

# User Manual

for

**gO Measurement-System<sup>®</sup>**



## 1. Delivery overview: gO Measurement-System

- 1 Base Station
- 1 to 6 Nodes of Type 1, 2 or 3
- 1 Power Supply
- 2 to 6 Sensor Clips
- 24 double-sided adhesive tapes water repellent (large)
- 1 double-sided adhesive roll tape
- 1 scissors
- 1 putty

### By E-Mail:

Login for the cloud-based analysis tool



Figure 1: Overview of the gOMS transportation box

## 2. Node and base station at a glance

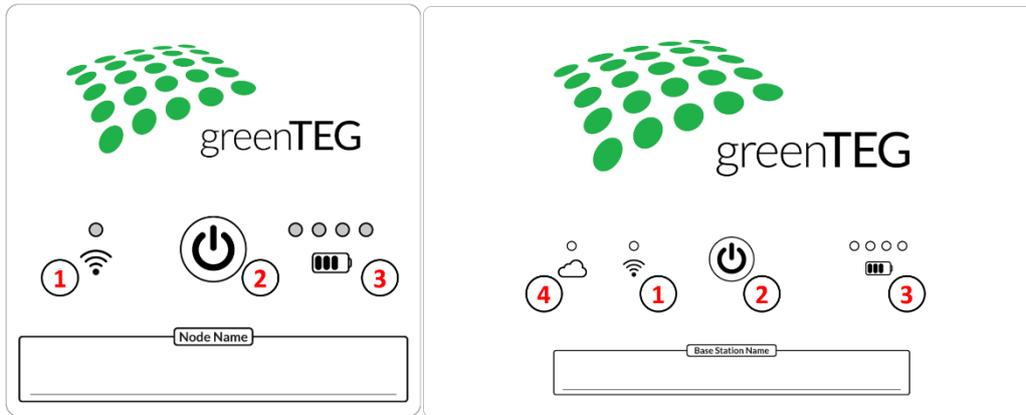


Figure 2: Node (left) and base station (right)

1. LoRaSC connection indicator
2. Power-button
3. Battery charge indicator
4. Cloud connection indicator

### 3. How to install the gO Measurement-System

In the following the correct installation and putting into service of the system is explained.

#### 1. Setting-up of the base station

1. Place the base station inside the building/object where you would like to do the measurements, at a location with good GSM network connection. We strongly recommend plugging in the power supply during the measurement, since base station battery life is 2 – 3 days.
2. Turn on the base station by pressing and holding the «power» button until the cloud connection indicator starts to flash. When pressing the «power» button only shortly the battery charging status can be seen. Please refer to section 4.2.1 *Dashboard*, to check the signal strength of the cellular (2G/3G) base station. Generally, the signal strength should be above 50%.

#### 2. Installation and startup of the nodes.

**NOTE:** The instructions in this section are only a quick summary of node installation procedures. It is necessary to read the gOMS Mounting Recommendations manual for more detailed instructions and precautions on all gOMS mounting options provided by greenTEG.

**Caution:** Sensor accuracy will only perform as per specifications if greenTEG mounting solutions are used. Any other non-greenTEG approved mounting solutions will result in measurement errors and possibly even safety issues.

**Optional:** Use thermographic imaging to help identify representative/interesting spots for the heat flux sensor placement on your building element

##### 2.1 Inside Node (Type 1):

1. Mount the node to the wall using at least 2 of the provided double-sided adhesive roll tapes or place it on a suitable spot next to the wall (for example a shelf). Please ensure that the adhesive tape removal tabs stick out from the side of the measurement node (see Fig. 3)
2. Mount the combined heat flux/surface temperature sensor with a strip of double-sided adhesive roll tape. It is important that the removal tab points to the side of the sensor and not to the direction of the sensor cable (see Fig. 3).
3. Mount the ambient air temperature sensor using the provided sensor holder and one piece of double-sided adhesive tape.
4. Turn on the node by holding the power button until the connection indicator starts to flash yellow. The node now automatically builds up a connection to the base station, which can take up to 2-3 minutes. As soon as the connection is established, the indicators color changes from yellow to green. When the power-button is pressed shortly the battery charging status can be seen. If the node shouldn't connect to the base station within 5min, the node should be restarted and/or relocated. Please refer to section 4.2.1 *Dashboard*, to check the signal strength between the node and the base station. Generally, if the signal quality is below 25% data might get lost.

