



## **INSTRUCTIONS FOR USE**

**SOLIDRH RD1 READER**

**SOLIDRH SH1 SENSOR**

**SOLIDRH SHR SENSOR**



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## Version

Instructions for use, version 1.3, 27 Aug. 2015.

## Documentation practices

The most important safety-related issues in this user manual are marked as follows:

<b>DANGER</b>	Notifies of a serious danger. Instructions must be read carefully. Non-adherence to instructions can cause a risk of personal injury or even death.
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<b>WARNING</b>	Notifies of a potential danger. Instructions must be read carefully. Non-adherence to instructions can cause product damages or a loss of important information.
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<b>NOTE</b>	Emphasis on important information related to the use of the product.
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## Safety

The SolidRH RD1 reader and the SolidRH SH series sensors are delivered as tested and approved. Please note the following precautions:

**DANGER**

Only equip the product with batteries and chargers delivered by Wiiste Oy.

Never disassemble or modify the product.

## Recycling



Disposing of the SolidRH devices or batteries as domestic waste is not allowed in any European country. Ensure the correct decommissioning of the product and battery by disposing them in accordance with local laws or disposal requirements on electrical products/batteries.

## Adherence to regulations

Both the SolidRH RD1 reader and the SolidRH SH- series sensors meet the requirements set in the directive on radio equipment and telecommunications terminal equipment (R&TTE) 1999/5/EC, in accordance with the harmonized standards and technical specifications:

Art. 3.1.a (Safety): EN 601010-1:2010

Art. 3.1.b (EMC): EN 301 489-1 V1.9.2  
EN 301 489-3 V1.4.1

Art. 3.2 (Spectrum): ETSI EN 300 330-1 V1.7.1  
ETSI EN 300 330-2 V1.5.1



## Patents

The SolidRH system is protected by the following patents and pending patents:

EP2751545, US20140216143, CA2847221, RU2014110928

## Manufacturing and Warranty

The product has been manufactured by Wiiste Oy, Tiiliruukinkatu 22, 33200 Tampere, Finland.

The SolidRH RD1 reader and the SolidRH SH series sensors are covered by a 12-month manufacturer's warranty, starting from the date of purchase. The requirement for the validity of a warranty for permanently installed sensors is that just before installation, the sensor is measured and its operation verified, using a reader, and that after the installation, the sensor is visible and its correct installation can thus be easily observed. The warranty does not cover damage caused by normal wear and tear, exceptional operating conditions, negligent handling or unauthorised modifications.

## Technical support

Wiiste Oy is responsible for the product's technical support, see contact information under Manufacturing and warranty or at [www.wiiste.com](http://www.wiiste.com).

## Service and calibration

The only maintenance procedure for the SolidRH RD1 reader and the SH series sensor to be performed by the user is the external cleaning of the device. Use a lint-free cloth dipped in mild detergent solution for the cleaning.

The SolidRH RD1 reader includes a sensor for measuring the ambient temperature and relative humidity. This is why it is recommended that the reader is calibrated once a year.

The SolidRH SH series sensors for permanent installation are delivered factory-calibrated. If stored and installed in accordance with the instructions, the sensor calibration is valid for one year. Typically, sensors are not calibrated after installation, so the gradual weakening of the measurement accuracy (see technical data) must be taken into consideration when examining the measurement results.

The SolidRH SHR sensor is delivered factory-calibrated. Operating conditions and frequency of use affect the calibration interval. The sensor must be re-calibrated, if there is reason to suspect that the specified measurement accuracy is no longer obtained. It is recommended that the sensor is calibrated at least once a year.

Wiiste Oy is responsible for the more demanding maintenance procedures and calibration, see contact information under Manufacturing and warranty or at [www.wiiste.com](http://www.wiiste.com).

**WARNING**

The SolidRH SH series sensors and the RD1 reader contain sensitive measurement electronics. Do not use solvents for cleaning. Do not allow any impurities or fluids to enter the sensor.

Do not allow the ingress of water or other fluids inside the SolidRH RD1 reader.

