

HFP01

Heat flux plate / heat flux sensor

HFP01 is the world's most popular sensor for heat flux measurement in the soil as well as through walls and building envelopes. The total thermal resistance is kept small by using a ceramics-plastic composite body. The sensor is very robust and stable. It is suitable for long term use on one location as well as repeated installation when a measuring system is used at multiple locations.



Figure 1 HFP01 heat flux plate; the opposite side has a blue coloured cover



Figure 2 HFP01 heat flux sensor in use

Introduction

HFP01 measures heat flux through the object in which it is incorporated or on which it is mounted, in W/m^2 . The sensor in HFP01 is a thermopile. This thermopile measures the temperature difference across the ceramics-plastic composite body of HFP01. A thermopile is a passive sensor; it does not require power. Using HFP01 is easy. It can be connected directly to commonly used data logging systems. The heat flux in W/m^2 is calculated by dividing the HFP01 output, a small voltage, by the sensitivity. The sensitivity is provided with HFP01 on its calibration certificate. A typical measurement location is equipped with 2 or more sensors. HFP01 is the world's most popular sensor for heat flux measurement in the soil as well as through walls and building envelopes.

Unique features and benefits

- low thermal resistance (essential for use on walls and windows)
- large guard area (required by the ISO 9869 standard)
- low electrical resistance (low pickup of electrical noise)
- high sensitivity (good signal to noise ratio in low-flux environments such as buildings)
- robustness, including a strong cable
- IP protection class: IP67 (essential for outdoor application)

Calibration

HFP01 calibration is traceable to international standards. The factory calibration method follows the recommended practice of ASTM C1130.

Standards

HFP01 can be used for on-site measurement of building envelope thermal resistance per unit area (R-value) and thermal transmittance (U-value) according to the standardised practices of ISO 9869, ASTM C1046 and ASTM 1155.

Robust and stable

Equipped with heavy-duty cabling, protective covers on both sides and potted so that moisture does not penetrate the sensor, HFP01 has proven to be very robust and stable. It survives long-term installation in soils, as well as repeated installation when a measuring system such as TRSYS01 is used at multiple locations.

Working with heat flux sensors

A typical measurement location is equipped with 2 heat flux sensors for good spatial averaging. If the sensitivity of a single sensor is too low, two or more sensors can electrically be put in series, creating an amplified single output signal. The user should analyse his own experiment and make his own uncertainty evaluation. More information can be found in the HFP01 manual. See also our application note [how to install a heat flux sensor](#).

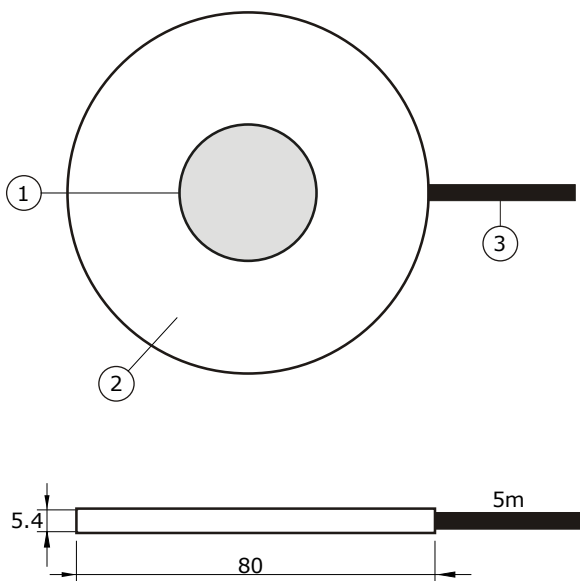


Figure 3 HFP01 heat flux plate: (1) sensing area, (2) passive guard of ceramics-plastic composite (3) cable, standard length is 5 m. Total sensor thickness including covers is 5.4×10^{-3} m. Dimensions in $\times 10^{-3}$ m

Suggested use

- building heat flux
- U-value and R-value measurements
- soil heat flux

HFP01 specifications

| | |
|-----------------------------------|---|
| Measurand | heat flux |
| Sensing area | $8 \times 10^{-4} \text{ m}^2$ |
| Guard width to thickness ratio | 5 m/m (as required by ISO 9869 D.3.1) |
| Sensor thermal resistance | $71 \times 10^{-4} \text{ K}/(\text{W}/\text{m}^2)$ |
| Sensor resistance range | 1 to 4 Ω |
| Sensor thickness | $5.4 \times 10^{-3} \text{ m}$ |
| Uncertainty of calibration | $\pm 3 \%$ ($k = 2$) |
| Measurement range | -2000 to 2000 W/m^2 |
| Sensitivity (nominal) | $60 \times 10^{-6} \text{ V}/(\text{W}/\text{m}^2)$ |
| Rated operating temperature range | -30 to +70 $^{\circ}\text{C}$ |
| Cable diameter | $4 \times 10^{-3} \text{ m}$ |
| IP protection class | IP67 |
| Standard cable length | 5 m |
| Options | longer cable length (10, 15, 20, 30, 40 m) BLK-80 black sticker GLD-80 gold sticker |

GLD and BLK sticker series

Would you like to study energy transport / heat flux in detail? Hukseflux helps taking your measurement to the next level: order HFP01 with radiation-absorbing black and radiation-reflecting gold stickers. You can then measure convective + radiative flux with one, and convective flux only with the other. Subtract the 2 measurements and you have radiative flux. BLK – GLD stickers can be applied by the user to the sensor. Optionally, they can be ordered pre-applied. See the BLK – GLD sticker series user manual and installation video for instructions.

