

RAPIDRH[®]5.0

Fast, Accurate Moisture Test for Concrete Floors



CE

Table of Contents

Rapid RH [®] Installation Steps	
Step 1: Drill the Hole.....	4
Step 2: Clean the Hole.....	5
Step 3: Insert the Smart Sensor/Base Sleeve	7
Step 4: Take Readings.....	9
Step 5: Remove the Smart Sensors	17
EasyCare CalCheck [®]	19
Troubleshooting	23
RH Testing Best Practices	24
Use Conditions	26
Service Temperature Adjustment Tool	27
Wagner Meters Limited Warranty	28

RAPID RH^{5.0}

Fast, Accurate Moisture Test for Concrete Floors

The Rapid RH[®] moisture testing system should be used on any project where moisture-sensitive floor coverings or coatings are to be applied over concrete slabs. Owners, general contractors, flooring contractors/installers, and testing companies need to be sure the tests they perform are accurate, repeatable, and available to all who need to know the current moisture condition of concrete slabs.

Rapid RH[®] significantly improves your project team's ability to instantly test and/or monitor the drying progress of a concrete slab without adding substantial cost to the project. The Rapid RH[®] enables you to take fast, accurate periodic readings that fully comply with industry standards. The Rapid RH[®] Smart Sensors are factory-calibrated and use CMOSens[®] technology to ensure the sensor's accuracy and fast equilibration.

Step 1: Drill the Hole

Correct hole depth and hole diameter are important in complying with the ASTM F2170 standard (see RH Testing Best Practices section on page 24). For easy installation of a Smart Sensor and/or Base Sleeve, a uniformly round hole is important. Drill a hole in the concrete slab to the required depth using a rotary hammer drill and a $\frac{3}{4}$ "-diameter masonry drill bit. Per the ASTM F2170 standard, drill the hole to a depth equaling 40% of the slab's thickness for slabs that are drying from one side, or 20% depth for a slab drying from two sides. For proper Rapid RH[®] 5.0 installation, be sure to position the drill perpendicular (90°) to the surface being tested.

TIP: If you do not have a depth gauge for your drill, mark or tape-off your drill bit to the correct depth setting.



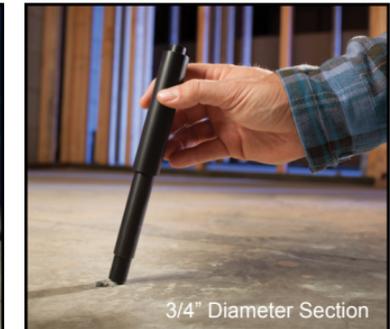
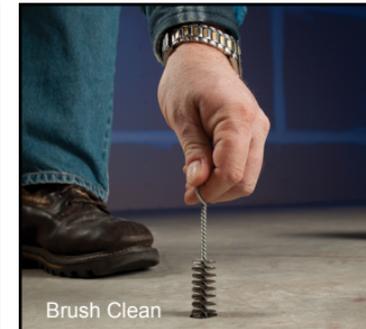
Step 2: Clean the Hole

Attach the vacuum attachment to the straight extension of a shop vacuum cleaner hose* and thoroughly vacuum up the dust in and around the hole.

Next, insert the wire bristle brush into the hole. Turn the brush several times to loosen pulverized concrete from the walls of the hole. Vacuum again. Repeat this step twice to ensure no loose concrete particles remain in the hole.