**DANGER**

The opening and modification of the SolidRH RD1 reader product is prohibited.

## Storage

The SolidRH RD1 reader and the SH series sensors must be stored away from the light and chemicals and their fumes, in a relative humidity of 20–80 %RH and a temperature of -10–+55 °C. It is recommended that products are stored in their sales packaging.

**NOTE**

Long-term storage of the SolidRH SH series sensors or the RD1 reader in an environment with a high moisture content or exposed to chemicals or their fumes, may cause errors in the measurement results. A measuring device stored in such conditions must be calibrated prior to use.

## SolidRH system

SolidRH is a system for the measurement of relative humidity and temperature in structures. The system is especially designed for measurements related to the detection of whether a covering material can be applied on top of a concrete surface, and for the long-term monitoring of structural humidity. All sensors which measure humidity and temperature are wireless and they can be read by using the same reader. From the reader, the measurement data can be transferred to a cloud service in order to enable easy data management and reporting. The system includes sensors for permanent installation in structures and a sensor especially designed for single measurements, using the bore-hole method. The system also enables monitoring measurements during a building's use without breaking any structures.

The SolidRH system includes the following devices, equipment and software:

- Humidity and temperature sensors
  - SolidRH SH1 (*permanent installation in the concrete pouring*)
  - SolidRH SHR (*bore-hole measurement*)
- Reader and equipment
  - SolidRH RD1 reader
  - Battery
  - Battery charger
  - USB cable
  - Device bag
- Software
  - WSync (*for data transfer between the reader and the cloud service*)
  - Relia (*cloud service for permanently installed sensors*)
  - Relia R (*cloud service for mobile sensors*)



# Humidity and temperature sensor: SolidRH SH1



## Serial numbering

Each sensor has a unique serial number. The serial number is programmed in the sensor memory and it is always read during the measuring. The serial number enables the measurement result to be allocated to the drawing, also when examining the results at a later time.

## Measurement depth

The sensor measures the concrete's relative humidity at the selected depth between 15–70 mm. The sensors are delivered pre-dimensioned and with the measurement depth stored in the sensor memory. More information on selecting the correct measurement depth can be found, for example, in the building information file card RT 14-10984 on the measurement of the relative humidity in concrete.

## Installation plan

The locations and measurement depths of the designed measurement points must be recorded in the installation plan before installation. Monitoring of the installation plan enables the use of correctly dimensioned sensors and facilitates the locating of the sensors in a measurement situation.

In order to enable measurement, it must be possible to place the reader above the sensor. This is why the planned locations of, e.g., walls and fixtures should be taken into consideration when designing the measurement points. This is also why sensors should not be placed directly adjacent to walls or piping.

## Installation

- In the installation location, align the surface of the concrete level and to the correct height.
- The sensor is pushed into the concrete with the tube facing down, such that the upper surface of the sensor remains level with the surface of the concrete. A sensor which has been placed in an oblique angle or has sunken in too deep must be lifted up and reinstalled.
- Install the sensors to be placed in the same measurement point at an interval of 15–25 cm.
- After installation of the sensor, the concrete surface can be finished by using a machine or by manual floating.

**NOTE**

Make sure that you perform the installation in accordance with the instructions. An incorrect installation depth will cause errors in the measurement results.

**WARNING**

Keep the sensor dipped in concrete and in a vertical position. Concrete inside a sensor can cause damage to the measurement electronics.

## After installation

After the concrete has dried, you can work in the vicinity of the measurement point as usual. The sensor has a 2-mm grinding allowance to enable the grinding of the concrete surface.

## Measurement

A sensor permanently installed in a structure is always ready for measurement. However, the ambient temperature has a significant effect on the relative humidity of the concrete, and, thus, in order to obtain a correct measurement result, the temperature of the concrete must have equilibrated close to the final operating temperature. A measurement error due to a temperature fluctuation can be caused, for example, by the sun shining on the measurement point or cold air flowing through a door.

Reading a measurement result has been instructed on page 16.

