# Q-sens

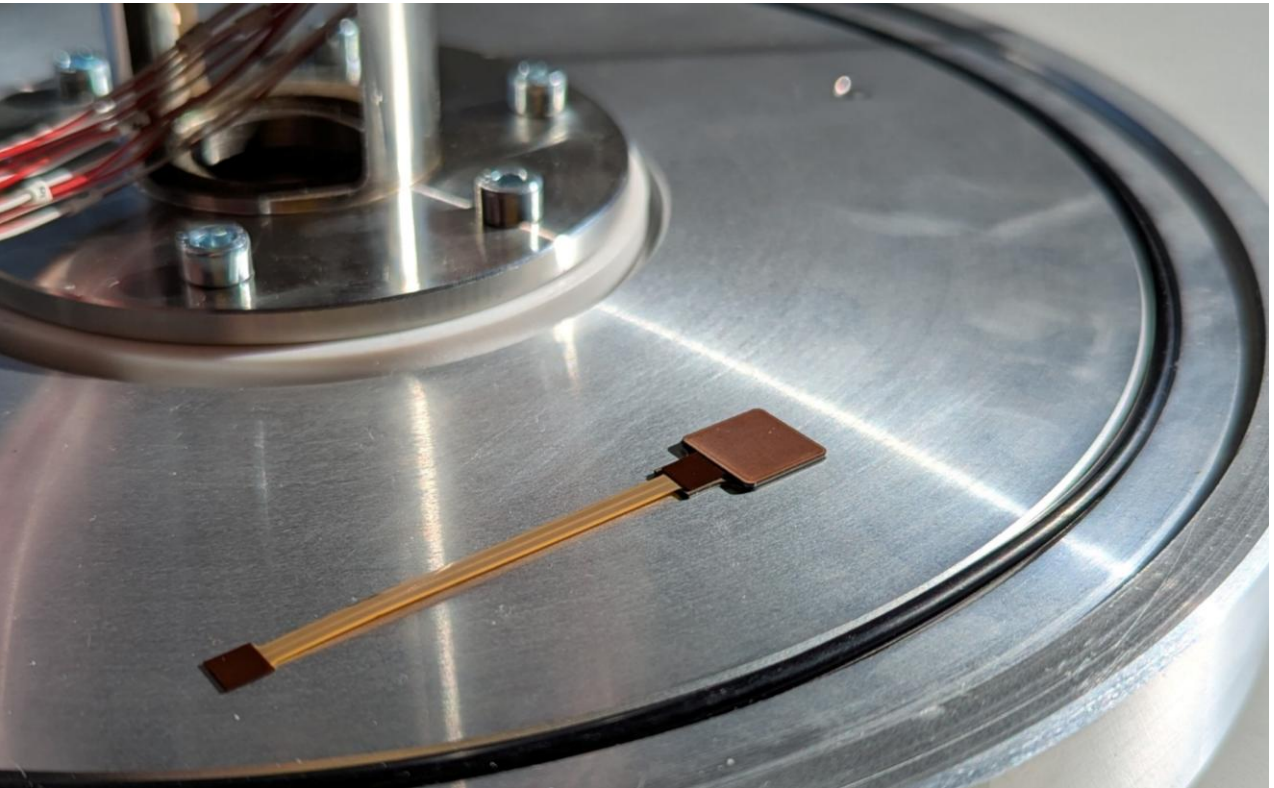
by Meerstetter

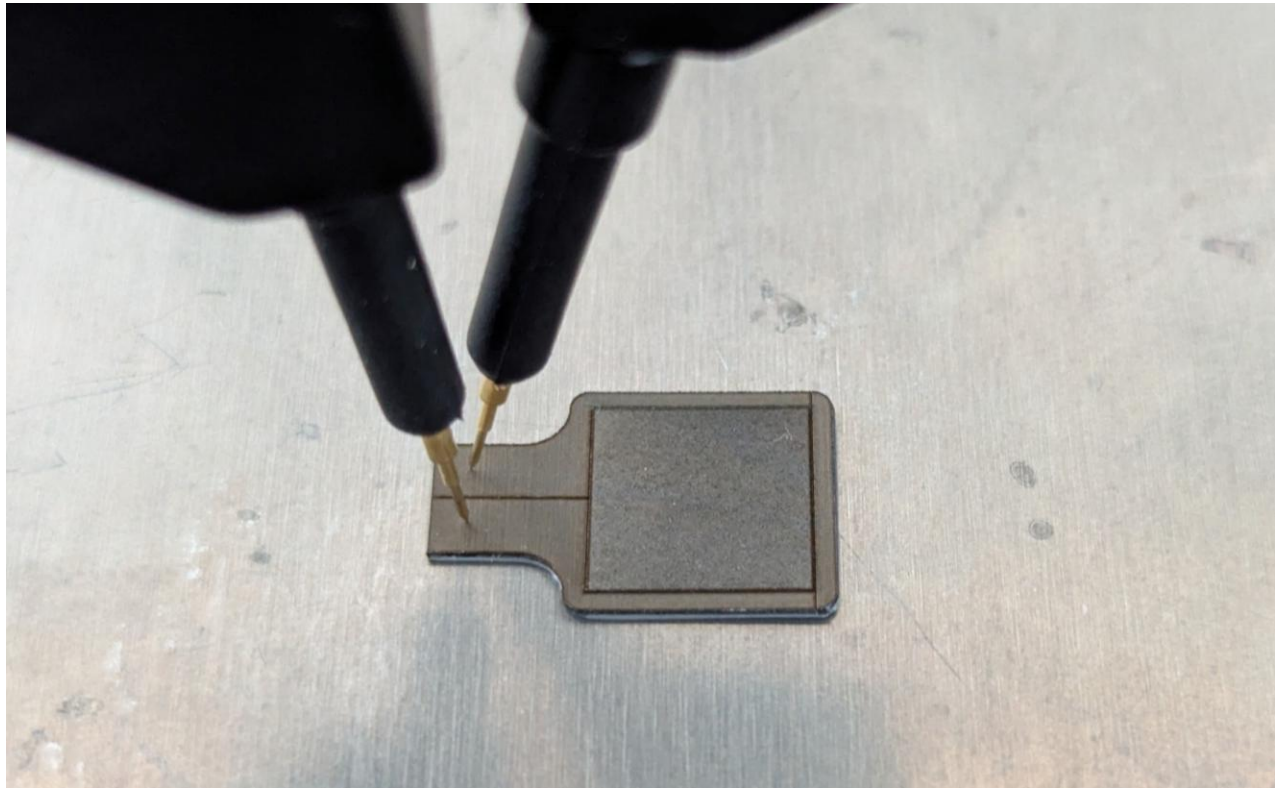
Technology overview

# Q-sens

## NEXT-GENERATION HEAT FLUX SENSOR

- Advanced thermoelectric device based on composite metamaterial
- Precise heat flux measurement
- Further applications in the pipeline