##### 2.2 (Outside) Node (Type 2):

1. Mount the node at the wall with putty or place it on a suitable spot nearby the wall (for example a window sill).
2. Mount the surface temperature sensor on the wall with a homogenous layer of putty. While applying the putty, please do not bend or kink the sensor cable.
3. Mount the ambient air temperature sensor with the sensor holder and some putty.
4. Turn on the node by holding the power button until the connection indicator starts to flash yellow. The node now automatically builds up a connection to the base station, which can take up to 2-3 minutes. As soon as the connection is established, the color of the indicators change from yellow to green. When the power button is pressed shortly the battery charging status can be seen. If the

node shouldn't connect to the base station within 5min, the node should be restarted and/or relocated.

**2.3 Additional nodes can be added by repeating step 2.1 and 2.2. Note that it is also possible to connect multiple inside nodes with one outside node, as long as the outside conditions can be assumed to be the same for both measuring spots (for example when measuring two U-values next to each other). It is then however only possible to assess a U-value and no additional R-value since the exact surface temperature of the outside wall is missing.**

#### 2.4 Humidity Measurements (Type 3)

1. Place the node at the spot where you would like to measure the humidity (normally in the middle of the room).
2. Mount the combined ambient air temperature and humidity sensor with the enclosed sensor clip and a piece of double-sided adhesive roll tape.
3. Optional: If you would like to measure an AW-value, you must measure the surface temperature as well with an additional node Type 1 or 2.
4. Turn on the node by holding the power-button until the connection indicator starts to flash yellow. The node now automatically builds up a connection to the base station, which can take up to 2-3 minutes. As soon as the connection is established, the indicators color changes from yellow to green. When the power-button is pressed shortly the battery charging status can be seen. If the node shouldn't connect to the base station within 5min, the node should be restarted and/or relocated.



Figure 3: How to mount the node correctly (left), the sensor correctly (middle) and incorrectly (right).

**2.5 After a successful completion of the measurements, the nodes and the base station can be turned off by pressing and holding the power button until all lights turn off. Detach the sensor, sensor clip and node by pulling on the removal tabs in a direction parallel to the wall (see Fig 4).**

**Caution:** Greatest caution is needed when detaching the heat flux and surface temperature sensors. You must NOT pull at the cable since you can easily break the sensor. For the detachment carefully pull at the removal tabs along the direction of the wall (see Fig. 4). If the wall/facade is very fragile, the tape may cause damage to the wall. In addition, usage of putty may leave oil stains on the wall.



Figure 4: How to remove the nodes/sensors correctly (left) and incorrectly (right)

## 4. Online Tool

Analysis and monitoring of the data on: <http://goms.greenteg.com>

### 1. First Login

During the first login you are asked to change your password. Use the login which was sent to you with delivery and follow the three steps shown below (see Fig. 5).

