Hukseflux
Thermal Sensors

TRSYS01

High-accuracy building thermal resistance measuring system with two measurement locations

TRSYS01 is a high-accuracy system for on-site measurement of thermal resistance, R, thermal conductance, the Λ-value, and thermal transmittance, the U-value, of building envelopes. TRSYS01 is mostly used for measurements according to standard practices of ISO 9869 and ASTM C1155 / C1046. The system is equipped with high-accuracy electronics, two heat flux sensors of model HFP01 as well as two pairs of matched thermocouples. The two measurement locations provide redundancy, leading to a high level of confidence in the measurement result. The high accuracy of the heat flux sensors and temperature difference measurements ensures that TRSYS01 continues measuring when other systems no longer perform; in particular at very low temperature differences across the wall.

Figure 1 *TRSYS01: the complete measuring system includes 2 HFP01 heat flux sensors and 2 matched TC thermocouple pairs (in total 4 temperature sensors) and the MCU01 measurement and control unit*

Figure 2 *HFP01 heat flux sensor and TC mounted on a wall*

Introduction

On-site measurements of thermal resistance, R, are often applied in studies of buildings. Alternatives are to measure its inverse value, the thermal conductance which is called the Λ-value, or the thermal transmittance which includes ambient air boundary layer thermal resistance, the U-value. The measurements of R are based on simultaneous time averaged measurement of heat flux Φ and differential temperature, ΔT, (using two temperature sensors on each on a different side of the wall).

$R = \Delta T / \Phi$

The ISO and ASTM standards give detailed directions concerning the measurement method, sensor installation and data analysis.
The TRSYS01 system employs dedicated sensors and electronics. Their high accuracy and sensitivity ensure that TRSYS01 will still measure under circumstances where competing systems no longer perform reliable measurements; i.e. down to very low heat fluxes and low temperature differences across the wall. The matched thermocouple pairs in TRSYS01, model TC, measure temperature differences with an uncertainty of better than 0.1 °C over the entire rated temperature range. TRSYS01 includes 2 x HFP01 heat flux plates. HFP01 is the world's most popular sensor for heat flux measurement in studies of buildings.

The system generates a measurement file, including time, heat flux, temperature and temperature difference for the two measurement locations. The measurement is stored in the MCU01 measurement and control unit, and later downloaded to a PC. The user is responsible for

data analysis, calculating the R-value or U-value of the building envelope according to the ISO or ASTM standards.

Suggested use

- building U-value and R-value measurement

Robust and stable

Equipped with heavy-duty components, TRSYS01 has proven to be very robust and stable. It survives repeated installation necessary in this application where measuring systems are typically used at multiple locations.

Expert training in thermal measurement

The measurements and the analyses that have to be performed are not straightforward; although the measurements are standardised, this always involves a significant element of expertise and a subjective data interpretation. Hukseflux helps to gain the necessary experience by offering operator training. Training vastly improves the level of service to the end user, the efficiency of working with the equipment and reduces the uncertainty of the end result. Please contact us for more information on training courses in thermal measurement at Hukseflux.

Calibration & conformity assessment

Calibration of TRSYS01 components is traceable to international standards. HFP01 and MCU01 are traceable to the international standards for voltage, current and length, the thermocouples to ITS-90. TRSYS01 undergoes a functional test at the factory. This conformity assessment includes temperature difference measurement accuracy.

Figure 3 *The robust and stable TRSYS01 system, including its MCU01 measurement and control unit, is supplied in a rugged carrying case*

TRSYS01 specifications

Measurand	heat flux (2 x)
Measurand	temperature (2 x)
Measurand	temperature difference (2 x)
Required data analysis to determine building R-value and U-value	to be performed by the user according to ISO and ASTM standard practices
Standards governing use of measuring system	ISO 9869 and ASTM C1155 / C1046
Number of measurement locations	2
Cable length per location	location 1: 10 m location 2: 20 m
Rated operating temperature range HFP01 and TC	-30 to +70 °C
Uncertainty of calibration heat flux sensors	± 3 % (k = 2)
Guard width to thickness ratio	5 m/m (as required by ISO 9869 D.3.1)
Acceptance interval temperature difference measurement	± 0.1 °C (required by ISO 9869, paragraph 5.2)
Measurement duration range	> 3 days
Data storage capacity	> 30 days
Adapter rated power supply	110-220 VAC, 50 / 60 Hz

MCU specifications

Temperature difference measurement resolution	0.02 °C
Heat flux measurement resolution	0.02 W/m^2
Connection to PC	via USB or RS232

Options

- rechargeable battery pack for autonomous use
- LP02 pyranometer
- more measurement locations

About Hukseflux

Hukseflux Thermal Sensors offers measurement solutions for the most challenging applications. We design and supply sensors as well as test & measuring systems, and offer related services such as engineering and consultancy. Hukseflux is ISO 9001:2008 certified. Hukseflux sensors, systems and services are offered worldwide via our office in Delft, the Netherlands and local distributors.

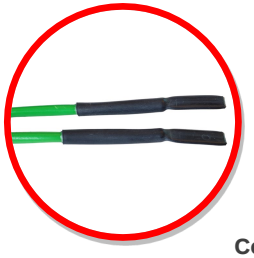
Interested in this product?
E-mail us at: info@hukseflux.com

Hukseflux
Thermal Sensors

MARKET LEADER IN HEAT FLUX MEASUREMENT

TRSYS outperforms other models and complies with ISO and ASTM standards: how?

TRSYS is the world's highest accuracy measuring system for building envelope thermal resistance measurement. It is one of the few systems with true compliance to ISO 9869. Purchasing a TRSYS is a good investment in accurate and stable measurement. TRSYS complies with the acceptance interval of the temperature difference measurement specified by ISO 9869 of ± 0.1 °C.



Temperature difference sensors: tested for 0.1 °C accuracy requirements

TRSYS thermocouple + electronics configuration meets ISO 9869 requirements of 0.1 °C accuracy over the 20 to 50 °C temperature range. Competitors are not tested for this.

Superior heat flux sensor, stable: waterproof (IP 67), corrosion-proof

Read more about why HFP01 is the best: high sensitivity, low thermal resistance, integrated passive guard, integrated thermal spreader.

Compliance testing: temperature difference test: step 1 at 20 °C

Put a pair of temperature sensors in a stirred glass of water of around 20 degrees C. Is the difference < 0.1 °C ? [PASS]
Difference > 0.1 °C ? [FAIL]
This test is done with every sensor pair in TRSYS.

Compliance testing: temperature difference test: step 2 at 50 °C

Put a pair of temperature sensors in a stirred glass of water of around 50 degrees C. Is the difference < 0.1 °C ? [PASS]
Difference > 0.1 °C ? [FAIL]
This test is done with every sensor pair in TRSYS.

Continues measuring when others give up: high sensitivity amplifier + high sensitivity sensors

The high accuracy of the heat flux sensors and temperature difference measurements ensures that TRSYS01 continues measuring when other systems no longer perform; in particular at very low temperature differences across the wall.

1 µV
60 µV/(W/m^2)
=> res 0.02 (W/m^2)
0.05 °C

Durable: sturdy "student and installer- proof"

TRSYS withstands rough handling and repeated installations typical for building applications. Student and installer- proof! Competing systems are often not suited to rough handling. Competing sensors often are mechanically weak.

Best paperwork

Hukseflux has the paperwork covered; HFP01 is provided with formally traceable calibration certificates. We calibrate in accordance with ASTM C1130. Also the temperature difference sensors are "individually" tested as matched pairs