IHF01
Industrial heat flux sensor

IHF01 industrial heat flux sensor measures heat flux and temperature, typically in industrial high-temperature environments. IHF01 is waterproof, withstands high pressures and is extremely robust. With signal wires electrically insulated from the sensor body, it complies with industrial safety standards, such as CE and ATEX for explosive areas. IHF01 is particularly suitable for trend-monitoring and comparative testing. The same technology can be used to manufacture heat flux sensors for different applications.

Introduction
IHF01 measures heat flux and surface temperature of industrial equipment like furnaces, boilers, fluidised beds, distillation columns and ovens. The sensors inside IHF01, a thermopile and a thermocouple, are protected by a fully sealed stainless steel body. It is suitable for long-term use at one location as well as repeated installation when a measuring system is used at multiple locations. IHF01 measures heat flux through the object on which it is mounted, in W/m², as well as the temperature in °C. The sensors in IHF01 are a thermopile and a type K thermocouple. The thermopile measures the local heat flux.

The thermocouple measures the absolute temperature of the surface on which HF01 is mounted, as well as the approximate sensor body temperature. A thermopile and a thermocouple are passive sensors; they do not require power. The part of the cabling closest to the sensor is a special high-temperature metal sheathed cable with an interlocked spiral stainless steel armour. The sensor as well as the high-temperature cable and armour withstand temperatures up to 900 °C. The temperature range is reduced to 650 °C in case the optional black coating is used. The low-temperature extension cable has a jacket of PTFE type plastic.

Suggested use
trend-monitoring and comparative measurement of heat flux and surface temperature in industrial installations. See also IHF02 for an industrial heat flux sensor with increased sensitivity.

IHF01 advantages
- robust
- suitable for use at high temperatures
- IP protection class: IP67
- signal wires electrically insulated from the sensor body

Figure 1 IHF01 industrial heat flux sensor

Figure 2 Example of an IHF01 industrial heat flux sensor mounted on a wall using tack-welded threads and spring-loaded bolts
Operation
Using IHF01 is easy. It can be connected directly to commonly used data logging systems. The heat flux, in W/m², is calculated by dividing the IHF01 output, a small voltage, by the sensitivity. The sensitivity is provided with IHF01 on its product certificate. Equipped with heavy duty cabling, and having a fully stainless steel casing so that moisture does not penetrate the sensor, IHF01 has proven to be very reliable. It survives long-term outdoor installation.

![Figure 3 IHF01 dimensions in x 10⁻³ m. T marks the location of the thermocouple.](image)

Options
- longer cable (specify total cable length for both cable types in m)
- black coating
- EC type examination certificate (ATEX) II 2 G Ex d IIC T6
- connector at IHF01 cable end
- low-temperature extension cable with 2 connectors, matching cable connector and chassis connector
- chassis connector with internal wiring (colour code of wiring identical to cable colour code)

IHF01 specifications

<table>
<thead>
<tr>
<th>Measurand</th>
<th>heat flux</th>
<th>temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat flux sensor</td>
<td>thermopile</td>
<td>thermocouple type K</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>thermocouple type K</td>
<td>thermocouple type K</td>
</tr>
<tr>
<td>Sensitivity (nominal)</td>
<td>$9 \times 10^{-9}$ V/(W/m²)</td>
<td>$9 \times 10^{-9}$ V/(W/m²)</td>
</tr>
<tr>
<td>Calibration traceability</td>
<td>to SI units</td>
<td>to SI units</td>
</tr>
<tr>
<td>Recommended number of sensors</td>
<td>2 per measurement location</td>
<td>2 per measurement location</td>
</tr>
<tr>
<td>Measurement range</td>
<td>$(-1000 \text{ to } +1000) \times 10^3$ W/m²</td>
<td>$(-1000 \text{ to } +1000) \times 10^3$ W/m²</td>
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<tr>
<td>Rated operating temperature ranges:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sensor and high temperature cable</td>
<td>-30 to +900 °C</td>
<td>-30 to +900 °C</td>
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<tr>
<td>optional black coating</td>
<td>-30 to +650 °C</td>
<td>-30 to +650 °C</td>
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<tr>
<td>low temperature extension cable</td>
<td>-30 to +240 °C</td>
<td>-30 to +240 °C</td>
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<tr>
<td>IP protection class</td>
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<td>IP67</td>
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<tr>
<td>Standard cable lengths:</td>
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<tr>
<td>high-temperature cable</td>
<td>1 m (see options)</td>
<td>1 m (see options)</td>
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<tr>
<td>low-temperature extension cable</td>
<td>3 m (see options)</td>
<td>3 m (see options)</td>
</tr>
<tr>
<td>Order code</td>
<td>IHF01 - high temperature cable length in m - low temperature extension cable length in m</td>
<td>IHF01 - high temperature cable length in m - low temperature extension cable length in m</td>
</tr>
</tbody>
</table>

See also
- model IHF02 for an industrial heat flux sensor with increased sensitivity
- model HF05 for a heat flux sensor with a high sensitivity at a lower temperature range
- our complete range of heat flux sensors
- our industrial heat flux sensors (PDF)

![Figure 4 IHF01: the heat flux sensor consist of a stainless steel body (1) which is connected via a rigid stainless steel coupler (3) to a flexible high-temperature metal sheathed cable with interlocked spiral stainless steel armour (6). After a transition piece (4), wires are extended using a low-temperature extension cable (7). In the standard configuration, the cable ends in bare wires (5). Two mounting flanges (2) are attached to the body. Dimensions in x 10⁻³ m.](image)
Trend-monitoring and comparative measurement
IHFO1 is most suitable for relative measurements, i.e. monitoring of trends relative to a certain reference point in time or comparing heat flux at one location to the heat flux at another location. If the user wants to perform accurate absolute measurements with IHFO1, as opposed to relative measurements, the user must make his own uncertainty evaluation and correction for systematic errors.

Figure 5 IHFO1 as delivered in its standard configuration

Calibration
IHFO1 calibration is traceable to international standards. The factory calibration method follows the recommended practice of ASTM C1130-17.

Figure 6 IHFO1 with spring-loaded bolts for mounting on a well-prepared flat surface using tack-welded threads

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 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
IHF01 outperforms competing models: how?

The IHF industrial heat flux sensor product range is the best available for use in unfriendly environments and at high temperatures. This is why.

High temperature
The IHF range sensors may be used up to 900 °C.

Durable: sturdy “installer-proof” connection
IHF01’s cable-to-sensor connection is a specially designed high-temperature metal sheathed cable, with strain relief. Installer-proof! Competing sensors often have weak and vulnerable wire connections. The connection from high temperature cable to low temperature extension cable is very sturdy and also has strain relief.

Stable: waterproof (IP67), corrosion-proof, pressure resistant
IHF01’s sensor-to-cable connection is full metal, waterproof and pressure resistant to 10 bar. The protection class is IP 67. Competing sensors often have wire connections with open contact to the environment. This is a large potential source of damage, as well as a starting point for corrosion and sensor instability.

Reliable and safe: electrically insulated signal wires
IHF01’s signal wires are electrically insulated. This guarantees electrical immunity. Competing sensors often have wire connections with open contact to the environment. This is a large potential source of measurement error (zero offsets caused by ground loops) as well as a potential safety issue.

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. IHF01 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.

Optional: Industry safety approvals
EC type examination certificate (ATEX) II 2 G EEx d IIC T6 for use in explosive environments.

Best paperwork
Hukseflux has the paperwork covered; IHF01 is provided with formally traceable calibration certificates. We calibrate in accordance with ASTM C1130.