HUKX

Sensor
Technology

Brochure

Foil heat flux sensor

FHF06

FHF06
High-temperature foil heat flux sensor

for temperatures up to 250 °C

Do you need a thin, flexible, and sensitive heat flux sensor that can withstand high temperatures? FHF06 foil heat flux sensor offers all that and more. With a rated temperature range from -70 to +250 °C, FHF06 measures heat flux from conduction, radiation, and convection. In case you do not need the high temperature range, consider our FHF05 series heat flux sensors. If FHF05 series or FHF06 do not meet your specific requirements, explore our full range of heat flux sensor models for special applications.

FHF06: Heat flux measurement in high-temperature environments

FHF06 is a high-temperature foil heat flux sensor engineered for temperatures up to 250 °C. This capability is made possible by its all-polyimide design, without using any glues. Other members of the FHF family, such as the FHF05 series sensors, are rated for use up to 120 °C. Like all FHF sensors, FHF06 is thin, flexible, and versatile.

Figure 1 FHF06 high-temperature foil heat flux sensor being used to monitor the performance of an oven. The sensor is suitable for use at temperatures up to 250 °C.

FHF06 measures heat flux (in W/m²) either through the object in which it is incorporated or on which it is mounted. Each sensor contains a thermopile that measures the temperature difference across FHF06's flexible body, which directly translates to heat flux. An integrated Type T thermocouple provides additional temperature measurement. Both the thermopile and thermocouple are passive sensors and do not require external power.

Figure 2 FHF06 high-temperature foil heat flux sensor installed for measurement on a car exhaust pipe. The sensor may be mounted on a curved surface.

Multiple small thermal spreaders form a conductive layer covering the sensor, reducing the thermal conductivity dependence of the measurement. With these incorporated spreaders, the sensitivity of FHF06 is independent of the thermal properties of its environment.

Using FHF06 is easy. It connects directly to commonly used data logging systems. The heat flux (in W/m²) is calculated by dividing FHF06's output, a small voltage, by the sensitivity, which is provided on its certificate.

Unique features and benefits

– high temperature resistance up to 250 °C continuous use
– flexible (bending radius ≥ 7.5 x 10^{-3} m)
– low thermal resistance
– fast response time
– integrated Type T thermocouple
– robust design, including cable connection block for strain relief
– IP67 protection rating (essential for outdoor and humid environments)
– integrated thermal spreaders for low thermal conductivity dependence
– sensor foil only: may be used in vacuum environments

Robust and stable

FHF06 has proven to be very robust and stable. The instrument is equipped with a potted cable connection block that prevents moisture from entering and also serves as strain relief.

Suggested use

Typical applications for FHF06:
– monitoring of plastics and composite molding
– battery research; thermal runoff
– analysis of industrial ovens
– rockets and space vehicles

Figure 3 The thin and flexible FHF06 can be easily mounted on a curved surface, like a pipe or tube.

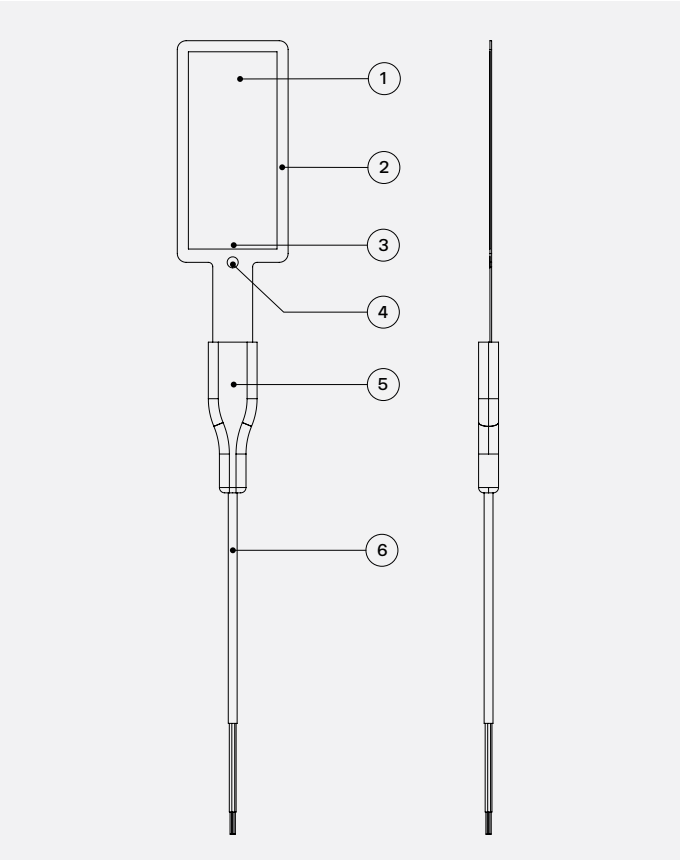

Figure 4 FHF06 high-temperature foil heat flux sensor:
1. sensing area with thermal spreaders
2. passive guard
3. Type T thermocouple
4. dot indicating front side
5. cable connection block for strain relief
6. cable, standard length is 2 m. Can be 2, 5 or 10 m.

