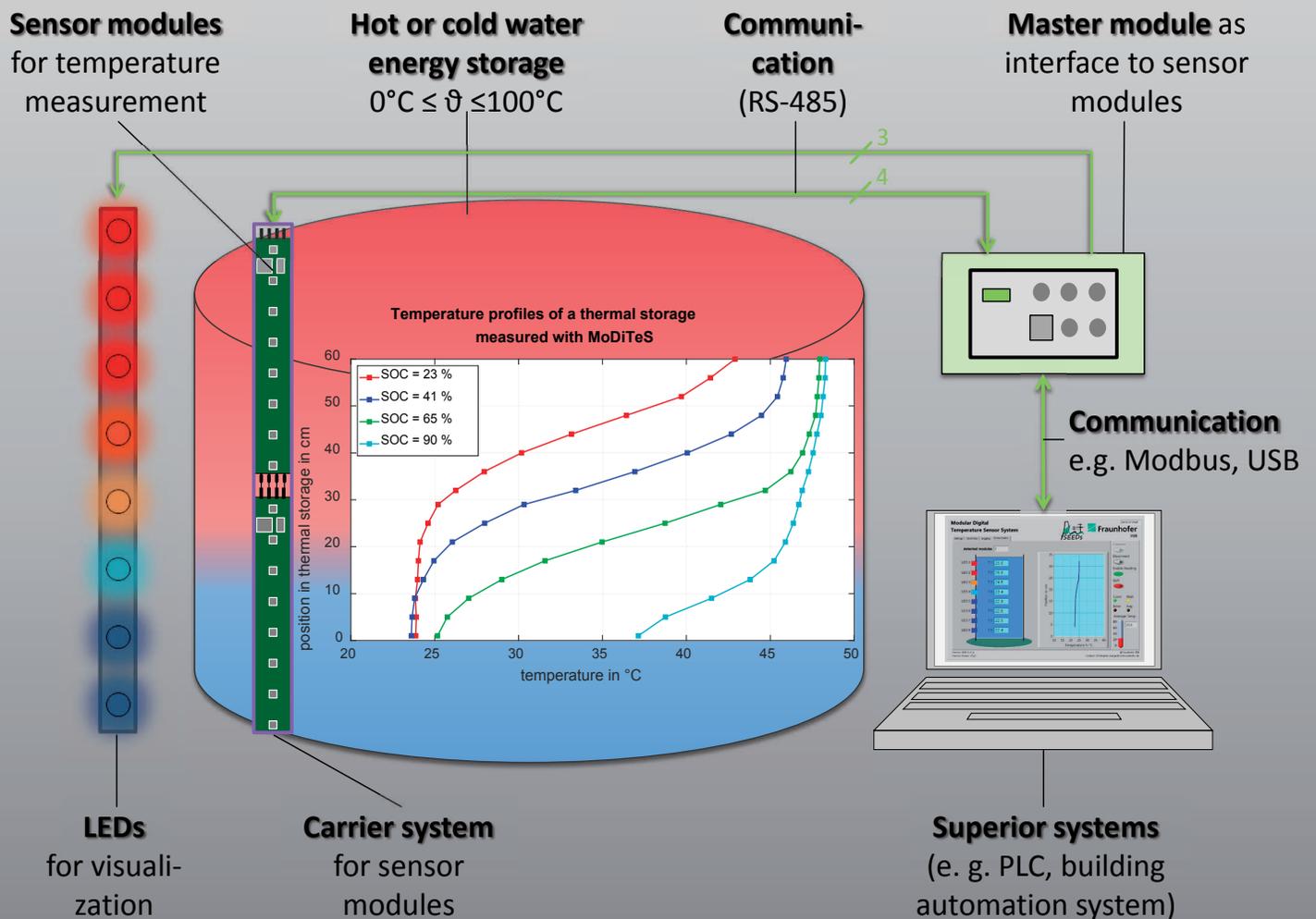
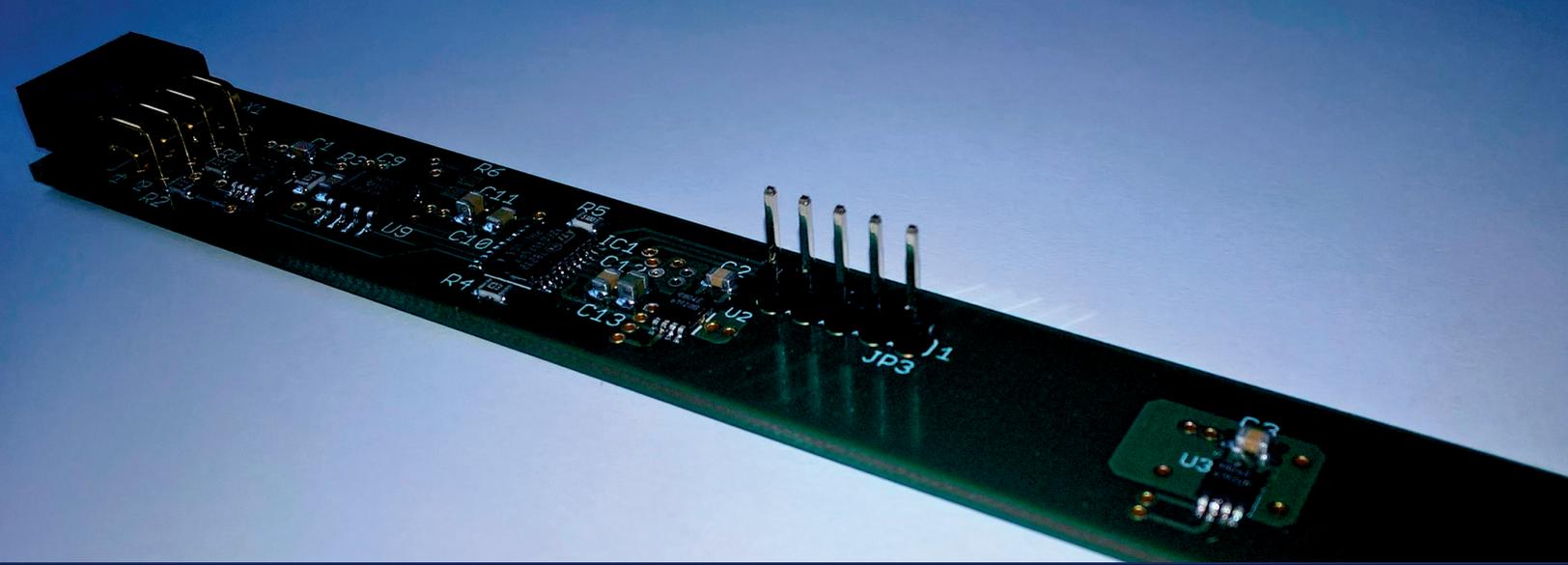


