

## Batteryless, Maintenance-free Wireless Bearing Condition Monitoring

*Known machine & process conditions mean:*

*Reduced operational risk, precise failure prediction and maintenance scheduling = reduced cost.*

### Continuous measurements minimize risks

- Plain and roller bearings  
Engines, motors, generators, turbines, gear boxes, drives...
- Measure temperature, vibration, humidity, pressure...
- Alarm message or cyclical condition feedback
- For both new installations and retrofit  
→ MAINTANANCE FREE

### What's New?

- Micropelt Thermogenerators convert the bearing's friction heat (or any other waste heat) into electrical energy to supply a wireless sensor node.
- Maintenance-free after installation
  - Condition monitoring on moving and rotating machine parts
  - Wireless sensing in obstructed locations
  - Functional also inside closed housings
  - All wiring saved, no sliding contacts
  - All low-power measurements supported
- Operational cost = purchase + mounting

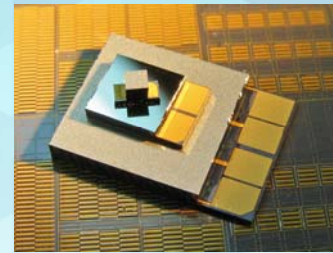
### Operational Benefits

- Knowing wear and tear levels
  - improves maintenance scheduling
  - reduces spares stock and redundancy
  - reduces operational risk and cost
- Only one-off deployment cost, no battery issues
- Reduced maintenance headcount

### How to implement?

- Determine sensible condition indicators
- Deploy TE-Power-Ring with wireless sensor
- Connect to radio receiver in reach
- Connect to supervisory system
- ✓ Benefit from knowing conditions wherever useful

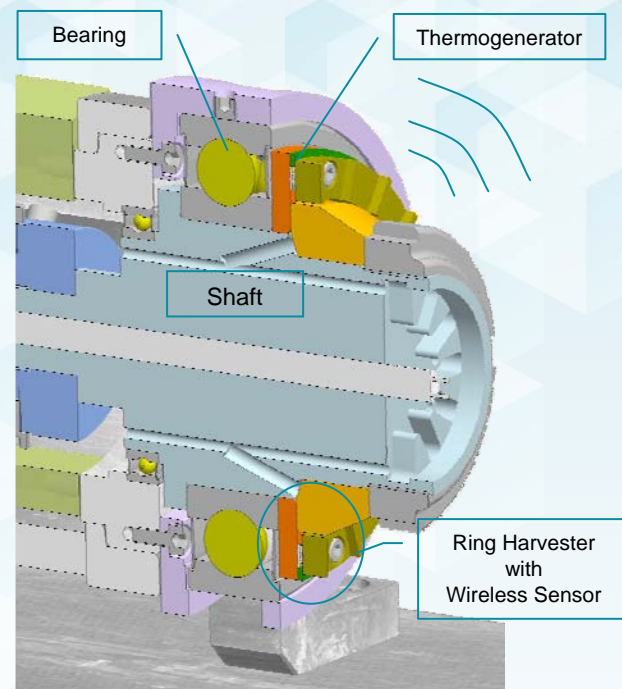
*Micropelt is a start-up chip maker. We are seeking Sensor OEM partners wanting to commercialize products like this. We supply engineering support, build prototypes and license our technologies.*



Chip-sized thermoelectric generators and coolers

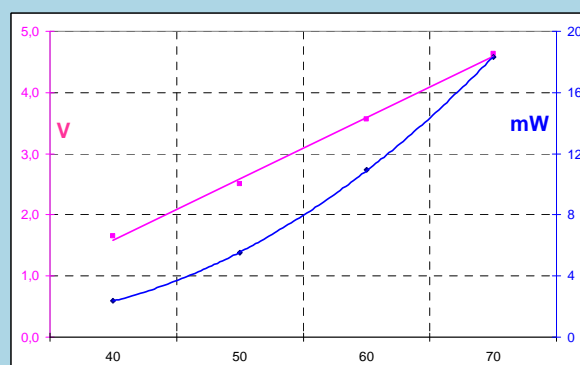


Thermogenerator-based wireless sensor for bearing monitoring



### Power from Waste Heat

Voltage (red) and power (blue) of the MPG-D751 Thermogenerator vs. hot side temperature using low thermal resistance heat sinking.

