Decagon KD2 Pro

The KD2 Pro is a handheld device used to measure thermal properties. It consists of a handheld controller and sensors that can be inserted into almost any material. The single needle sensors measure thermal conductivity and resistivity; while the dual needle sensor measures thermal conductivity, resistivity, volumetric specific heat capacity and diffusivity.

KD2 Pro Thermal Properties Analyser Features
The KD2 Pro is a fully portable field and lab thermal properties analyser. It uses the transient line heat source method to measure thermal conductivity, resistivity, diffusivity, and specific heat. Sophisticated data analysis is based on 30+ years of research experience on heat and mass transfer in soils and other porous materials.

Excellent Accuracy
The compact KD2 Pro controller is much more than a simple readout for time and temperature. A proprietary algorithm fits time and temperature data with exponential integral functions using a non-linear least squares method. This fully mathematical solution delivers thermal conductivity/resistivity to within ±10%.

Corrects for Temperature Drift
Temperature changes of a thousandth of a degree per second -the sun warming the soil, for example, or someone walking into the lab – destroy the accuracy of thermal properties calculations. Unlike other thermal needle systems, the KD2 Pro corrects for linear temperature drift that can cause large errors.

Applications:

- Greenhouse Management
- Microbial Ecology
- Watershed Characterisation
- Plant Ecology
- Soil Respiration

ABOUT THE KD2 PRO THERMAL PROPERTIES ANALYSER

CHOOSING A SENSOR

The KD2 Pro comes with three separate sensors designed for measurements in specific sample types, the KS-1, TR-1, and SH-1. The RK-1 is also available for purchase with your KD2 Pro.

The read time is the time, in minutes, the KD2 Pro takes to gather data for computing thermal properties. It applies heat to the sensor for half of the set time, and takes measurements over the full time. The KD2 Pro waits thirty seconds for temperature equilibration before heating starts, so the entire measurement time should be the "Read Time" plus 30 seconds. The sensor takes sixty temperature readings during the read time, so the number entered here also determines the number of seconds between temperature readings. This number displays in the upper right corner of the screen and is available with each data record after downloading. Default read times are one minute for the KS-1 sensor, two minutes for the SH-1 sensor, five minutes for the TR-1 sensor, and ten minutes for the (optional) RK-1 Sensor.

KS-1

The small (6 cm long, 1.3 mm diameter) single needle KS-1 sensor measures thermal conductivity and thermal resistivity. We designed the KS-1 for liquid samples and insulating materials. However, the small size of the needle and typically short heating time make the KS-1 a poor choice for granular samples such as soil and powders where contact resistance can be an important source of error.

Decagon KD2 Pro

TR-1

The large (10 cm long, 2.4 mm diameter) single needle TR-1 sensor measures thermal conductivity and thermal resistivity. We designed the TR-1 primarily for soil, concrete, and other granular or solid materials. However, despite its durability, the TR-1 is a hollow needle that will bend with enough applied force.

SH-1

The dual needle SH-1 sensor measures volumetric heat capacity, thermal diffusivity, thermal conductivity, and thermal resistivity. The SH-1 is compatible with most solid and granular materials, but operator's should not use it in liquids due to the large heat pulse and resulting free convection in liquid samples.

RK-1

The thick (6 cm long, 3.9 mm diameter) single needle RK-1 sensor measures thermal conductivity and thermal resistivity. We designed the RK-1 specifically for use in hard materials like rock or cured concrete, where you must use a rotary hammer to drill a hole to accommodate the sensor.

SENSOR	TR-1	RK-1	KS-1	SH-1
MEASUREMENT ACCURACY	Read time: 5 Minutes (Conductivity): ±10% from 0.2 – 4 W/(m·K) ±0.02 W/(m·K) from 0.01 – 0.2 W/(m·K)	Read time: 10 Minutes (Conductivity): ±10% from 0.2 – 6 W/(m·K) ±0.02 W/(m·K) from 0.1 – 0.2 W/(m·K)	Read time: 60 Seconds (Conductivity): ±5% from 0.2 – 2 W/(m·K) ±0.01 W/(m·K) from 0.02 – 0.2 W/(m·K)	Read time: 2 Minutes (Conductivity) ±10% from 0.2 – 2 W/(m·K) ±0.01 W/(m·K) from 0.02 – 0.2 W/(m·K) (Diffusivity) ±10% at conductivities above 0.1 W/(m·K) (Volumetric Specific Heat) ±10% at conductivities above 0.1 W/(m·K)

RANGES

Enabling better global research outcomes in soil, plant & environmental monitoring.
www.ictinternational.com : sales@ictinternational.com.au : +612 6772 6770

ICT
INTERNATIONAL

Decagon KD2 Pro

Specifications

Accuracy:	± 5 to ± 10% Thermal Conductivity/Resistivity ± 10% Specific Heat ± 10% Thermal Diffusivity
Measurement Speed:	1, 2, 5, & 10 min. read times depending on measurement type (see user's manual for more information).
Data Storage:	4,095 readings, flash memory
Compliance to Standards:	ASTM Standard D5334-08 and IEEE Standard 442-1981
Operating Environment of Sensors:	-50° to 150°C
Battery Source:	4 AA
Auto-Read Mode:	Users can collect unattended data at user-defined intervals in the auto-read mode
Type:	Ultra low-power 16-bit microcontroller w/ 24-bit A/D converter
Display:	Liquid Crystal Display (LCD) 7.5 cm x 4 cm
Case Dimensions:	15.5 cm x 9.5 cm x 3.5 cm
Included Accessories:	KS-1 Thermal Conductivity/Resistivity sensor (for liquids) TR-1 Thermal Conductivity/Resistivity sensor (for solids) SH-1 Dual-Needle Thermal Diffusivity and Specific Heat sensor (for solids) User's manual Pelican carrying case Readout stand Performance verification standards Thermal grease Drill bit for drilling pilot holes in materials Concrete pilot pin KD2 Pro download utility RS232 cable
Calibration:	Each KD2 Pro comes factory calibrated and includes performance verification standards
Range of Measurements:	K: 0.02 to 4 $Wm^{-1} C^{-1}$ D: 0.1 to 1.0 $mm^2 s^{-1}$ R: 0.25 to 50mC W^{-1} C: 0.5 to 4 $MJ\ m^{-3} C^{-1}$* Accuracy and measurement range vary with sensor type.