## Quick Thermal Conductivity Meter

# QTM-710/700


KYOTO ELECTRONICS MANUFACTURING CO.,LTD.

# SUMMARY

## Quick and Easy Measurement of Thermal Conductivity of Sample!

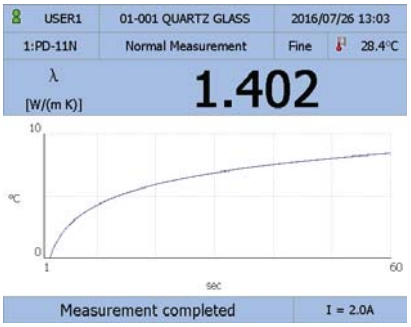
The thermal conductivity of various samples such as block form or sheet in manufacturing, construction, handcraft, soil or the food industry can be measured with the Quick Thermal Conductivity Meter QTM-710/700.
Thermal conductivity can be measured quickly and easily and with good reproduction simply by placing the probe on the uniform-temperature sample surface.

- Thermal insulating material of fiber or foamed plastic
- Plastic, glass, wood, etc.
- Sheet, leather, etc.
- Bread dough, mashed food, powder, etc.
- High heat insulation material, ceramics, etc.

# FEATURE

## Clear and easy operation with the 5.7 inch color LCD touchscreen

The touchscreen enables intuitive operation. The history of the measured values can be called up by pressing the measurement display once, which quickly displays the necessary information and the operation menu.




Result window


## Quick measurement with 3ch probes

Solid surfaces and film can be measured continuously without changing the probe when the same type or other types of various probe are connected.

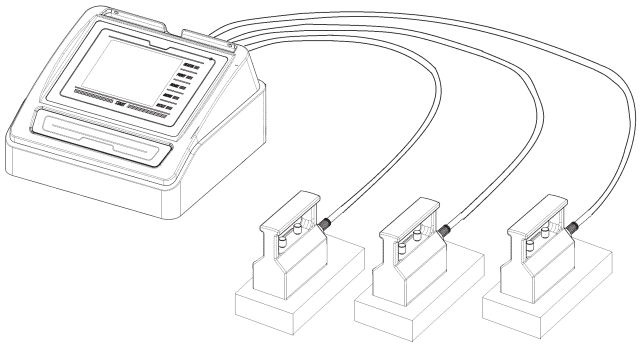
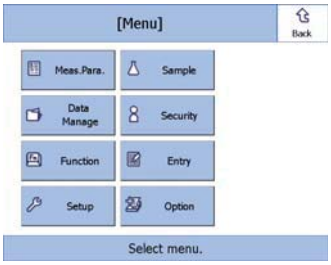



Image of connection of various probes

## Security function

Password settings and security level can be selected according to the intended use and environment.
It is possible to restrict access to certain settings for non-management users.




## Easy data transfer with USB

The measured data are easily transferred to personal computers using USB.
The data are saved in CSV format and can be viewed and edited in spreadsheets.

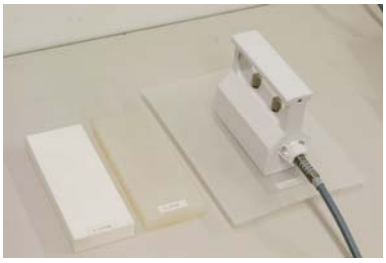

## The probe is traceability compliant

To further improve the reliability of the measured values a traceability system for the thermal conductivity of the standard substance (reference plate) has been set up.

# FEATURE

## Built-in thin film measurement QTM-710

It is possible to measure the thermal conductivity of sheeted samples such as films or a sheet of fiber products.
Display of the average calculation of the measured value and temperature rise features enable easy analysis.



