

**exact**® LEADQuick™  
Smart Photometer System®

 **Bluetooth**®  
SMART

## ***Instruction Manual***

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**Ideal for Screening for Lead, Mercury,  
and Cadmium in Potable Water**

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U.S. Patent No. 7,333,194, South African Patent No. 2007/0628,  
EU Patent #1,725,864, and International Patent Appl. No. PCT/US2005/033985



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**Industrial Test Systems, Inc.**

Innovators of Water Quality Testing



Technical Specifications		eXact® LEADQuick with Bluetooth® SMART (486900BT)	
Measurement method	Photometric	Sample required	4mL (0.13oz)
Light source	Light Emitting Diode (LED)	Operating temp range	0°—50°C (32°—122°F)
Wavelength	476nm	Power supply	(4) AAA alkaline batteries
ABS range	.001 — 2.00	Battery life	>2000 tests
Photometric precision	.001	Weight	140g (5oz)
Cell path-length	20 mm	Waterproof rating	Exceeds IP67
Display	3-digit customized liquid crystal display with annunciators	Electromagnetic compliance (EMC)	Emitted interference – EN61326 Immunity to interference – EN61326
Cell chamber	Custom-molded, proprietary, PET plastic fused into chamber, non-removable	Dimensions	5 x 3.5 x 16.5 cm (2 x 1.4 x 6.375) in W x D x H

## About your eXact® LEADQuick photometer

In order to save power, the meter is designed to turn off after 5 minutes (timed from the last button pressed). Should the meter turn off in the middle of a test, the last stored zero in the meter will remain valid when the meter is turned on again. Also, the test result is stored in memory for easy retrieval.

The eXact® LEADQuick meter is controlled by four buttons:



While meter is off, when pressed, this turns meter on.  
When meter is on, when pressed, this zeros meter.



When pressed and re-pressed, this advances the display to the next MENU test.  
When pressed and held down for two seconds (continue holding down), the instrument automatically retrieves the last 20 measurements in the MENU displayed. Beginning with the most recent measurement stored (20) through the oldest measurement stored (1). This recall is available for each MENU test.



When pressed, this initiates countdown timing and count up timing as appropriate for the MENU test.

## eXact® LEADQuick Meter Messages

The following are some common messages that may be displayed, including error messages. If an error message other than those listed below is displayed, please contact technical support in the USA at (803) 329-0162 (ext. 0).

LCD Message	Description	Corrective Action
HI	In READ mode: test sample concentration is above the measurement range (test specific).	Dilute and retest. Dilution Kit available (Part Number 487200).
LO	In READ mode: test sample concentration is below the measurement range (test specific).	Sample value is below measurement range.
LO	In ZERO mode: sample absorbance (due to a cloudy or colored sample or a dirty cell) is too high to zero	Dilute sample, filter sample, or clean cell. Testing cannot proceed until a valid ZERO is achieved.
ER	Excessive stray light detected. Normally this does not occur, even when testing in sunlight.	Place the CELL COVER over the CELL for zeroing and for reading result. Moving to a shaded area can also fix this problem.
	Low battery indication.	Replace the batteries.
Flashing result on LCD	Lost connection to eXact iDip® app	Press ZERO/ON to stop flashing. Remove and replace the battery cover if flashing continues for future tests.

## About Bluetooth® SMART

Bluetooth® SMART is a low-power wireless networking standard which uses short radio waves to allow electronic devices to communicate with each other. The eXact® LEADQuick with Bluetooth® SMART comes standard with Bluetooth® 4.0 technology, a class 2 device with a wireless working distance of up to 30 feet (10 meters) and a 2.1 Mbps data transfer rate. This allows a seamless transfer of data between a smart device and the eXact® LEADQuick with Bluetooth® SMART.



## About the Sample Cell (built-in 4mL)

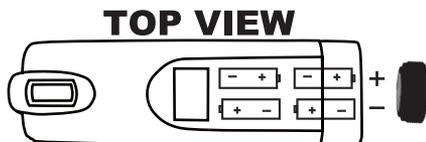
The built-in Sample Cell (CELL) is transparent plastic and, when filled to the top, contains 4mL. The sturdy CELL design will last for over 20,000 readings. Scratches on the CELL will not interfere or compromise the accuracy of the readings because of its fixed position. For best accuracy, rinse cell with clean water immediately after a test is completed. Do not use solvents, such as acetone, to clean the cell. When the CELL becomes stained or cloudy from repeated testing, or when the meter does not blank when you press the ZERO/ON button, the cell needs to be cleaned. Clean as follows: Fill cell with clean water and move the Cell cleaning brush up-and-down and back-and-forth along the walls of the cell. Afterwards, rinse the cell and the meter is ready for use again. Cleaning the cell regularly is especially recommended after you run a test that is using turbidity or precipitation chemistry for analysis (Calcium Hardness, Sulfate, Chloride, and Cyanuric Acid).

## How to install or replace "AAA" batteries

*Batteries are not included. The meter requires (4) AAA in order to function.*

- 1 Unscrew the O-ring sealed battery cover counter-clockwise. Use proper sized pliers if necessary. Do not disturb the sealing O-ring.
- 2 Remove the used batteries and install 4 new AAA batteries following the diagram for correct polarity (see diagram). We recommend high quality AAA alkaline batteries be used.
- 3 Replace the battery cover. Be sure to tighten the cover securely. This is necessary for meter to ensure it is waterproof.
- 4 Dispose of the used batteries in accordance with your local regulations.
- 5 Press  button to confirm the meter turns on. The meter is now ready for operation.

Meter will not work if battery orientation is incorrect.