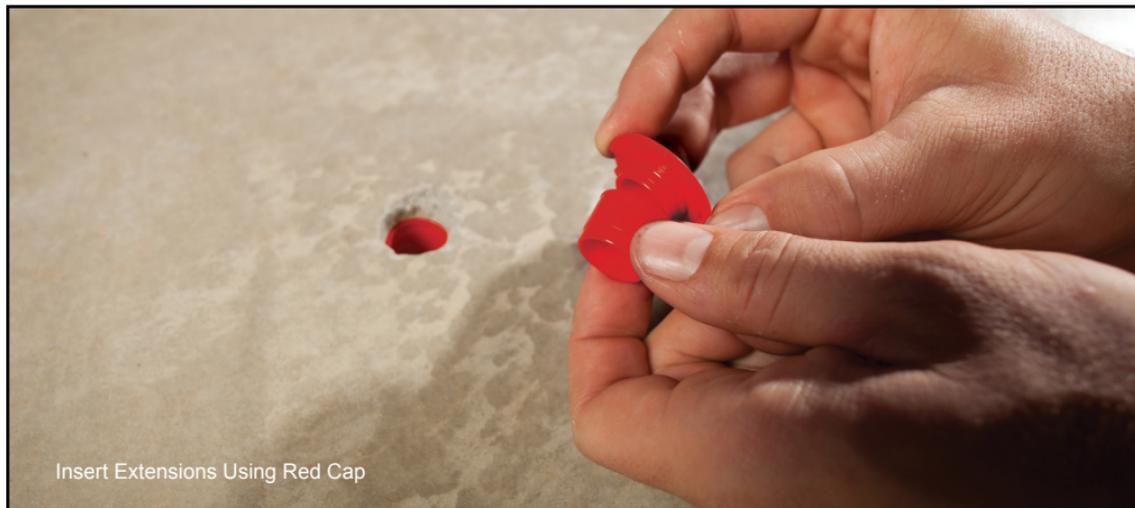
IMPORTANT: Correct Diameter and Hole Uniformity: Use the $\frac{3}{4}$ "-diameter section of the black insertion tool as a diameter and uniformity gauge to ensure a correct and uniformly round hole. If the $\frac{3}{4}$ "-diameter section of the tool will not go easily into the hole, the drill bit may be out-of-spec (worn out, etc.) or the hole may not have a uniform diameter from top to bottom. Not performing this step may cause damage to a Smart Sensor and/or Base Sleeve when attempting insertion.

**The vacuum attachment may require an adapter depending on vacuum model.*



Step 2: Clean the Hole (Cont.)

Directly out of the package, the Smart Sensor/Base Sleeve combination is 1.6" in length or 40% of a 4" thick slab. ASTM F2170, Section 10.2 states: "Slab drying from top only (example: slab on ground with vapor retarder below, or slab on metal deck): 40% depth. Slab drying from top and bottom (example: elevated structural slab not in metal deck): 20% depth." Each Smart Sensor/Base Sleeve pack includes a number of short (0.4") extensions that can be inserted into the Base Sleeve to enable use in thicker slabs. Adding one extension increases the Base Sleeve length to 2" for testing 5" thick slabs to the 40% depth. Keep any unused extensions for future jobs. If needed, you



Insert Extensions Using Red Cap

Step 3: Insert Smart Sensor/Base Sleeve

can use additional extensions to increase the length of the Base Sleeve for thicker slab applications.

In summary, add one extension insert to a Base Sleeve for every 1" increase in slab thickness over 4" to meet the 40% depth requirement. The extension inserts make the Base Sleeve's usage flexible for varying thicknesses of concrete.

If this is the first time you will be using your 5.0 system, take a Smart Sensor/Base Sleeve combination directly out of the package, and with no extensions installed, insert it into the hole using the insertion tool with red cap placed atop for ease in pushing down on the insertion tool. Push down on the insertion tool with cap to insert the Smart Sensor/Base Sleeve combination into the hole, "seating" it at the bottom (**review the IMPORTANT hole diameter and uniformity comment under Step 2**). Under no circumstances should you tap or hammer the insertion tool during insertion. Doing so may cause damage and will void any warranty.

At this point, for 1.6" depth holes (40% of 4"), insert a



Insert Smart Sensor and/or Base Sleeve Combination Using Insertion Tool

Step 3: Insert Smart Sensor/Base Sleeve (Cont.)

protective cap into the top of the Base Sleeve, and push the cap down to the concrete surface. Or, if testing in thicker slabs, assemble the proper number of extensions, and with the protective cap inserted into the top most extension, push down the extensions and cap into the hole to the concrete surface, until fully seated on the Base Sleeve, completing the installation. At this point, if you have installed the Smart Sensor and the Base Sleeve, remove the protective cap and, utilizing the Sensor Extraction Tool, remove the Smart Sensor from the Base Sleeve, replacing the cap into the Base Sleeve. (More details in Step 5: Remove the Smart Sensors, page 17.)

