

# 4230A Series RF Power Meter



- 10 kHz to 100GHz measurement range
- > 200 measurements per second
- Single or dual-channel display
- 90-dB dynamic range, depending on sensor
- -70 dBm to +44 dBm, depending on sensor
- HP437, HP438, and Boonton 4220A emulation
- Automatically loads sensor data
- Simple software control
- IEEE-488 interface standard

The 4230A series is an extremely accurate one or two-channel RF power meter that provides the high measurement speed required in production test with the simplicity of operation required on the bench. It can measure power levels from -70 dBm to +44 dBm and is exceptionally fast, > 200 readings per second. Its 20-character, 4-line display is easy to read and provides simultaneous display of dual channels with a bar graph display proportional to its numeric display.

## FIVE-DIGIT RESOLUTION, 90-DB DYNAMIC RANGE.

The 4230A series displays measurement data with up to 5-digit resolution in dB and linear units. The 4232A can display input and output power simultaneously, making comparisons simple. Log or linear readouts can be selected along with +/- difference and ratios.

## YOUR EXISTING SENSORS CAN BE USED...

The 4230A series is compatible with every Boonton diode, thermocouple, and waveguide sensor you're likely to have, from 10 kHz to 100 GHz. Any sensor can be upgraded with a sensor data adapter to automatically download sensor information to the instrument. The 4230A series integrates smoothly with ATE systems, via its standard IEEE-488

Available LabVIEW<sup>®</sup> software drivers unleash the power of the PC for data analysis and reporting, and allow the 4230A series to integrate smoothly with other instruments into an ATE system. Emulation of HP437, 438, and 4220A is standard.



Backlit LCD provides simultaneous readings of both channels. It displays readings with up to 5-digit resolution in different units for gain and output power comparisons, CW and peak measurements, +/- differences and ratios, and bar graphs for rapid peaking and tuning adjustments.

To 100 GHz



# 9230 Series RF Voltmeter

- 10 Hz to 2.5 GHz measurement range
- Dual-channel and differential voltage measurements
- 200  $\mu$ V to 300 V measurement range
- 1% accuracy at full scale
- True RMS response below 30 mV
- Optional 50-ohm terminated sensor to 2.5 GHz
- Optional low-frequency probe for measurements from 10 Hz to 100 MHz
- DC recorder output
- IEEE-488 interface standard

The 9230 series is the latest addition to Boonton's popular 9200 series of RF voltmeters that combines accuracy, smart probes, and operator features that have never been available before in its price range. It is simple enough to use on the bench, and comprehensive enough to integrate into an ATE system.

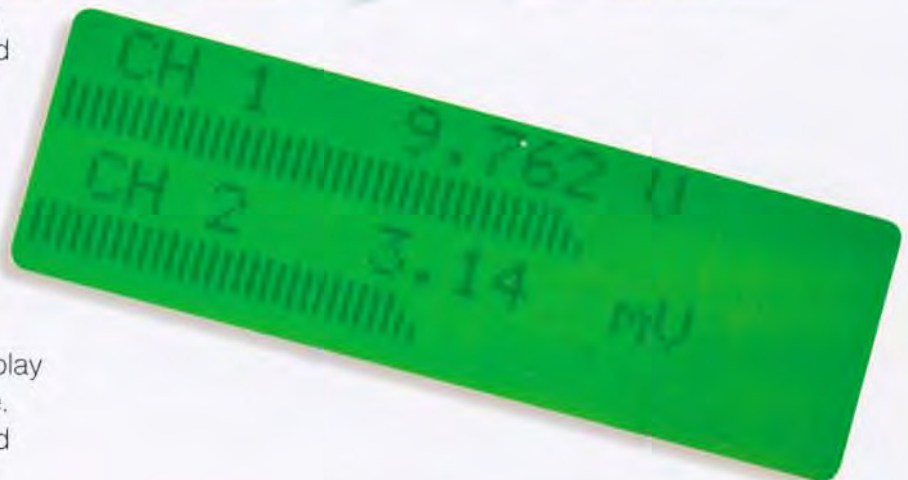
Boonton's proven voltage probes directly measure from 200  $\mu$ V to 10 V with usable indication as low as 50  $\mu$ V and have true RMS response below 30 mV. A 100-to-1 divider allows operation to 300 V. Boonton's voltage probes and sensors allow the 9230 series to display power levels in dBm. The compact sensor data adapter allows any probe to download calibration data to the instrument automatically as soon as it is plugged in. Data for probes that do not have sensor data adapters can be stored in nonvolatile memory.