## 2-year limited warranty

Registration of your eXact® photometer must be received within 30 days from date of purchase to activate the warranty. The eXact® photometer is warranted to be free from defects in materials and workmanship for a period of two (2) years from the date of purchase by the customer. ITS will repair or replace any part of the product which is deemed to be faulty or otherwise defective. The non-transferable warranty does not cover product damage caused by abuse (such as crushing a tablet in the cell) or improper use. If the meter is faulty or otherwise defective contact ITS by phone (+1-803-329-9712 Ext. 0) or email (its@sensafe.com) to describe the problem and obtain a return authorization form before returning the photometer to ITS. Damage caused by improper packing of the photometer for return shipment to ITS will not be covered by the warranty. Customer is responsible for shipping charges to ITS. ITS pays postage when photometer is returned to customer. A maximum processing fee of \$75 will be charged for repair or replacement of non-registered photometers and damages not covered by this warranty. Registration is available over the phone (+1-803-329-9712 Ext. 0) or on-line at [sensafe.com/micro/warranty/](http://sensafe.com/micro/warranty/) (Personal data is kept confidential).

## Lead in Water Recommendation for “First Draw Sample”

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The EPA 2007 Lead and Copper Rule Revision has a heavy lead testing focus on schools. The sampling is tiered:

1. “First draw sample” - sample a line unused for at least 8 to 18 hours. Draw the first 250mL to test. This measures the lead contribution from fixtures.
2. “Flushed sample” - before any water is used in the morning allow the line to run for 30 seconds, and then collect a 250mL sample. This measures the lead contribution from internal piping.

The June 1991 Lead and Copper Rule Fact Sheet recommended 1 liter of water from a tap unused for 6 hours. This is not mentioned in the 2007 revisions to the rule.

The amount of flushing determines what part of the system is being evaluated for lead. If the volume of water in the system can be determined (e.g. gallons of water/linear ft. of pipe) the amount of flushing can help isolate the source of the lead contamination. It appears that this approach is used by some cities as they do mandated lead testing of their water systems.

## About *eXact® Strip Micro*

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The eXact® LEADQuick with Bluetooth® SMART is designed to work with our line of eXact® Micro Strips. This type of reagent delivery method is designed to give the most precise accuracy reading for testing various water quality parameters.

eXact® Strip Micro has been designed to offer the user a more “Green” and cost-effective alternative to testing. Instead of using a 10mL water sample, eXact® Strip Micro uses a 4mL water sample, which uses up to 60% less chemical per test. The accuracy of the meter is maintained by designing the photo cell with a 20 mm path-length.

## Ready Snap® Procedure

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When there is a question about the quality of a ReagentStrip™, your test method, or the photometer you are using, then it is recommended to test the SYSTEM (reagent, you, and photometer) by using the appropriate READY SNAP™ solution.

Follow the procedure below for the test you are running. If you get the acceptable result using the READY SNAP™ solution, then you can be confident that the reagent, you, and the photometer are working as a SYSTEM correctly.

**1** Snap off top of ReadySnap™ 1 vial safely and add one (1) drop of Acid-1 (486999) to Solution in ampoule. **2** Mix Solution by sucking up liquid with plastic pipette. **3** Turn on eXact® LEADQuick™ meter and scroll to PB MENU. **4** Using pipette, fill meter CELL with Solution and then empty cell. **5** Fill meter CELL again with Solution and tilt meter forward to make room for Pb-2 Reagent. **6** Add five drops of Pb-2 Reagent (488375-B). **7** Dip Pb-3 Strip (486997) into cell and immediately push READ. Move strip in a gentle, back and forth motion (approx. 2 strokes/Sec) for 20 seconds. Remove strip after “1” on the display disappears. **8** Display will flash and automatically start to count up from 1 to 60. After the 60 seconds, meter automatically zeros. **9** Dip Pb-4 Strip (486995) into cell and immediately press READ. Move strip in a gentle, back and forth motion (approx. 2 strokes/Sec) for 20 seconds. Remove strip after “1” on the display disappears. **10** Display will flash and automatically count up from 1 to 60. After the 60 seconds, the cursor will move across display while the meter prepares to measure the sample. Record results displayed (this result is automatically stored in PB Menu). **11** After testing is completed, rinse CELL at least three times.



**MENU:**  
Opens  
slide-out for  
easy access to  
all app features

**HOME SCREEN**

**HISTORY:**  
Accesses  
saved results  
which can be  
sorted, edited,  
and emailed.  
Also accesses  
History Map



**CALENDAR:**  
Displays your  
schedule/  
appointments

**CUSTOMERS:**  
Attaches  
results to  
people and/or  
locations from  
your smart  
device contacts

**STORE:**  
Opens store  
to unlock  
additional tests

**TEST:**  
Initiates water  
testing

**RESULTS:**  
Accesses temporary  
results that have  
not been saved to  
history

**BLUETOOTH  
DEVICE**

**TEST RESULT SCREEN**

M20BT B00007v69.02

**TEST  
ABBREVIATION**

**TESTING  
PARAMETER**

Alkalinity, Total AL

**PARAMETER  
UNIT OF MEASURE**

Scroll unit of measure values.  
Some tests offer results in  
multiple units of measure.

81  
ppm

**TEST RESULT**

**DOTS INDICATE  
MULTIPLE UNITS OF MEASURE**  
(Available for some tests)

## Download the App

Using your smart device, download the eXact iDip® app. To see if your smart device is compatible, please see our compatibility list at [sensafe.com/compatible-devices/](https://www.sensafe.com/compatible-devices/).

We are constantly improving the eXact iDip® app and welcome your suggestions to help make our product even better. Visit [www.sensafe.com/idip](https://www.sensafe.com/idip) or e-mail your feedback to [exactidip@sensafe.com](mailto:exactidip@sensafe.com).