Remember: Correct depth of the hole is critical to adhere to the ASTM F2170 test method. (See the RH Testing Best Practices section on page 24.)

Caution: NEVER use your reader device (either the Smart Reader or the Easy Reader) to install the Smart Sensor and/or Base Sleeve.



Sensor Extraction Tool removes the Smart Sensor from the Base Sleeve

Step 4: Take Readings

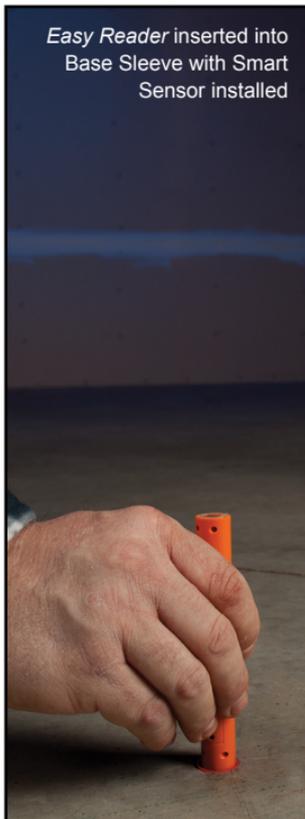
The standard Rapid RH® *Easy Reader* (with LCD display) or the Rapid RH® *Smart Reader* with Bluetooth® (in conjunction with the *DataMaster™* app available for Apple and Android devices) can be used.

IMPORTANT NOTE: *The Rapid RH® 5.0 version allows for reuse of the 5.0 Smart Sensors from job to job. Using the standard Easy Reader or the Smart Reader (in conjunction with the DataMaster™ app), you can obtain readings, move sensors from one test hole to another, and manually document and provide your own F2170-compliant reports (Rapid RH® sensor packs and kits come with location grid documents and report templates to make it easy to manually document your testing. Additional copies can be obtained at rapidrh.com).*

Using the Smart Reader and DataMaster™ app, you have the ability on a job to store each sensor's readings and/or upload them to Wagner's f2170reports.com website for more automated and easier generating of compliant reports.

"Leapfrogging" of a sensor from location to location on a job can be time-consuming. You are encouraged to have enough 5.0 Smart Sensors to cover the quantity of test holes required for your largest jobs. If you have a very large project requiring far more 5.0 sensors

Easy Reader inserted into Base Sleeve with Smart Sensor installed



Step 4: Take Readings (Cont.)

than you have, consider using the Rapid RH® 4.0 single use sensors to make the remainder of the required tests.

After proper acclimation of the capped off environment within the Base Sleeve (currently at least now 24 hours per the ASTM F2170 standard) return to the jobsite, remove the protective cap from the Base Sleeve and reinstall the Smart Sensor utilizing the Sensor Extraction tool. Once you have firmly seated the Smart Sensor at the bottom of the Base Sleeve, replace the cap, and after one hour you can begin to periodically (every 15 minutes or so) take readings, until you have assurance that the Smart Sensor has fully equilibrated, and is providing stable relative humidity and temperature values. **NOTE:** This time is a general guideline. Please refer to the ASTM standard for specifics.

When ready to take readings, remove the protective cap from the Base Sleeve, and ensure no dust or debris is inside. **NOTE: DO NOT** vacuum out the Smart Sensor, as this may inadvertently extract the sensor brain module out of the Base Sleeve. It is preferred that you use a bulb-type suction device.