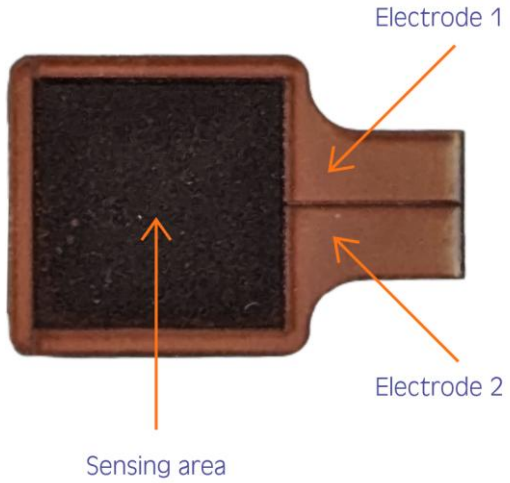




# Q-sens overview

## Working element

Q-sens plate overview




## Components

Q-sens plate

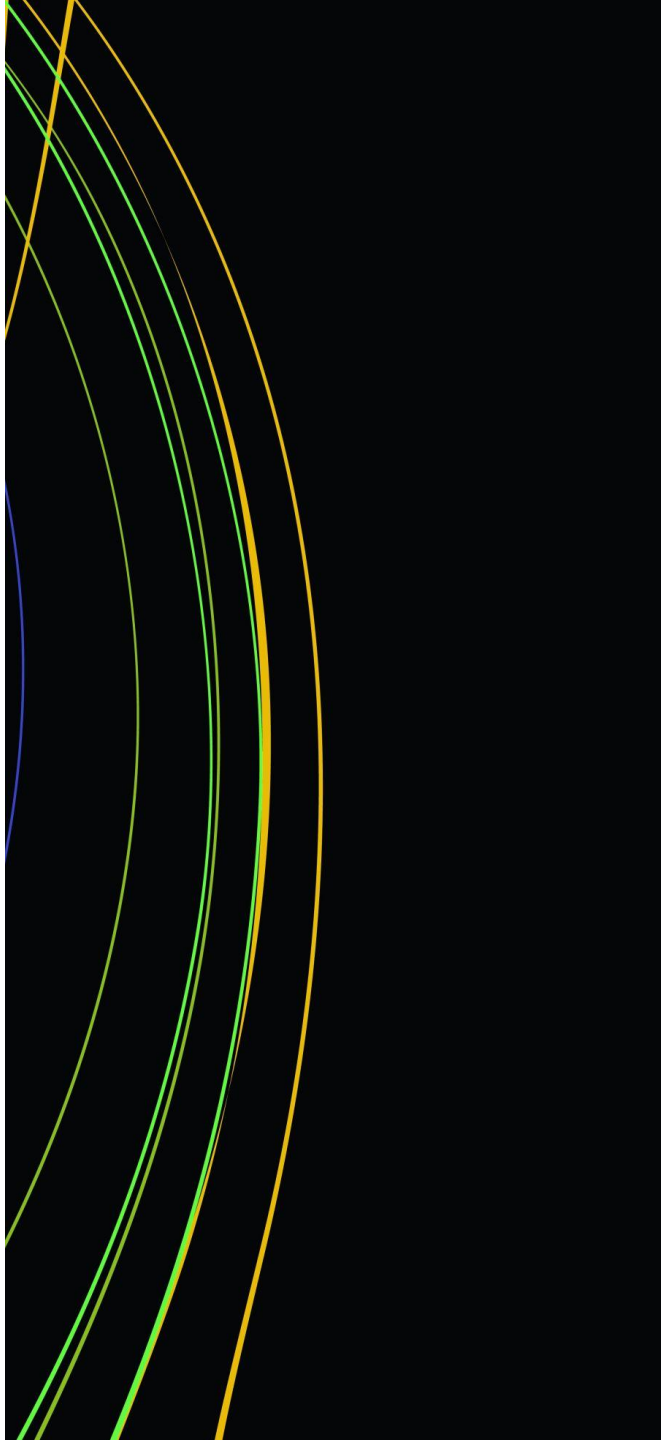
Packaging

Flex PCB cable


## Assembled Q-sens

# Q-sens technology advantages

- **Utilization of advanced metamaterials** with optimized thermoelectric properties
- **Enhanced heat flow management** with high thermal conductivity and low thickness
- **Simplified and scalable device designs**
- **Innovative architectures** tailored per application
- **Low internal electrical resistance** to minimize power losses
- **Cost-effective integration** with photovoltaic (P-V) systems
- **Potential for additional physical effects** to further boost efficiency



# Key features

- **Simple Design** – Single thermoelectric metamaterial reduces complexity
- **Ultra-Fast Response** – Measured nanosecond response times
- **High Stability** – Consistent output in extreme environments
- **High-Temperature Operation** – Withstands up to 1300 K for particular composites
- **High Thermal Conductivity** – minimizing installation impact
- **Passive Operation** – Ideal for remote sensing and IoT
- **Customizable Geometry** – Precise tuning for specific needs

