Measuring Thermal Properties in the field or the lab has never been easier with the KD2 or KD2 Pro.

- Decagon manufactures easy-to-use instrumentation for the measurement of thermal properties: thermal conductivity, thermal resistivity, specific heat (heat capacity) and thermal diffusivity.

Below are the standards, the approved methods, and the specified needle dimensions.

The KD2 Pro TR-1 needle is 2.4mm in diameter and 100mm long. The KS-1 needle is 1.27mm in diameter and 60mm long.

**AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)**

- **STANDARD D5334-00**
  - This standard specifies a transient heated needle method.
  - 1. Needles should be 100mm long, 1.8mm in diameter.
  - The Annex note A1.1 specifies that a shorter needle may be used. For soft rock samples, a shorter needle may be used. The needle length should not be less than 25.4mm to avoid boundary effects.
  - 2. ASTM also recommends using thermal grease to provide better contact between the sample and the probe. Each KD2 Pro shipment includes thermal grease.
  - 3. This method is the same as the transient line heat source (below) D5930-01.

**INSTITUTE OF ELECTRICAL & ELECTRONIC ENGINEERS (IEEE)**

- **STANDARD 442-1981**
  - This standard specifies a line heat source technique.
  - 1. IEEE specifies two lengths of needles:
    - Field- 200cm long and 8mm in diameter
    - Lab- 100mm long and 2.4mm in diameter.
  - "The two techniques differ primarily in the size of the needle and portability requirements."

**SOIL SCIENCE SOCIETY OF AMERICA (SSSA), METHODS OF SOIL ANALYSIS PART 4 PHYSICAL METHODS 5.3**

- Thermal Conductivity pp 1209-1226
  - This standard specifies a line heat source technique.
  - 1. "Line heat source probes use of thin needles made from stainless steel tubing roughly 1mm in diameter has proved successful."
  - 2. Typical lengths of the single probe vary from 3 to 25cm.
KD2 Pro Complies with Published Standards

Below are the standards, the approved methods, and the specified needle dimensions.

The KD2 Pro TR-1 needle is 2.4mm in diameter and 100mm long. The KS-1 needle is 1.27mm in diameter and 60mm long.

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM) STANDARD D5334-00
This standard specifies a transient heated needle method.
1. Needles should be 100mm long, 1.8mm in diameter.
   The Annex note A1.1 specifies that a shorter needle may be used. For soft rock samples, a shorter needle may be used. The needle length should not be less than 25.4mm to avoid boundary effects.
2. ASTM also recommends using thermal grease to provide better contact between the sample and the probe. Each KD2 Pro shipment includes thermal grease.
3. This method is the same as the transient line heat source method (below) D5930-01.

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM) STANDARD D5930-01
This standard specifies a transient heated needle method.
1. Needles should have a length-to-diameter ratio greater than 20.
2. This method is the same as the transient heated needle (above) D5334-00.

INSTITUTE OF ELECTRICAL & ELECTRONIC ENGINEERS (IEEE) STANDARD 442-1981
This standard specifies a line heat source technique.
1. IEEE specifies two lengths of needles:
   Field- 200cm long and 8mm in diameter
   Lab- 100mm long and 2.4mm in diameter.
   "The two techniques differ primarily in the size of the needle and portability requirements."

SOIL SCIENCE SOCIETY OF AMERICA (SSSA), METHODS OF SOIL ANALYSIS PART 4 PHYSICAL METHODS 5.3
Thermal Conductivity pp 1209-1226
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1. "Line heat source probes use of thin needles made from stainless steel tubing roughly 1mm in diameter has proved successful."
2. Typical lengths of the single probe vary from 3 to 25cm.
The KD2 Pro uses three interchangeable sensors to measure thermal diffusivity, specific heat (heat capacity), thermal conductivity and thermal resistivity. Using the transient line heat source method, the KD2 Pro takes measurements at 1-second intervals during a 90-second measurement cycle. It then analyzes the data and corrects for sample temperature drift—providing accurate thermal properties measurements.

Users can read values directly or download raw values for analysis as required by IEEE and ASTM Standards. It also features an automated mode where users can set the measurement interval and collect unattended data.

The new KD2 Pro

- Single Needle Technology
- Requires No Calibration
- Stainless Steel Case
- Displays in Engineering Units
- Small Needle Minimizes Material Disturbance

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Each KD2 Pro comes factory calibrated and includes performance verification standards.

The original KD2

The pocket-sized KD2 uses a single sensor to measure thermal conductivity and thermal resistivity. It uses the transient line heat source method to calculate and display the thermal conductivity in 90-seconds. The small needle size results in very little compaction during installation and allows for a short heating time—minimizing thermally induced drying around the probe.

The thermal conductivity of ice is not constant. It is a function of the rate of freezing.

The KD2 is ideal for fast measurement of thermal conductivity in a variety of solids and liquids.

KS-1 6cm SENSOR

The KS-1 is ideal for measuring thermal conductivity and thermal resistivity. Conforms to ASTM Standard D5334-00.

TR-1 10cm SENSOR


SH-1 30mm Dual SENSOR

The SH-1 is the only sensor that measures thermal diffusivity and specific heat. 30mm long, 1.28mm diameter, 6mm spacing.

Measurement Time
90 Seconds

Accuracy*
7% Specific Heat
5% - 10% Thermal Conductivity/Resistivity
5% Thermal Diffusivity

Measurement Ranges*
K: 0.02 to 2 Wm$^{-1}$C$^{-1}$
D: 0.1 to 1.0 mm$^2$s$^{-1}$
R: 0.5 to 50 mC W$^{-1}$
C: 0.5 to 4 MJ m$^{-3}$C$^{-1}$

Cable Length
0.8m

Cable Length
0.8m

Case Size
15.5cm x 9.5cm x 3.5cm

Data Storage
4096 readings, flash memory

Power Requirement
4 AA Batteries

KD2 Specifications

- Single Needle Technology
- Requires No Calibration
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*Accuracy and measurement range vary with sensor type.

www.thermal.decagon.com