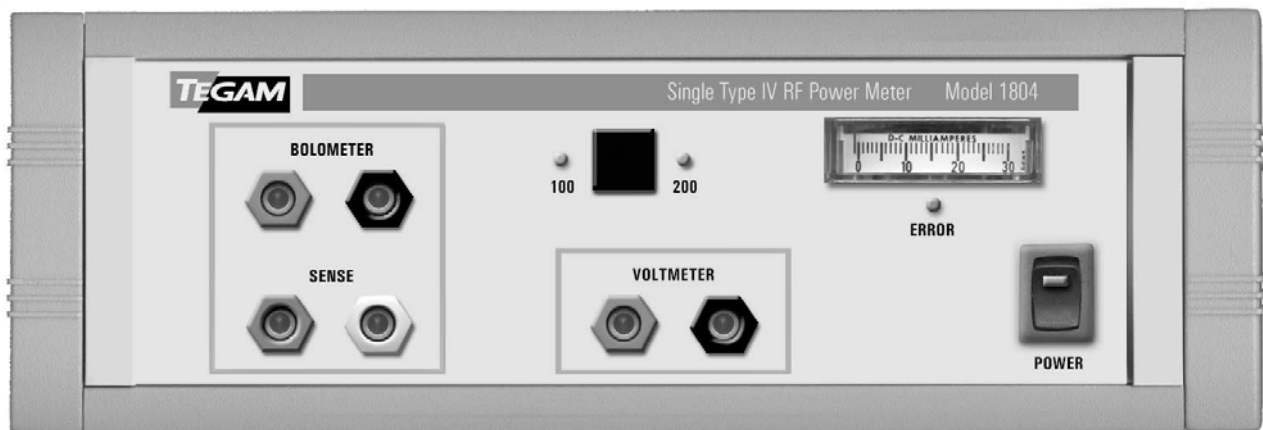


OPERATING & INSTRUCTION MANUAL

TEGAM, INC.

MODEL 1804 Single Type IV Power Meter

REV: C
January, 2004

This owner's manual was as current as possible when this product was manufactured. However, products are constantly being updated and improved. Because of this, some differences may occur between the description in this manual and the product you receive.

MODEL #'s 1804-120V, 1804-220V

P/N 1804-900-01CD

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Unpacking & Inspection:

Each Model 1804 is put through a series of electrical and mechanical inspections before shipment to the customer. Upon receipt of your instrument, unpack all of the items from the shipping carton and inspect for any damage that may have occurred during transit. Report any damaged items to the shipping agent. Retain and use the original packing material for reshipment if necessary.

UPON RECEIPT, INSPECT THE CARTON FOR THE FOLLOWING ITEMS:

Model 1804 Single Type IV Power Meter	
Model 1804 Operating Instructions	P/N 1804-900-01A
Power Cord	P/N 068-21
2 Shorting Links (installed on 1804)	P/N 138-495
Mount Bias Cables: 1 set	P/N 138-526

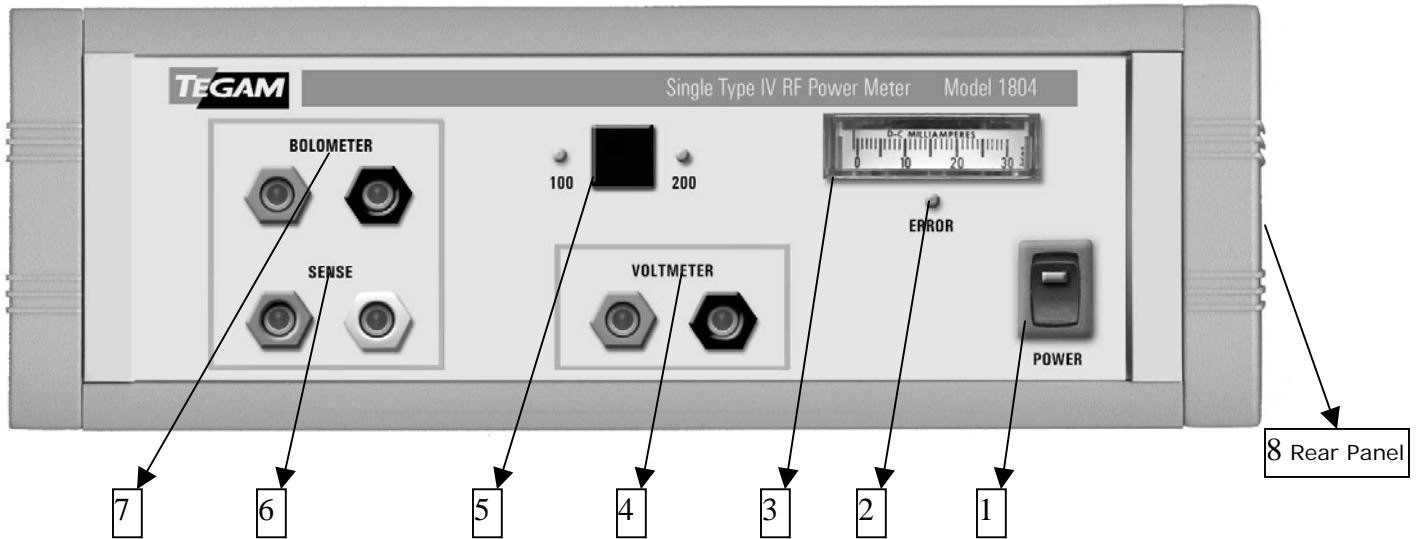
USE THE PROPER FUSE:

To avoid fire hazard, use only the correct fuse type as specified in the " Performance Specifications" section of the manual.