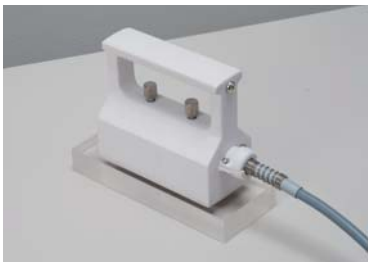
The sheeted sample can be measured without the use of a PC, and the detailed result can be printed out on a connected A4 printer.

| | | | |
|---|---|---|---|
| Model: | QTM-710 | | Print: 2016/07/26 14:40 |
| Serial: | | | Page: 1/1 |
| Operator: | User | Date: | 2015/11/10 12:19 |
| Sample No: | 16-001 | Sample ID: | TF 0.3mm PD-11 6 Q3 |
| Meas.Mode: | Thin Film Measurement | | |
| Probe Unit: | PD-11N | | |
| Probe No: | 00006 | | |
| Probe Const: | Main | | |
| λ: | 0.2035 [W/(m K)] | | |

| | λ [W/(m K)] | 1st | 2nd | 3rd | 4th | 5th | AVG. |
|---|---|---|---|---|---|---|---|
| Polye No.6 QTM70003 | 0.03637 | 0.8303 | 0.8394 | 0.8342 | 0.8294 | 0.8451 | 0.8357 |
| SiliconNo.6 QTM70003 | 0.2228 | -0.03954 | -0.02269 | -0.03809 | -0.01906 | -0.03984 | -0.03184 |
| QuartzNo6 QTM70003 | 1.425 | -0.3844 | -0.4255 | -0.4093 | -0.3787 | -0.4767 | -0.4149 |

## Box type probe PD-11N QTM-710 QTM-700

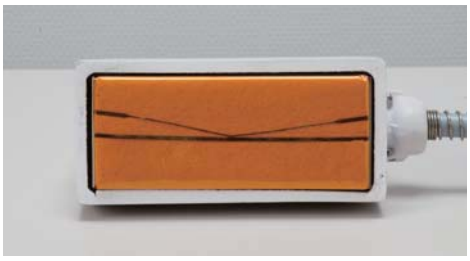
Thermal conductivity is measured by simply placing the probe on a smooth sample surface. The PD-11N enables various measurements of the sample in block, powder and sheet.



- Heat insulation material
- Ceramics
- Rubber
- Plastic
- Glass

## Insulated moisture-proof probe PD-13N QTM-710 QTM-700

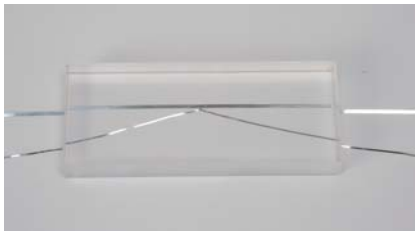
PD-13N is covered the insulation film to PD-11N.
Thermal conductivity of aqueous materials and conductive materials are possible to measure with PD-13N.



- Food
- Concrete paste
- Metal

## High-temperature probe PD-31N QTM-710 QTM-700

Thermal conductivity is measured by placing the sample between the heater and the temperature sensor.
The PD-31N is a conventional type of sensor and allows the thermal conductivity in higher temperature ranges to be measured.



- New material
- Firebrick
- Heat insulation material

## Vessel for powder QTM-710 QTM-700

Thermal conductivity in the bulk density *of the powder sample can be measured using the optional container for powder (using scales). (The mass of the collected sample must be known.)
*To calculate the bulk density the mass of the sample is required.

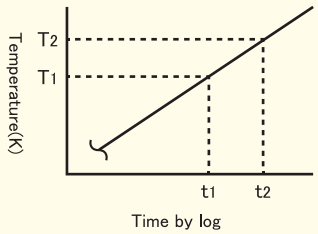
# MEASUREMENT PRINCIPLE

## Hot Wire Method (Transient Hot Wire Method)

The temperature of the heater wire will rise since the heat is generated when applying the constant current to the heater wire stretched in a straight line inside the sample. The temperature rise will be a straight line as shown in the right figure when the time axis is switched to a logarithmic scale.
The angle of this straight line is in reverse proportion to the thermal conductivity of the sample. The angle becomes large if the thermal conductivity of the sample is low, and the angle becomes small if it is high. Therefore, the thermal conductivity can be obtained from this angle.
QTM-710/700 measures the thermal conductivity with the box type probe (PD-11N and PD-13N) which uses the hot wire method and with the high-temperature probe (PD-31N) based on the hot wire method.

$$\lambda = \frac{q \cdot \ln(t_2/t_1)}{4\pi(T_2 - T_1)}$$

| | | |
|---|---|---|
| $\lambda$ | : Conductivity of sample | [W/(m K)] |
| q | : Thermal unit of heater per time and length | [W/m] |
| $t_1$. $t_2$ | : Time | [sec] |
| $T_1$. $T_2$ | : Temperature at t1 and t2 | [K] |




## Thin film measurement

The measurement of thin sheet samples for thermal conductivity is based on the comparison of the sample with a reference plate during a temperature rise when both are heated by the probe.
Before measuring, prepare two to four homogeneous samples of known thermal conductivity. (Fig.1.)