## ADD A SECOND CHANNEL.

The 9230 series also can be specified with a second channel input that provides a duplicate set of input amplifiers and circuits with connectors for a second voltage probe or sensor. This feature allows the instrument to display channels 1 and 2 as well as ratio and difference. Other features include a DC recorder output and IEEE-488 interface



## To 2.5 GHz





# The 5230 Series: Measure power and voltage together.

For sheer measurement capability, nothing tops our new 5230 series RF power meter/voltmeter. Building on the unparalleled performance of our 4230 series, the 5230 series is the only instrument that lets you make RF power and voltage measurements simultaneously, at power levels from -70 dBm to +44 dBm and voltage from 200  $\mu$ V to 300 V. So in the same time you currently measure power, the 5230 series measures both power and voltage. Combine this performance with dynamic range of 90 dB, a single-channel sampling rate of > 200 samples per second, and two-channel measurements of >100 samples per second, and you have the recipe for unparalleled throughput in production test.

## SENSOR AND PROBE CALIBRATION DATA DOWNLOADED AUTOMATICALLY.

The time-consuming process of changing sensors and reentering calibration data is a damper on production throughput. To combat this problem, our sensor data adapters store calibration data for an individual sensor in an EEPROM and download it as soon as the sensor is connected to the instrument. You'll never have to enter calibration data again. The 5230 series can also store calibration data for four sensors or probes in nonvolatile memory.

## IT COULDN'T BE EASIER.

Take a look at the 5230 series front panel, and you'll see we designed the 5230 series to make testing trouble free. Together, the bright backlit display and simple keypad make operation easy. And behind the scene, comprehensive software performs all of the functions that clutter up the front panels of lesser instruments. You press a key, the 5230 series does the rest.

There's far more to the 5230 series as well, including simultaneous display of two channels, each of which can be voltage or power. The 5230 series also fits into ATE systems with ease, thanks to standard IEEE-488



## YOUR EXISTING SENSORS AND PROBES WORK JUST FINE WITH THE 5230 SERIES.

The 5230 series is compatible with every Boonton diode, thermocouple, and waveguide power sensor or voltage probe you're likely to have. Any sensor or probe can be upgraded with a sensor data adapter to automatically download calibration data to the instrument.

LabVIEW® software drivers are available that let you combine the power of the 5230 series with the versatility of a PC, opening unlimited possibilities for data analysis and archival. In addition, LabVIEW smoothes the integration of the 5230 series with other instruments in a production ATE environment. Emulation of HP437, 438, 4220A and 4230A is standard.

Speed, accuracy, ease of use make the 5230 series the most exciting new RF power measurement system available...and your best investment for the future.



High-speed readings offer a new level of precision testing. With advanced digital signal processing and fast-response sensors, Boonton's 4230A and 5230 series provide > 200 readings per second over a 90-dB dynamic range for fast, accurate testing and increased manufacturing throughput.





## 4230A Series Power Meter

The 4230A series is the latest of many generations of RF Power Meters from Boonton. Our heritage in power measurements has evolved over many decades. The specifications for the 4230A series and the power measurement features of the 5230 series continue this pedigree of high performance and accuracy.