## Reading distance

The typical maximum reading distance between a sensor and the reader is 40 mm. However, the surrounding material affects the reading distance. Some materials which conduct electricity or contain metal can prevent the reading of the sensor altogether. Make sure that the planned material and covering-material thickness are suitable before installing the sensors.

# Humidity and temperature sensor: SolidRH SHR



## Intended use

SolidRH SHR is intended for the measurement of the relative humidity and temperature in air and structures. It is especially designed for the precise bore-hole measurement, as specified in the building information file card RT 14-10984 on the measurement of the relative humidity in concrete. This instruction mainly handles the humidity measurement of concrete, using the bore-hole method.

## Serial numbering

Each sensor has a unique serial number. The serial number is programmed in the sensor memory and it is always read during the measuring.

## Measurement conditions

The temperature and its fluctuation carries a significant effect on the result of the relative humidity measurements. With regard to indications as to when a concrete surface can be covered, in order to obtain a correct measurement result in bore-hole measurements, the temperature of the concrete must have equilibrated close to the final operating temperature. Floor heating should be turned off, at the latest, a week prior to starting the measurement. There should not be a significant temperature difference between the structure to be measured and the ambient air, and the conditions must be sufficiently, stable starting from the time when the measurement hole is drilled and throughout the entire measurement. It should be noted that even if the conditions are mainly uniform, a measurement error caused by a temperature fluctuation in the measurement point can also be caused by a momentary sunshine or cold air leaking through the door.

**NOTE**

Ensure the correct measurement conditions. An excessively low or high temperature, a change in the temperature or a temperature difference between the sensor and the structure can cause a significant error in the measurement result.

## Measurement preparations

The prerequisites, preparations, work phases and measurement depths for a bore-hole measurement are described in more detail in the building information file card RT 14-10984 on the measurement of relative humidity in concrete. The following provides a rough outline of the process.

- A hole with a diameter of 16 mm is drilled in the measurement point precisely to the desired measurement depth.
- The hole is cleaned, using a vacuum cleaner with a suitable nozzle which fits in the hole.
- A finished measurement sleeve or a tube made from a suitable length of 16-mm electrical conduit is fitted inside the hole. The measurement sleeve is pressed all the way to the bottom of the hole. The junction of the tube and the concrete is sealed, both from the bottom part of the sleeve and the top part of the concrete, using non-hygroscopic sealing putty.
- The tube is vacuumed again with a suitable nozzle which fits in the hole.
- The upper part of the tube is sealed with a suitable plug or non-hygroscopic sealing putty. Alternatively, the sensor can be placed in the tube already at this stage (see Measurement).
- The measurement hole is left to equilibrate for three days before the measurement.

**NOTE**

Perform the preparations meticulously. An incorrect bore-hole depth, careless cleaning or insufficient sealing can cause errors in the measurement results.

## Measurement

In a bore-hole measurement, the sensor is installed in the measurement sleeve, such that the sensor reaches the bottom of the hole and, at the same time, closes the upper part of the sleeve tightly. The correct depth and sealing of the upper part of the sleeve is reached easily by using a measurement sleeve with a length of 120 mm and an inner diameter of 12.5–13.0 mm. If necessary, sealing is ensured by using non-hygroscopic sealing putty.