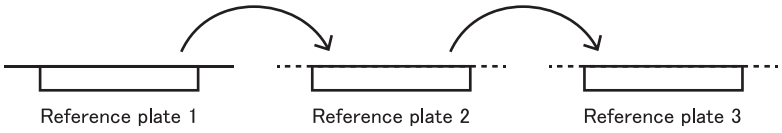


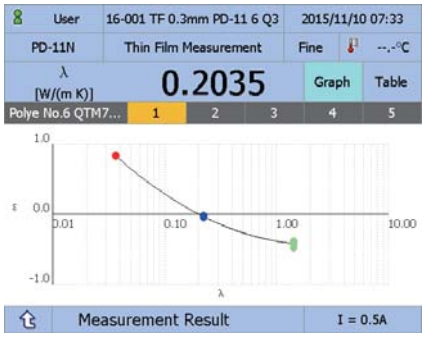

Fig. 1 Measuring method

Place a sample closely on the plate and heat it with the probe. Then, monitor the temperature rise versus logarithmic time for some period to find the deviation from the initial state. Apply this method to a couple of plates and obtain the relation between the thermal conductivity and the deviation.
When the thermal conductivity of the sample is higher than that of reference plate, the deviation becomes positive value, and when it is lower, the deviation becomes negative.

Find the point of intersection where the deviation equals zero on the $\varepsilon$ (deviation) versus $\lambda$ (thermal conductivity) plot.

## Measurement example (thin film measurement)

PTFE sheet




| Ref | Ref λ | 1 | 2 | 3 | 4 | 5 | AVG |
|---|---|---|---|---|---|---|---|
| Polye No.6 QTM | 0.03637 | 0.8303 | 0.8394 | 0.8342 | 0.8294 | 0.8451 | 0.8357 |
| Silicone No.6 QTM | 0.2228 | −0.03954 | −0.02269 | −0.03809 | −0.01906 | −0.03984 | −0.03184 |
| Quartz No.6 QTM | 1.425 | −0.3844 | −0.4255 | −0.4093 | −0.3787 | −0.4767 | −0.4149 |

# PRODUCT STRUCTURE／SPECIFICATION

## Product structure

### ■QTM-710 ＜for sheet sample＞

- Main unit
- Aluminum cooling plate
- Reference plate (clear quartz/silicone rubber/ polyethylene foam)
- Probe is selectable (PD-11N or PD-13N)

### ■QTM-700 ＜Not for sheet sample＞※

- Main unit
- Aluminum cooling plate
- Reference plate (silicone rubber)
- PD-11N or PD-13N

※Note that the thin sheet sample is unable to measure with QTM-700.

## Specification

| Specification | Contents | |
|---|---|---|
| Name | Quick Thermal Conductivity Meter | |
| Type | QTM-710 | QTM-700 |
| Method | Hot Wire Method | |
| Accuracy※1 | Within ±5% reading value per reference plate※2 (room temp. only) | |
| Repeatability※1 | 3% (at the measurement of reference plate) | |
| Thin film measurement | Able | Unable |
| On-window display | 5.7 inch color LCD | |
| Language | English / Japanese / Mandarin Chinese / Korean | |
| External I/O | RS232C ： 2ch (Printer, Data Acquisition Software)<br>USB ： 2ch (Printer, USB flash drive) | |
| Ambient conditions | Temperature : 5 to 35℃<br>Humidity : 85%RH or below (no condensation) | |
| Power supply | DC24V 5A (main unit), AC100-240V±10% 50/60Hz (AC adaptor) | |
| Dimensions | 262(W)×276(D)×158(H)mm | |
| Weight | Approx. 4kg | |
| CE marking | CE marking (EN61326-1, EN61010-1), suitable for RoHS | |

※1 Accuracy and repeatability of thin film measurement depend on the state of the sample.

