



# *Heat Flow Meters and Sensors*

## *<HFM-201 / HFM-215>*



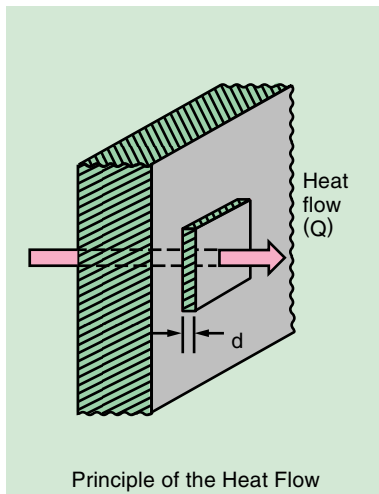
**KYOTO ELECTRONICS**

A measurement of heat flow provides important and detailed thermal data that cannot be given by a measurement of temperature alone.

The HFM series have the highest accuracy and reproducibility of the measurement of such heat flow because of the absolute calibration device. And the operation is extremely simple and easy as well. The HFM series enjoy a very high reputation and are used in various fields.

## Principle

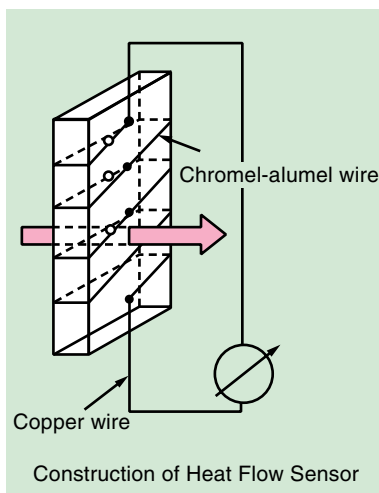
The heat flow analysis is made based on the principle as shown below: If a thin plate with a thermal conductivity of  $(\text{kcal/m} \cdot \text{h} \cdot )$  and a thickness of  $d$  (m) is contacted on a heat radiating surface as the figure shows, a heat flow  $Q$  ( $\text{kcal/m}^2 \cdot \text{h}$ , or  $\text{W/m}^2$ ) which goes through the thin plate after it reaches to an equilibrium can be given by:



$$Q = \frac{\lambda}{d} \times T$$

Where :  $T$  = Temperature difference between two sides of the thin plate, and  $\lambda$  and  $d$  are known values.

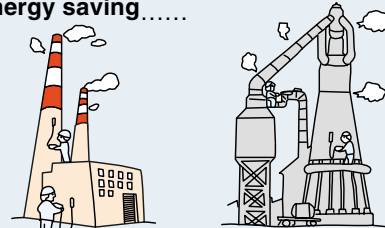
A heat flow sensor is made of a thin material with a low thermal conductivity. And its differential thermocouple has multi-contacts to improve an overall sensitivity.



## Applications

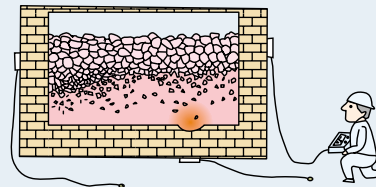
For energy saving, control of furnace, better living, etc., there are so many possible applications of the Heat Flow Meter. And the needs for such measurements are rapidly increasing.

### For energy saving .....



"Isn't there any heat loss in the plant?"

### For safety control of furnace .....



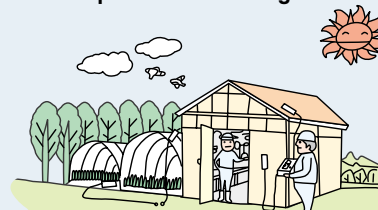
"Something is wrong here!?"

### For measurement of thermal characteristics of houses .....



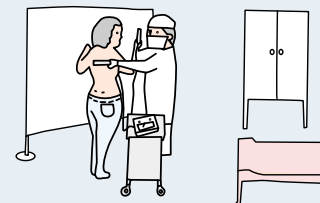
"For a comfortable living condition!"

### For development of solar & geothermal energy .....



"Grow up , grow up!"

### For medical research .....



"It can measure such a low heat flow generated by a human body."

New hand-held type convenient meter  
for on-site use

# Portable Heat Flow Meter

(not CE conformed)

## HFM-201

### Features

Heat flow level in  $W/m^2$  or  $kcal/m^2h$  and temperature  $^{\circ}C$  can be switched and shown on display.