## Menu

The **Menu slide-out** is available from any screen within the app. The **Menu** allows you to access any of the app's features with ease.



## HOW TO VIEW YOUR GPS LOCATION

In the **Settings** screen you can view your current GPS coordinates.

## ABOUT

Access the End-User License Agreement and contact information to reach our offices in the USA and Europe from the **About** section located in the **Menu** slide-out.

Located in the About section you can find which version of the app you are running. Be sure to check for updates and install the latest version before running a test as we are constantly updating and adding more features to the app!

## Test

You can utilize two different testing methods under **Test**; Manual Entry or Bluetooth Device.



## BLUETOOTH TEST

Tests will be performed with your eXact® LEADQuick.

## MANUAL TEST

This feature allows you to utilize other testing methods and manually enter your results into the app. Begin by selecting **'Test'**, **'Manual entry'**, then **'Change value'** to enter.

## History

The **History** stores all your saved test result information and allows you to sort by date, customer name, or test type.



## HOW TO SORT BY CUSTOMER

To sort by **Customer** begin by clicking **'RESULTS'**, then **'Sort by'**, **'Customer'**. You can then scroll through your list of customers, by name, to find a specific test result.

## HOW TO SORT BY DATE

To sort by **Date** begin by clicking **'RESULTS'** then **'Sort by'**, **'Date'**. You can then scroll through a list of tests performed by date. You can also set a specific date range period by selecting **'Date range'**. Then set your **From** and **To** date ranges.

## HOW TO SORT BY TESTS

To sort by **Test** begin by clicking **'RESULTS'** then **'Sort by'**, **'Test'**. You can then scroll through a list of tests sorted in alphabetical order.

## HOW TO ACCESS HISTORY MAP

The History Map stores GPS locations of testing sites. See page 10 for instructions on utilizing this feature.



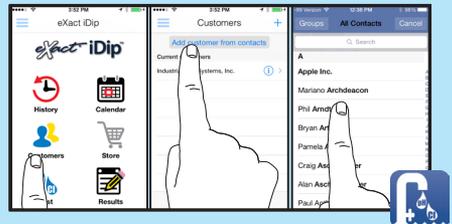
The benefits of purchasing an eXact LEADQuick with Bluetooth® SMART are the ability to connect your photometer to a smartphone or tablet and use our specially designed app to easily save, send, and share your test results. First, select your test using the menu selections on your LEADQuick then run the test and the results will simultaneously display on the app and on your LEADQuick with Bluetooth® SMART. From the app, you can save, send, and share the results directly linked to your customers information and GPS location to include date/time stamp. The eXact iDip® app is available for use on both Apple and Android devices. The app is compatible with Bluetooth 4.0 devices (Android 4.4 and up and Apple iOS 7.0 and up) For a full list of compatible devices please visit [sensafe.com/compatible-devices/](http://sensafe.com/compatible-devices/).



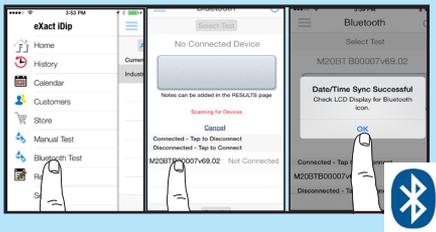
*When using your eXact® LEADQuick with Bluetooth® SMART and the eXact iDip® app. You will need to complete the following steps after you have rinsed and filled your cell with the water sample and prior to zeroing your meter and dipping your strip.*

## HOW TO SELECT A CUSTOMER

From your smartphone/tablet, launch the eXact iDip® app. Select '**Customers**' from the home screen. From the Customers list '**Add customer from contacts**' or create a new contact by selecting the '+' in the upper right hand corner.



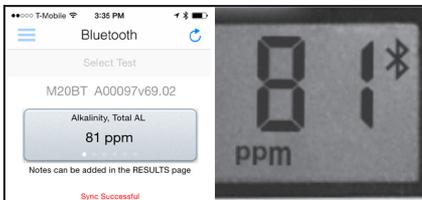
*Please Note: When you select a new customer, this customer will not appear in the list until you have run and saved a test using the app and your eXact® LEADQuick with Bluetooth® SMART photometer.*



## HOW TO CONNECT VIA BLUETOOTH

Tap the menu slide out screen '☰' and select '**Bluetooth Test**'. Select your eXact® LEADQuick from the list located at the bottom of the screen. Verify it has connected and tap '**OK**'.

*The serial number is located on the back of your device, this will display in the app. Refer to the serial number to ensure you are connected to the correct device.*



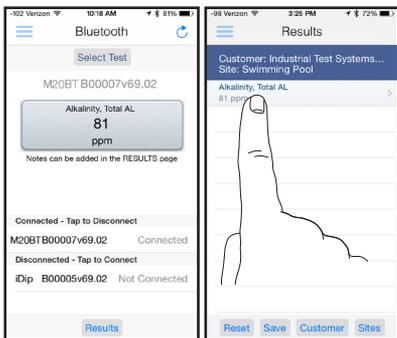
## READ RESULTS

Results will display simultaneously on the LEADQuick photometer and app.

*Please note that batch uploading tests saved on your eXact LEADQuick to a smartphone/tablet is not yet available. If you want to save a test result from your LEADQuick to the app, you will need to run the test while connected to the app or enter the result manually.*

# Managing data with the eXact® iDip app

After you have run your test, you can save, send, and share your results, by following the steps below.

