



wekomm

BM6010A Bolometer Bridge

BM6010A

The BM6010A is a Standards Laboratory grade instrument used to measure accurately high-frequency or microwave power in terms of substituted DC power. The BM6010A is an improved replacement for well known Technology Type II bridge power measurement system.

The BM6010A design goal was to replace or supersede the Tech II bridge in every aspect. As the Tech II bridge was commonly used as a standards lab calibration instrument, the requirements in terms of precision, stability and quality are very high. The BM6010A meets all those requirements and is already used at National Metrology Institutes to aid primary reference calibration.

In comparison to the venerable Tech Type II bridge, the BM6010A profits from modern electronics components and a carefully revised overall design. In addition, the instrument is now micro-

processor controlled, offering the user a modern, intuitive touch screen operation as well as a complete remote control capability using SCPI compatible commands. The BM6010A can therefore be used in a complete remote controlled environment, operating at the highest standards.

Many improvements have been made during the development of the BM6010A. The complete bridge circuit is now much more stable, resulting in a usually stable operation without any oscillation or the need of external capacitors.

The reference voltage source operates on a completely new level. Unprecedented in linearity and stability, the need for an external reference voltage source is eliminated. With a linearity error of $1.5 \mu\text{V/V}$, the reference voltage source even outperforms many dedicated reference voltage sources. In combination with the remote control capability, the BM6010A is the perfect fit for

Instrument Overview



many applications, the Tech II bridge was not able to provide.

The instrument is not direct reading; the power must be calculated. Using data from the internal reference voltage source provides data, precise enough for most requirements. For more demanding measurements and National Metrology Institute applications, a precise external voltmeter is highly recommended.

The system itself is intended for use with bolometer mounts. These may have either a coaxial or waveguide input and use either a thermistor or a barretter as the bolometer element. The frequency and power range covered, depends on the bolometer mount used. In general the measured power level will not exceed 10 milliwatts.

The BM6010A consists of three units: a self-balancing bolometer bridge, a reference voltage generator and a Zero Voltmeter. These functional separate units are mounted together in one case and will be operated together.

A highlight of the bridge design is the use of four extremely stable and precise resistors, made by wekomm. These resistors are adjusted to a precision of better than $0.5 \mu\Omega/\Omega$. This fact makes the measurement bridge one of the most precise units on the market. A stability of better than $10\mu\Omega/\Omega$ per year guarantees even long term performance. In ad-

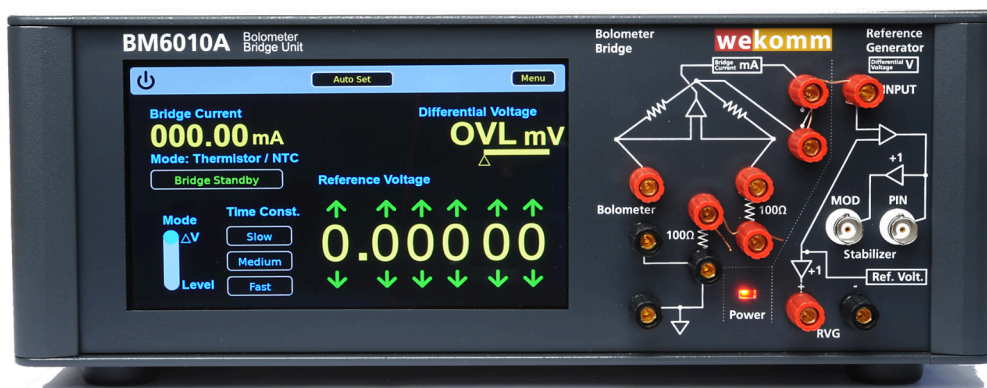
dition all four resistors are mounted within special temperature shields to maintain their value even under adverse conditions.

The internal reference voltage generator can be digitally controlled either via manual touch screen operation, automatic setting or via remote control commands. It's precision provides the best accuracy available for RF power measurement. The use of the reference voltage generator as a stable voltage source in conjunction with an external voltmeter produces the most accurate measurements. This technique is particularly important at low power levels, i.e., less than 10 milliwatts.

The Zero Voltmeter is also designed to be used as a precision power stabilizer. The stabilizer has two output connectors; one with a limited power output capability to drive a PIN diode modulator, the other with a 100 mA maximum output to drive a ferrite modulator. Finally, the reference voltage generator can be used as a 0-10 volt DC source. Output impedance is less than 20 milliohms; available output current depends on the voltage setting.

