



Quick Thermal Conductivity Meter

**QTM-710/700**



# 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 food industry is possible to measure with Quick Thermal Conductivity Meter QTM-710/700.

The thermal conductivity can be measured in a short time, with ease and in a good reproduction just by measuring to place the probe on the sample surface of the uniform temperature.

- 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.

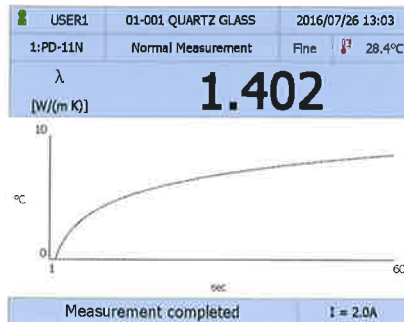


# FEATURE

## Clear and easy operation with the touch-screen of 5.7 inch color LCD

Intuitive operation is possible with touch-screen.  
History of measured values can be seen by pressing the display of the measurement result once, and necessary information and operation menu is displayed speedily.

Result window



## Quick measurement with 3ch probes

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

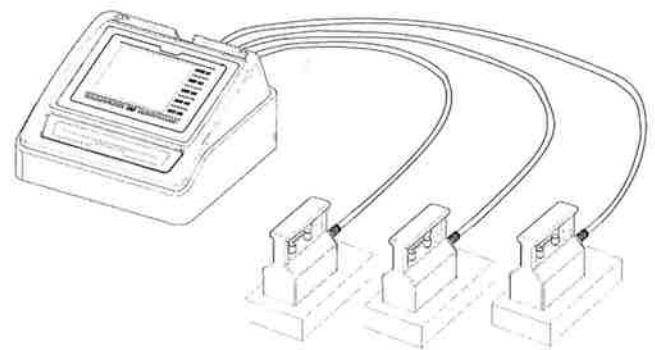
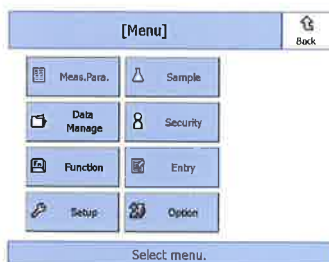


Image of connection of various probes

## Security function

Password setting and security level can be selected in accordance with the intended use and the environment.  
Operation is possible to limit the proper use of manager and users.



## Easy data transfer with USB

Measurement data transfer to personal computer is easy with USB.

Data is possible to view and edit in the spreadsheet software because since being saved in CSV format.



## Probe is compliant with traceability.

Traceability system of the thermal conductivity standard substance (reference plate) is established for the purpose of further improvement of the reliability of the measured values.



## Built-in Thin film measurement QTM-710

Thermal conductivity of the sheeted sample such as a film and a sheet of fiber products is possible to measure.

The result is easy to analyze since an average calculation of the measured value and rise temperature features is able to display.



The measurement of the sheeted sample is possible without personal computer, and the detailed result can be printed to connect with 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		
$\lambda$ :	0.2035 [W/(m K)]		

	$\lambda$ [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
Silicon No.6 QTM70003	0.2228	-0.03954	-0.02269	-0.03809	-0.01906	-0.03964	-0.03184
Quantum6 QTM70003	1.425	-0.3644	-0.4255	-0.4093	-0.3787	-0.4767	-0.4149

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

Thermal conductivity is easy to measure just when placing the probe on the smooth surface of a sample.

Various measurements of the sample in block, powder and sheet are possible with PD-11N.



- 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 being sandwiched the heater and the temperature sensor with the same samples. PD-31N is a conventional type of sensor and the thermal conductivity in higher temperature range is possible to measure with PD-31N.



- New material
- Firebrick
- Heat insulation material

## Vessel for powder QTM-710 QTM-700

Thermal conductivity in the bulk density of the powder sample is possible to measure with the optional vessel for powder (with a scale).

(The mass of the collected sample is necessary.)

※The calculation of bulk density is required the mass of the sample.