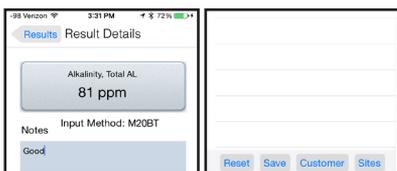
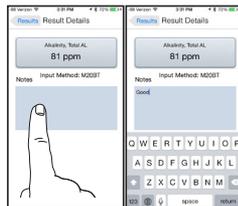


## MANAGING DATA (SAVE/SEND/SHARE)

When all tests have been performed, select 'Results' at the bottom of the screen. To add notes tap the desired test result.

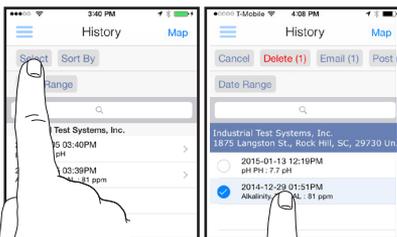
### TYPE NOTES

Add any notes you wish into the 'Notes' box. The additions will be automatically saved.



## MANAGING DATA (SAVE/SEND/SHARE)

Go back to 'Results' and select 'Save' to store the test results with notes into 'RESULTS'



## HOW TO MANAGE DATA IN HISTORY

In History, you can edit, select, and email your results.

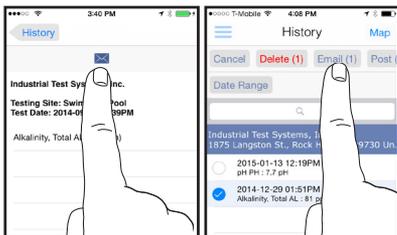
To email, you can either tap an individual result, or use the 'Select' button to access multiple data points.

## HOW TO EMAIL RESULTS FROM HISTORY

(1) Press the blue envelope icon from a single result selection.

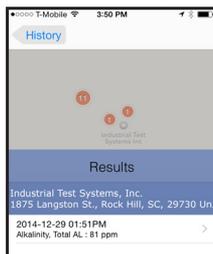
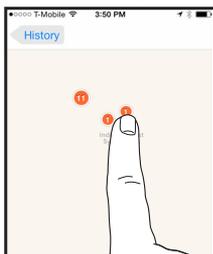
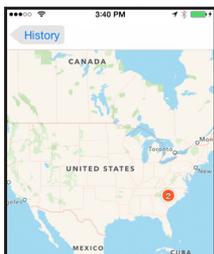
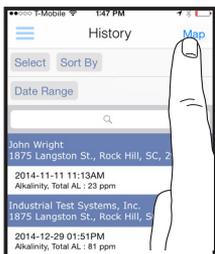
(2) To select multiple test results, tap 'select', choose results, and then 'email' to send the result information for all selected results. **The app will automatically attach your test result information and a .csv file to the email.**

Add recipients and tap send to complete.



## ACCESSING RESULTS FROM HISTORY MAP

Tap 'Map' on 'RESULTS' page to access the History Map. Double tap or use fingers to zoom into an area. Select a pin by tapping to bring up results. From the specific location you can bring up the test results details page.



# Total Lead in Water Test Procedure

Uses Reagent Set Part Number 486901



## 1 PREPARE SAMPLE FOR TESTING

Collect water sample in 50mL conical tube to the 50mL line. Add five (5) drops of **ACID-1 Reagent, Part #486999**. Mix and allow to sit for at least five (5) minutes. After this time, TEST SAMPLE is ready for testing.



## 2 TURN METER ON

Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current MENU selection, followed by the last reading.



## 3 SELECT TEST: Pb

Press and re-press the **MENU** button until the display shows the parameter Pb.



## 4 ADD SAMPLE TO CELL

Using the TEST SAMPLE from above, fill and empty the CELL four (4) times. Finally, fill cell to capacity with the TEST SAMPLE. Tilt meter forward to allow excess sample to flow out in order to make room for Pb-2 Reagent addition below.



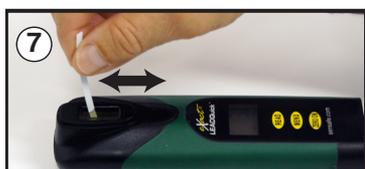
## 5 ADD REAGENT PB-2

Add five (5) drops of **eXact® Reagent Pb-2, Part #488375-B**.



## 6 DIP STRIP & PRESS READ

Dip the **eXact® Strip Pb-3, Part No. 486997** into the CELL and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) and begin immediately counting up from **1 to 60**. After the 60 seconds, the meter automatically zeros. The cursor will move across the display followed by **0 µg (µg/L)**.



## 7 DIP STRIP & PRESS READ

Dip the **eXact® Strip Pb-4, Part No. 486995** into the CELL and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) begin immediately counting up from **1 to 60**. After the 60 seconds, the cursor will move across the display, informing you that it is about to measure the sample as **µg (µg/L)**. Record result (this result is automatically stored in **PB**). After testing is complete discard sample and rinse cell at least three times with clean water.

## Soluble Lead Test Procedure

Collect water sample in 50mL conical tube to the 50mL line. Add two (2) drops of eXact® Reagent Pb-2, Part #488375-B. TEST SAMPLE is ready for testing. Turn meter on and select test menu PB. Using the TEST SAMPLE from above, fill and empty the CELL four (4) times. Finally, fill cell to capacity with the TEST SAMPLE. Then perform steps 6 and 7 from above.

To get results as Colloidal Lead, subtract the Soluble Lead value from the Total Lead value.

# Mercury in Water Test Procedure

Uses Reagent Set Part Number 486901



- 1 PREPARE SAMPLE FOR TESTING**  
Collect water sample in 50mL conical tube to the 50mL line. Add five (5) drops of **ACID-1 Reagent, Part #486999**. Mix and allow to sit for at least five (5) minutes. After this time, TEST SAMPLE is ready for testing.



