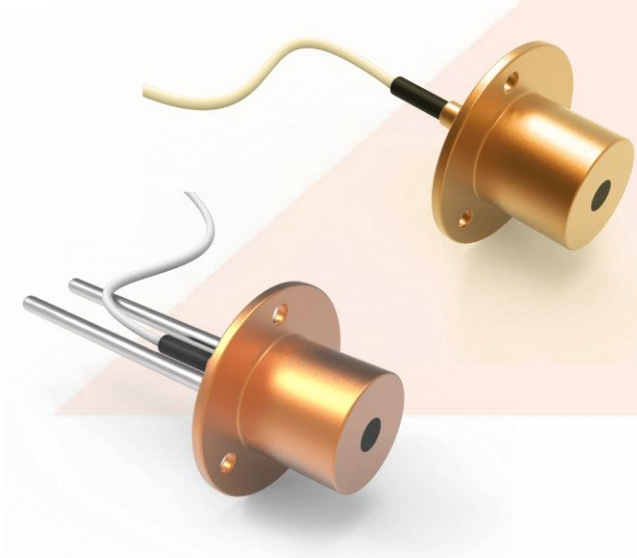
Heat Flux Sensor

TEMPSENS



A heat flux sensor is a transducer that generates an electrical signal proportional to the total heat rate applied to the sensor's surface. The sensor works on the principle of the gardon gauge. These sensors majorly measure the heat transfer through radiation mode and account for the heat's effect due to convection heat.

Schmidt-Boelter gauges are heat flux sensors that measure heat flux in the 1 to 5 W/cm^2 range. These types of heat flux sensors have a black absorber and are intended to monitor convection and radiation heat flow. The output voltage of a thermopile sensor is proportional to the input irradiance. The multiple thermocouple thermopile technology is used in conventional Schmidt-Boelter gauges.

The measured heat is divided by the sensor's surface area to determine the heat flux. Each transducer will provide a self-generated 10-millivolts (nominal) output at the design heat flux level. The sensor has a black absorbent coating on a thin metallic circular foil that absorbs the incident heat. Then this heat is transferred radially (parallel to the absorbing surface) to the heat sink welded around the periphery of the foil. A single differential generates the emf output thermocouple between the foil center temperature and foil edge temperature.

Technical Parameters

Parameters	Cooled and Uncooled both type of sensor
Heat Flux (maximum)	1-5, 10, 30 W/cm²
Technology	Gardon Gauge and Schmidt-Boelter Gauge
Sensor Output	Linear output, 10mv nominal at full range
Over Range	25% of Rated Heat Flux
Accuracy	±5% or Better
Repeatability	2%
Measurement Duration	60s for 10 W/cm²
Sensor	Differential Thermocouple and Thermopile Sensor
Dimension	Diameter 25mm, Length 25mm
Mounting	Flange
Cable	Specify either 2 or 5 m
ISO Standard	ISO17025 Accredited calibration certificate (Optional)

Standard Features

- Linear Output
- Output Proportional to Heat Transfer Rate
- Accurate, Rugged, Reliable
- Convenient Mounting
- Measure Total Heat Flux (Radiation & Conduction)
- Measure Radiant Heat Flux

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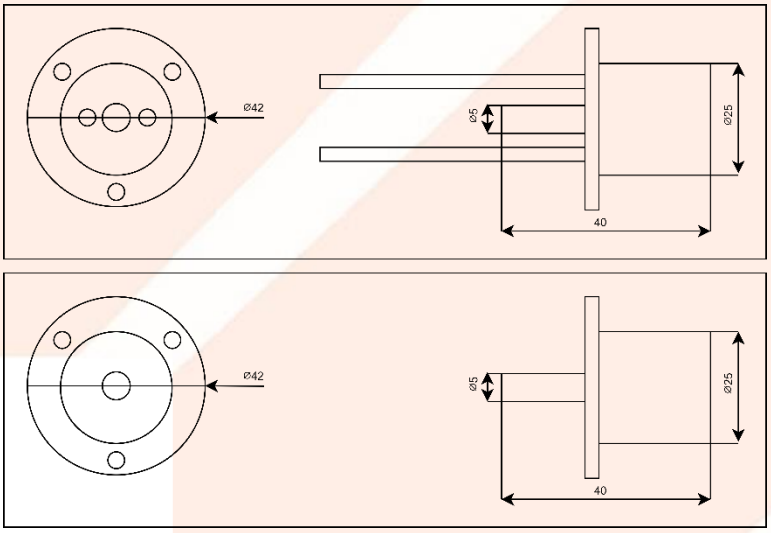
Standard configuration of cooled/uncooled models