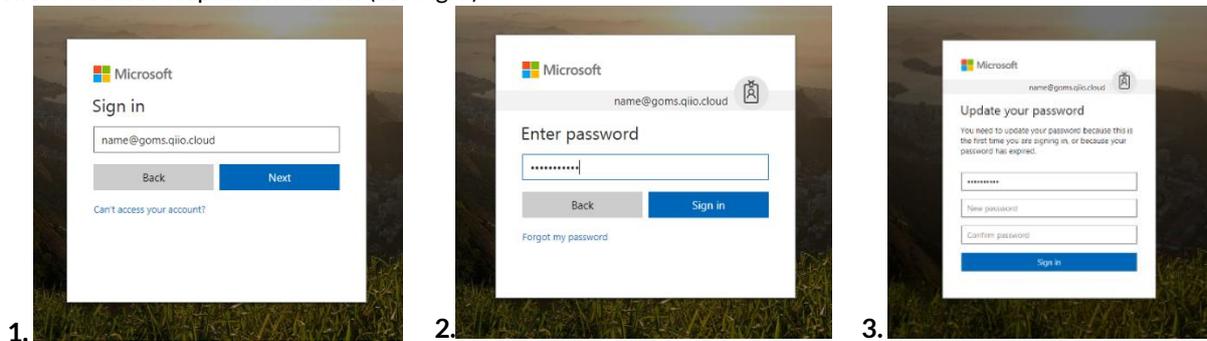


Figure 5: Screens for first login

## 2. Online tool main views

### 2.1 Dashboard

The online tool has two important pages. The first page is the Dashboard where one can see the live measurement data for the base station and the nodes that are currently connected. It helps you to check if the nodes are connected and measuring. In the Dashboard one can also see the battery level and the signal strength of the nodes and the base station. Specifically, the signal strength percentage of the nodes refers to the signal strength between the node and

the base station and has to be above 25% (otherwise data might get lost), whereas the signal strength percentage for the base station represents the cellular (2G/3G) signal and has to be roughly above 50%.

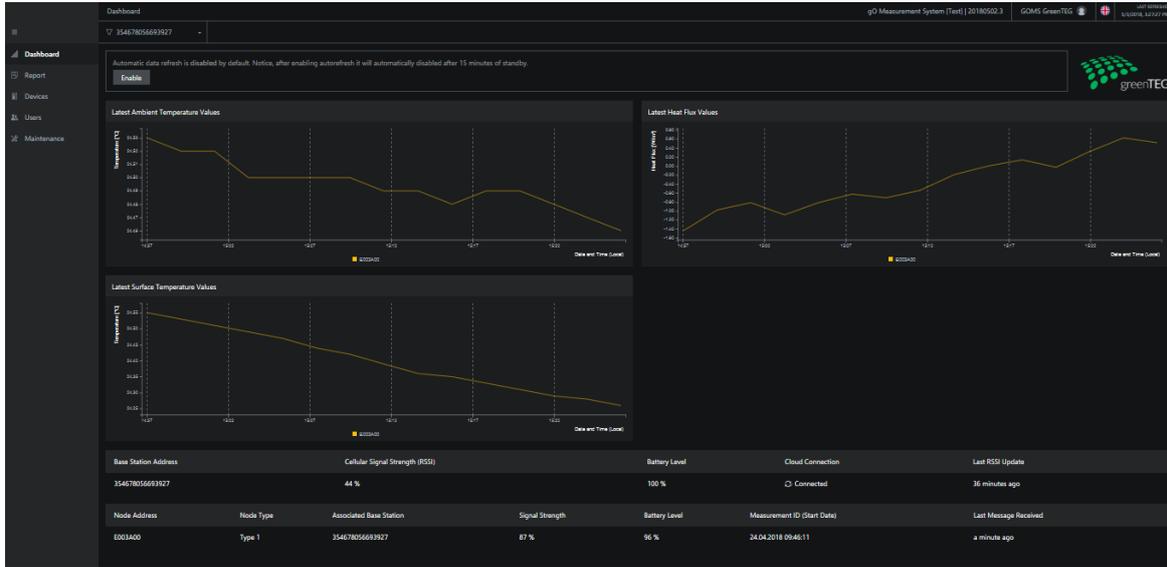


Figure 6: Live View

## 2.2 Report

The second page is the Report. The report tools can be accessed by clicking on “Report” in the menu on the left-hand side. On the upper left side of the report page one can select the desired data analysis tool that can be one of the following:

“U-value calculator”, “AW (humidity) calculator” or “Raw Data export”.