# Modular Digital Temperature Sensor System (MoDiTeS)

*for measurements inside thermal storages*





## Description

Standard techniques for temperature measurement in thermal energy storages require high cabling efforts and high investment costs. Thus only a few measuring points were installed. Therefore, the storage's state of charge and other important parameters cannot be calculated precisely although it is essential for efficient operational strategies.

The Modular Digital Temperature Sensor System developed at the Fraunhofer IISB is composed of the following components:

- **sensor modules** for integration into thermal storages with up to eight temperature sensors per module and integrated analysis functions (filters, averages etc.)
- **master module** for requesting measurements of the sensor modules and for communicating to control systems (for example PLCs, building management systems etc.)

The current hard- and firmware supports applications with up to 98 sensor modules (respectively about 780 measuring points).

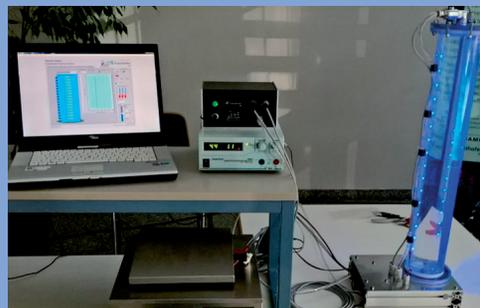
## Advantages

- **Low production costs:** a great number of measuring points and thus a high spatial resolution is possible
- **Easy wiring:** only a four wire cable is needed due to the digital communication
- **High accuracy:** calibrated sensors and eliminated analog signal lines provide accuracies up to  $\pm 0.1$  °C
- **Flexibility:** sensor modules can be combined variably due to an automatic addressing process
- **Expandability:** easy modular integration of further sensors (e. g. pressure)
- **Connectivity:** variable interfaces possible (e.g. Modbus, CAN and others)

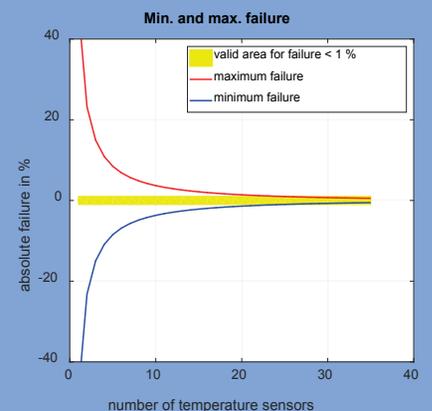
## Services and solutions

- **Development** of sensor systems for infrastructure applications
- **Algorithms** for intelligent monitoring of thermal storages. Examples:
  - accurate state of charge calculation
  - maximum charge and discharge power for an optimal temperature profile and high efficiency
- **Simulation tool** for computing minimal number of required measurement points
- **Simulation and implementation** of operational strategies for thermal storages based on detailed measurements

## Sensor and master module, demonstrator



**Photo:** Demonstrator of Modular Digital Temperature Sensor System



**Simulation result:** Minimal number of sensors for a typical temperature profile, 25 sensors are required

## Fraunhofer Institute for Integrated Systems and Device Technology IISB



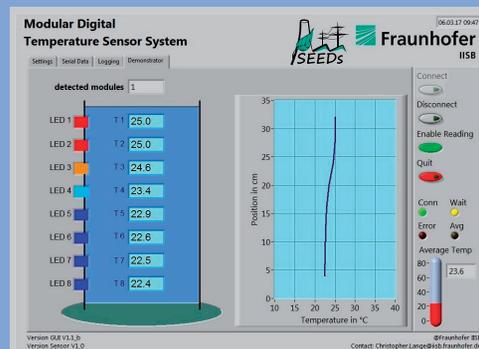
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**Screenshot:** Graphical user interface (GUI) for demonstrating the Temperature Sensor System



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