Temperature sensor can be switched between Chromel-Alumel thermocouple and Copper-Constantan thermocouple.

Heat flow sensor model TR2-B is included.

Data memory can save 20 groups of files totaling 100 sets of data in storage.

2-way power source from two AA dry cells (80-hour continuous run) or from AC adapter.

External communication via RS-232C interface is standard.

Carrying case is included.

Optional printer is available.



Item	Specifications
<b>Measurement object</b>	Heat flow and temperature
<b>Measurement range</b>	Heat flow: 0~±9999 $W/m^2$ or $kcal/m^2h$
	Temperature: Chromel-Alumel thermocouple -99.9~999.9 $^{\circ}C$
	Temperature: Copper-Constantan thermocouple -199.9~400.0 $^{\circ}C$
<b>Selectable units</b>	Heat flow: $W/m^2$ , $kcal/m^2h$ or Temperature: $^{\circ}C$
<b>Sampling cycle</b>	Selectable from 1, 2, 5 or 10 seconds
<b>Display update</b>	Synchronized with sampling cycle
<b>Determination of mean value</b>	Selection from moving average of 1 set (When set at 'Off'), 2 sets, 10 sets and 30 sets of data
<b>A and B Constants</b>	A and B sensor constants are input by key entry.
<b>Data memory</b>	20 groups can be filed and total 100 sets of data are stored.
<b>External communication</b>	RS-232C port (one channel)
<b>Ambient conditions</b>	Temperature: 0~50 $^{\circ}C$ Humidity: 20~80%RH (subject no condensation)
<b>Power source</b>	2 AA dry cells (80-hour continuous run) or AC adapter
<b>Dimension</b>	82(W) X 232(L) X 22(H) (mm)
<b>Weight</b>	Approx. 220g
<b>Accessories</b>	Heat flow sensor model TR2-B-----One AA dry cell-----Two AC adapter-----One Operation manual-----One Carrying case-----One
<b>Options</b>	-Data Capture Software for PC -Connecting cable for PC -Printer IDP-100 -Connecting cable for printer

Seeking the mobility of the Data logger

## Multiple-point Heat Flow Meter

### HFM-215

#### Features

Compact and lightweight design in pursuit of the mobility of a data logger.

5.5-inch wide-angle color LCD can show trend graph, bar graph, digital display and the like.

6-channel measurement allows data to be continuously stored for 27 hours with 1-sec data saving cycle.

Data can be stored in 3.5-inch floppy disk.

Standard Ethernet feature enables data saving across a network.

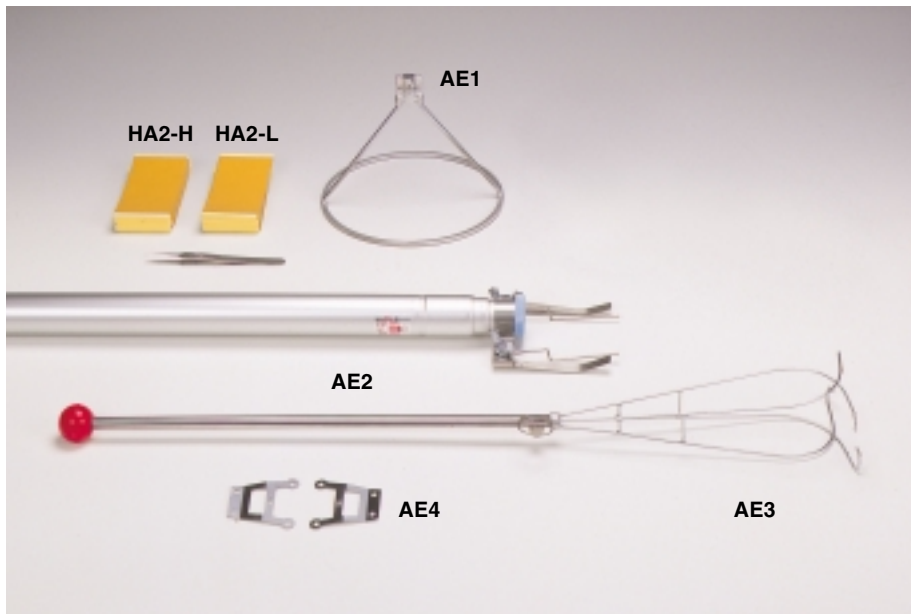
E-mail and Web monitoring functions are also standard.

Rechargeable battery and AC adapter are included.



