

eXact® Micro 7+

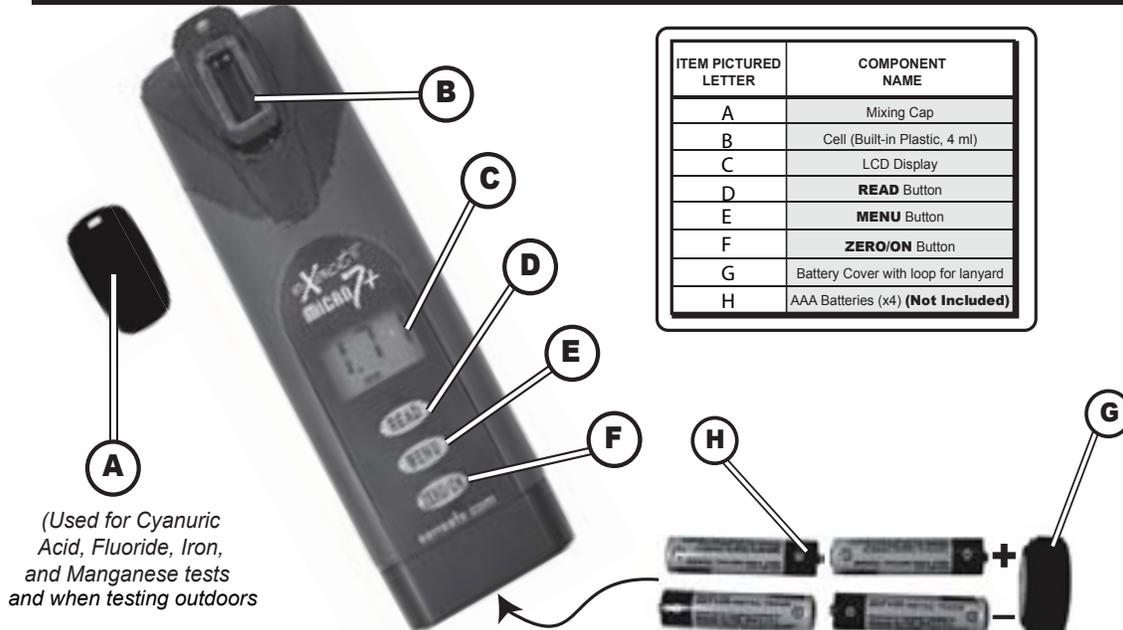
Advanced Photometer System

USEPA, DIN, & ISO Compliant for Free & Total Chlorine Testing
(4500-CL G, DIN Standard 38 408 G4, ISO 7393/2)

U.S. Patent No. 7,333,194, U.S. Patent No. 7,491,546, South African Patent No. 2007/0628 and international patent applications including International Patent Appln. No. PCT/US2005/033985; and Eur. Pat. App. 1,725,864



eXact® Micro 7+ Photometer



ITEM PICTURED LETTER	COMPONENT NAME
A	Mixing Cap
B	Cell (Built-in Plastic, 4 ml)
C	LCD Display
D	READ Button
E	MENU Button
F	ZERO/ON Button
G	Battery Cover with loop for lanyard
H	AAA Batteries (x4) (Not Included)

(Used for Cyanuric Acid, Fluoride, Iron, and Manganese tests and when testing outdoors)

eXact® Micro 7+ Meter Specifications

Measurement Method:	Photometric	Cell Chamber:	Custom-molded, proprietary, PET plastic fused into chamber, non-removable
Light Source:	Light Emitting Diode (LED)	Sample Required:	4 ml (0.13 oz)
Wavelength:	525 nm	Operating Temperature Range:	0 - 50°C (32° - 122°F)
Transmission Range:	100 - 0.00 %T	Power Supply:	(4) AAA alkaline batteries (Not Included)
Photometric Precision:	+/- 0.1/0.01 %T	Battery Life:	>2000 tests with alkaline batteries
Automatic Range Selection:	See Specifications below	Electromagnetic Compliance (EMC):	Emitted Interference - EN 61326 Immunity to Interference - EN 61326
Display:	3-digit customized liquid crystal display with annunciators	Waterproof Rating:	Exceeds IP67
CELL Pathlength:	20mm	Weight:	Instrument: 140 g (5 oz)
		Dimensions:	Instrument: 5 (W) x 3.5 (D) x 16.5 (H) cm; (2 x 1.4 x 6.375 in)

We offer a “Green” Alternative

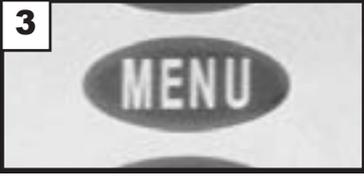
eXact® Strip Micro 7+ has been designed to offer the user a more “Green” and cost-effective alternative to testing. Instead of using a 10ml water sample, eXact® Strip Micro 7+ uses a 4ml water sample, which uses up to 60% less chemical per test. The accuracy of the meter is maintained by designing the photo cell with a 20mm pathlength.