- The sensor is provided with or without provision for water cooling of transducer body.
- Basic uncool sensor nominal temperature will be 200°C.
- Water cooled should be specified if cooled sensor expected to achieve above 400°F or 200°C.



Applications

- Main application is like in ground and flight aerospace testing
- Fire testing, flammability testing
- Heat transfer research
- Material development and furnace development

Accessories

REMOVABLE WINDOW ATTACHMENTS, with the standard sapphire or optional window materials, are available to limit the essential transducer to the measurement of radiation heat flux only. To measure the convection heat transfer, one can take the measurements with (Radiation) and without (Radiation + Convection) a window and subtract the heat flux readings. View restrictor attachments are available to limit the angle of view for the basic transducer to 150°, 120°, 90°, 60°, 30°, 15° or 7° for narrow view angle measurements. The standard window is a sapphire window. Other types of windows are also available at customer request. The different window works on different wavelengths. The detailed wavelength range of different windows are specified in the following table:

TO SUBSTITUTE WINDOW ON RADIOMETER INSTEAD OF SAPPHIRE (CUSTOMIZED)

(Approximate Transmittance Data, Details Available)

Substitute Window, (1mm unless noted)	Symbol, Insert in P/N	Useful Wavelength Range, micrometers	"Flat" Wavelength Range, micrometers
Sapphire (0.5mm)		0.2-5.5	0.4-4.2
Quartz (0.5mm)	QW	0.12-4	0.27-3
Calcium Fluoride	CaF2W	0.3-11.5	0.7-9
KRS-5	KRS-5W	0.6-50	0.6-30
Zinc Sulfide	ZnSW	0.5-14.5	0.8-12
Barium Fluoride	BaF2W	0.5-12.5	0.3-10
Zinc Selenide	ZnSeW	0.5-22	0.7-17
Cadmium Telluride	CdTeW	0.8-30	1.0-20

Voltage source meter provided with sensor as per customer requirements.