- 2 TURN METER ON**  
Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current MENU selection, followed by the last reading.



- 3 SELECT TEST: HG**  
Press and re-press the **MENU** button until the display shows the parameter HG.



- 4 ADD SAMPLE TO CELL**  
Using the TEST SAMPLE from above, fill and empty the **CELL** four (4) times. Finally, fill cell to capacity with the TEST SAMPLE. Tilt meter forward to allow excess sample to flow out in order to make room for Pb-2 Reagent addition below.



- 5 ADD REAGENT PB-2**  
Add five (5) drops of **eXact® Reagent Pb-2, Part #488375-B**.



- 6 DIP STRIP & PRESS READ**  
Dip the **eXact® Strip Pb-3, Part No. 486997** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) and begin immediately counting up from **1 to 60**. After the 60 seconds, the meter automatically zeros. The cursor will move across the display followed by **0 µg (µg/L)**.



- 7 DIP STRIP & PRESS READ**  
Dip the **eXact® Strip Pb-4, Part No. 486995** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) begin immediately counting up from **1 to 60**. After the 60 seconds, the cursor will move across the display, informing you that it is about to measure the sample as **µg (µg/L)**. Record result (this result is automatically stored in **PB**). After testing is complete discard sample and rinse cell at least three times with clean water.

# Cadmium in Water Test Procedure

Uses Reagent Set Part Number 486904



## 1 PREPARE SAMPLE FOR TESTING

Collect water sample in 50mL conical tube to the 50mL line. Add five (5) drops of **HCl-1 Reagent, Part #486994**. Mix and allow to sit for at least five (5) minutes. After this time, TEST SAMPLE is ready for testing.



## 2 TURN METER ON

Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current MENU selection, followed by the last reading.



## 3 SELECT TEST: Cd

Press and re-press the **MENU** button until the display shows the parameter Cd.



## 4 ADD SAMPLE TO CELL

Using the TEST SAMPLE from above, fill and empty the **CELL** four (4) times. Finally, fill cell to capacity with the TEST SAMPLE. Tilt meter forward to allow excess sample to flow out in order to make room for Pb-2 Reagent addition below.



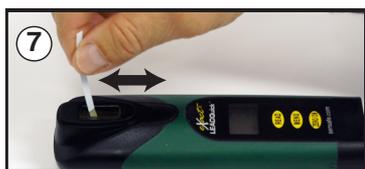
## 5 ADD REAGENT PB-2

Add five (5) drops of **eXact® Reagent Pb-2, Part #488375-B**.



## 6 DIP STRIP & PRESS READ

Dip the **eXact® Strip Pb-3, Part No. 486996** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) and begin immediately counting up from **1 to 240**. After the 240 seconds, the meter automatically zeros. The cursor will move across the display followed by **0 µg (µg/L)**.



## 7 DIP STRIP & PRESS READ

Dip the **eXact® Strip Pb-4, Part No. 486995** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after "1" on the display disappears.** The display will flash (- - -) begin immediately counting up from **1 to 240**. After the 240 seconds, the cursor will move across the display, informing you that it is about to measure the sample as **µg (µg/L)**. Record result (this result is automatically stored in **PB**). After testing is complete discard sample and rinse cell at least three times with clean water.

## Spiked Recovery Test Method For Interferences

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The Spiked Recovery Test Method (also referred to as Standard Additions Method) is used to verify that LEADQuick™ gives accurate results for your water sample. If you find an unexplained difference in results when compared to another test method it is reasonable that you should resolve the issue. A good way to resolve the issue is by a technique commonly used by analytical chemists every day. This technique is often referred to as Spiked Recovery Test Method for Interferences. The following information explains how to perform the test method. You will need a Lead standard solution. The idea behind this method is as follows:

1. Add a known amount or concentration of Lead standard solution to the questionable sample. This is now the “spiked sample.” It is recommended to add a Standard Solution amount that is at least equivalent to three times the minimum detectable limit of the test (10 µg/L or ppb).
2. Test the spiked and un-spiked (original) samples using the same reagents, instrument and technique or test method. The spiked sample should show an increase equal to the amount of standard added. The value obtained is called the **Recovery**. Ideally the % recovery is 100%. Results are acceptable if the % recovery is +/- 10%. The formula for calculating percent Recovery is below.
3. If the percent recovery is not in the acceptable range there may be interferences. You can consider diluting the sample with lead free water past the point of interference, within the detection limit of the test kit. You can also consider calculating the actual lead in the sample (see below) as long as the %Recovery is above a reasonable level such as 40%.The percent recovery formula is as follows:

$$\% \text{ Recovery} = \frac{100(cs-cu)}{K}$$

Where:

cs = concentration found through testing of the spiked sample

cu = concentration found through testing of the un-spiked sample

(NOTE: result should be adjusted for the dilution of the spike volume if volume change is more than 5%)

K = concentration of the spike added to the sample

**Example 1:** An un-spiked questionable sample measures 10 ppb Lead. A separate 10mL portion of the questionable sample was spiked by adding 20 µL of a 10 ppm Lead standard solution. This is the equivalent of adding 20 ppb Lead to the water sample. The spiked solution was measured by the same method as the original sample. The Spiked result was 28 ppb (Cs)

cs = 28 ppb

cu = 10 ppb

k = 20 ppb

$$\% \text{ Recovery} = \frac{100(28-10)}{20} = 90\% \quad (\text{Recovery result acceptable})$$

**Example 2:** In another water sample using a similar spiked method as in Example 1 the results were

cs = 30 ppb

cu = 18 ppb

k = 20 ppb

$$\% \text{ Recovery} = \frac{100(30-18)}{20} = 60\% \quad (\text{Recovery result unacceptable})$$

**Calculating the Lead:** In this example the percent recovery value is low and suggests that, with this test, the water sample gives lead results that are 60% of the actual concentration. To calculate the concentration of lead in this sample divide the expected recovery (100%) by the observed recovery (60%) to get the interference correction factor (100% / 60% = 1.67). Multiply the interference correction factor by the un-spiked sample result (cu) for the actual concentration of lead in the sample (1.67 x 18 ppb = 30 ppb).

