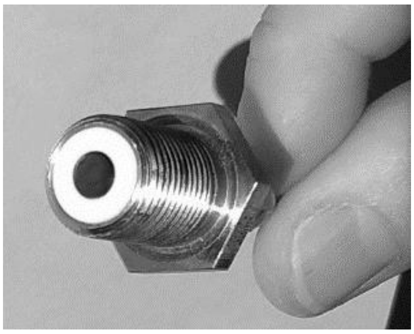
NEXTHERM SENSING



Inertia Heat Fluxmeters: the IHF series

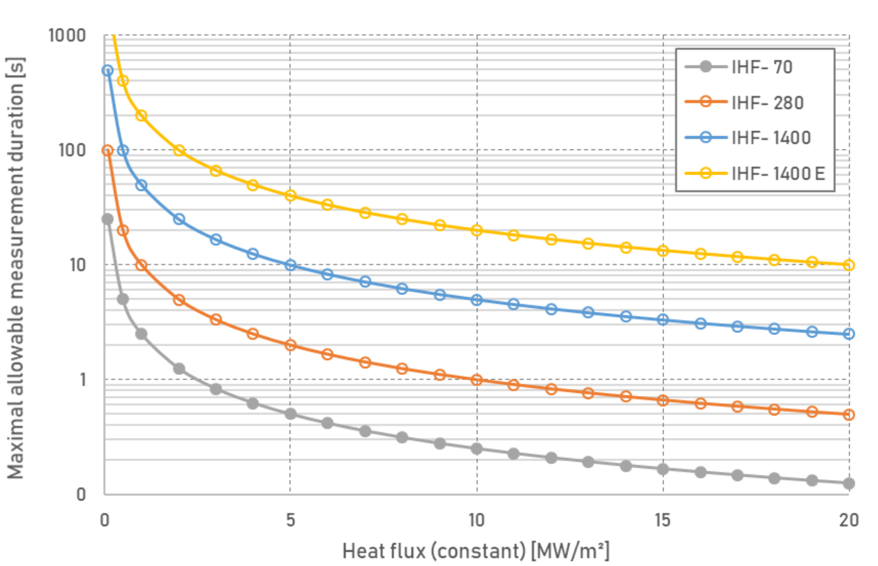
Sensors of the IHF (*Inertia Heat Fluxmeters*) series are intended for fixed duration (one-shot) or cycling measurements. IHF devices are based on a principle called “thermal inertia”: a calorimetric element of well-known thermal properties (as a function of temperature) collects on its front face the incident heat flux, which is then deduced by time derivation of the measured mean temperature. IHF sensors can be declined in radiative (radiometers), convective and total fluxmeters.

STANDARD IHF SENSORS

IHF sensors are available in four standard versions, according to both heat flux level and measurement duration. All versions are given a maximal error of 5%FS (full scale)*. The following table gives the duration versus flux (assumed constant) envelope for each model, along with the 63% response time.

** Specification 5%FS max. Real error determined by certified calibration.*

Standard model	Heat capacity	Typical duration-flux envelope	Rise time (τ63%)
IHF-70	70 Joule	10 seconds under 250 kW/m²	<15ms
IHF-280	280 Joule	10 seconds under 1 MW/m²	<0.1s
IHF-1400	1400 Joule	10 seconds under 5 MW/m² 50 seconds under 1 MW/m²	<0.2s
IHF-1400E *	1400 Joule	10 seconds under 20 MW/m² 200 seconds under 1 MW/m²	<0.4s
** Extended duration version obtained by advanced sensitive element geometry*			



Duration versus flux envelope of the four standard IHF sensors

IHF-70 sensor is designed for transient measurement of highly dynamic phenomena, such as ignition, flame propagation, detonation, etc. due to very thin sensitive element, which limits nevertheless its usage for long-duration measurement.

IHF-280 and IHF-1400 are the most used sensors of our standard IHF series due to their high versatility, from fast high flux events to quasi-steady low flux process.

IHF-1400E is an extended version of the IHF-1400 offering impressive long duration measurement.

For higher flux or measurement duration (*iow,* above the IHF-1400E curve), choose the cooled CHF series.