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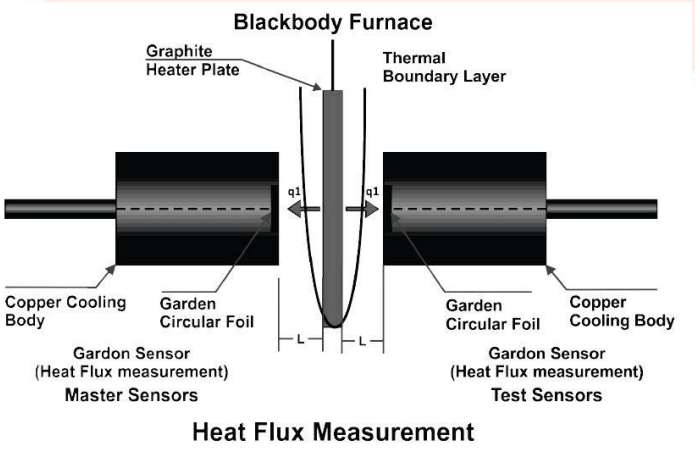
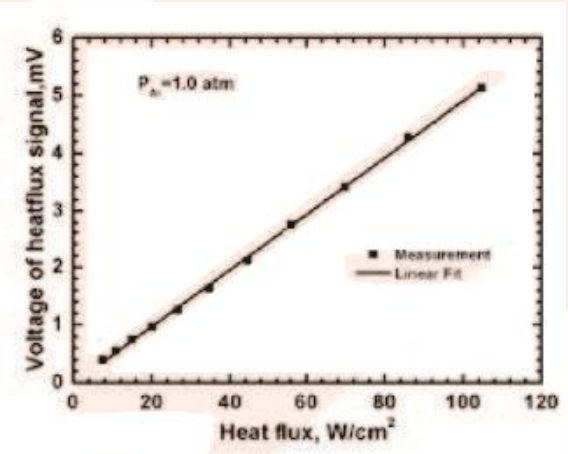
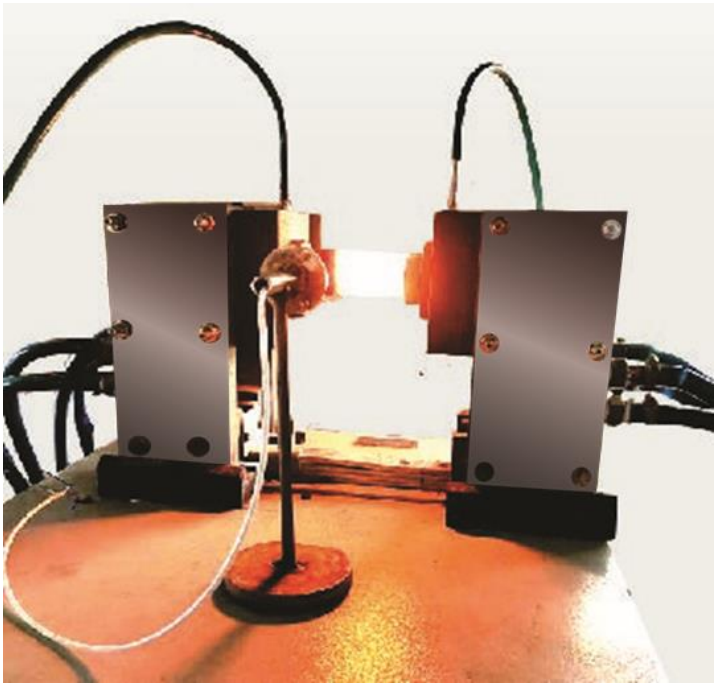
Heat Flux Sensor Calibration Method

- It works on the principle of axial one-dimensional heat flow.
- It measures the temperature difference across a thin, thermally insulating layer to determine the incident heat flux. Due to the axial flow of heat, the temperature distribution across the sensing surface is uniform.
- The maximum body temperature is limited to about 200°C when the sensor is not water-cooled.
- All of the calibrations show a linear response of the sensor, with regression factors close to unity.



Heat Flux Measurement





- Heat flux sensor mainly used for fire and fire resistance.
- We have designed our heat flux sensors according to the theoretical analysis with suitable foil thickness and diameter of foil.
- To calibrate heat flux sensor, an experimental setup is prepared.
- The experimental apparatus consists of a heat flux sensor, a data acquisition unit, and a PC.
- The calibration of gauge is dependent on the radiated flux and measuring output or response of the sensor.
- The sensor based upon thermocouple response and output measured with precise volt-meter (measuring unit).

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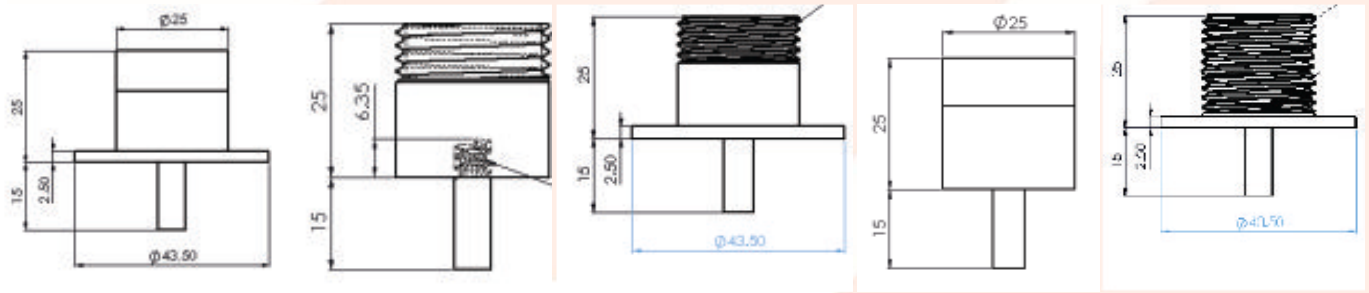
Standard Mounting Configurations