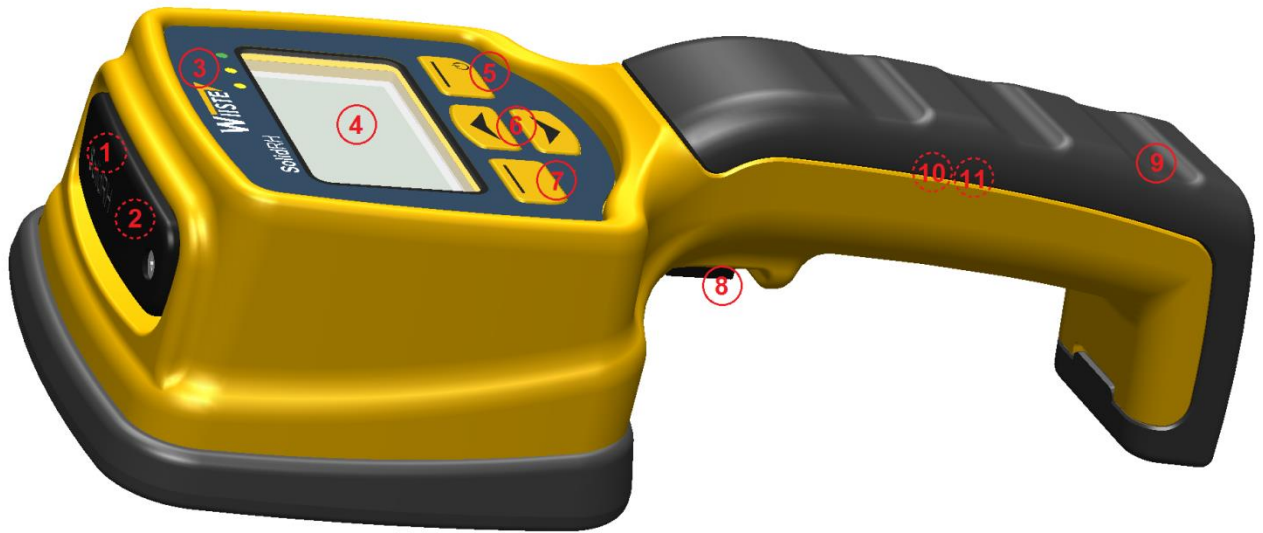
Before reading the measurement result, the sensor should be left to equilibrate in the measurement sleeve for a minimum of one hour.

Reading a measurement result has been instructed on page 16.

## Reading distance

The typical maximum reading distance between a sensor and the reader is 40 mm. The surrounding material affects the reading distance.

## Reader: SolidRH RD1



1	USB connector
2	Sensor for measuring ambient conditions
3	Indicators
4	Display
5	Function key / Power key
6	Arrow keys
7	Function key
8	Trigger
9	Battery compartment cover
10	Battery
11	Battery holder and release strap

### Commissioning

- Charge the battery (10), using the delivered charger.
- Open the battery compartment by pulling the lower part of the battery compartment cover (9) to the rear and detach the cover.
- Place the battery (10) in the holder (11), such that the positive terminal faces toward the keyboard and the release strap remains under the battery.
- Close the battery compartment by first placing the front part of the cover (9) in place and then snapping the lower part of the cover in the locking position.
- Start the device. Set the correct time and date.

### Turning the power on and off

- Start the device by pressing the power button (5) for approx. 2 seconds. When the device starts, a sound signal is given and the device type and version number are

shown on the display momentarily. After this, the device transfers to the basic mode.

- To turn off the device, press the power button (5) for approx. 3 seconds.

## Function of the display

- The information bar at the top of the display (4) always shows the following information:
  - Date
  - Time
  - Ambient relative humidity (RH[%])<sup>1</sup>
  - Ambient temperature (T[°C])<sup>1</sup>
  - Battery status
- The key-function bar at the lower part of the display (4) shows the functions to be activated using the function keys (5, 7) and the arrow keys (6).

## Sensor measurement

- In the basic mode, start the sensor search by pressing the trigger (8) all the way down. The search will continue as long as the trigger is pressed or until the measurement has been completed.
- Place the device above the sensor. You can utilise the indicators (3) and the sound signal in locating the correct spot:
  - Yellow indicator: Search in progress.
  - Two yellow indicators; slow sound signal: The sensor is close.
  - Two yellow indicators and one green indicator; fast sound signal: The sensor is at a measurement distance.
  - Green indicator; long sound signal: Sensor measurement is in progress.
- After the search/measurement has been completed, all indicators will be turned off. When the measurement is successful, the relative humidity and temperature, along with the sensor's serial number and measurement depth, are shown on the display and the result is stored in the device's memory. If the measurement fails, the display returns to the basic mode.



<sup>1</sup> When measuring ambient conditions, you should consider the device equilibrating to the ambient temperature.