Item	Specifications
<b>Measurement object</b>	Heat flow and temperature
<b>Measurement range</b>	Heat flow: 0~±99999 W/m <sup>2</sup> or kcal/m <sup>2</sup> h
	Temperature: Chromel-Alumel thermocouple -200~1200°C Temperature: Copper-Constantan thermocouple -200~400°C
<b>Selectable units</b>	Heat flow: W/m <sup>2</sup> , kcal/m <sup>2</sup> h or Temperature: °C
<b>Sampling cycle</b>	Selectable from 1, 2, 5, 10, 30, 60, 120, 300 or 600 seconds
<b>Display update</b>	Synchronized with sampling cycle
<b>Operation function</b>	Various operations between channels are possible.
<b>A and B Constants</b>	A and B sensor constants can be input by key entry.
<b>Number of sensors</b>	'A' constant type sensor: Max. 12
	'A, B' constant type sensor: Max. 5
<b>Display</b>	Trend graph or bar graph in 16 colors
<b>Data memory</b>	6-channel measurement can continuously store data for 27 hours with 1-sec data saving cycle.
<b>External memory device</b>	3.5-inch floppy disk drive
<b>External communication</b>	Ethernet (10BASE-T): 1-channel Web server function
	E-mail communication
<b>Ambient conditions</b>	Temperature: 0~40°C
	Humidity: 20~80%RH (subject no condensation)
<b>Power source</b>	Rechargeable battery (with a standard AC adapter)
<b>Dimension</b>	152(W) X 240(L) X 225(H) (mm)
<b>Weight</b>	Approx. 4kg
<b>Accessories</b>	AC adapter-----One Data Capture Software for PC-----One Operation manual-----One
<b>Options</b>	-Connecting cable for PC -Carrying case

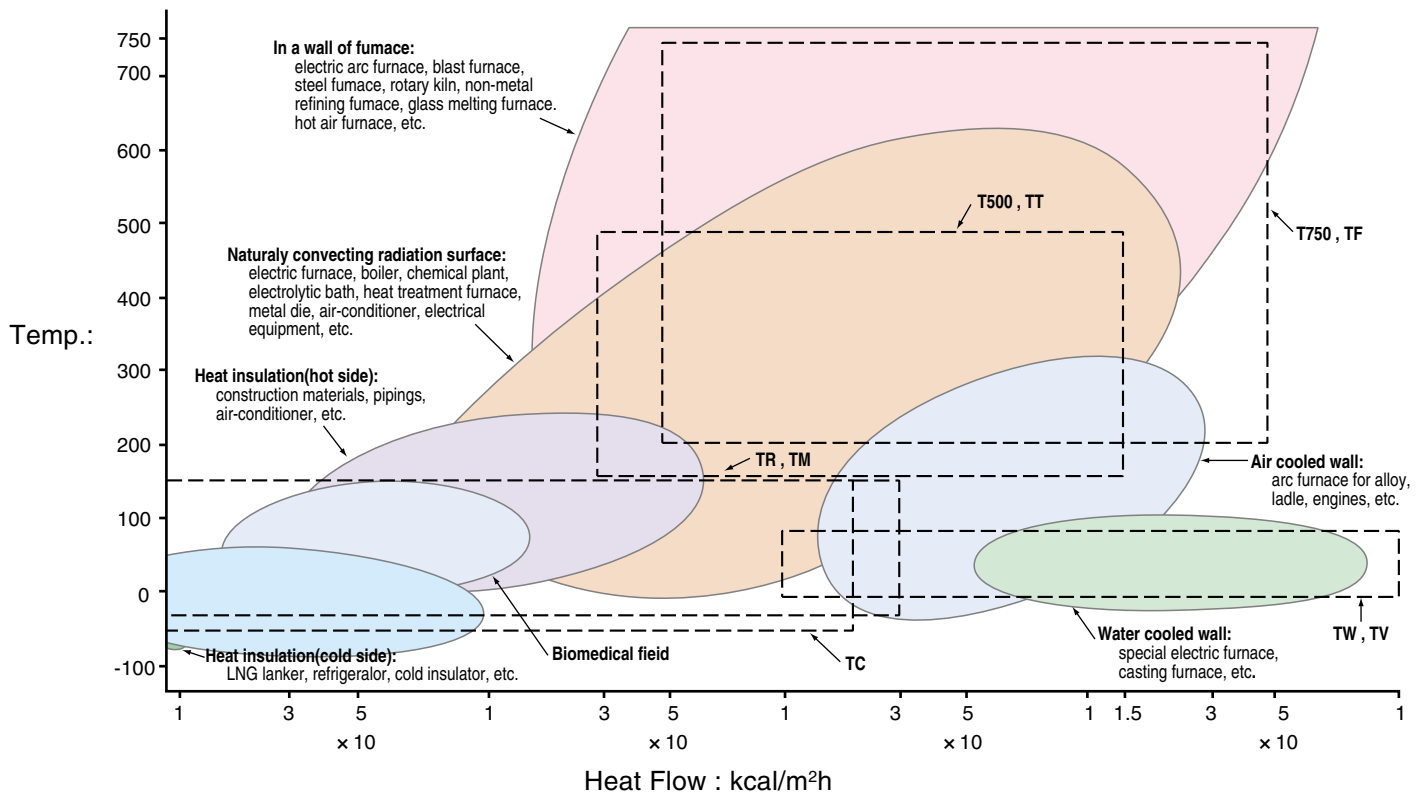
## Accessories(optional)