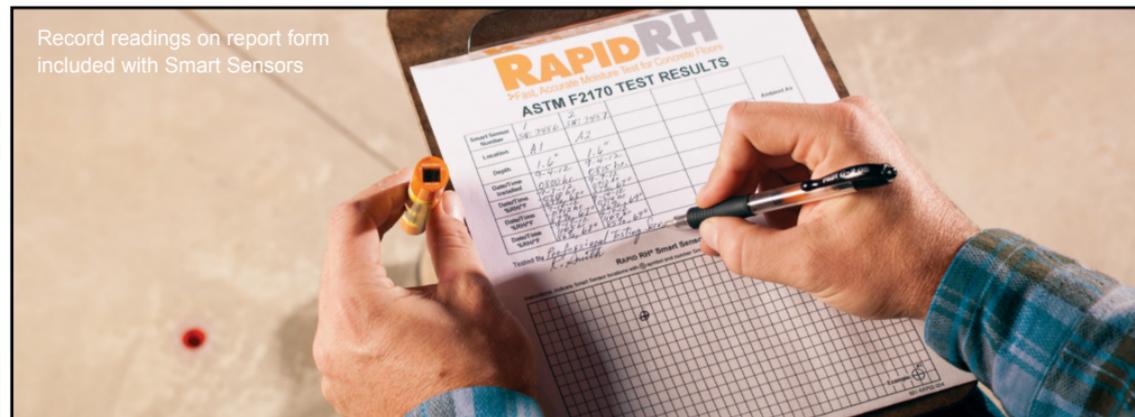
Regardless of the type of reader you are using, insert firmly into Base Sleeve until it comes fully into contact with the Smart Sensor:

- If using the *Easy Reader*, hold it in place until the first relative humidity reading appears (about 3 seconds) on the LCD display, and then immediately remove the reader.
- Once the *Easy Reader* is removed from the Smart Sensor, the relative humidity

and temperature values will continue to toggle back and forth on the display for approximately 5 minutes or until the *Easy Reader* is reinserted into another Smart Sensor. **NOTE:** During the toggling of the readings, when the cursor is next to the %RH symbol, the value shown is the in-hole relative humidity reading; when the cursor is next to the °F or °C symbol*, the value shown is the in-hole temperature.

- After taking a reading with the *Easy Reader* and wait at least 5 seconds before trying to obtain another reading. Replace the reader's plastic end caps when not in use.

*Rapid RH® *Easy Readers* that display temperature in Celsius can be identified by their blue labels and blue plastic protective caps.



Step 4: Take Readings (Cont.)

- If using the Smart Reader with the DataMaster™ app, the in-hole ambient relative humidity and temperature readings will appear on the screen of your Apple or Android device within approximately two seconds. Immediately remove the Smart Reader.

NOTE: The DataMaster™ app can be downloaded from Google Play or iTunes.



The Rapid RH® Smart Sensor's patented design equilibrates (acclimates) faster than any other concrete relative humidity sensing device. Project scheduling decisions regarding the slab can usually be made one hour after installation. Just remember to follow the ASTM F2170 procedures pertaining to minimum equilibration time for correct and required reporting of the test results.

On a job, if a Smart Sensor is moved and inserted into another fully-equilibrated (24 hours minimum) test hole with the Base Sleeve and finned-base section already installed with protective cap, after one hour you can begin to periodically (every 15 minutes or so) take readings, until you have assurance that the Smart Sensor has fully equilibrated, and is providing stable relative humidity and temperature values.

If future additional testing is needed on any test hole, remove the Smart Sensor with the Smart Sensor Extraction Tool, and place the protective cap back into the Base Sleeve. When you are ready to retest, refer to the above paragraph for testing a fully-equilibrated test hole.

Step 4: Take Readings (Cont.)

If using the standard *Easy Reader*, or the Smart Reader with the DataMaster™ app, manually record readings on the enclosed report form in the spaces provided for information required by ASTM F2170, including the date, time, %RH, and temperature. The grid at the bottom of the report form can be used to record test hole locations. Extra copies of the report form and an ASTM F2170 checklist can be downloaded at rapidrh.com. You can also visit rhspec.com to visit links to various finished flooring manufacturers' installation guides and their RH thresholds. For any additional questions related to what RH levels are appropriate, please contact the manufacturer of the product to be applied to the concrete slab.



If using the Smart Reader with the Rapid RH® DataMaster™ app, as mentioned earlier, sensors' readings will be stored in the app and can be uploaded to the f2170reports.com website.