## Browsing the measurement results

- In the basic mode, start the browsing of previous measurement results by pressing the arrow key (6).
- Previous measurement results can be scrolled by using the arrow keys. The device shows, at a maximum, the last 40 measured sensor measurement results in chronological order (the last measurement is shown first) The five latest measurements are shown for each sensor.
- Return to the basic mode by pressing the function key on the right (5).

## Settings

- In the basic mode, move to the setting menu by pressing the function key on the right (5).
- Browse the menu by using the arrow keys (6) and select the setting to be changed by pressing the left function key (7). See below for further instructions on changing the selected setting.
- Return to the basic mode by pressing the function key on the right (5).

### Language

- Browse the options by using the arrow keys (6) and activate your selection by pressing the left function key (7).
- Return to the setting menu by pressing the function key on the right (5).

### Date and Time

- Change the selected value by using the arrow keys (6).
- Move to the next value by pressing the left function key (7). By pressing the key at the last value, you can set a new date and time for the device.
- Cancel changes and return to the setting menu by pressing the function key on the right (5).

### Resetting the memory

- Browse the options by using the arrow keys (6) and activate your selection by pressing the left function key (7).
- Return to the setting menu by pressing the function key on the right (5).

## Replacing the battery

- Open the battery compartment by pulling the lower part of the battery compartment cover (9) to the rear and detach the cover.
- Remove the discharged battery (10) from its holder (11) by pulling from the release strap.
- Charge the empty battery (10) according to the separate instruction delivered with the charger.
- Place the fully charged battery (10) in the holder (11), such that the positive terminal faces toward the keyboard and the release strap remains under the battery.

- Close the battery compartment by first placing the front part of the cover (9) in place and then snapping the lower part of the cover in the locking position.

## Data transfer to the Relia service

- Start the data transfer software WSync. If necessary, first download and install the software on your computer. For more detailed information, see [www.wiiste.com](http://www.wiiste.com).
- Turn on the device.
- Bend the USB connector's (1) rubber cover and connect the USB cable to the device. Connect the other end of the cable to the computer's USB port. When the cable has been connected, the message "USB connected" appears on the display.
- Data transfer to the computer and further to the Relia service starts automatically. Note that data transfer to the Relia service requires a network connection.
- When the WSync software informs that the data transfer from the device to the computer has been completed, you can detach the USB cable and turn the device off.
- When the WSync software indicates that data transfer to the Relia service has been completed, you can close the software.

## Battery

The SolidRH SH1 sensor does not include a battery or an energy source; the required energy is transferred wirelessly by using the reader when performing the measurement.

SolidRH RD1 reader battery:

18650 Rechargeable Li-Ion, 3.6V / 3,100 mAh / 11.16 Wh. Maximum output power 7A.

The battery includes a safety circuit for overcharging, short-circuit current and deep cycle.

**NOTE**

Dispose of batteries in accordance with regulations. Do not dispose of them along with domestic waste.

**DANGER**

Only equip the product with batteries and chargers delivered by Wiiste Oy.

## Battery charger

The specifics and user instructions for a battery charger are delivered separately with the charger.

**DANGER**

Only equip the product with batteries and chargers delivered by Wiiste Oy.

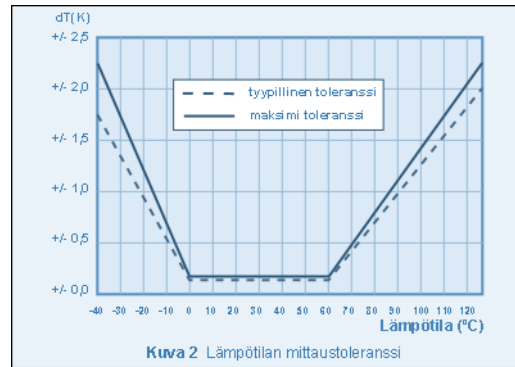
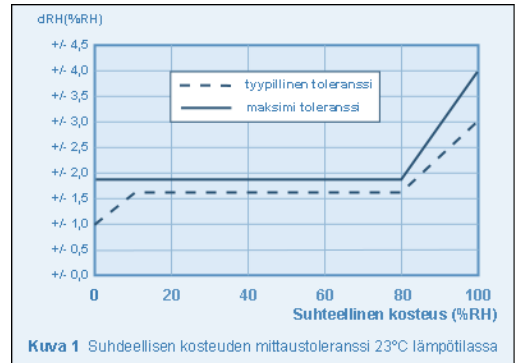
## Technical data