## Lead in Soil Test Procedure

**Extraction Method** (Pb-1P, 0.1mL scoop, and 50mL Plastic Conical tube are not supplied, but required to perform this test)

**Add one level scoop (0.1mL volume scoop, which holds approximately 0.14 grams) of soil sample to a clean 50mL, graduated, plastic conical tube. Add Twenty (20) drops of Pb-1P, Part No. 487925-P15 to the conical tube. Swirl the mixture for a few seconds or until all soil is suspended and mixed well. After five minutes, bring the volume of the sample to 50mL using deionized, distilled, or lead free tap water. Cap and mix this solution. This solution is now identified as the Soil Extraction Solution (SES). Wait one (1) minute, or more, for suspended solids to settle, then perform the test as follows:**

Add 1.0mL (1000 µl) of SES sample to a clean 50mL conical tube. Do not add **Pb-1P, Part No. 487925-P15** to the conical tube. Adjust the volume of the cell to 50mL using lead free tap water. Mix sample. Test Sample is ready for testing.

Press the **ZERO/ON** button to power the meter on; the display will show all annunciators, then the current **MENU** selection, followed by the last reading.

Press and re-press the **MENU** button until the display shows the parameter **Pb**.

Rinse the **CELL** at least 3 times with the Test Sample above. Finally, fill cell to capacity with the Test Sample. Tilt meter forward to allow excess sample to flow out in order to make room for **Pb-2** Reagent addition below.

Add five (5) drops of **eXact® Reagent Pb-2, Part No. 488375-B**.

Dip the **eXact® Strip Pb-3, Part No. 486997** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after “1” on the display disappears.** The display will flash (- - -) and begin immediately counting up from **1 to 60**. After the 60 seconds, the meter automatically zeros. The cursor will move across the display followed by 0 µg (µg/L).

Dip the **eXact® Strip Pb-4, Part No. 486995** into the **CELL** and immediately press **READ**. This starts the **20 SECOND** countdown timer. During this time move the strip in a gentle back and forth motion. **Remove and discard the strip after “1” on the display disappears.** The display will flash (- - -) and begin immediately counting up from **1 to 60**. After the 60 seconds, the cursor will move across the display, informing you that it is about to measure the sample as µg (µg/L). Record result displayed (this result is automatically stored in **Pb**). After testing is complete discard sample and rinse cell immediately.

To convert the value in step 7 from µg/L to mg/kg use **17.86** as the multiplication factor:  
(For example: 65 µg/L × **17.86** = 1161 mg/kg)

**NOTE:** If no Lead is found when 1.0mL SES sample is used in Step 1, then try 2mL of the SES for lower detection. If the result reads “HI”, then the SES sample should be retested using a 0.01mL sample in Step 1. Pb-1P and Pb-2 drops required for these SES volume variations are listed in the chart below.

SES Volume	Pb-1P Drops	Pb-2 Drops	Multiplication Factor	Range (mg/Kg)	Accuracy %
0.01mL	0	5	1786	up to 300,000	±40
1mL	0	5	17.86	18 to 3000	±25
2mL	0	5	8.93	18 to 1500	±25

## Lead Recovery in Various Water Samples:

Our laboratory has performed numerous Spiked Recovery tests using water samples from around the world. The water samples were obtained in the locations as identified below. The water was collected in clean plastic bottles and shipped to our lab. The samples were not preserved by acid and not refrigerated.

Each sample was spiked in duplicate at two different spiked concentrations (20µg/L and 50µg/L) giving a total of four spiked tests. Except for two water samples the % recovery of spiked water samples had an acceptable average for the four spiked water tests (within +/- 10%). The Highland, NC well water averaged a 74% Recovery and the Seattle, WA municipal water averaged 83.5% Recovery.

Water sample lead (Pb<sup>2+</sup>) concentrations found for all samples were below 3ppb, and reported as 0, except for Rock Hill, SC water (exposed to lead).

Water Origin	Water Type*	Water Sample µg/L	Spiked 20ppb ppb (µg/L)	% Recovery	Spiked 50ppb ppb (µg/L)	% Recovery
Vienna, Austria	M	0	21	105	52	104
repeated		0	19	95	51	102
Munich, Germany	M	0	21	105	54	108
repeated		0	19	95	46	92
Kusnacht, Switzerland	M	0	20	100	51	102
repeated		0	19	95	54	108
Paris, France	M	0	19	95	50	100
repeated		0	20	100	45	90
Washington, DC	M	0	23	119	52	104
repeated		0	20	100	49	98
Philadelphia, PA	M	0	17	85	45	90
repeated		0	23	119	43	86
Phoenix, AZ	M	0	20	100	47	94
repeated		0	21	105	47	94
Edgewater, MD	W	0	22	110	50	100
repeated		0	16	80	46	92
Highland, NC	W	0	15	75	36	72
repeated		0	15	75	37	74
Rockwell, NC	W	0	22	110	51	102
repeated		0	23	119	50	100
Las Vegas, NV	M	0	19	95	52	104
repeated		0	17	85	49	98
Chicago, IL	M	0	21	105	51	102
repeated		0	16	80	52	104
Rock Hill, SC	W	0	18	90	47	94
repeated		0	17	85	46	92
Melbourne, Australia	M	0	20	100	47	94
repeated		0	19	95	45	90
Rock Hill, SC (exposed to lead)	M	5	25	100	56	102
repeated		5	26	104	52	95
Weaverville, NC	M	0	16	80	52	104
repeated		0	20	100	46	92
Anaheim, CA	M	0	19	95	53	106
repeated		0	21	105	47	94
Seattle, WA	M	0	16	80	45	90
repeated		0	16	80	42	84
Kilowna, BC, Canada	M	0	19	95	51	102
repeated		0	21	105	53	106

