

THERMAL CONDUCTIVITY INSTRUMENT

- Conforms to ASTM C 518 & ISO 8301
- Specimen size: 63mm (2.5") diameter
- Thickness Range from 0 to 25 mm (1")
- Compact size
- Accuracy better than 4%
- Easy to use, rapid operation
- Microprocessor based
- Stand alone operation
- Adapts to non parallel samples
- Operation from 50°C to 190°C (plate)
- Digital Thickness readout to 0.001"
- Powerful 24 Bit A/D Converter
- Two Thin-Film Heat Flux Transducers
- Temperature Control to 0.01°C
- Two Pyrex Standards provided
- Ideal for higher conductivity materials
- No need to recalibrate for years
- Full One Year Parts and Labor Warranty
- Suitable for R&D and QC testing
- WinTherm50 Software extends flexibility
- Extremely energy efficient



Eliminates Air Interface in Calculation

Regular Heat Flow Meter instruments measure only the **sum** of the sample's thermal resistance and the sample/instrument's thermal contact resistances. The FOX50 instrument using "Wintherm50" software developed by LaserComp, Inc. is able to measure both these values using the Two-Thickness Procedure of calibrations and tests. This gives accurate thermal conductivity measurements of the sample itself.

The sophisticated digital temperature control algorithm monitors the plate temperatures 20 times per second and rapidly brings the system to the selected equilibrium test condition. Outlets in the back of the FOX50 enable use of additional thermocouples to measure the temperature of the sample's surfaces.

Instrument Description and Procedure

The FOX50 instrument consists of two basic sections: the main body and the stack section. All the electronics are housed in the main body. The stack section of the instrument is the actual test chamber. The sample can be placed between the two plates in the test stack. The upper plate is stationary. The lower plate pneumatically moves up and down to assure good contact with the sample and minimize interface resistance. The displayed thickness will be accurate to within 0.025mm (0.001") of the sample thickness. Pressing ENT will initiate the test at the first setpoint. The instrument automatically advances to the next setpoints if more than one were entered. The results are displayed at the end of the test.

Option to Eliminate Air Interface in Calculation

The FOX50 provides the ability to measure a sample's thermal conductivity without the error introduced by the inclusion of the air interface resistance, which can be more than that of the sample. It uses the same Two-thickness measurements used by The National Institute of Standards and Technology (NIST) to get reliable thermal conductivity values of Pyroceram on their Guarded-Hot-Plate.

Transducers and Thermocouples

A high output Thin Film Heat Flux Transducer, developed by LaserComp, is permanently bonded to the surface of each plate. The transducers are of the integrating type with a 1" by 1" active area in the center. Overall thickness is only 0.040", precluding heat flow distortion. A type E thermocouple is bonded in the center of each transducer and both are sealed to insure consistent precision over time. Because each is within 0.005" of the sample's surface they provide accurate readings of the sample's surface temperature (within 0.01°C) and heat flux (within 0.6µV). The same thermocouple is used for control of the plate temperature.

Electronic Power and Control

At the heart of the FOX50 instrument is a very powerful Digital Signal Processor and a 24 Bit Analog to Digital Converter. The A/D Converter converts the signals from the thermocouples and heat flow transducers to the digital domain. The resolution on the conversion is 0.6 µV. This translates to a resolution of 0.01°C for temperature. For typical samples the resolution of transducer readings is 0.05%.

The DSP controls all aspects of the instrument's operation, from the user interface to sending data to the host computer and calculating the results. The

fox50

Specimen Size:	63 mm (2.5") diameter 0 to 25 mm (0 to 1") thick
Temperature range:	50°C to 190°C (122°F to 374°F)
Absolute accuracy:	+/- 5%
Reproducibility:	+/- 2%
Conductivity range:	0.1 to 10 W/mK (0.633 to 60.3 BTU in/hr ft ² °F)
Conductance:	should not exceed: 600 W/m ² °C (110 BTU/h ft ² °F)
Utility requirements:	110/220V 50/60 Hz switchable at 300VA cooling water at 18°C or less air pressure @ 4atm (60 psi) very low consumption

DSP's most important task is to monitor the temperatures of the plates and to perform a multistage PID algorithm to control the plates at +/- 0.01°C of the test setpoint temperature. Based on the outcome of the algorithm, new control signals are sent to the Power Output Board in each acquisition cycle (every 0.5 sec.). The Power Output Board provides the power to the solid state heating/cooling system in each plate. Both plates are identical allowing for testing with heat flow up or down. The low thermal mass design of the plates combined with the power of the DSP and Power Output Board enable extremely fast attainment of setpoints.

Wintherm50 Software

Wintherm50 Software package operating under Microsoft Win95/98 or NT/XP allows for connection of FOX50 to an IBM compatible computer through a standard RS 232 interface. Through a series of windows all the test parameters and format of outputs can be setup and changed at any time during the test. The software provides complete control of the instrument at all times. All selected data is automatically stored on a hard disk. Once the test conditions have been set and the test started, the computer can be used to display any desired outputs in a series of windows. Two FOX50 (and as many as 8 with modest additional hardware) instruments can be run simultaneously on one host computer.