<b>Specification</b>	<b>Model 4230A/Model 5230 Power Meter specifications, RF Voltmeter specifications same as 9230, opposite page</b>	
<b>Frequency Range:</b>	10 kHz to 100 GHz, sensor dependent.	
<b>Power Range:</b>	-70 dBm to +44 dBm, sensor dependent.	
<b>Number of Channels:</b>	One or two.	
<b>Measurement:</b>	Speed: 1 channel: 200 readings/sec. 2 channels: 100 readings/sec.	
<b>Power Sensors:</b>	Accepts sensor data adapter and internally stores up to 4 sensors with full-calibration data, including high-frequency calibration factors, stored in nonvolatile memory. Sensor menu accesses sensors displaying sensor serial number. Compatible with all Boonton CW power sensors. *See Sensor Data Sheet.	
<b>Dynamic Range:</b>	Up to 90 dB with diode sensors; 50 dB with thermocouple sensors. *See Power Sensor Specifications.	
<b>Inputs:</b>	Front panel sensor connectors standard. Rear panel inputs optional.	
<b>Outputs:</b>	Front panel PWR REF connector, 0 dBm, 50 MHz. Rear panel RECORDER BNC connector, 0 to 10 V into 1 MΩ. Output impedance is 9.09 kΩ. May be operated into 1 kΩ for 1V fs. Rear panel IEEE-488	
<b>Emulation:</b>	HP437 and 438 and BEC 4220A (native mode).	
<b>Displays:</b>	Menu-driven 20-character x 4-line LCD display. Simultaneous display of dual channels with bar graph proportional to data display.	
<b>Display Units:</b>	Absolute, watts and dBm. Relative, dBr.	
<b>Display Resolution:</b>	5 digits, nW, μW, mW, and W; 0.001 dB, dBm, and dBr.	
<b>Measurement Accuracy:</b>	Total accuracy is the sum of the following uncertainties (errors are +/- worst case):	
<b>Instrumentation Accuracy:</b>	0.002% at full scale.	
<b>Power Reference Uncertainty:</b>	Output frequency: 50 MHz +/- 1.5%. Output level: 0 dBm level accuracy: +/- 0.7% (25°C) for 90 days. +/- 0.9% RSS, 1.2% worst case (0° to +55°C) for 1 year. Source impedance: 50 +/- 1 ohm. SWR: < 1.05. Harmonic output: < -50 dBc.	
<b>Other Uncertainties:</b>	For sensor, noise, high-frequency calibration uncertainty, *See Power Sensor Specifications.	
<b>Calibration Factors:</b>	+3 dB to -3 dB in 0.01 dB steps. These calibration factors are stored in nonvolatile memory. When a frequency other than that stored is used, the meter linearly interpolates between the calibration factor above and below the frequency entered to obtain a calibration factor.	
<b>Ranging:</b>	Automatic or manual.	
<b>Filtering:</b>	Filter times in 0.05-second intervals to 20 seconds.	
<b>Zeroing:</b>	Automatic function to calculate, store, and apply zero corrections to each range.	
<b>Display Offset:</b>	-99.99 to 99.99 in 0.01-dB steps (dBr).	
<b>Power Consumption:</b>	100, 120, 220, or 240 VAC (±10%), 50 to 60 Hz or 400 Hz, 24 VA maximum.	
<b>Operating Temperature:</b>	0° to +55 °C.	
<b>Weight:</b>	7 lbs. (3.2 kg.).	
<b>Dimensions:</b>	8.26 in. (21.0 cm) wide, 3.48 in. (8.9 cm) high, 13.5 in. (34.3 cm) deep.	
<b>Standard IEEE-488 Bus:</b>	Complies with IEEE-488 and implements SH1, AH1, T6, L4, SR1, RL1, DC1, and DT1.	
<b>Accessories Required:</b>	One or more of the available power sensors and a 5-ft. power sensor cable Model 41-2A and one sensor data adapter (one per channel included) are required.	
<b>Accessories Available:</b>	<b>41-2A/10</b> Sensor/Probe Interconnecting Cable (10 ft.) <b>41-2A/20</b> Sensor/Probe Interconnecting Cable (20 ft.) <b>41-2A/50</b> Sensor/Probe Interconnecting Cable (50 ft.) <b>41-2A/100</b> Sensor/Probe Interconnecting Cable (100 ft.) <b>95004701A</b> F/F Adapter, 41-2A. <b>95004901A</b> Bulkhead Connector F/F <b>Rack Mounting Kit</b> 95403001A <b>Rack Slide Kit</b> 95005901A <b>Sensor Data Adapter</b> 95109001A	<b>Ordering Information:</b> <b>4231A</b> Single Channel <b>4232A</b> Dual Channel

### POWER SENSORS

Diode Sensors			Thermocouple Sensors		
Model Number	Frequency (MHz-GHz)	Power (dBm)	Model Number	Frequency (MHz-GHz)	Power (dBm)
51011 EMC	0.001 to 7	-60 to +20	51100	10 to 18	-30 to +20
51011	0.1 to 12.4	-60 to +20	51101	0.1 to 4.2	-30 to +20
51012	0.1 to 2	-60 to +20	51102	30 to 26.5	-30 to +20
51013	0.1 to 18	-60 to +20	51200	10 to 18	-10 to +37
51015	0.1 to 18	-50 to +30	51201	0.1 to 4.2	-10 to +37
51033	0.1 to 18	-40 to +33	51300	10 to 18	0 to +44
51071	10 to 26.5	-70 to +20	51301	0.1 to 4.2	0 to +44
51072	30 to 40	-70 to +20			
51075	0.5 to 18	-70 to +20			
51077	0.5 to 18	-60 to +30			
51078	0.1 to 18	-20 to +37			

**Waveguide Sensors.** Consult factory for details for K, Ka, Q, U, V, and W band sensors. Specifications subject to change without notice.



CE Safety Approval Insures Acceptance in the EU.