Instrument Description:

The Model 1804 Single Type IV RF Power Meter is designed for use with bolometer elements and an external DVM to measure high frequency power, microwave power and insertion loss. It can also function as a standard for the calibration of RF detectors, RF voltmeters, and bolometer elements (mounts) manufactured by TEGAM, Weinschel, and Agilent (HP). Mounts easily interface to the 1804's universal front panel binding post connection. Calibration of temperature-compensated mounts can be performed by adding the TEGAM Model 1820 RF Mount Heater. The exclusive use of 100% DC substituted power eliminates the effect of AC components on the bridge circuit which has been shown to introduce a substantial error in the substituted power due to the short-term time constant of some bolometer elements. Substituted DC power levels ranging from 10 μ W to 30mW can be measured to within $\pm 0.003\%$, which makes this an ideal instrument for insertion loss measurements. Regardless of the application, all measurements can be made directly traceable to primary voltage and resistance standards. The Model 1804 Type IV RF Power Meter is designed to bias either 100 or 200 ohm mounts and is thus compatible with Aligent (HP) 478A, 486A and 8477A thermistor mounts and the TEGAM Model M1110, M1111, M1118, and M1120 Terminating Series Mounts (refer to applicable data sheets for mount specifications). A front panel switch selects the operating resistance for the power meter. Each power meter has a bolometer current meter and a fault LED indicator that illuminates under any condition preventing loop balance. Terminals are provided for an external DVM, negative bolometer, and voltage sense.

Front Panel:



1- Power switch---Unit power

2- Error LED indicator--- Indicates conditions preventing loop balance (Open Circuit)

3- Bolometer Current Meter---Measures with a resolution of 1mA, the thermistor bias current level applied to the attached thermistor mount.

4- Voltmeter Terminals---The DC voltage present at these terminals is equivalent to the voltage across the thermistor element.

5- 100/200 ohm Operating Resistance Switch---Configures the bridge circuitry to either 100-ohm or 200-ohm operation. Depending on the position of this switch, either the 100-ohm or 200-ohm operational indicator will be illuminated

6- Mount Sense Lead Connectors---Voltage present at these connectors is proportional to the effective DC current passing through the thermistor element. The use of the voltage potential at these connectors reduces errors associated with lead resistance.

7- Bolometer Mount Bias Connectors---Pass the DC current applied by the 1804 to and from the attached thermistor mount.

8- Float/Ground Switch (On Rear Panel)---This switch grounds or ungrounds (floats) the 1804 depending on whether or not the thermistor and DVM are grounded.

Power Source:

The Model 1804 may be operated from an AC power source of 105-125 or 210-250 Vac, 47 to 420 Hz, 12 Watts, depending on which model you selected.

Line Fuse:

The line fuse is located in a fuse holder immediately next to the Power connector. Fuse requirements are 110Vac-1/2 Amp Slo-Blo, or 220Vac-1/4 Amp Slo-Blo depending on model selected.

Power Cord:

The Model 1804 is supplied with a three-conductor power cord for connection to an AC power source. When plugged into an appropriate receptacle, the cord also grounds the instrument for the protection of operating personnel. If it is necessary to use a 2-contact electrical outlet, install a 3-to-2-conductor adaptor, and connect the adaptor lead to ground.

Storage Information:

The Model 1804 may be stored for extended periods without incurring damage to the internal circuitry.

Temperature: -40°F to +167°F (-40°C to 75°C)
 Humidity: ≤ 95% -Non-Condensing

Operational Theory; Bridge Circuits:

The Model 1804 contains a self-balancing bridge circuit. This circuit in a closed loop configuration, consists of two legs: a precision resistance leg (100 or 200 ohm) and a leg containing a thermistor element. The precision leg maintains a constant effective resistance value of either 100 or 200 ohms depending on the bridge operating resistance selection. Conditions when a Tegam type terminating thermistor mount is temperature stabilized by the Model 1820 RF Mount Heater, the thermistor resistance varies solely due to the application of RF and DC power.

Operational Theory; Power Measurements:

The Model 1804 uses the principle of DC substitution to provide a measure of RF power. DC substitution refers to the measurements of RF power according to the amount of DC power which must be substituted for the RF power in a bolometer in order to cause equivalent thermal effects. This principle extends to the determination of terminating thermistor mount calibration (ratio of substituted DC power to the power incident on the thermistor mount) by the following formulas:

$$P_{RF} = P_{dc}/K_1$$

Where:

P_{RF} = the RF power incident on the terminating mount
 P_{dc} = the DC substituted power as measured at the Model 1804
 K_1 = the measured or known calibration factor for the terminating mount.