Suitable electronics

The combined measurement of heat flux and temperature provides a complete picture of the system's thermal behavior. Heat flux sensors produce a small millivolt signal output and are often combined with thermocouples as part of a larger test or measuring system. We have several preferred solutions for amplification, data logging, and data visualization. To learn more, view our application notes on sensor amplification or FHF sensors with Hioki data loggers.

Options

– with 5 or 10 m cable lengths
– separate cable in 2, 5, or 10 m lengths
– sensor foil only (without wiring and without connection block)
– LI19 hand-held read-out unit/data logger
NOTE: LI19 measures heat flux only.

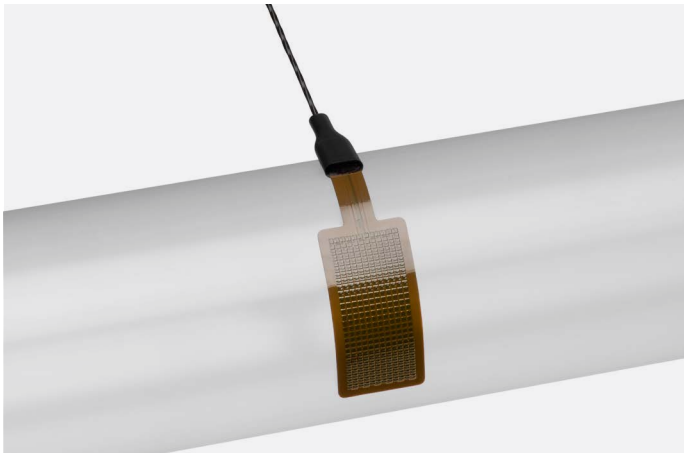

Figure 4 FHF06 high-temperature foil heat flux sensor with integrated thermal spreaders: thin, flexible, and versatile.

Calibration

FHF06 calibration is traceable to international standards. The factory calibration method follows the recommended practice of ASTM C1130-21.

Working with heat flux sensors

When used under high-temperature conditions, the FHF06 sensitivity to heat flux may be different than stated on its certificate. Refer to the user manual for correcting this temperature dependence.

Installation

There are various ways to install a heat flux sensor. See our application note on how to install a heat flux sensor for more information.

See also

– FHF05 series: general-purpose heat flux sensor in five sizes with five sensitivities
– FHF05SC series: for a self-calibrating version of FHF05-50X50 and -85X85
– HTR02 series heater: for calibration and verification of the performance of FHF-type sensors
– Hukx offers a complete product range of high-quality heat flux sensors for any budget

FHF06 specifications

General specifications

measurand	heat flux
measurand	temperature
temperature sensor	Type T thermocouple, IEC 60584-1 Class 2*
thermal spreaders	included
rated bending radius	≥ 7.5 x 10^{-3} m
rated load on cable	≤ 1.6 kg
outer dimensions (w x b) foil with guard	(25 x 50) x 10^{-3} m
sensor thermal resistance	12 x 10^{-4} K/(W/m^2)
sensor thickness	0.38 x 10^{-3} m
uncertainty of calibration	± 5 % (k = 2)
measurement range	(-20 to +20) x 10^{3} W/m^2
sensitivity (nominal)	5 x 10^{-6} V/(W/m^2)
asymmetry	< 2 %

rated operating temperature range continuous use** cable: connection block: label at the end of the cable:	 -70 to +250 °C -70 to +250 °C -70 to +250 °C -40 to + 120 °C
IP protection class	IP67***
rated operating pressure range	up to 25 bar
standard cable length options	2 m 5 or 10 m cable length separate cable without cable****

* Temperature measurement uncertainty: ± 1 or 0.0075 × T °C. For details, see the user manual.

** When measuring at temperatures of -160 °C, contact Hukx.

*** See appendix on long-term use under condensing, wet, and underwater conditions.

**** Sensor foil only (without cable and cable connection block) may be used in vacuum environments.

About Hukx

Hukx is the leading innovator in solar radiation and heat flux sensor technology. We are proud to set the standard in high-accuracy measurement, and to be working at the heart of the energy transition.

Customers worldwide rely on our bestselling pyranometers and heat flux sensors. From sensor design and selection to supply and recalibration, we support you across the entire lifecycle.

Hukx is headquartered in the Netherlands, with locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia, and Japan.

Let us help you select the best sensor for your application.
Get in touch with our experts today via: info@hukx.com

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