These features make the BM6010A a modern reference instrument, to provide highest possible precision in RF power measurements, making the instrument the preferable choice for this type of primary measurements.

Front and Rear view



General Specifications



DISPLAY:	7" colour display, capacitive touch
RESOLUTION:	800 x 480 pixel
EXTERNAL CONNECTIONS:	(Rear) Power, USB-Port, Ethernet
UPDATE POSSIBLE:	Over internet connection or USB
RTC:	No
POWER SUPPLY:	115 or 230V AC, please order appropriately
WEIGHT:	3 kg
DIMENSIONS	L 24.5cm x W 26cm x H 14cm (all dimensions including feet, binding posts and rear connectors)
RESISTANCE OF BRIDGE ARMS:	Known to ± 0.0058 Y and Z differ by less than 0.0028.
NOISE:	Less than 0.05 μ W.
BOLOMETER MOUNT:	May have positive or negative temperature coefficient (barretter or thermistor).
BOLOMETER MOUNT RESISTANCE:	50, 100, or 200 ohms, set by means of front panel links.
MAXMIUM BRIDGE CURRENT:	Up to 120 mA metered, up to 150 mA maximum.

Power Range

The Power Range depends on external bolometer mount used

BOLOMETER MOUNT RESISTANCE	50 Ω	100 Ω	200 Ω
BIAS POWER AT 60mA BRIDGE CURRENT (Front panel meter maximum)	45 mW	90 mW	180 mW
MAXIMUM BIAS POWER	222 mW	222 mW	222 mW
BRIDGE CURRENT BIAS POWER (Front Panel Meter Shorted)	100 mA	100 mA	100 mA

Accuracy

The table below lists the error in a substituted DC power measurement of 10 mW RF, for two typical thermistor mounts. No term is included for the bolometer lead resistance, since this error is measurable and correctable.

BOLOMETER MOUNT	100 Ω Thermistor ($\gamma = -11,750 \Omega/W$)	200 Ω Thermistor ($\gamma = -12,300 \Omega/W$)
BRIDGE ARMS RESISTOR ERRORS, TOTAL	+/- 0.0050%	+/- 0.0054%
BRIDGE ELECTRONIC ERRORS, TOTAL	+/- 0.0008%	+/- 0.0007%
TOTAL BRIDGE ERROR	+/- 0.0058%	+/- 0.0061%

Reference Voltage



OUTPUT VOLTAGE:	0-9.99999 volts.
ACCURACY:	1 $\mu\text{V/V}$ immediately after adjustment. 10 $\mu\text{V/V}$ within one year.
OUTPUT CURRENT:	$\geq 5\text{mA}$ maximum Short circuit protected
OUTPUT IMPEDANCE:	20 milliohms at front panel terminal.
STABILITY:	At constant temperature after 4hrs warmup. 1hr: 1 $\mu\text{V/V}$ of setting plus 1 μV 24hr: 2 $\mu\text{V/V}$ of setting plus 2 μV 30 Day: 2 $\mu\text{V/Vm}$ of setting plus 5 μV
TEMPERATURE COEFFICIENT:	(2 $\mu\text{V/V}$ + 1 μV) per $^{\circ}\text{C}$.

Output Current

Depends on the voltage setting according of the equation $I_{\text{out}} - (10.4 - E_{\text{out}})/10$ amperes.
Short circuit protected by +15 V bridge power supply current limiting or power limiting of internal amplifiers.

Power Stabilizer

OUTPUT CURRENT:	
PIN:	5 mA maximum.
MOD:	300 mA maximum.
STABILIZATION FACTOR:	$\Delta P_{\text{RF out}} / \Delta P_{\text{RF in}}$ At 0.1 mW through 10 mW RF in a 200 ohm thermistor
LEVELING DETECTOR:	$<10^{-6}$ typical.

Options

These are additional components for adjusting, calibrating and operation the Bolometer Bridge

BM6015A	Bolometer Mount Substitute Plug (Adjustment and Performance Test procedures)
LTC9010A	Low Thermal Cable 2-wire (Connect Bolometer Bridge to external Voltmeter)
BM6016A	Calibration Cable for Instrument adjustment (Adjustment and Performance Test procedures)
BM6010A-H	Case with carrying-handle (must be specified at ordering time)

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