\*M = Municipal, W = Well

## Summary of LEADQuick™ Chemistry for Lead (Pb<sup>2+</sup>) Detection:

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Lead in the water sample is first solubilized to Pb<sup>2+</sup> by the addition of the Nitric Acid reagent. Pb-2 Buffer is then added to make the solution alkali. The eXact® Strip Pb-3 is dipped for 20 seconds with gentle motion, which adds the porphyrin indicator, and mixes the solution. After a one minute wait, which allows for the porphyrin and Pb<sup>2+</sup> to form a colorimetric complex, the eXact® LEADQuick™ Colorimeter automatically zeros. The eXact® Strip Pb-4 is dipped into the cell sample for twenty seconds with gentle motion. This motion releases EDTA into the sample which then breaks up the colorimetric porphyrin-Pb<sup>2+</sup> complex. After a one minute wait, the result is displayed in µg (µg/L) as Lead. The Mercury test uses a similar chemistry. Cadmium uses Hydrochloric Acid for solubilization of the Cadmium ion, and this test requires more indicator reagent.

A procedure using the porphyrin 5,10,15,20-terakis(1-methylpyridinium-4-yl)porphine as indicator is described in *Mirochim Acta* volume 157, page 87-91 published in 2007 K. Kawamura, et al. For convenience the indicator is referred to as TMPYP. Our modified test procedure is patented. In combination with the eXact® Strip reagent delivery device, and by not removing the cell from the meter between the zeroing and reading steps; LEADQuick™ delivers optimum accuracy and sensitivity. Please refer to the Lead Test Interference chart (Table 1) for details as to the highest concentration of ions the test can tolerate. From our lab and contract lab studies with LEADQuick™ we find that over 90% of the typical potable, municipally treated water samples experience no interference. Before you start using the LEAD-Quick™ with potable water samples in your area use the “Standard Additions” method to determine if there are any interferences in your water that may require consideration.

Interfering ions listed, except for Mercury and Cadmium, inhibit the TMPYP-Pb<sup>2+</sup> complex formation above the concentrations given. Mercury and Cadmium give similar color reaction with TMPYP. Mercury is rarely found in tap water above 0.005 mg/L. A procedure modification is not yet available to remove Mercury interference. Typical Cadmium levels in tap water will not interfere in the Lead and Mercury procedures using Nitric Acid. Hardness ions such as Calcium and Magnesium are tolerated as noted in Table 1. When the water sample has Total Hardness minerals above 400 mg/L, the Pb-4 addition of EDTA may be inadequate; and the TMPYP-Pb<sup>2+</sup> complex may not be completely destroyed and the lead reading will be low. If you suspect this, do a Spiked Recovery Test (page 14).

It is recommended that for best results this test be done on unpreserved, freshly drawn water samples. Water samples that have been preserved with strong Nitric Acid for lead testing will require alkali neutralization of excess acid to a pH of about 2.5; and the Acid-1 addition can be skipped. After the Pb-2 addition step the pH should be verified if pH issue is a concern; and ideally should be between 9.0 and 9.6 pH.

A test kit is also available for detection of Lead in paint. Contact our Sales Department for details, or go to [www.sensafe.com](http://www.sensafe.com).

**Table 1:**

<b>Lead Test (PB MENU) Interferences</b> (Similar interferences can be expected for Mercury and Cadmium Tests.)			
<b>Ion</b>	<b>Interference Level</b>	<b>Ion</b>	<b>Interference Level</b>
Aluminum, Al <sup>3+</sup>	2 mg/L	Magnesium, Mg <sup>2+</sup>	200 mg/L
Barium, Ba <sup>2+</sup>	3 mg/L	Manganese, Mn <sup>2+</sup>	0.5 mg/L
Bromide, Br <sup>-</sup>	20 mg/L	Mercury, Hg <sup>2+</sup>	0.01 mg/L
Cadmium, Cd <sup>2+</sup>	0.07 mg/L	Nickel, Ni <sup>2+</sup>	1 mg/L
Calcium, Ca <sup>2+</sup>	500 mg/L	Nitrogen, Ammonium, NH <sub>4</sub> <sup>+</sup>	40 mg/L
Chloride, Cl <sup>-</sup>	150 mg/L	Nitrogen, Nitrate, NO <sub>3</sub> <sup>-</sup>	20 mg/L
Chromium, Cr <sup>3+</sup>	0.1 mg/L	Nitrogen, Nitrite, N <sub>2</sub> <sup>-</sup>	300 mg/L
Cobalt, Co <sup>2+</sup>	1 mg/L	Phosphate, PO <sub>4</sub> <sup>3-</sup>	100 mg/L
Copper, Cu <sup>2+</sup>	5 mg/L	Sulfate, SO <sub>4</sub> <sup>2-</sup>	200 mg/L
Fluoride, F <sup>-</sup>	40 mg/L	Tin, Sn <sup>2+</sup>	0.2 mg/L
Iron, Fe <sup>2+</sup>	0.2 mg/L	Zinc, Zn <sup>2+</sup>	2 mg/L
Iron, Fe <sup>+3</sup>	0.1 mg/L	<b>Rev. 07/03/07</b>	

## About your Water Sample

If the water sample you are testing has a pH of 6.5 to 8.5, then the LEADQuick™ Reagent System will give valid results. If your water sample is below pH 6.5 or above pH 8.5, or has a Total Alkalinity above 200 PPM; then the pH of the water needs to be adjusted to between pH 7 and 8 before testing begins. Use 1.0N HCl or 1.0N NaOH to adjust the pH of your water sample. Iron above 0.1 ppm can be present in well water samples. It is recommended that the absence of iron be confirmed by the Iron Check Test (part number 480025). If your results are different from what you expect, then after the test is completed, check the pH of the reacted sample. The chemistry, to work properly, should have a final pH of 9.0 to 10.0. If your pH is below 9.0, then add six drops of PB-2 in step 5. If pH is above 10.0, then add four drops of PB-2 in step 5.