## 9230 Series RF Voltmeter

Boonton's legacy in RF Voltage Measurements is regarded by experts as second to none. The unsurpassed accuracy of previous generations of RF Voltmeters evolves into a high-performance RF Voltmeter, 9230 series. The specifications for the 9230 series and the voltage measurement specifications of the 5230 series are stated below.

Specification	Model 9230/Model 5230 Voltmeter specifications, RF Power Meter specifications opposite page																																					
<b>Voltage Range:</b>	200 $\mu$ V to 10 V in eight ranges (300 V to 700 MHz with a 100:1 divider). Indications to 50 $\mu$ V.																																					
<b>Voltage Display:</b>	1 mV to 300 V fs.																																					
<b>Decibel Range:</b>	> 90 dB in eight ranges, 0.01 dB resolution. dBmV      0 dB = 1 mV dBV        0 dB = 1 V dBW        0 dB = 1 W dBm        0 dB = 1 mW calculated from voltage drop across a selectable Z, reference, 5 to 2000 ohms. dB         0 dB = any desired reference level. Reference level can be selected at front panel to 0.01 dB resolution if display range of +/- 99.99 dB is not exceeded.																																					
<b>Frequency Range:</b>	10 kHz to 1.2 GHz, with 952001A probes. 100 kHz to 2.5 GHz with Model 952009 series voltage sensor. 10 Hz to 100 MHz with Model 952016 probe.																																					
<b>Waveform Response:</b>	RMS to 30 mV, calibrated in the RMS of a sine wave above 30 mV (RMS to 3 V and 700 MHz with 100:1 divider).																																					
<b>Crest Factor:</b>	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="6">Direct Input</th> </tr> <tr> <th>Level</th> <th>300 <math>\mu</math>V</th> <th>1 mV</th> <th>3 mV</th> <th>10 mV</th> <th>30 mV</th> </tr> </thead> <tbody> <tr> <td>Crest Factor</td> <td>140</td> <td>42</td> <td>14</td> <td>4.2</td> <td>1.4</td> </tr> </tbody> </table> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="6">With Divider</th> </tr> <tr> <th>Level</th> <th>30 mV</th> <th>100 mV</th> <th>300 mV</th> <th>1 V</th> <th>3 V</th> </tr> </thead> <tbody> <tr> <td>Crest Factor</td> <td>140</td> <td>42</td> <td>14</td> <td>4.2</td> <td>1.4</td> </tr> </tbody> </table>		Direct Input						Level	300 $\mu$ V	1 mV	3 mV	10 mV	30 mV	Crest Factor	140	42	14	4.2	1.4	With Divider						Level	30 mV	100 mV	300 mV	1 V	3 V	Crest Factor	140	42	14	4.2	1.4
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<b>Input Capacitance:</b>	Less than 1.5 pF.																																					
<b>Maximum AC Input:</b>	10 V at all frequencies and ranges.																																					
<b>Maximum DC Input:</b>	200 V at all frequencies and ranges.																																					
<b>Recorder Output:</b>	10 V fs, proportional to indicated voltage in mV mode over each range. 7 V = 0 dBm regardless of Z, in dB mode. Sensitivity of 1 V per 10 dB change over entire range.																																					
<b>Line Stability:</b>	Less than 0.2% of reading with +/- 10% line voltage change at reference line conditions (115 to 120 VAC, 50 to 400 Hz).																																					
<b>Zero:</b>	Automatic, operated by panel key switch. Usable after 5-minute warm-up.																																					
<b>Basic Uncertainty:</b>	Voltage level (mV)	mV																																				
	3000 to 10,000	$\pm$ 2% of reading; $\pm$ 2 counts																																				
	3 to 3000	$\pm$ 1% of reading; $\pm$ 1 count																																				
	1 to 3	$\pm$ 2% of reading; $\pm$ 2 counts																																				
	0.2 to 1	$\pm$ 3% of reading; $\pm$ 3 counts																																				
<b>Options Available:</b>	<b>Rack Mounting Kit</b> 95403001A <b>Rack Slide Kit</b> 95005901A <b>Sensor Data Adapter</b> 95109001A	<b>Ordering Information:</b> <b>9231</b> Single-input channel. Includes accessories as stated above. <b>9232</b> Dual-input channels. Allow display of channels 1 and 2 and ratio of channels expressed in dB. <b>5231</b> Single channel. <b>5232</b> Dual channel.																																				

### 9230 SERIES PROBES (Not included in basic instrument)

Model Number	Description	Frequency
952063	Standard Probe	10 kHz to 1.2 GHz
952064	Low-Frequency Probe	10 Hz to 100 MHz
952009	50-Ohm Voltage Sensor	100 kHz to 2.5 GHz