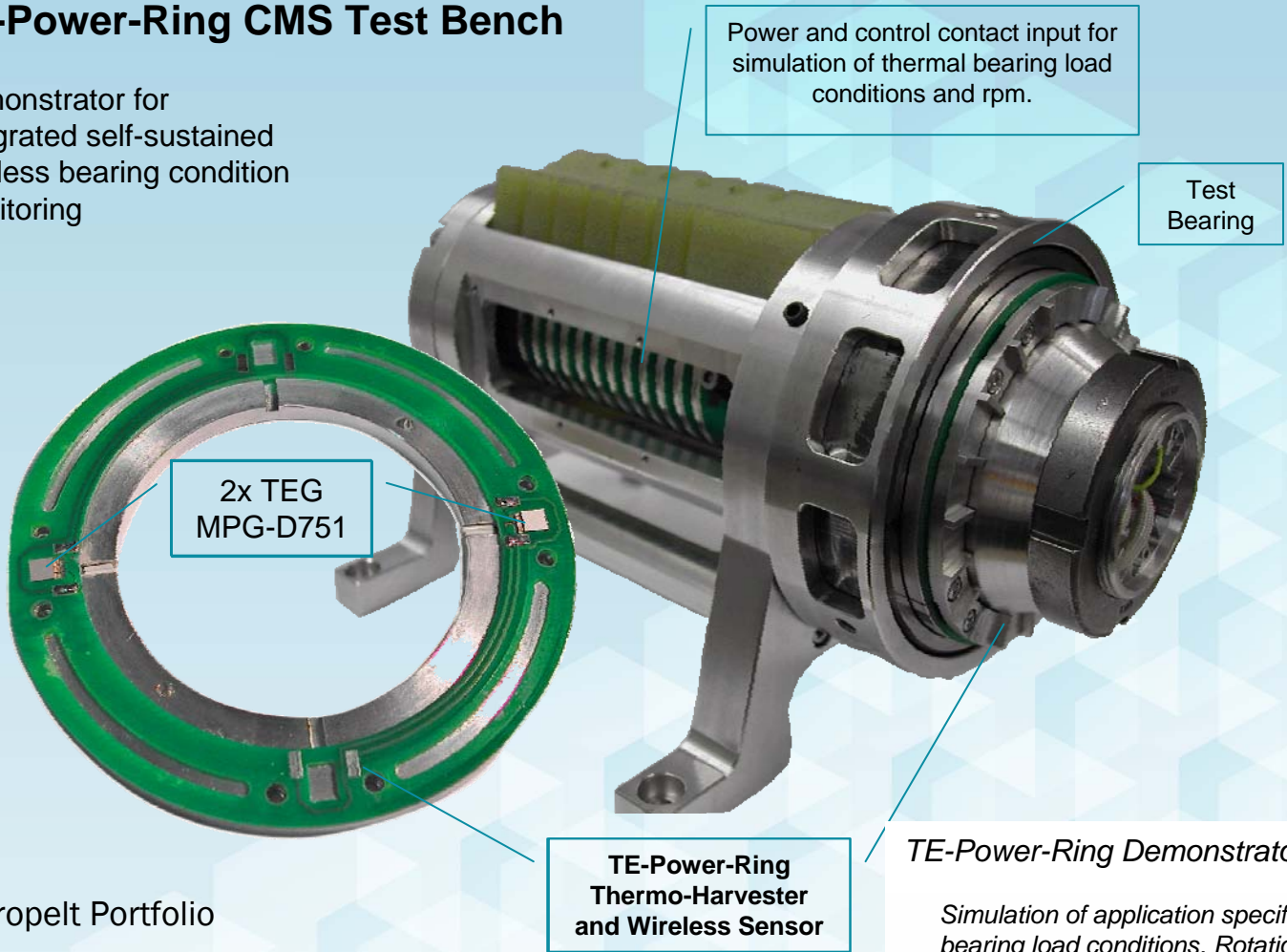


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 Samples and Eval-Kits on stock!

## TE-Power-Ring CMS Test Bench

Demonstrator for Integrated self-sustained wireless bearing condition monitoring



*TE-Power-Ring Demonstrator*

*Simulation of application specific bearing load conditions. Rotation speed and heat dissipation can be set to measure sustainable power levels from the TE-Power-Ring thermo-harvester (TEG) - wirelessly.*

### Control Parameters:

- Bearing heat dissipation (load)
- Bearing rotation speed (rpm)

### Measured Parameters

- TEG hot side - $T_{hot}$
- TEG cold side - $T_{cold}$
- TEG Voltage - $U_{TEG}$

## Micropelt Portfolio

### Life Science (PCR)



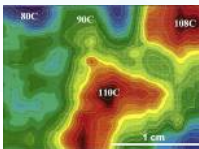
PCR (Polymerase Chain Reaction) cycler systems are being used in genetic diagnostics and research. Heating and cooling power of  $>100 \text{ Watt/cm}^2$  of Micropelt devices provide gradients of  $>15^\circ\text{C/s}$  (vs.  $3^\circ\text{C/s}$  legacy) resulting in smaller, faster and more precise cycler systems – and less operational cost.

### Laser Cooling



Thermoelectric temperature control extends life of telecom and sensor lasers and stabilizes emitted wavelengths. Miniaturized Micropelt TE coolers reduce cost, energy consumption and assembly effort of Laser Systems and sub-assemblies.

### Chip Cooling

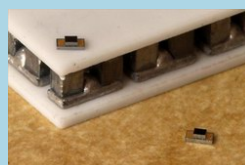


Ever increasing feature density of modern multicore processors feature more and more performance limiting hot spots. Three-dimensional SIPs add to the problem. With its extreme heat pumping capacity a Micropelt spot-cooler can help fixing it.

### Micropelt versus legacy Thermoelectrics:

- 10 x more cooling power
- 50 x more thermocouples per  $\text{mm}^2$
- 100 x faster reaction
- 1000 x smaller in volume

Heater/Coolers, Thermogenerators and TE Sensors are available in footprints from  $< 1\text{mm}^2$  to  $12 \text{mm}^2$  to match any custom application.



MPC-D303 compared to a conventional TE Element

[www.micropelt.com](http://www.micropelt.com)

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