<b>AE1</b>	Support for T750
<b>AE2</b>	Pole for measurement with T500 and TW at high places
<b>AE3</b>	Hand-holder for T500 and TW
<b>AE4</b>	Metal fittings for affixing T500 and TW
<b>HA2-H</b>	Double-face adhesive sheets for TR and TM usable at 70~150
<b>HA2-L</b>	Double-face adhesive sheets for TR and TM usable at - 40~80

## There will be the most suitable sensor for every requirement!

A coverage of each sensor (application, temp. and heat flow ranges)







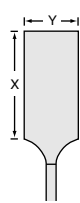
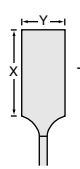
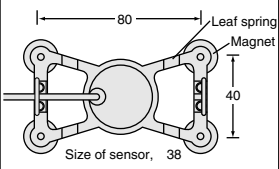
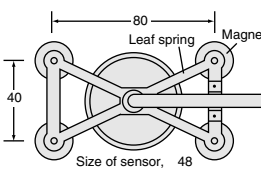
For HFM-201	TR-B Series	TM1-B	T500B-B	TW-B																		
For HFM-215	TR-C Series	TM1-C	T500B-C	TW-C																		
																						
<b>Application</b>	For low heat flow	For low heat flow (small size)	For high heat flow	For heat flow from water-cooled surfaces																		
<b>Features &amp; Applications</b>	Being highly sensitive, the TR type sensor is capable of accurately measuring heat flow down to as low as 10 kcal/m <sup>2</sup> ·h. It can be easily mounted on the object; in view of its flexibility, this is true in the case of objects with curved surfaces as well. As the TR type sensor comes in various sizes, as can be seen from the listing below, it can be selected in accordance with the requirement of the objects to be measured. The TR type sensor can be used in a wide variety of applications including the measurement of heat loss from insulated piping and the testing of heat characteristic of buildings. It can also be embedded in insulating materials or soil. In this case, however, a special calibration (extra charge) is required for accurate measurement.	Although its characteristics are almost the same as those of the TR type, the TM type sensor is of small size so as to enable measurement of heat radiation from living bodies and small parts of equipment.	Having excellent thermal resistance and durability, the T500 type sensor can be continuously used on surfaces having temperatures as high as 500 . Since it is suited to measuring heat flow from high temperature surfaces, e.g., electric furnace walls, the T500 type sensor can be used in a wide variety of applications, ranging from energy saving to furnace operation control.	The TW type sensor is designed for measuring heat flow from water-cooled furnace walls. Although the large heat transfer coefficient at water-cooled surfaces usually makes it difficult to measure heat flow, development of the TW type sensor has solved this problem. The highly corrosion resistant material of the sensor enables it to be used in seawater.																		
<b>Normal heat flow range</b>	10~3,000 kcal/m <sup>2</sup> · h	10~3,000 kcal/m <sup>2</sup> · h	300~15,000 kcal/m <sup>2</sup> · h	1,000~100,000 kcal/m <sup>2</sup> · h																		
<b>Normal temperature range</b>	-40~150	-40~150	70~500	0~90																		