AN IMPORTANT COMMENT ON SENSOR SERIAL NUMBERS:

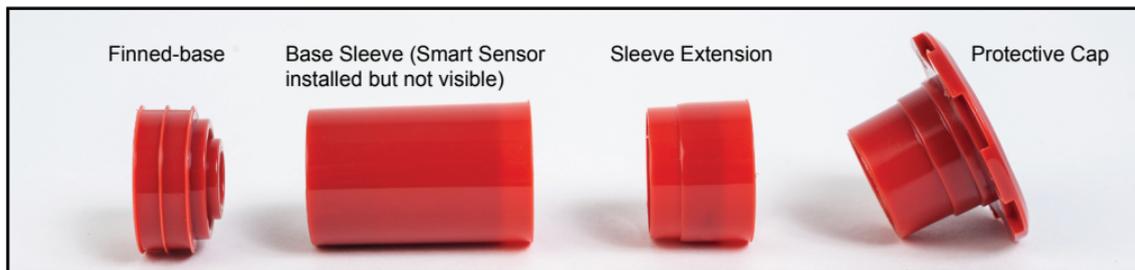
Whether it is a 5.0 (reusable) or 4.0 (single use) device, every Rapid RH® Smart Sensor has a barcode serial number label on the outside of the Base Sleeve when you first pull it out of the factory packaging. ASTM F2170 documentation has stipulations for documenting sensor serial numbers for moisture testing on your jobs, so keeping track of sensor serial numbers is important for report documentation and verification of calibration. With your 5.0 reusable sensor packages, additional blank serial number labels are included if an original barcode serial number label or original Base Sleeve gets damaged.

NOTE: Fresh out of the factory packaging, a 5.0 Smart Sensor assembly consists of three discrete parts: 1. Base Sleeve (with barcode serial number); 2. A finned-base section, and; 3. The actual Smart Sensor that has already been inserted at the factory into the Base Sleeve, and therefore associated with that serial number label on its original Base Sleeve.

The actual Smart Sensors can be removed from their original Base Sleeves (if the sleeve gets damaged from use, etc.), but attempt to keep the original Base Sleeve

Step 4: Take Readings (Cont.)

number with its original Smart Sensor; whether it's a replacement Base Sleeve or not. The key point is keeping track of your serial numbers. If you do happen to lose this serial number connection between a Smart Sensor and the original Base Sleeve, contact Wagner at (844) 786-8643 for assistance.



NOTE: You can remove a sensor brain module out of its base sleeve by gently pushing on the sensor brain module from the bottom, which will loosen it from the base sleeve, allowing you to drop it through the base sleeve into your hand.

Step 5: Remove the Smart Sensors

The Rapid RH[®] 5.0 system was primarily and intelligently designed to allow the reuse of the Smart Sensors. Special polytetrafluoroethylene (PTFE) filtering of the sensors and EasyCare CalCheck[®] salt solution chambers are two of the key points that allow for reuse (checking calibration and caring for these sensors is discussed in the EasyCare CalCheck[®] section beginning on page 19). This particular section is dedicated to correct procedures for extracting a Smart Sensor for later reuse, on the same job, or on another job.

To extract the Smart Sensor only, simply insert the metal end of the Smart Sensor Extraction Tool into the Base Sleeve until it touches the top of the Smart Sensor. Slowly turn the tool counterclockwise until it drops into the “slots” of the Smart Sensor then turn tool counterclockwise until it stops. At this point, gently turn



Step 5: Remove the Smart Sensor (Cont.)



the tool counterclockwise while pulling up. If you are going to be doing future testing of this hole, make sure you put a protective cap on the sleeve. When ready to obtain additional readings, you can just reverse the above removal process to reinstall the Smart Sensor into the Base Sleeve.

Using the convenient hooked extraction tool, you will be extracting the Base Sleeve and sensor brain module (as mentioned earlier, the lower finned-base is used once, and stays in the hole). To extract the Base Sleeve with Smart Sensor, put the hooked extraction tool down into the Base Sleeve, seat the hook into the inside of the sleeve and pull up quickly and firmly.

On the other hand, if future readings are no longer needed, skim-coat the hole with a cementitious patching compound compatible with the flooring manufacturer's installation instructions.