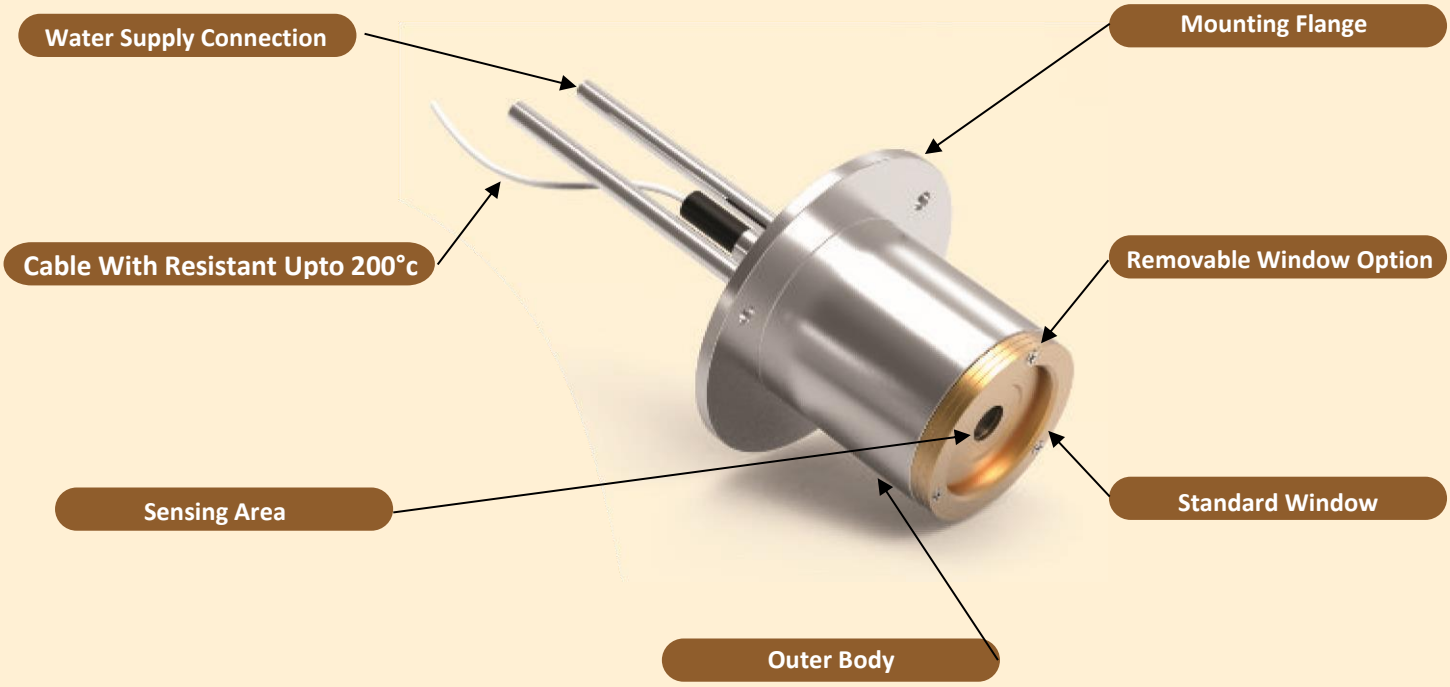
There are various mounting configurations according to the industry requirements.



SMOOTH BODY WITH FLANGE	PARTIAL THREADED BODY No Flange	PARTIAL THREADED BODY WITH FLANGE	SMOOTH BODY WITHOUT FLANGE	THREADED BODY WITH FLANGE

All mounting flanges are 1.73" dia. with 0.150" dia. mounting holes equally spaced on a 1.375" dia. bolt circle. Water-cooling tubes (when specified) of 1/8" dia. and 4" long made with stainless steel tube (Other tube diameters and fittings are available). All threaded bodies have 1-12 UNF-2A threads.

Over View



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