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gO Measurement-System

Wireless multi-channel measurement system for U-value, temperature, and humidity





gSKIN® Sensing: the new greenTEG online measurement system «quantify thermal insulation quality & beyond»

What is the U-value and why is it important?

- The U-value is the most important value for the user independent assessment of the energy requirement of a building
- The heat transfer coefficient (U-value) describes how much energy flows through a building element, e.g. a wall
- The lower the U-value, the better the insulation
- Quantitative assessment of heat bridges is possible. Sources of mold can easily be detected

$$U\text{-Value} = \frac{\text{Heat Flux}}{\text{Temperature difference (inside / outside)}}$$

For a precise planning of an energetic refurbishment the U-value is necessary

- The composition of a wall is often not fully known, especially of older buildings
- Materials change over time, for example because of humidity
- Missing hard data leads to unnecessary expenses for insulation
- It is difficult to assess the insulation quality, for example after project termination and acceptance of construction



The gO Measurement-System enables easy measurements of the U-value!

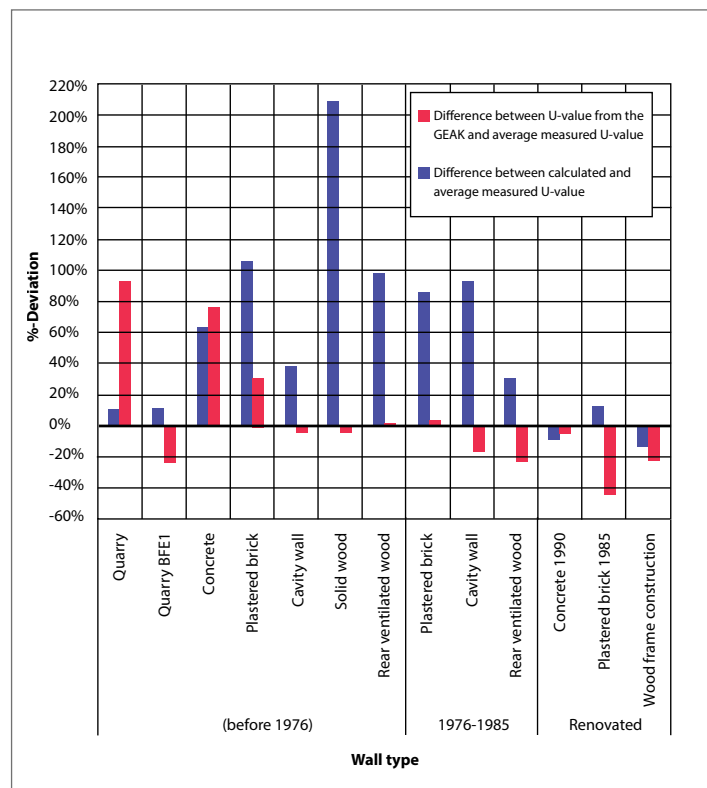
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Study by the Swiss Federal Office of Energy: Measuring Is Better Than Calculating

- The Swiss Federal Office of Energy commissioned a study¹ in which Hässig Sustech GmbH measured the U-values of different types of walls and compared them with the calculated U-values of building energy certificates
- For this study 100 U-value measurements were conducted with the gSKIN® U-Value Kit

Study results

- Big differences between the measured and the calculated U-values
- Big differences between the calculated and measured U-values when the wall composition was insufficiently documented
- Extra costs can occur during energetic refurbishments



¹<https://www.aramis.admin.ch/Default.aspx?DocumentID=35285>

The market for refurbishments will grow



50% of the German building stock needs to be renovated within the next 20 years¹



In about 17% of all apartments mold occurs. This causes annual costs of about EUR 4 Mrd.⁶



More than half of the British building stock was built before 1960 and has very low energy efficiency. To reach the climate goals, far reaching refurbishments are necessary.²



80% of the Swiss building stock is over 40 years old⁴ and consumes approximately 50% of the total energy consumption

1 Dena, Sanierungsstudie Teil 2, S. 7

2 <https://www.theguardian.com/environment/damian-carrington-blog/2013/nov/29/uk-homes-most-expensive-heat-eu-fuel-poverty>

3 Institut für Bauforschung e.V., Schimmelpilzschäden: Schadenbilder – Ursachen – Folgen, 2015

4 https://www.nzz.ch/energie_immobilien/der-versteckte-verbrauch-und-die-vielen-alten-haeuser-1.17314765

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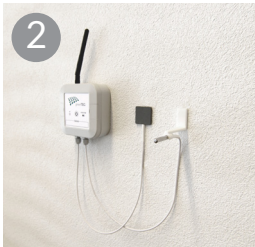
Measuring the U-value with the gO Measurement-System



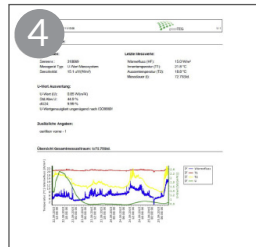
1. Install and start base station.