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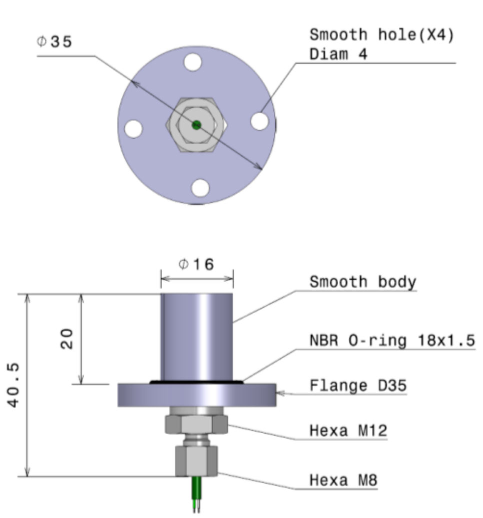
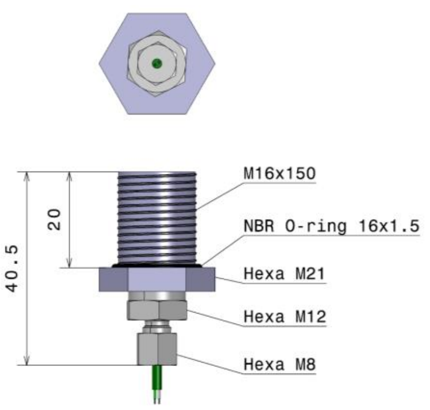
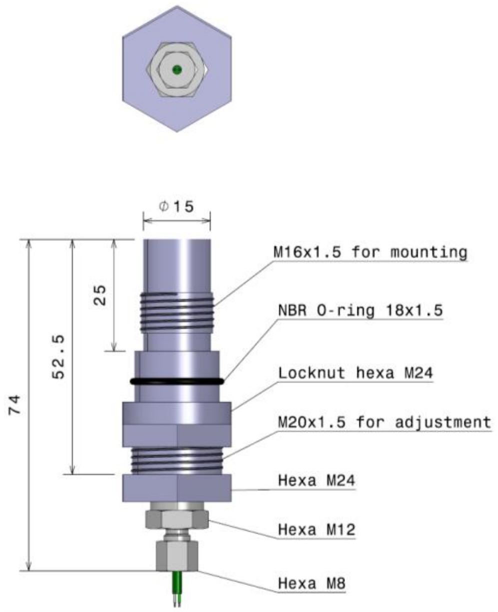
- In their convection-type version, the sensitive element of the sensor is made of a highly reflecting surface treatment (emissivity <0.05) in order to suppress as far as possible radiative contribution.
- In their radiation-type version (radiometers), the sensitive element of the sensor is isolated from the external environment by the means of a window, so as to suppress any convective contribution. Window transmissivity in characterized in our laboratory over a large spectrum. In that case, the sensitive element is made of a highly absorbing surface treatment (emissivity >0.95), also spectrally characterized.
- In their total-type version, the sensitive element is analogous to the radiation-type version, but is directly exposed to the external environment so as to catch combined radiative-convective heat transfers. If convection can be neglected in your application, this version can be turned into a large view angle radiometer.

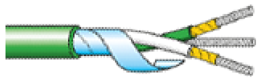
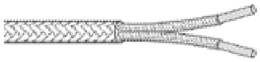
MECHANICAL INTERFACE

NexTherm fluxmeters can be integrated in various housings. Tailored interfaces can also be designed to answer you special needs (miniature support, lateral lead wire routing, adhesive mounting, etc.). Baseline support material is stainless steel 316L. Other materials on request. Every unit is delivered with a Thermolok® seal glang (Thermocoax type MG20) for lead wire leak-tightness.

Flange mounting	Thread mounting	Fine thread mounting
		
Very simple mounting method, by screwing four points of a flat flange. Sealing by NBR (nitrile) O-ring (copper and graphite flat-ring also available). Other flange shape and smooth hole diameter on request.	Hexagonal head bolt-type fastening. Sealing by NBR (nitrile) O-ring (copper and graphite flat-ring also available). Other diameter, length and thread pitch on request.	Fine adjustment of the depth by a locknut, allowing a perfect flush-mounting of the measuring surface. Peripheral NBR (nitrile) O-ring seal.
Mounting reference : M1	Mounting reference : M2	Mounting reference : M3

ELECTRICAL INTERFACE

In standard version, inertia heat flux sensors are equipped with type K (chromel-alumel) thermocouple lead wires (0.5mm diameter). Baseline finish is silicon sheathing with glass silk insulation (reference W4), which constitutes a good compromise between thermomechanical resistance (480°C) and flexibility. Standard wire length is 1 meter. Miniature type K connector with flat plug (reference C1) completes the baseline version.