| Manufacturer | Model | Type | Operating temp. [°C] | Sensitivity | Response time [s] | Comment |
|---|---|---|---|---|---|---|
| **Vatell** | Termogage | Gardon gauge | 200 / 900 with water cooling | 1000-2000 $\mu V/(W/cm^2)$ | 10^-3 | Large size |
| | HFM | TP | 350 / 800 with water cooling | 10-150 $\mu V/(W/cm^2)$ | 10^-4 - 10^-5 | Not available |
| **RdF** | Micro-Foil | TP | < 184 / 260 | N/A | N/A | Flexible |
| **RMT Ltd** | 1MC04-1MD06 | TP | < 200 | 20-80 $mV/cm^2$ | 0.1-1 | Area max 13x13mm, thickness >1mm |
| **Wuntronic** | FM and FRM | TP | < 150 | 126-378 $(W/m^2)/mV$ | 3 | Thickness >1.5mm |
| **Captec** | Heat flow sensor | TP | < 120 / 300 | 0.5 $\mu V/(W/m^2)$ | N/A | Custom made |
| **EKO** | MF-180 / HF-10S / MF-180M / HF-30S | TP | -30 – 120 | 28 $\mu V/(W/m^2)$ | 13 - 28 | Area 300x300x0.5m |
| **Omega** | HFS-5 / HFS-6 / UHFS-09 | TP | -50 – 120 / -20 – 150 | 13-1500 $mV/(W/cm^2)$ | 5 | Price > 700$ |
| **FluxTeq** | HTHFS-01 | TP | up to 1000 | 300 $\mu V/(W/cm^2)$ | N/A | Thickness >3mm |
| | Ultra-09 | TP | -20 – 200 | 100 $\mu V/(W/cm^2)$ | 5 | Price > 500$ |
| | PHFS-01 | TP | -50 – 120 | 770 $\mu V/(W/cm^2)$ | 0.6 | Low temp. |
| **greenTEG** | gSKIN-XM | TP | < 80 | 10 $\mu V/(W/cm^2)$ | N/A | Price > 290 CHF |
| | gSKIN-XI | TP | < 80 | 10 $\mu V/(W/cm^2)$ | N/A | Price 699 CHF |
| **Hukseflux** | FHF04 | TP | -70 – 120 | 11 $\mu V/(W/m^2)$ | N/A | Flexible |
| | GG01 | Gardon gauge | N/A | N/A | N/A | Large size |
| | IHF02 | TP | up to 900 | 0.25 $\mu V/(W/m^2)$ | N/A | 6mm thick |
| | HFP01 | TP | -30 – 70 | 60 $\mu V/(W/m^2)$ | N/A | 5.4mm thick |

# Gen 1 Factsheet

| | |
|---|---|
| **Sensing plate size:** | from $5x5$ to $20x20$ mm, larger sizes on-demand |
| **Thickness:** | 0.8 mm standard, 0.5 mm possible |
| **Temperature range:** | $-50°C\ to\ 500°C$ |
| **Sensitivity:** | $5\ -\ 20\,\frac{\mu V}{W}$ (area dependent) |
| **Thermal conductivity:** | $\sim 300\ W/(m * K)$ |

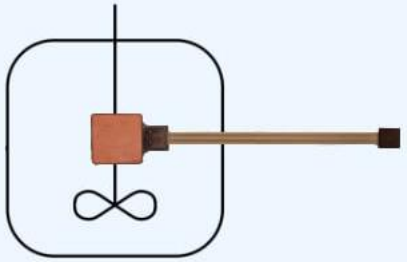
Additional options available upon request