The design of the U-value calculator is shown in Figure 7. In both tools (U-value and AW calculator) the data gets refreshed automatically and in real time. To analyze the data, one has to select a time period which contains the desired measurement, select a base station, a measurement start and the desired node pairing (one inside node and one outside node). By clicking “Apply” the measurement data gets processed and a U-value (or AW-value) is calculated. In the U-value calculator it is also verified if the measurement fulfills the ISO 9869 conditions. If needed, the data can be downloaded by clicking the “Export to CSV” button. The AW-value calculator works the same way.

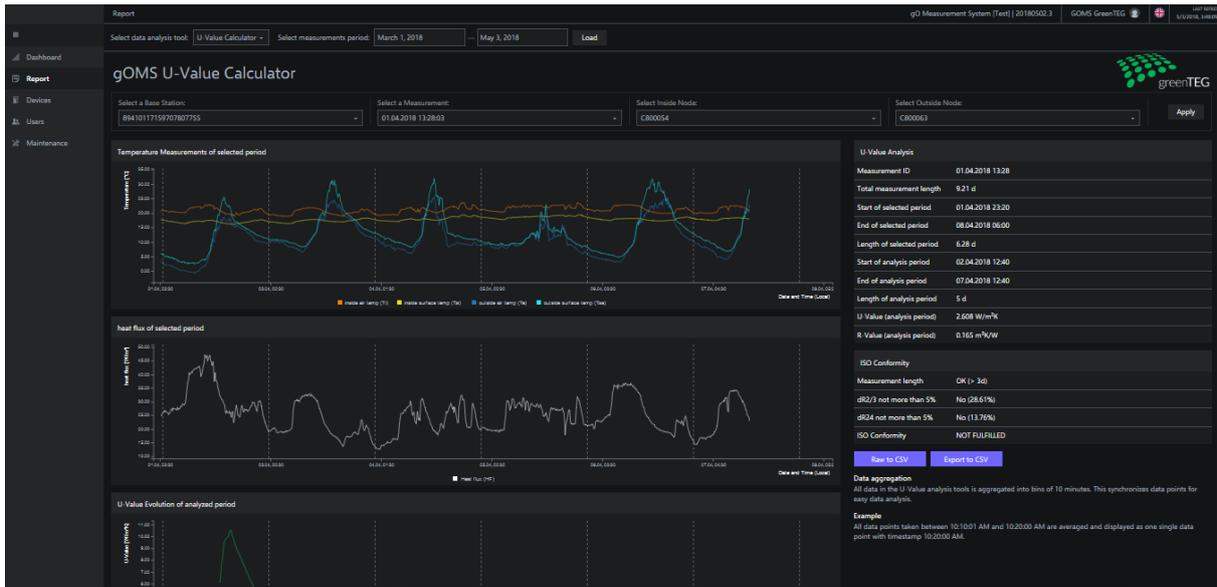


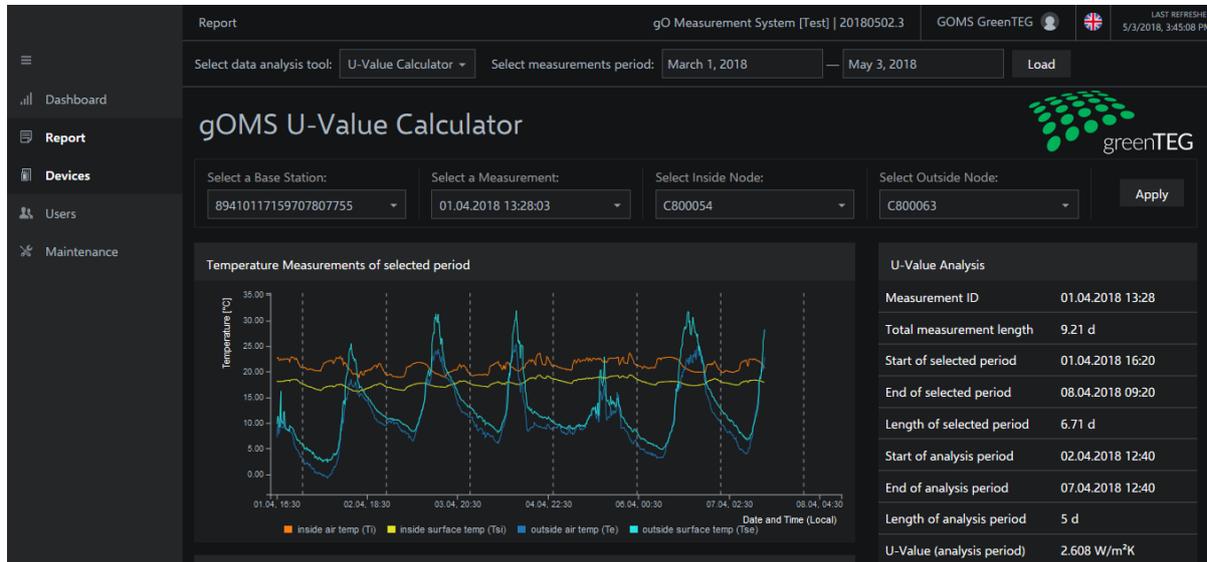
Figure 7: U-value calculator view

The “raw data export” tool allows the download of all the measurement data of one node.

## 5. Print the report

To print a PDF report, you can use the print function from your web browser. Since the webpage is too large to fit on a single A4 page one has to go through the following steps (here Mozilla Firefox was used):

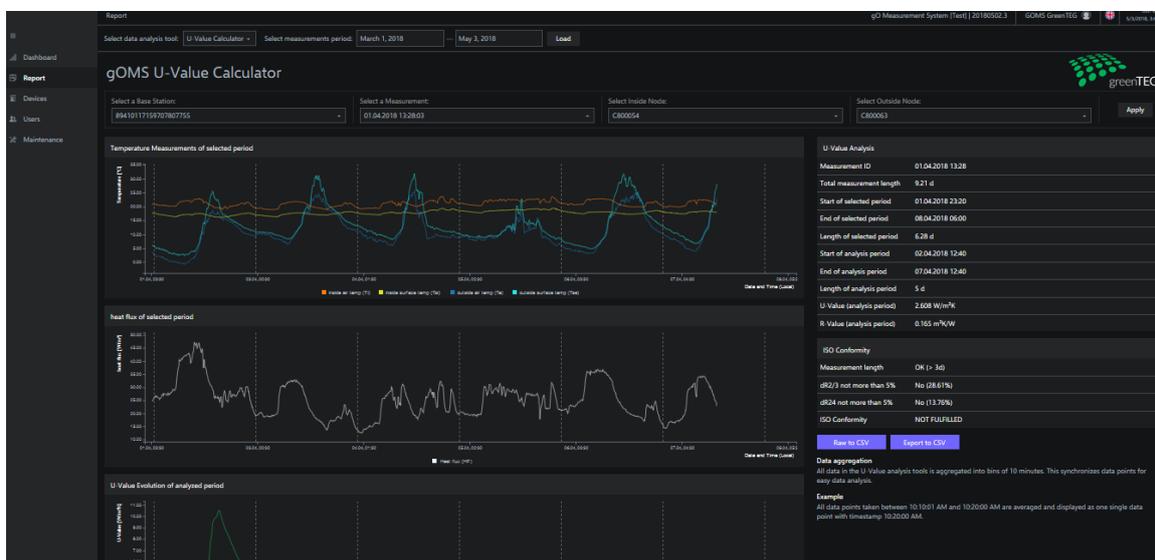
### 1. Choose the measurement data you want to analyze (as described before)