<b>Material</b>																						
<b>Core material</b>	Silicone rubber	Silicone rubber	Air	Silicone rubber																		
<b>Covering material</b>	Silicone rubber	Silicone rubber	Stainless steel	Inconel																		
<b>Nominal sensitivity</b>	80 kcal/m <sup>2</sup> · h · mV	300 kcal/m <sup>2</sup> · h · mV	800 kcal/m <sup>2</sup> · h · mV	3,000 kcal/m <sup>2</sup> · h · mV																		
<b>Mounting method</b>	Use double-face adhesive sheet to affix the sensor to the surface of the insulating material, etc. KEM's double-face adhesive sheet HA2-L or HA2-H is recommended.		The magnets attached to the sensor will keep it in place if the object to be measured has an iron surface. When the surface of the object is of a material other than iron, use AE4, which is available as an optional accessory. The sensor can be mounted on pipes as small as 600mm in diameter.	Same as that for T500 type sensor. The magnets attached to the TW type sensor make it easily mountable, even while the object is being water-cooled.																		
<b>Shape &amp; Dimensions</b>	 <table border="0"> <tr> <td>TR2</td> <td>(X) (Y) (t)</td> </tr> <tr> <td></td> <td>100 × 50 × 3</td> </tr> <tr> <td></td> <td>(standard)</td> </tr> <tr> <td>TR6</td> <td>50 × 30 × 3</td> </tr> <tr> <td></td> <td>Following is also available as special order;</td> </tr> <tr> <td>TR3</td> <td>250 × 250 × 3</td> </tr> </table>	TR2	(X) (Y) (t)		100 × 50 × 3		(standard)	TR6	50 × 30 × 3		Following is also available as special order;	TR3	250 × 250 × 3	 <table border="0"> <tr> <td>TM1</td> <td>(X) (Y) (t)</td> </tr> <tr> <td></td> <td>30 × 15 × 1.5</td> </tr> <tr> <td></td> <td>(standard)</td> </tr> </table>	TM1	(X) (Y) (t)		30 × 15 × 1.5		(standard)	 <p>Size of sensor, 38</p> <p>An T500 type sensor of 20mm in diameter is available as a special order. (photo 1)</p>	 <p>Size of sensor, 48</p>
TR2	(X) (Y) (t)																					
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TR3	250 × 250 × 3																					
TM1	(X) (Y) (t)																					
	30 × 15 × 1.5																					
	(standard)																					
<b>Other</b>			Although the T500B type sensor (color : black) is generally employed, use the T500S type sensor (color : silver) for surfaces that are silver color coated or have a metallic luster (emissivity, 0.5 max for both). Also available is the TT type. An T500 type sensor that has been provided with longer durability.  (photo 2)	The TW type sensor for water-cooled surfaces is particularly recommended for operation control of furnaces in view of its remarkable durability.  (photo 3)																		

Photo1

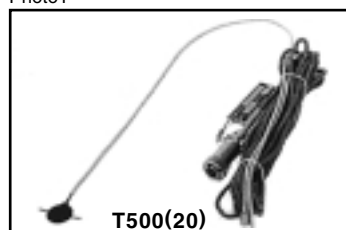





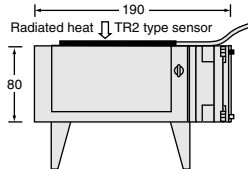
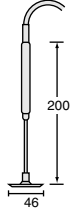
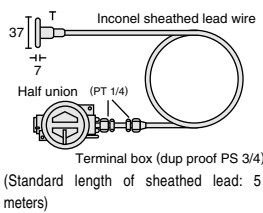
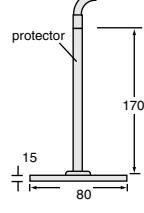
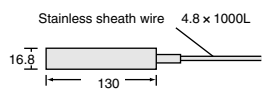