The Model 1804 measures high frequency or microwave power in terms of a DC voltage change. The Model 1804 does not measure the RF power level directly. Instead, it measures DC voltages before and after the application of RF power using a DVM, or a DMM. The difference between these voltages is proportional to the RF effect on the thermistor's resistance and is calculated in terms of DC-substituted bias required to rebalance the bridge as follows:

$$P_{dc} = [(V_1)^2 - (V_2)^2]/R_o$$

Where:

V_1 = DVM reading across the precision resistance leg in the absence of RF power.
 V_2 = DVM reading across the precision resistance leg with RF power applied.
 R_o = Mount operating resistance (100 or 200 ohms)
 P_{dc} = DC power across the precision resistance leg which is proportional to the applied RF power.

Performance Specifications:**RF (Substituted dc) Power Measurement**

Typical Power Measurement Accuracy:	$\pm 0.03\% + 2\mu\text{W}$ when used with Fluke Model 8505A, 8506A, Agilent (HP) 3458A voltmeters, or equivalent
Measurement Range:	10 μW to 30mW
Substitution Bridge Accuracy:	$\pm 0.003\%$
Temperature Range:	+50°F to 104°F (+10 to +40°C) Operating -40°F to +167°F (-40 to +75°C) Storage
Connectors:	Binding Post, standard 0.75" spacing for Banana plugs.
Power Requirements:	105-125 or 210-250 Vac, 47 to 420 Hz, 12 Watts (voltage is factory set based on Model ordered)
Fuses:	110Vac-1/2 Amp Slo-Blo 220Vac-1/4 Amp Slo-Blo
Power Cord:	068-21
Weight :	Net 6.20 lbs. (2.82 kg)
Physical Dimensions:	Height 85.61 mm (3.37 in) Width 250.00 mm (9.84 in) Depth 260.00 mm (10.24 in)

Rack Mounting:

The Model 1804 can be shelf mounted in any cabinet or rack designed according to EIA RS-310 and MIL-STD-189

Warranty:

TEGAM, INC. warrants this product to be free from defects in material and workmanship for a period of one year from date of shipment. During the warranty period, we will, at our option, either repair or replace any product that proves to be defective.

To exercise the warranty, contact TEGAM, INC ,Ten Tegam Way, Geneva, Ohio 44041, Phone 440-466-6100, Fax 440-466-6110, M-F 8 a.m. to 5 p.m. ET. You will be given prompt assistance, return instructions, and a Return Material Authorization (RMA) number. Send the instrument after you have received an RMA number, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty, or at least 90 days, whichever is longer.

Limitation of Warranty:

TEGAM, INC's. warranty does not apply to defects resulting from the modification or misuse of any product or part. This warranty also does not apply to fuses, batteries, or damage from battery leakage.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. TEGAM, INC. shall not be liable for any indirect, special or consequential damages.

Statement of Calibration:

This instrument has been inspected and tested in accordance with specifications published by TEGAM, INC. The accuracy and calibration of this instrument are traceable to the National Institute of Standards and Technology through equipment that is calibrated at planned intervals by comparison to certified standards maintained in the laboratories of TEGAM, INC.

How to Contact TEGAM:

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Ten Tegam Way
Geneva, OH 44041
Phone: (440) 466-6100
Fax: (440) 466-6110
Email: sales@tegam.com
Web: www.tegam.com

Troubleshooting:

The TEGAM, Inc. Model 1804 has been designed to provide many years of trouble-free performance. However, there are some instances where harsh operating environments or excessive physical strain may cause premature failure. Should a malfunction of the Model 1804 be discovered, it is recommended that certain steps be taken in order to assist our Service Department in identifying the cause of the malfunction. Below is a summary of some commonly-observed symptoms and some possible causes for them.

No Power.

Check power cord
Check fuse

Error LED is Illuminated.

Open Circuit on Bolometer Mount Bias Connectors...Check connections
Check Thermistor Mount...Blown Element

No reading on the Bolometer Current Meter when connected to a Thermistor Mount (No error LED).

Internal problem, return for service
Check for correct position of 100/200 ohm Operating Resistance Switch...Dependent on Mount Resistance (100 or 200 ohms)

High voltage (approx 11VDC) on Voltmeter Terminals with Thermistor Mount attached.

Check Thermistor Mount...Blown Element
Internal problem, return for service

Preparation for Repair Service:

Once you have verified that the cause for the Model 1804 malfunction cannot be solved in the field and the need for service arises, contact TEGAM, Inc.'s customer service to obtain an RMA (Return Material Authorization) number.

The RMA number is unique to your instrument and will help us identify your instrument and to address the particular service request by you which is assigned to that RMA number. Of even greater importance, a detailed written description of the problem should be attached to the instrument. Once this information is prepared and sent with the instrument under its assigned RMA number to the Service Department, we will do our part in making sure that you receive the best possible customer service and turn-around time possible.