### SolidRH SH1 sensor

Characteristic	Description/Value
<b>Relative humidity</b>	
Measurement range	0–100 %RH
Accuracy	
0–90 %RH	±2.5 %RH
above 90 %RH	±3.0 %RH
Hysteresis	< ±1 %RH
Linearity error	< ±1 %RH
Stability	< ±0.5 %RH per year
<b>Temperature</b>	
Measurement range	-40–+125 °C
Accuracy	typ. ±0.2 °C, range 0–60 °C
Reproducibility	±0.1 °C
<b>General information</b>	
Operating temperature	0–+40 °C
Measurement depth	15–70 mm
Measurement pipe diameter	10 mm
Maximum length	74 mm
Maximum width	60 mm
Weight	8 g
Protection class	IP 23

## SolidRH SHR sensor

Characteristic	Description/Value
<b>Relative humidity</b>	
Measurement range <sup>2</sup>	0–100 %RH
Nominal accuracy <sup>3</sup>	See Figure 1
Reproducibility <sup>4</sup>	± 0.2 % RH
Hysteresis	< ±1 %RH
Resolution	0.1 %RH
Linearity error	< ±1 %RH
Element's response time T <sub>63</sub>	< 4 s
Tk residual error	0.05 % RH / K (0 ... 60°)
Long-term stability	< ±0.5 %RH per year
Sensor type	capacitive polymer
<b>Temperature</b>	
Measurement range	-40–+125 °C
Accuracy	See Figure 2
Reproducibility	±0.1 °C
Resolution	0.1 °C
Element's response time	< 5 s
Long-term stability	< 0.05 K / a
Sensor type	PTAT
<b>General information</b>	
Operating temperature	0–+40 °C
Recommended measurement sleeve	
length	120 mm
inner diameter	12.5–13 mm
Length	150.5 mm
Frame diameter	10–25 mm
Weight	33 g
Protection class	IP 65



<sup>2</sup> The maximum condensation point is limited to 80 °C.

<sup>3</sup> Accuracy has been tested at 23 °C in the direction of rising relative humidity. The Tk residual error, linearity error or hysteresis have not been considered in the accuracy.

<sup>4</sup> Reproducibility has been measured in the same direction, and it does not consider hysteresis.

## SolidRH RD1 reader

Characteristic	Description/Value
<b>Electrical</b>	
Nominal operating voltage	3.6 V
Power consumption during measurement	typ. 700 mA
Operating time	
idling	30 h
Continuous measurement	4.5 h
<b>Ambient measurement</b>	
<b>Relative humidity</b>	
Measurement range	0–100 %RH
Accuracy <sup>5</sup>	typ. ±3.0 %RH between 20–80 %RH
Stability	< 0.5 %RH per year
<b>Temperature</b>	
Measurement range	-40–+125 °C
Accuracy <sup>2</sup>	typ. ±0.3 °C, range 0–60 °C
<b>General information</b>	
Operating temperature	0–50 °C
Storage temperature	-10–55 °C
Dimensions (HxWxD)	261 x 118 x 77 mm
Weight (incl. battery)	600 g
Protection class	IP 54
Falling weight impact resistance	1 metre
Battery	18650 rechargeable Li-Ion, 3.6 V
User interface languages	Finnish, English
Display	240 x 128

<sup>5</sup> In a normal use, the measurement of ambient conditions is indicative. In order to obtain the specified accuracy, the device must be allowed to reach an equilibrium with the surrounding conditions for, at least, one hour. During the equilibrating time, the device must be turned off.



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