Photo2



Photo3



T750-B	TF-B	TG-B	TC-B	Sensor with heat sink
T750-C	TF-C	TG-C	TC-C	
				
For high heat flow (embedding type)	For high heat flow (durable, embedding type)	For low heat flow (embedding, heat-resistant type)	For low heat flow (durable, embedding type)	For radiated heat
The T750 type sensor was developed for embedding in furnace walls or insulating materials to measure heat flowing from them. As its excellent thermal resistance enables it to be continuously used on parts having temperatures as high as 750 °C, the sensor is highly suited to measuring heat flow from electric furnace walls etc.	Although basically the same as the T750 type, the TF type sensor has much greater durability. Since it can be used continuously for many hours, embedded in high temperature wells of blast furnaces, electric furnaces, etc., the TF type sensor is highly suited for use in operation control.	Highly sensitive and developed for embedding in soil, the TG type sensor is excellent in water, corrosion and thermal resistance. It is, therefore, suited measuring of terrestrial heat in volcanic regions.	Highly sensitive waterproof sensor, durable for embedding in concrete or underground, especially for low temperature (-100 °C), the TC type is ideal for measurement on LNG Container or Freezer.	TR2 type sensor or T500B type sensor equipped with a heat sink. It has a wide variety of applications such as measurement of heat radiation from flames for fire prevention tests, and from the sun.  Low heat flow sensor with heat sink (TR2/HS).
500~50,000 kcal/m <sup>2</sup> · h	500~50,000 kcal/m <sup>2</sup> · h	10~3,000 kcal/m <sup>2</sup> · h	0~2,000 kcal/m <sup>2</sup> · h	 The TR2 type sensor equipped with an air-cooling type heat sink. The radiation fins are forcibly cooled by air.
200~750	200~750	-40~300	-50~150	
Air	Air	Silicone resin	Teflon	
Stainless steel	Inconel	Silicone resin	Stainless	
800 kcal/m <sup>2</sup> · h · mV	1,000 kcal/m <sup>2</sup> · h · mV	60 kcal/m <sup>2</sup> · h · mV	20 kcal/m <sup>2</sup> · h · mV	
Ordinarily position the principal part of the sensor at a right angle to the direction of heat flow, in embedding the sensor in the furnace wall, insulating material or powdery material. When embedding the sensor in powdery materials, use the optionally available support AE1 to keep the sensor in position.	Embed the principal part of the TF-type sensor in the same way as T750 type sensor. Place a support at an appropriate place and mount the terminal heat on it.	Embed the principal part of the sensor in soil, etc. in the same way as T750 type sensor.	Embed sensor in a right angle against heat flow.	
			 Teflon lead (Specify desired length)	
When measuring heat flow from surfaces having temperature of more than 500 °C (750 °C max), use the T750S type sensor.	The terminal head is connected to MC with a pair of copper leads and a pair of CA compensating leads.			The specification of the sensor itself is the same as TR2 and T500B types. Turn over the surface when measured value shows in opposite.

(The specifications are subject to change without notice.)

## Quick Thermal Conductivity Meter

# QTM-500

Probe Sensors to Any of  
Your Application Needs!

Thermal Conductivity of All  
Kinds of Sample Materials  
by Just One TC Meter!



## Specification QTM-500

Type and model name	QTM-500 Quick Thermal Conductivity Meter	
Measuring method	Hot Wire method	
Measuring range	0.023 to 12W/mk	
Precision	± 5% reading value per reference plate	
Reproducibility	± 3% reading value per reference plate	
Temperature	- 10 to 200 (Thermal bath is necessary for measurement at different temperature than room)	
Measuring time	Standard 60sec (specimen must be in equilibrium)	
Sensor	PD-11 Box Probe Constantan heater wire and chromel-alumel thermocouple	
Heater current precision	± 0.05% of setup value	
Display	30 characters 7 lines LCD with back light Display: Thermal conductivity: 0. x x x x ~ x x x . x W/mK Measuring temperature: - 100 to 1000 Guiding message for measurement	
Minimum sample required	approx. 100W x 50L x 20 thick mm or more	
External output	RS232C 1 channels Thermocouple electro-motive force 1 channel	
Ambient condition	Temperature: 5 to 35 Humidity: below 85%RH	
Power source	AC100 to 240V	50/60Hz
Power consumption	60W	
Dimension	Main unit: 300W x 475D x 175Hmm Box probe: 100W x 50D x 100Hmm	
Weight	9kg	
Supplied parts	1. PD-11 Box probe 1pce 2. Probe constant card 1pce 3. Power cord with ground wire 1pce 4. AC3-pin adapter (AC100V area only) 1pce 5. Ground wire 1pce 6. Power fuse 2pce 7. Reference plate: R1-2 Clear quartz in box 1pce R2-2 silicone rubber in box 1pce R3-2 polyethylene form in box 1pce 8. Cooling plate (aluminum) 1pce 9. Brush 1pce 10. Operation manual 1copy	

## Applications

- 1) Research and development of new materials :  
The measurement of Fibers, Papers, Rubbers, Plastics, Glasses, Ceramics and etc.
- 2) Quality control and assesment of performance :  
The measurement of Constructions, Fibers, Papers, Plastics, Concrete, Glasses, Ceramics and etc.

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