Application

Signal conditioning / amplification

Meerstetter Controller or DAQ

PC




Integrated Q-sens

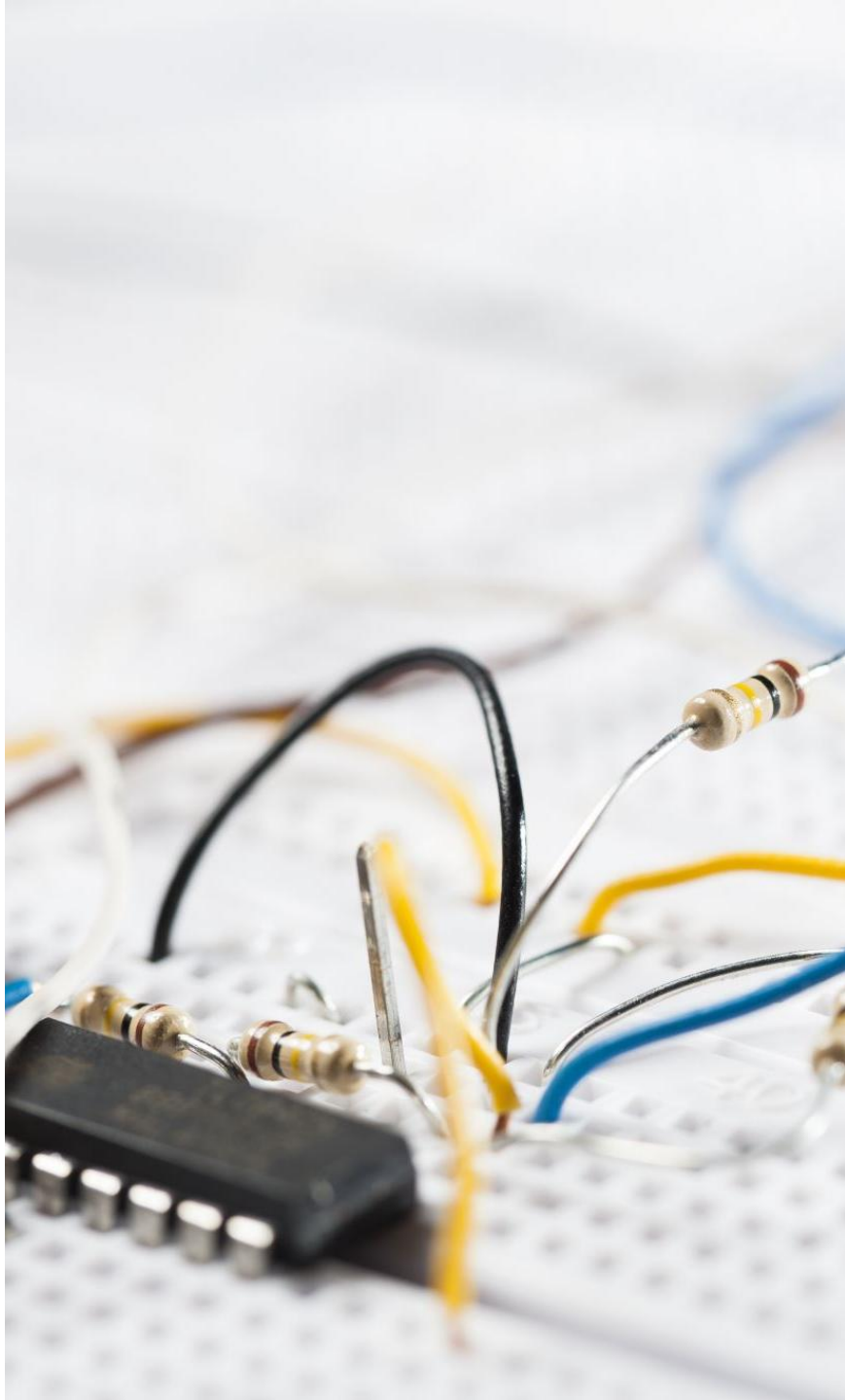
TEC-1161-10A (e.g.)

# Integration with Meerstetter ecosystem

- **Seamless Integration** – Designed to work effortlessly within the Meerstetter control universe
- **Signal Conditioning** – All necessary signal processing provided by Meerstetter
- **Enhanced Performance** – Optimized for stability and long-term monitoring in harsh conditions
- **Customizable Solutions** – Tailored integration to meet specific application needs
- **Full Support** – Comprehensive assistance from Meerstetter's team for smooth implementation

# Demonstrated Q-sens applications

| Scientific Research | Industrial and Collaborative Projects |
|---|---|
| • Turbine Blade Experiments | • 160 MW Turbogenerator Heat Flux Measurement |
| • Permanent Magnet Motor Thermal Control | • Nuclear Fuel Storage Heat and Mass Transfer Studies |
| • Containment Model Heat Flux Measurement | • Pulp and Paper Mill Reactor Heat Flux Measurement |
| • Li-Ion Battery SoH Monitoring | • Boiler Combustion Control Probe Development |
| • IGBT Modules Thermal Management | • High-Voltage Power Cables Electrical Current Measurement |
| • Fire Detection Sensor Development | • Reflux Condensation Phenomena Research |
| • Heat Transfer in Turning Operations | • Chemical Reactor Monitoring System Development |
| • Photosynthesis Heat Flux Measurement | • Diesel Engine Cylinder Heat Flux Measurement |
| • Laser Power Measurement | • Smart Heat Flux Sensing Platform Project (SELENA) |



# Thank you for your attention

Contact info:

Filip Janasz

Scientific Advisor

Dr.sc. ETHZ, M.Eng.

Meerstetter Engineering GmbH

Schulhausgasse 12, CH-3113 Rubigen

Switzerland

Phone: +41 31 529 21 00

Direct: +41 31 529 21 44

filip.janasz@meerstetter.ch