※2 Reference plate (clear quartz / silicone rubber / polyethylene foam)

＜Normal measurement＞

| Probe | Box type probe PD-11N | Insulated moisture-proof probe PD-13N | High-temperature probe PD-31N |
|---|---|---|---|
| Method | Hot Wire Probe Method | | Hot Wire Method |
| Measurement range | 0.03～12W/(m K) | | 0.06～5W/(m K) |
| Dimensions | 110(W)×50(D)×100(H)mm | | |
| Measurement temperature | 5～35℃ | | -100～1000℃ |
| Measurement time | 60sec | | 60sec※ |
| Sample size | 100×50×20 mm or more | | 100×50×20 mm or more/2 pieces |

※Optionally set the measurement time.

＜Thin film measurement＞

| Probe | Box type probe PD-11N | Insulated moisture-proof probe PD-13N |
|---|---|---|
| Measurement range | 0.03～5W/(m K) | |
| Measurement temperature | 5～35℃ | |
| Measurement time | 60sec | |
| Sample size | Size:100×50 mm or more<br>Thickness:Indication as to the thermal conductivity of the sample.<br>0.1W/(m K) → 0.1mm or more<br>5 W/(m K) → 5mm or more | |

# OPTION

| Part Number | Part Name | Remarks |
|---|---|---|
| 12-06477 | PD-11N Box Type Probe | |
| 12-06477-01 | PD-13N Insulated Moisture-proof Probe | |
| 12-06479 | PD-31N High-temperature Probe | |
| 12-06753 | Reference Plate/Clear Quartz for QTM-700 | Approx. $\lambda$ =1.4 W/(m K) |
| 12-06753-01 | Reference Plate/Silicone Rubber for QTM-700 | Approx. $\lambda$ =0.2 W/(m K) |
| 12-06753-02 | Reference Plate/Polyethylene Foam for QTM-700 | Approx. $\lambda$ =0.03 W/(m K) |
| 12-06753-03 | Plate/Silicone Sponge H for QTM-700 | Approx. $\lambda$ =0.07 W/(m K) |
| 12-06753-04 | Plate/Silicone Sponge L for QTM-700 | Approx. $\lambda$ =0.1 W/(m K) |
| 12-06753-05 | Plate/Zirconia for QTM-700 | Approx. $\lambda$ =3 W/(m K) |
| 12-06753-06 | Plate/Mullite for QTM-700 | Approx. $\lambda$ =5 W/(m K) |
| 12-06753-07 | Plate/Hastelloy C for QTM-700 | Approx. $\lambda$ =9 W/(m K) |
| 20-07341 | Aluminum Cooling Plate | |
| 12-01876 | Vessel for Powder | for PD-11N |
| 69-00670 | Brush | |
| IDP-100 | Dot Matrix Printer | |
| 64-00625 | Connection Cable (MiniDIN8P-DSUB9PM) 160mm | for IDP-100/SOFT-CAP |
| 12-02013 | RS-232C Connection Cable (9P-25P) 1m | for IDP-100 |
| 12-04260 | Printing Roll RP5860 4rolls Set | for IDP-100 |
| 69-00719 | Ribbon Cartridge IR-91B Black | for IDP-100 |
| DP-600 | Thermal Printer | |
| 64-00643-03 | USB Cable | for DP-600 |
| 69-00522-01 | Thermal Roll Paper P-58-30 (10 rolls) | for DP-600 |
| 12-03265 | Data Acquisition Software (SOFT CAP) | |
| 12-02012 | RS-232C Connection Cable (9P-9P) 2m | for SOFT-CAP |
| 64-00177-00 | USB Serial Transducer US232R-10 | for SOFT-CAP |

The above reference plates and plates are also common to QTM-710.

Thermal Printer
DP-600

Dot Matrix Printer
IDP-100

Vessel for powder
12-01876

Reference plate/Aluminum cooling plate

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