.

The HP 436A Power Meter also features optional programmability; the Hewlett-Packard Interface Bus (HP-IB) interface is available. This interface allows full remote control of all power meter functions (CAL function can be programmed to either 100 percent or the CAL factor which has been manually set on the front panel). This option may be added by the user at a later time.

HP 436A Specifications

Frequency range: 100 kHz to 50 GHz, sensor dependent.

Power Range (display calibrated in watts, dBm, and dB relative to reference power level). -70 to $+44$ dBm (100 pW to 25W), sensor dependent.

Average Power Measurements

At microwave frequencies, power is the best measure of signal amplitude because, unlike voltage and current, power remains constant along a lossless transmission line. For this reason, power meters are almost indispensable for microwave measurements. Typical applications include monitoring transmitter power levels, calibrating signal generators, leveling signal sources, and measuring transmission characteristics of unknown devices.

To satisfy the requirements of this broad range of applications Hewlett-Packard has developed a family of general purpose microwave power meters and power sensors. The power sensors use a diode, thermocouple, or thermistor as the power sensing element, and it is important to understand the merits of each of these sensors before choosing a particular power meter.

Power Meters and Sensors

Hewlett-Packard makes six average-reading power meters. The HP 438A is a dual channel power meter designed for ATE systems applications. The 435B, 436A and 437B are analog and digital meters, which are designed to operate with HP's line of

Accuracy

Instrumentation

Watt mode: $\pm 0.5\%$.

dBm mode: ± 0.02 dB ± 0.001 dB/ $^{\circ}$ C.

dB (REL) mode¹: ± 0.02 dB ± 0.001 dB/ $^{\circ}$ C.

Zero: automatic, operated by a front-panel switch.

Zero set: $\pm 0.5\%$ of full scale on most sensitive range, typical; ± 1 count on other ranges.

Zero carry over: $\pm 0.2\%$ of full scale when zeroed on the most sensitive range.

Power reference: internal 50 MHz oscillator with Type N female connector on front panel (or rear panel, Option 003 only).

Power output: 1.0 mW. Factory set to $\pm 0.7\%$ traceable to the National Bureau of Standards.

Accuracy: $\pm 1.2\%$ worst case ($\pm 0.9\%$ rss) for one year.

Supplemental Characteristics

Recorder output: linearly proportional to indicated power with 1 volt corresponding to full scale and 0.316 volts to -5 dB; 1 k Ω output impedance, BNC connector.

Power consumption: 100, 120, 220, or 240 V ($+5\%$, -10%), 48 to 66 Hz, and 360 to 440 Hz; < 20 V \cdot A (< 23 V \cdot A with option 022).

HP-IB Function codes: AH1, C0, DC2, DT0, LE0, PP0, RL2, SH1, SR0, T3, TE0. (For more on these codes refer to the HP-IB section in this catalog.)

Weight: net, 4.5 kg (10 lb). Shipping, 5.5 kg (12 lb).

Size: 134 H x 213 W x 279 mm D (5.2" x 8.4" x 11.0").

Accessories

Furnished: HP 11730A, 1.5 m (5 ft) cable for power sensor; 2.3 m (7.5 ft) power cable. Mains plug shipped to match destination requirements.

Available: To select non-standard lengths for power sensor cables, select option 004 (delete sensor cables) and order as required from HP 11730A-F, power sensor cables. Lengths are available from 1.5 metres (5 ft) to 61 metres (200 ft). To rack mount one HP 436A by itself, order **HP 5061-9657** Rack Mount Adapter Kit.

Ordering Information

HP 436A Power Meter

Option 003: Reference oscillator output on rear panel only.

Option 004: Delete power sensor cable

Option 022: Digital input/output, fully compatible with HP Interface Bus (HP-IB)

Option 908: Kit for rack mounting one HP 436A

Option 910: Extra operating and service manual

Option W30: Two additional years of return-to-HP warranty

Price

\$2900

no charge

Less \$75

Add \$500

\$35

Add \$25

Add \$60

☎ Fast-ship product - see page 766 of 88 catalog.

¹ Specifications are for within range measurements. For range-to-range accuracy add another ± 0.02 dB.

thermocouple and diode power sensors. The HP 432 power meters are designed to operate with HP's line of thermistor mounts: the HP 432A is an analog power meter, and the HP 432B is digital with BCD output.

Thermocouple power sensors are generally preferred for measuring power because they exhibit lower SWR and wider dynamic range than previously used thermistor elements. Low SWR is directly responsible for superior accuracy since mismatch errors are lower.

Literature

Application Note 64-1, Fundamentals of RF and Microwave Power Measurements, deals with the general theory of microwave power measurements. It covers the basic principals of measurement, calculation of measurement uncertainty, traceability, etc.

Application Note 64-2, Extended Applications of Automatic Power Meters, discusses an automatic power meter system for measuring attenuation, gain saturation and the calibration factor of power sensors.