## Kit Specifications

The test detects from 0 to 500 µg/L or ppb levels of Lead as Pb<sup>2+</sup>. The most accurate test range will be 3 to 200 µg/L. For this range, the Test resolution is 1 ppb, minimum detection is 3 µg/L, and accuracy is +/-3 µg/L or +/-6% (whichever is higher), when used with an eXact® LEADQuick™ Colorimeter. If lead level is above 500 µg/L (ppb), dilute sample with lead-free water before retesting.

The MCL (**Maximum Contaminant Levels allowed**) for drinking water as set by the USEPA for Pb<sup>2+</sup> is 15 µg/L (WHO is 10 µg/L); Mercury (Hg<sup>2+</sup>) is 2 µg/L; and Cadmium (Cd<sup>2+</sup>) is 5µg/L.

## Tips for Best Accuracy

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1. Become familiar with the meter and the different tests by reading the instructions carefully.

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2. Observe the dip time (as required for the test) for accurate results.

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3. Be sure the CELL is filled to capacity. Then, tilt meter forward to discard about 0.2mL of the cell volume. This allows for the Pb-2 addition to be performed without overfilling the CELL.

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4. Rinse the CELL with clean water immediately after completing the test. (Some test reagents will stain or coat the CELL)

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5. It is recommended that the sample be allowed to sit for 5 minutes or longer in Step 1 to facilitate Acid reaction. Additional time would be recommended if the detection of solid Lead or Cadmium, containing particles, are of interest.

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6. Store the meter and all test materials out of direct sunlight and away from chemical storage areas.

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7. Minimize exposure of meter and test reagents to heat. Storage below 80°F (27°C) is recommended. DO NOT REFRIGERATE TEST REAGENTS.

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8. Dry the outside of the meter when testing is complete or before storage of the meter.

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9. Each eXact® Strip Micro is valid for ONLY one test. Discard strip after single use in regular trash that is inaccessible to children and pets.

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10. Each bottle of eXact® Strip Micro contains the quantity of strips notated on the bottle. Due to the manufacturing process, you may find one or two strips that are noticeably smaller or larger in width than the normal strips in the bottle. These should be discarded. Using these strips may give unreliable results.

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11. If conversion table(s) are supplied, they have a unique revision number. It is recommended that you visit [www.sensafe.com](http://www.sensafe.com) to check for any updated revisions and details.

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12. Tests are calibrated at 75°F +/- 2°F (24°C +/- 1°C). It is recommended that the water sample be warmed before testing if sample temperature is below 60°F / 16°C.

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13. Our lab testing with the LEADQuick meter has shown that zeroing and measuring of the sample does not require any cell cover for accurate results, even in full sunlight.

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14. Remove batteries when meter is not used for more than a month.

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15. It is recommended that for best results this test be done on unpreserved, freshly drawn water samples. Water samples that have been preserved with strong Nitric Acid for lead testing will require alkali neutralization of excess acid to a pH of about 2.5; and the Acid-1 addition can be skipped. After the Pb-2 addition step the pH should be verified if pH issue is a concern; and ideally should be between 9.0 and 9.6 pH.

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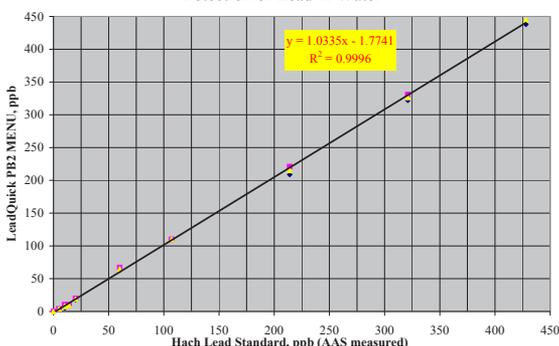
# eXact® LEADQuick Accuracy

Hach® Lead Standard Solution, 10 mg/L as Pb<sup>2+</sup> (Cat. 23748-20) was verified by Atomic Absorption and used with the eXact® LEADQuick™ Meter, PB MENU to confirm precision and accuracy.

Hach® AAS, Lead Std, ppb	Meter 1 PB MENU ppb	Meter 2 PB MENU ppb	Average PB MENU ppb
0	0	0	0
5	4	4	4
10	6	10	8
10.7	6	10	8
14	10	10	10
20	18	20	19
60	63	67	65
107	110	110	110
214	209	221	215
321	322	331	326.5
428	438	451	444.5

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Detection of Lead in Water



## Available reagents / Reorder information

PARAMETER / TEST	PART #	RANGE (µg/L)	±% BEST ACCURACY	# OF TESTS
Lead in Water	486901	1 – 500	6	50
Mercury in Water	486901	10 – 600	6	50
Cadmium in Water	486904	10 – 600	6	50
Dilution Kit	487200	N/A	N/A	N/A

Visit us online: [sensafe.com/leadquick](http://sensafe.com/leadquick)  
for up-to-date product information.



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