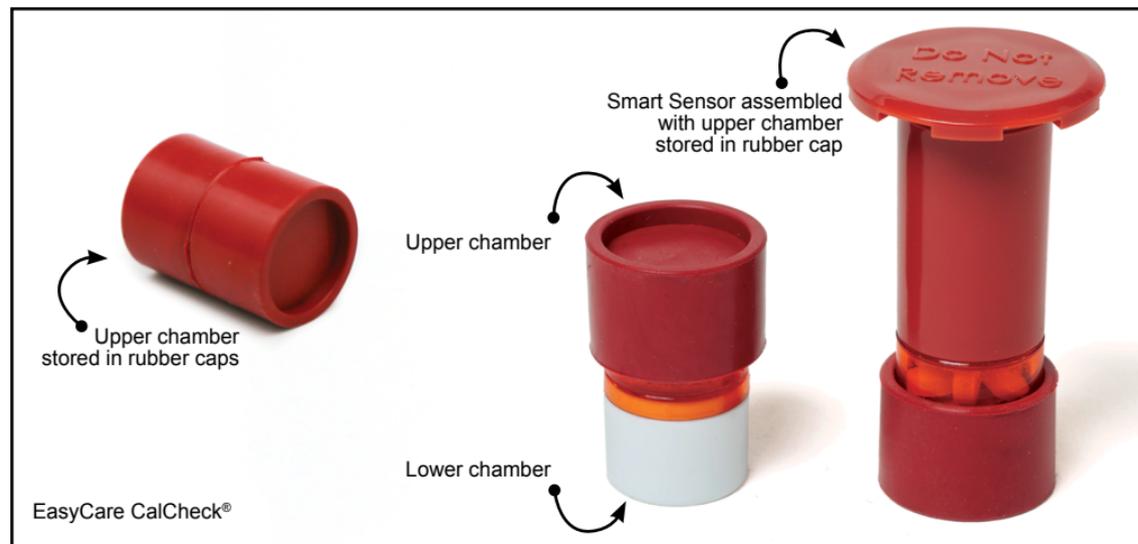
NOTE: *The inexpensive, short finned-base section remains in the hole, and therefore is not recovered for future testing of other holes. Additional finned-base sections can be purchased separately from Wagner.*

EasyCare CalCheck®

The EasyCare CalCheck® : Checking Calibration

The revolutionary and patented EasyCare CalCheck® saturated salt solution calibration references were designed to make it easy to meet the ASTM F2170 requirement for verifying calibration of your Rapid RH® 5.0 Smart Sensors.

Each EasyCare CalCheck® is comprised of a top and bottom chamber, and two rubber caps. The top chamber is the actual saturated salt solution chamber with a white PTFE



EasyCare CalCheck® (Cont.)

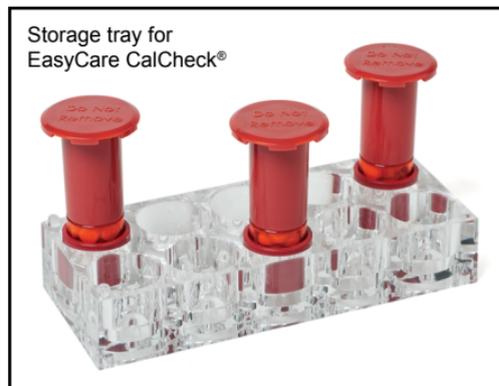
filter on top; you will see traces of a sodium chloride salt tablet in this upper chamber. The bottom chamber is refillable.* When a Base Sleeve - with inserted Smart Sensor - is attached to the top section of the EasyCare CalCheck®, a tightly-sealed, 75% relative humidity environment is created between the top of the EasyCare CalCheck® and the bottom of the actual Smart Sensor.

IMPORTANT: Always keep the red rubber caps on the top sections of the EasyCare CalChecks® when they are not being used for checking sensor calibration or when a Smart Sensor is not being stored on top. Also, once the EasyCare CalCheck® is fully charged, make sure to separate the top chamber from the bottom chamber. Store the bottom chamber for future recharging and insert the top chamber into one of the rubber caps provided.



CHECKING THE CALIBRATION OF YOUR SENSORS: The EasyCare CalCheck® used to verify calibration of your Rapid RH® 5.0 Smart Sensors. The ASTM F2170 test standard calls for checking sensor (probe) calibration 30 days before use.

An EasyCare CalCheck® chamber can be recharged when necessary with ordinary potable water, rather than having to use distilled water. Filling/recharging is detailed in **Rapid RH® 5.0 Best Practices and Charging of EasyCare CalChecks® document that came with your 5.0 kit, also available at rapidrh.com.*



It is recommended that you plan your routine calibration checks such that you always have verified sensors before you go on a job to do testing.