The screenshot shows the 'gOMS U-Value Calculator' interface. At the top, there are navigation tabs for 'Report', 'Dashboard', 'Devices', 'Users', and 'Maintenance'. The main area contains several input fields: 'Select data analysis tool' (U-Value Calculator), 'Select measurements period' (March 1, 2018 to May 3, 2018), 'Select a Base Station' (89410117159707807755), 'Select a Measurement' (01.04.2018 13:28:03), 'Select Inside Node' (C800054), and 'Select Outside Node' (C800063). Below these is a 'Temperature Measurements of selected period' graph showing four data series: inside air temp (Ti), inside surface temp (Tsi), outside air temp (Te), and outside surface temp (Tse). To the right, a 'U-Value Analysis' table provides the following data:

Measurement ID	01.04.2018 13:28
Total measurement length	9.21 d
Start of selected period	01.04.2018 16:20
End of selected period	08.04.2018 09:20
Length of selected period	6.71 d
Start of analysis period	02.04.2018 12:40
End of analysis period	07.04.2018 12:40
Length of analysis period	5 d
U-Value (analysis period)	2.608 W/m <sup>2</sup> K

### 2. Press **Ctrl + +** to adjust the zoom (suggested: 50% zoom out, landscape orientation)

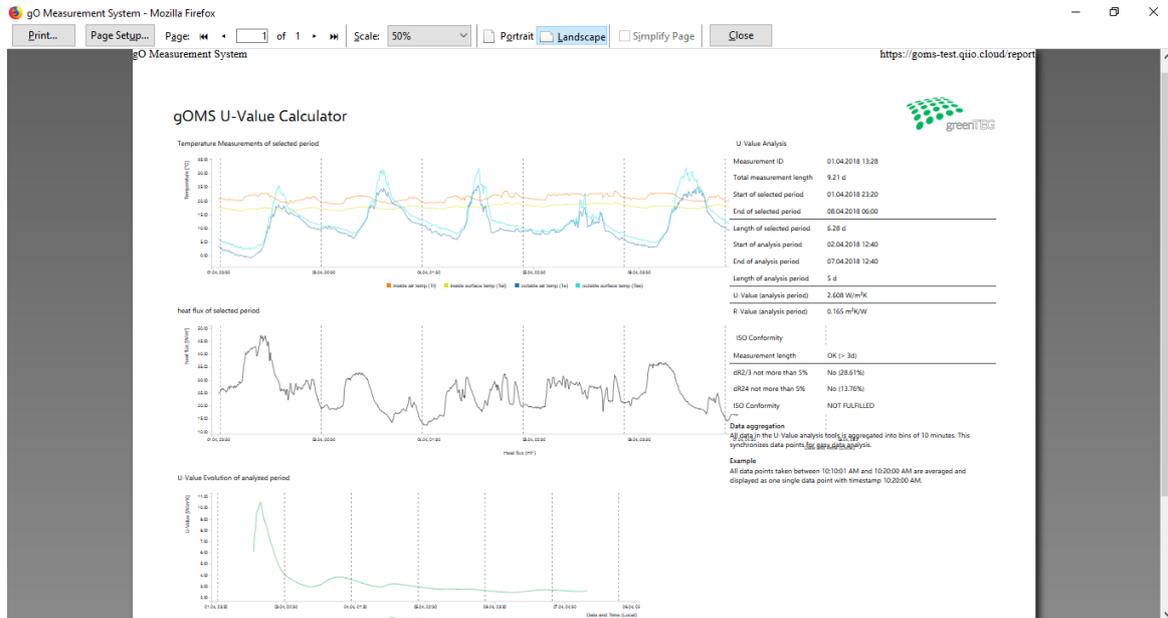


This screenshot shows the same interface as above but with zoomed-in graphs. The 'Temperature Measurements of selected period' graph is zoomed in to show more detail of the temperature fluctuations. Below it, a 'Heat Flux of selected period' graph is visible, showing heat flux in W/m². At the bottom, a 'U Value Evolution of analyzed period' graph shows the U-value over time. The 'U-Value Analysis' table on the right now includes additional data:

Measurement ID	01.04.2018 13:28
Total measurement length	9.21 d
Start of selected period	01.04.2018 23:20
End of selected period	08.04.2018 06:00
Length of selected period	6.28 d
Start of analysis period	02.04.2018 12:40
End of analysis period	07.04.2018 12:40
Length of analysis period	5 d
U-Value (analysis period)	2.608 W/m <sup>2</sup> K
R-Value (analysis period)	0.165 m <sup>2</sup> /KW
ISO Conformity	
Measurement length	OK (> 3d)
dR2/3 not more than 5%	No (28.61%)
dR24 not more than 5%	No (13.76%)
ISO Conformity	NOT FULFILLED

Buttons for 'Back to CSV' and 'Export to CSV' are visible at the bottom of the analysis table. A 'Data aggregation' note states: 'All data in the U-Value analysis tool is aggregated into bins of 10 minutes. This synchronizes data points for easy data analysis.' An 'Example' note states: 'All data points taken between 10:00:01 AM and 10:20:00 AM are averaged and displayed as one single data point with timestamp 10:20:00 AM.'

3. Press **Ctrl + p**, or use the print function of your browser, to print the report or create a pdf



## 6. Requirements for an ISO 9869 compliant U-value measurement

In the following the most important aspects for an ISO 9869 compliant U-value measurement are listed. For more detailed information the reader is referred to the complete ISO 9869 documentation.

### Mounting of the surface temperature sensor and the (combined) surface temperature/heat flux sensor

- Always use the supplied double-sided adhesive tapes to mount the sensor since it has been calibrated for it.
- Inside and outside sensors must be mounted exactly opposite to each other at the same wall for good results.

### Mounting of the ambient temperature sensor

- Use the supplied sensor clips to mount the sensor.
- Avoid direct solar radiation onto the sensor.
- Place the sensor between 5-10cm next to the heat flux or surface temperature sensor.

### General:

- The duration of the measurement should be at least 72h.
- A temperature difference between inside and outside temperature of at least 5°C over the entire period is recommended.
- If surrounding conditions are strongly fluctuating it might take longer than 72h to assess an ISO 9869 compliant U-value.

## 7. Charging of the measurement system

With the supplied power supply, it takes approximately 6 hours to charge the base station and 2 hours to charge a node. We suggest to not use cheap chargers as these are often not reliable and can lead to technical problems. For additional chargers and power banks visit our e-shop or contact us.

## 8. Mini FAQ

- **How do I turn of the base station?**  
Press the power button until the cloud and LoRa indicator starts to flash. It takes then approx. 30 seconds until the base station is completely shut down. During this time both indicators flash orange/yellow.
- **Where can I find more information on how to install and analyze a measurement?**  
On greenTEG's YouTube channel you can find various explanatory videos on the gOMS. Moreover, you can find case studies and a software tutorial on the greenTEG Homepage.
- **How can I check the battery level of a node/base station?**  
There are two options. Either you press shortly the power button. Then you should be able to see the battery level directly from the battery indicator. Another possibility is to go into the Live Data view of the analysis tool. There, you can see both the battery level of the (running) nodes and of the relevant base station. This is only possible if the system is running.
- **What should I do if a node is not responding?**  
If your node doesn't react (e.g. by using a non-compatible charger) you can do a reset of the node. First, switch off the node and charge it for at least 10 minutes. Then press and hold the power button for around 30 seconds. The node will switch on, the LoRaSC connection indicator will turn yellow and the node will switch off again. Now you can use the node as usual.

### Disclaimer

The above restrictions, recommendations, materials, etc. do not cover all possible cases and items. This document is not to be considered complete and is subject to change without prior notice. In particular, greenTEG assumes no liability for damages caused by the (de-)installation of the system at the wall.

### Revision History

Date	Revision	Changes
15.01.2018	0.1 (preliminary)	Initial version
30.01.2018	0.2 (preliminary)	Detachment of the sensors
15.02.2018	1	Various improvements
07.05.2018	1.1	Updated text and screenshots for new firmware
14.01.2019	1.2	Updated with Roll Tape usage instructions and thermographic imaging recommendation