Lead wire type	View	Reference
PFA insulation, SS braid shielding		W1
Glass fiber insulation, SS braid shielding		W2
Fire-proof Mica-PR / low smoke composite		W3
Standard glass silk insulation (480°C)		W4
High temperature glass silk insulation (800°C)		W5
Ultra-high temperature ceramic fiber insulation (1400°C)		W6

Connector type	View	Reference
Miniature plastic body, flat plugs, standard temperature (220°C)		C1
Miniature ceramic body (cast alumina), flat plugs, high temperature (650°C)		C2
Flat plugs, cable gland reinforcement		C3

On request, other cable finishes are possible (*e.g.*: ceramic or metallic rigid sheath, multi-pair bundles, etc..), as well as other type K connectors (*e.g.*:, panel mounting, cable gland, ...).

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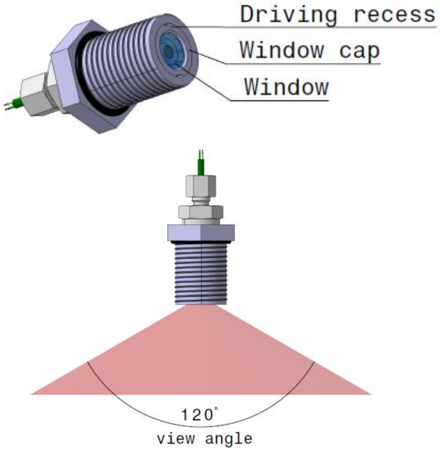
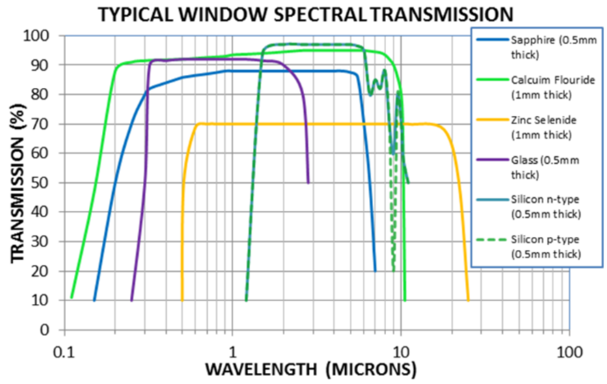
TAILORED IHF SENSORS

On request, we can build specific and optimized IHF sensors matching your application in terms of heat flux level, duration, response time, interfaces, etc. Indeed, the standard IHF line can be enriched with intermediate heat capacity levels.

In their radiometer version, NexTherm masters advanced optical solution (glasses and surface treatments) allowing to target peculiar spectral band (*e.g.* near IR, far IR, singular wave length filtering).





Window material	Full transmission range	Max. transmission / range (for a 2mm thickness)	Melting point
Sapphire (Al_2O_3)	0.22 to 5.5 µm	85% @ [0.22,4.2] µm	2040°C
KRS-5 ($TiBr_{42}I_{58}$)	0.6 to 40 µm	65-71% @ [0.6,30] µm	414.5°C
Calcium fluoride (CaF_2)	0.13 to 10 µm	90-95% @ [0.2,7.0] µm	1360°C
N-BK7 (borosilicate)	0.35 to 2.5 µm	90% @ [0.35,2.1] µm	557°C
Quartz (fused SiO_2)	0.18 to 3.5 µm	92% @ [0.5,3.4] µm	1710°C
Zinc selenide (ZnSe)	0.55 to 15 µm	70% [1.1,15] µm	1525°C

Sapphire, quartz, ZnSe, … As many glass types allowing to target specific radiative bands in your application © Infrared Materials

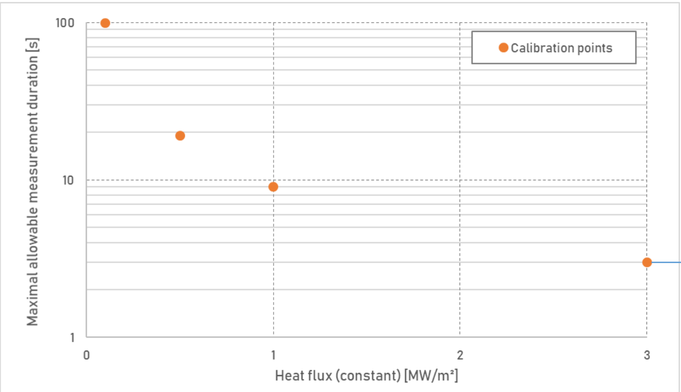
In addition to these various substrates, custom coatings can be envisaged to obtain interferential narrow bandpass filters with very high optical density (up to 4) in the rejection band, along with a better than 91% transmission in the pass region.