NOTE: For best precision in this calibration-check process, it is highly recommended that you use the Smart Reader/DataMaster™ app combination to check calibration. Manual checks can be done with the Easy Reader or Smart Reader/DataMaster™ app combination, but some manual correction may be necessary

(refer to **Rapid RH® 5.0 Best Practices and Charging of EasyCare CalChecks®** document). Regardless of what particular reader device you use, with a Base Sleeve and Smart Sensor combination already installed on top of the EasyCare CalCheck® for at least a few hours, insert the reader firmly into the Base Sleeve until it comes into contact with the Smart Sensor. If using the Smart Reader/DataMaster™ app combination, the Smart Sensor data will show on your Apple or Android device while running the DataMaster™ app.

If a message comes up on the DataMaster™ app indicating that a Smart Sensor is not within calibration, or a manual check against ASTM E104 tables indicates the sensor is not within calibration, do not be immediately alarmed. It is probably, in most cases, that

the sensor is OK, but that the EasyCare CalChecks® and/or sensor is just not currently equilibrated. A few more hours of time should be allowed to pass to allow for this. As a reminder, it is highly recommended that you review the **Rapid RH® 5.0 Best Practices and Charging of EasyCare CalChecks®** document.

Calibration check data for your Smart Sensors is stored in the DataMaster™ app.

After one year of usage, all 5.0 sensors will need to be replaced with new smart sensors that have current NIST-certified calibration certificates to ensure compliance with ASTM F2170. Replacement sensors can be ordered by calling (844) 786-8643.



Calibration check data for your Smart Sensors is stored in the DataMaster™ app.



Easy Reader LCD display shows “ER”: The Rapid RH® *Easy Reader* may not be properly communicating with the Smart Sensor for the following reasons:

1. The *Easy Reader* was not in contact with the Smart Sensor long enough. Hold the *Easy Reader* in the Smart Sensor until the first relative humidity reading appears on the screen, then remove.
2. Debris is blocking proper contact. Check the Smart Sensor housing for any debris.

Replace the batteries: The *Easy Reader* comes with two AAAA alkaline batteries. To replace the batteries, open up the battery cover by removing the one battery cover screw with a jeweler's Phillips screwdriver.

DO NOT OPEN UP THE FULL BODY OF THE EASY READER AT ANY TIME.

RH Testing Best Practices



New concrete slabs should be allowed to cure and dry for as long as possible before performing any type of moisture testing. Even though some methods state to wait at least 28 days after a concrete pour before setting up test instruments, it is often prudent to wait much longer.* Minimizing the amount of time between initiating any moisture testing on a slab and obtaining the final results per testing standards increases the chance that the test results will more accurately indicate the condition of the concrete around the test location.

On all slabs (new and old), it is recommended to do test sampling, prior to completing testing, according to the ASTM F2170 standard's requirement, in regards to the number of test sites. It is good practice to initially only set up a portion of the test locations ultimately required and use those few locations as a means to indicate when the rest of the tests should be performed. If extended periods of time have elapsed between initially setting up

test locations and obtaining the final results per testing standards, then it is good practice to set a few new tests to confirm and validate what the older test locations are currently indicating. For sensors experiencing 95% RH for longer durations of time, an upward drift up to a few percentage points may be experienced.

Additionally, it is good practice to let the sensors lie on the slab for about 10 minutes or so prior to installation, until they reach temperature equilibrium with the slab to prevent any dew point issues that might cause condensation on or around the sensor (**NOTE:** Wagner has not heard of any reports where this has actually been an issue, but it is still a best use practice). For more information on relative humidity in concrete floors and moisture testing, go to www.cement.org to order the book "Concrete Floors and Moisture" by Howard Kanare.