3. Place sensor node for the outer temperature measurement at about the same height as the inner sensor node inside the building. Measurement process starts automatically with start of the base station.

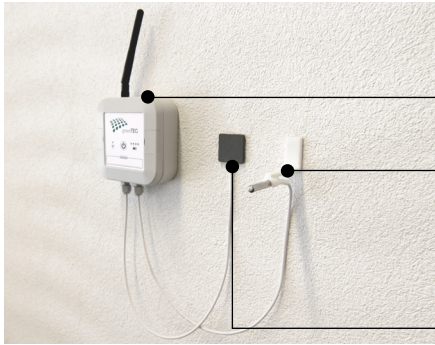


2. Place the sensor nodes on the inner wall, ensuring they are no more than 100m from the base station. Check connection to the base station.



4. Live view of the measurement results via cloud, inclusive U-value.

Sensor node inside



Measurement node

- Wireless transmittance to base station
- Range of about 700m outdoors and 100m indoors
- Very long battery lifetime of about 7 days or via USB connection

Temperature sensor

- Highest precision
- Especially designed for air temperature measurements
- Distance holder for simple and fast set-up
- Reproducible,

Heat flux sensor

- Highest precision
- Very high sensitivity
- Robust
- Easy mounting
- Surface temperature sensor integrated for simultaneous R-value measurement

Sensor node outside



Temperature sensor (inside)

- Highest precision
- Especially designed for air temperature measurements
- Distance holder for simple and fast set-up
- Reproducible

Surface temperature sensor (outside)

- Surface temperature sensor integrated for simultaneous R-value measurement

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Gateway



- Data transmission via WIFI or 2G / 3G
- All measurements can be monitored live via the cloud
- Measurements of up to 7 days without recharging of the battery
- Automatic detection of different measurement nodes and connections

Cloud-Solution

- Live view of all sensor data, including U-value
- Platform independent and continuously updated measurements can be viewed via cell phone, tablet or laptop
- Managing and viewing of different systems
- Easy data management with a data base



Advantages of the gO Measurement-System

- User friendly system for U- and R-value measurements
- Wireless solution which makes measurements in difficult environments possible
- Fast and easy set-up
- Parallel measurements on different spots possible
- Easy data management, remote monitoring and remote read-out via cloud
- Measurement according to ISO 9869
- Optimal addition to thermography
- Extendable system, for example with humidity sensors for mould detection



Status quo assessment before refurbishment



- A precise status quo assessment of the U-value before a refurbishment increases the quality of the overall planning.

Mould detection



- Dew point assessment via room humidity and surface temperature measurement
- Quantitative assessment of heat bridges via U-value measurement

Check after project finalization



- In case of dispute between project partners, a non-invasive U-value measurement can increase the transparency between the project partners

Research and development, quality control



- Exact measurement tool for U-value measurement in R&D of new insulation materials
- Tool for quality control in the production of insulation materials

Users

- Energy Consultants
- Architects
- Building physicists
- Insulation experts
- Scientists
- Mould experts

The gO Measurement-System can be used in many different applications. U-value measurements provide data for decisions in building physics and related fields

gO Measurement-System Specifications

Gateway

Cloud connection:	3G / 4G (worldwide) or WIFI connection
Sensor node connection:	LoRa SC protocol (868/815 MHZ)
Reach:	>700m (Outside) >100m (Inside)
Power source:	Integrated battery or power adaptor
Number of sensor nodes	up to 16 per gateway

Sensor nodes

Sensor node facade inside	1 Room temp. (+/- 0.1° C) 1 Surface temp. (1/- 0.1° C) 1 Heat flux (+/-3%)
Sensor node facade outside	1 Room temp. (+/- 0.1° C) 1 Surface temp. (+/- 0.1° C)
Power source	1 Room temp. (+/- 0.1° C) 1 Humidity (+/-2) Available starting 2018
	Intergrated battery (up to 7 days) or USB power adapter

Contact greenTEG for additional information

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About greenTEG

greenTEG AG was founded in 2009 as a spin-off of the Swiss Federal Institute of Technology (ETH). The company develops, manufactures, and markets thermal sensors for heat flux and laser power/position measurements and provides consulting on the thermal integration of its products. Today, greenTEG supplies OEMs as well as scientists in corporate and university labs around the world with its unique products. The greenTEG team consists of 15 specialists in engineering, materials science, physics, and electric engineering. All sensors are fully developed and manufactured in Zurich, Switzerland.