# MEASUREMENT PRINCIPLE

## Hot Wire Method (Transient Hot Wire Method)

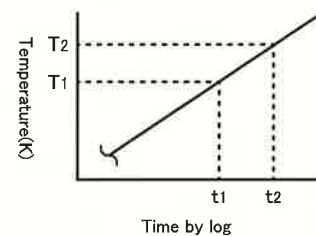
The temperature of the heater wire will rise since the heat is generated when applying the constant current to the heater wire stretched in a straight line inside the sample. The temperature rise will be a straight line as shown in the right figure when the time axis is switched to a logarithmic scale.

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 Box type probe (PD-11N and PD-13N) which applies Hot wire method and High-temperature probe (PD-31N) based on 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  $t_1$  and  $t_2$  [K]



## Thin film measurement

Measurement of thin sheet sample for thermal conductivity is based on the comparison of sample with a reference plate in temperature rise when both of them are heated by the probe.

Before measurement, prepare two to four homogeneous samples of known thermal conductivity. (Fig. 1.)

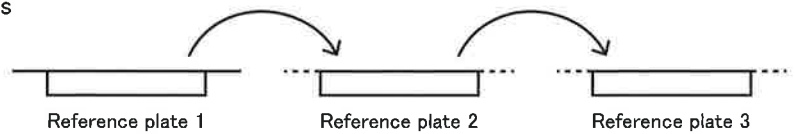


Fig. 1 Measuring method

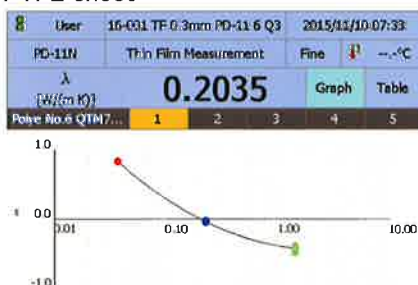
Place a sample closely on the plate and heat it by the probe. Then, monitor the temperature rise versus logarithmic time for some period to find the deviation from the initial state. Apply this method to a couple of plates and obtain the relation between the thermal conductivity and the deviation.

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 $\lambda$	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 $\pm 5\%$ 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	
External I/O	RS232C : 2ch (Printer, Data Acquisition Software) USB : 2ch (Printer, USB flash drive)	
Ambient conditions	Temperature : 5 to 35°C Humidity : 85%RH or below (no condensation)	
Power supply	DC24V 5A (main unit), AC100-240V $\pm 10\%$ 50/60Hz (AC adaptor)	
Dimensions	262(W) $\times$ 276(D) $\times$ 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 (Quartz glass / 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) $\times$ 50(D) $\times$ 100(H) mm		
Measurement temperature	5~35°C		-100~1000°C
Measurement time	60sec		60sec*
Sample size	100 $\times$ 50 $\times$ 20 mm or more		100 $\times$ 50 $\times$ 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°C	
Measurement time	60sec	
Sample size	Size:100 $\times$ 50 mm or more Thickness:Indication as to the thermal conductivity of the sample	

Part Number	Part Description	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. $\lambda = 1.4 \text{ W/(m K)}$
12-06753-01	Reference plate/Silicone rubber for QTM-700	Approx. $\lambda = 0.2 \text{ W/(m K)}$
12-06753-02	Reference plate/Polyethylene foam for QTM-700	Approx. $\lambda = 0.03 \text{ W/(m K)}$
12-06753-03	Plate/Silicone sponge H for QTM-700	Approx. $\lambda = 0.07 \text{ W/(m K)}$
12-06753-04	Plate/Silicone sponge L for QTM-700	Approx. $\lambda = 0.1 \text{ W/(m K)}$
12-06753-05	Plate/Zirconia for QTM-700	Approx. $\lambda = 3 \text{ W/(m K)}$
12-06753-06	Plate/Mullite for QTM-700	Approx. $\lambda = 5 \text{ W/(m K)}$
12-06753-07	Plate/Hastelloy C for QTM-700	Approx. $\lambda = 9 \text{ W/(m K)}$
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 M-677 MiniDIN8P-DSUB9PM	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	USB2.0 Cable L=0.9m USB2-AMBM-03	for DP-600
69-00522-01	Thermal Roll Paper P-58-30 (10 rolls)	for DP-600
12-03265	Data Acquisition Software	
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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