View restriction: Note that the integration of a window generates a reduction of the sensitive element view angle (ideally a hemispherical field of 180°). NexTherm radiometers are provided with many possible view angles, from 10° to 120°.

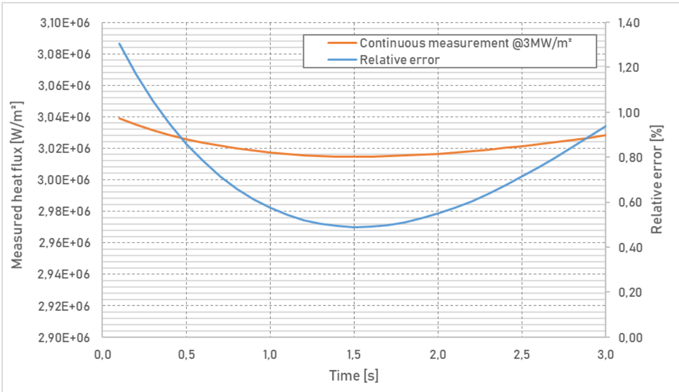
CALIBRATION

Since IHF sensors are based on a temperature measurement, a two-step calibration procedure is implemented. First, a temperature calibration is performed in a refractory furnace to determine the measurement error with respect to a reference temperature probe. Then, a heat flux calibration is performed on a laser bench to obtain a network of curves with different flux-duration profiles, respecting the maximum thermal capacity of the sensor.

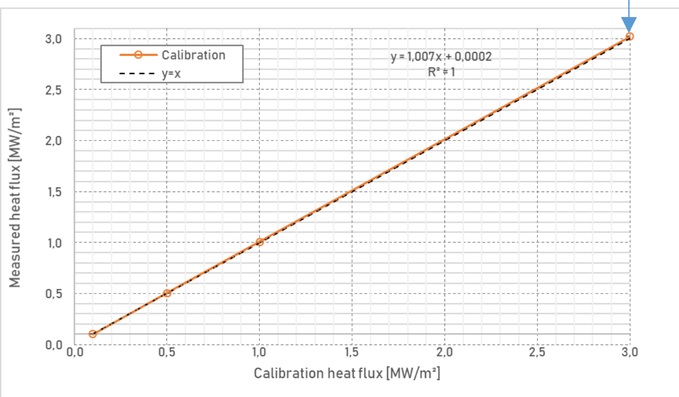
Systematic error on sensor temperature in lower than 0.1°C.



Selection of the calibration points respecting the thermal capacity (this example: IHF-280 model)



Calibration for each flux-duration point (this example: incoming flux of 3MW/m² during 3 seconds)



Calibration points			
Calibration Flux [MW/m²]	Duration [s]	Measured Flux [MW/m²]	σ (SD) [W/m²]
0,1	99	1,01E-01	249
0,5	19	5,04E-01	1161
1	9	1,01E+00	2150
3	3	3,02E+00	6450

Building of the calibration curve by gathering all flux-duration points

DATA ACQUISITION & POST-PROCESSING: THE NEXTEST™ TOOL

Measurement is now an easy task thanks to our proprietary analysis tool called NexTest™, powered by National Instrument LabView®. In three steps, you will be able to register you sensor, run measurement and post-process it. Measurements are immediately available as both raw data and graphics. Advanced analysis can be carried out to get signals numerically filtered, when your process is highly instable for example.

NexTherm also offers a field suitcase equipped with a cutting-edge data acquisition system (16 channels, 24 bit, 20kHz per channel, 1 microsecond synchronization, 8 Go RAM, 256Go SSD, Windows 10 OS, possible external triggering, Gig-Ethernet communication interface).

ORDERING

For standard model ordering, please use the following referencing:

IHF-C-M-W-C-F

with the corresponding coding:

- C : heat capacity level (70,280,1400,1400E)
- M : mounting (flange M1, thread M2, fine thread M3)
- W : wire type (W1 to W6)
- C : connector type (C1 to C3)
- F : sensor finishing (TF : total flux, CF: convective flux)

Example: for a convective flux sensor of 280 Joule heat capacity with a standard flange mounting, glass fiber insulated lead wire and standard connector: IHF-280-M1-W2-C1-CF.

For other configurations (including window selection for radiometers), please contact us.

SALES CONTACT

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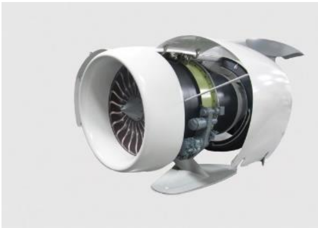

Turbomachines

Furnaces/Foundry

Fire safety

Braking systems