Options

- longer cable, in multiples of 5 m, cable lengths above 20 m in multiples of 10 m
- BLK-80 black sticker (to measure radiative as well as convective heat flux)
- GLD-80 gold sticker (to measure convective heat flux only)
- BLK - GLD sticker series can also be ordered pre-applied at the factory

See also

- if measuring in soil, in case a high level of quality assurance and accuracy of the measurement is needed, consider use of model [HFP01SC](#)
- model [HFP03](#) for increased sensitivity (also consider putting two or more HFP01's electrically in series)
- [BLK - GLD sticker series](#) to separate radiative and convective heat fluxes
- view our complete [range of heat flux sensors](#)

- view the **TRSYS01** building thermal resistance measuring system which includes 2 x HFP01 and 4 x matched thermocouple type K
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Figure 4 HFP01 heat flux plate: with BLK-80 and GLD-80 stickers to measure radiative and convective heat fluxes separately

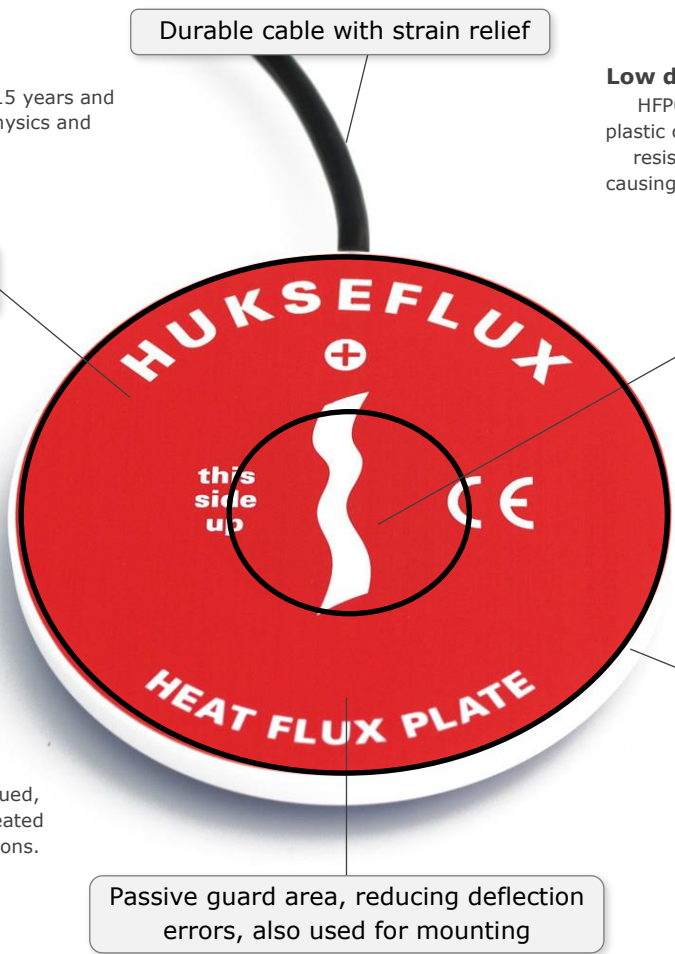
About Hukseflux

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. With our laboratory facilities, we provide testing services including material characterisation and calibration. Our main area of expertise is measurement of heat transfer and thermal quantities such as solar radiation, heat flux and thermal conductivity. 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@huksefluxusa.com

HFP01 outperforms competing models: how?

HFP01 is the world's market leading model for building and soil heat flux measurement. Purchasing a HFP01 is a good investment in accurate and stable measurement.



World market leader

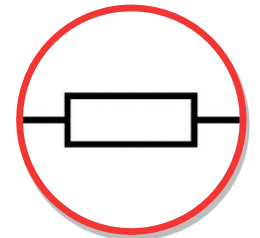
HFP01 is on the market for more than 15 years and used by the vast majority of building physics and meteorological institutes.

Corrosion-proof plastic cover protecting the complete sensor

Durable cable with strain relief

Low disturbance: small thermal resistance

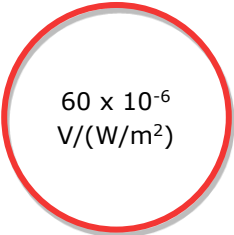
HFP01 is 5.4 mm thick, but thanks to its ceramics-plastic composite body it is thermally thin. Its thermal resistance is comparable to 1.4 mm normal plastic, causing little disturbance of the undisturbed heat flux.



Sensitive area with thermal spreader

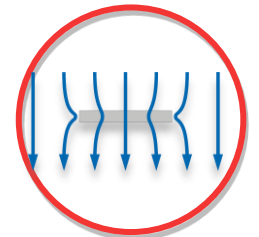
Continues measuring when others give up: high sensitivity

For buildings and soil you need at least $50 \times 10^{-6} \text{ V}/(\text{W}/\text{m}^2)$ sensitivity to measure down to the $0.2 \text{ W}/\text{m}^2$ level. Competing sensors are often not sufficiently sensitive, and stop measuring anything significant while HFP01 can still measure.



High accuracy: passive guard included

A passive guard, i.e. a non-sensitive part around the sensor is essential to avoid errors due to edge effects, HFP01 includes guard according to ISO 9869. Competing models often have sensitive parts running to the edge of the sensor, resulting in large potential measurement errors.



Ceramic plastic composite body, equivalent thickness in plastic 1.4 mm

Passive guard area, reducing deflection errors, also used for mounting



Durable: sturdy "student and installer-proof" connection

HFP01's cable to sensor connection is glued, and withstands rough handling and repeated installations typical for building applications. Student and installer-proof! Competing sensors often have wire connections on weak solder pads.

Best paperwork

Hukseflux has the paperwork covered; HFP01 is provided with formally traceable calibration certificates. We calibrate in accordance with ASTM C1130.