The drying rate of standard Portland cement-based concrete slabs has been studied extensively. For slabs drying from one side, a very general rule-of-thumb as a drying rate is approximately 30 days of drying time for each inch of thickness of the slab for the relative humidity level to reach somewhere in the 85%-90% range. **This is only a very rough approximate guideline, and drying times can, and often are, much longer if good drying conditions (closed-in space, environmental controls on, etc.) are **not** present. Additionally, other factors such as the densifying of a slab surface from heavy power-troweling, additional water added to the concrete at time of pour, rain, or construction water sitting on a slab, etc., can drastically affect the drying time of a concrete slab.*

Use Conditions

The Rapid RH[®] 5.0 is intended for interior use only. It is imperative that the interior application area be protected from weather elements such as rain and snow to prevent water intrusion. The Rapid RH[®] 5.0 is not to be used in concrete less than 28 days old (see RH Testing Best Practices section on page 24). Follow ASTM F2170 “Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes”¹.

NIST² traceable accuracy:

Readings at +/- 1.8% RH from 10% to 90%

Readings at +/- 3% RH from 90% to 95%

Avoid severe cold or hot storage environments (i.e. vehicles)

¹Available from ASTM International, P.O. Box C700,

West Conshohocken, PA 19428-2959, www.astm.org

²National Institute of Standards and Technology

Service Temperature Adjustment Tool

The ASTM F2170 standard mandates measuring RH at service conditions. But your project’s timeline may be such that you’d like to be able to estimate RH before reaching service conditions.

Wagner Meters offers a simple-to-use, science-based RH estimator tool that adjusts for service temperature. The easiest way to use this handy tool is with the Rapid RH[®] DataMaster™ app, available for both iOS and Android devices. The estimator tool is also available online at wagnermeters.com/rhtemp where you can also watch a short introductory video for more information.

Simply obtain the RH and temperature readings of your concrete slab with your Rapid RH[®], then use the DataMaster™ app, the online estimator tool, or download the service temperature adjustment table to get an estimated RH value at service conditions.

Note: *The service temperature adjustment tool was developed by CTLGroup, a wholly-owned subsidiary of the Portland Cement Association.*

Wagner Meters **Limited Warranty**

Wagner Meters warrants the Rapid RH[®] 5.0 Smart Sensor and Rapid RH[®] *Easy Reader* products against defects in material and workmanship for one (1) year from the date of purchase, subject to the following terms and conditions:

Wagner Meters' liability under this warranty shall be limited, at Wagner Meters' option, to the repair or replacement of products or any part thereof, which are demonstrated to be defective. To exercise this warranty, the customer must send product back with a copy of the proof of purchase date, the reason for return and, if Wagner determines it is under warranty, Wagner will replace the customer's product. This limited warranty does not apply if the product has been damaged by accident, negligent handling, misuse, alteration, damage during shipment, or improper service. Wagner Meters shall in no event be liable for any breach of warranty or defect in this product, which exceeds the amount of purchase price of the product.

Relative humidity is one of many factors necessary for construction decisions. Wagner Meters does not assume responsibility for any particular construction decision based on the readings of this instrument and does not guarantee any specific construction results.

The method of use of this instrument and the interpretation of the readings are beyond the control of the manufacturer. Wagner Meters cannot accept responsibility for any loss, consequential or otherwise, resulting from the use of the Rapid RH[®] 5.0 and its accessories.

If the Smart Reader/*Easy Reader* does not appear to function properly for any reason, contact Wagner Meters for remedy.

This warranty is in lieu of all other warranties, whether oral or written, express or implied. Any implied warranties, including implied warranties of merchantability and fitness for a particular purpose, are excluded. If this product is not in good working order as warranted above, the customer's sole remedy shall be repair or replacement as provided above.

This warranty is personal to the customer purchasing the product from Wagner Meters or from its authorized distributors and is not transferable.

The agents and employees of Wagner Meters are not authorized to make modifications of this warranty or additional warranties binding on Wagner Meters. Accordingly, additional statements, whether oral or written, except written statements from an officer of Wagner Meters, do not constitute warranties and should not be relied upon by the customer.



WAGNER[®]
METERS

Unleash Your Expertise

**For more information on relative humidity testing
and to order online go to**

www.RapidRH.com

Wagner Meters

326 Pine Grove Road

Rogue River, OR 97537

Worldwide Toll-Free: (844) 786-8643

The RAPID RH[®] 5.0 is registered under U.S. Patent 7,231,815, 8,047,056, 9,032,791 & 9,588,092.

©Wagner Meters 2019

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher. The information in this document is subject to change without notice.



500-RRP50-001 rev E