eXact® Micro 7+ Direct Read Specifications

Menu	Tests for ¹	Range	Resolution	Accuracy
CL1	Free Chlorine & Total Chlorine (DPD-1) & (DPD-3)	0.00 - 11.0 ppm	0.01 (0.00-0.99 ppm)	±2% (0.00-0.99 ppm)
			0.1 (1.00-10.0 ppm)	±12% (0.00-10.0 ppm)
PH2	pH	6.5 - 8.4 ppm	0.1	±0.3pH
BR3	Bromine	0.0 - 14 ppm	0.01	±3% (0.00-0.99 ppm)
			0.01 / 0.1	±8% (0.00-10.0 ppm)
AL4	Total Alkalinity	12 - 180 ppm	0.1 (12.00-100.0 ppm)	±0% (12.00-100.0 ppm)
			1 (100.00-180.0 ppm)	±14% (100.00-180.0 ppm)
CA5	Calcium Hardness as CaCO ₃	10 - 500 ppm	1	±5% (100.00-500.0 ppm)
CUE	Copper (Cu+2)	0.04 - 8.0 ppm	0.01 (0.04-0.99 ppm)	±3% (0.04-0.99 ppm)
			0.1 (1.00-8.00 ppm)	
TR7	Transmission ² (Other tests coming soon)	99.9 - 0.01 %T	0.1 (99.9-10.0 %T)	±1%
			0.01 (0.00-0.01 %T)	
HR8	HR Free Chlorine	0 - 300 ppm	1	±0%

¹ Performance verified with various salt systems, pool and spa water samples with optimal water temperature at 10-40°C / 50-104°F.

² Measurement requires a conversion chart for value.

MENU	DPD-1 Free Chlorine Test Procedure		CL
CL1			
1		1 REMOVE STRIP	Remove one (1) <i>eXact® Strip Micro CL (DPD-1), Part No. FCLA-7001</i> from the bottle before beginning the test. Set the strip in a dry, convenient place and recap the bottle immediately.
2a		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.
2b		3 SELECT TEST: CL1	Press and re-press the MENU button until the display shows the parameter CL1 . CL1 is also used for testing: Total Chlorine (DPD-4), Ozone (DPD-4), Permanganate (DPD-1), and Total Chlorine (DPD-3).
3		4 RINSE AND FILL CELL WITH SAMPLE	Rinse the CELL at least 3 times with the water sample you will be testing - rinsing minimizes the potential for cross-contamination from a previous test. Finally, fill cell to capacity (4ml) with the water sample.
4		5 ZERO METER	Press the ZERO/ON button. The cursor will move across the display followed by 0.00 PPM . Sample is ready for testing.
5		6 DIP STRIP AND PRESS "READ"	Dip the <i>eXact® Strip Micro CL (DPD-1), Part No. FCLA-7001</i> 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.
6		7 RECORD RESULT DISPLAYED	The cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in CL1).

For best results with this eXact® Micro 7+ Photometer and DPD-1 strips:

This version of the eXact® Micro 7+ meter has a range to 11ppm Chlorine. The algorithm for Free Chlorine (CL1) with the use of DPD-1 strip gives most accurate results below 6ppm.

For Chlorine testing above 6ppm, you may use the eXact® Strip Micro HRC, Part No.

FCLA-7002, product. This procedure can be found on page 5.

About Your eXact® Micro 7+ Instrument

In order to save power, the meter is designed to turn off after 3 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® Micro 7+ meter is controlled by three buttons:

1. **ZERO/ON:** When first pressed, this button turns the meter on. When the meter is on and this button is pressed, it zeroes the sample in the cell. Once the meter is zeroed, this zero value applies to all parameters and is stored and retained even when meter turns off. However, it is recommended that each new water sample analyzed is zeroed before testing, to maximize sensitivity and accuracy.
2. **MENU:** With each press, the MENU button advances through the tests in the following sequence: CL1, PH2, BR3, AL4, CA5, CU6, TR7, HR8. Each test menu can store up to 20 results. To **retrieve the stored results**, go to the desired test using the MENU key. When the desired test is displayed, **press and hold down the MENU key**. Continue holding down the MENU key to scroll the stored results for that test, starting with the most recent result. The meter will display, from memory, the last 20 readings in sequence beginning with -20, which is the latest result, followed by -19, which is the 2nd latest result, etc; and finally -01, which is the oldest result retained. Only the last 20 readings are stored in each menu. This meter is able to store 160 results in memory (20 in each menu).
3. **READ:** When pressed once, this button starts the timer for the parameter being tested. When pressed a second time the meter exits the timer and immediately prepares to colorimetrically measure the sample, and simultaneously stores the measurement in memory.

If the parameter being measured is below or above the detection range, the display will show "**LO**" (Under Range) or "**HI**" (Over Range), respectively. This feature is menu specific and does not apply to all parameters.

About The Accuracy / Calibration Of The Micro 7+ System

All tests have been calibrated using certified reference standards and standard analytical spectrophotometric methods. The algorithms in the software reflect the best correlation of the eXact® Micro 7+ Systems against the AWWA, US EPA, DIN, and ISO reference test methods for chlorine. Studies show that the eXact® Micro 7+ System repeatedly agrees with an EPA Compliant reference method greater than 99% ($R^2 = 0.9989$, 0 - 6.0 ppm - see page 10). The eXact® Micro 7+ Advanced Photometric System has been factory calibrated for your convenience. You can expect the fixed calibrations in the meter to be valid for the life of the meter because of the quality, Long-Life LED, the photo cell, and the software as written into the meter. This is why the meter comes with a 2-Year Warranty. NOTE: Test algorithms in the new version of photometer (serial numbers above 5000) give accurate results in fresh and salt water.

Compliance Verification for Free and Total Chlorine Testing

This DPD test system is accepted by most health departments because this test is USEPA (DIN Standard 38 408 G4, ISO 7393/2) accepted for testing requirements for Free and Total Chlorine. The Micro 7+ meter uses a wavelength of 525nm; and the compliance requirement is that the colorimeter wavelength is between 490 and 530nm. The eXact® Strip Micro CL (DPD-1) uses the same reagents and proportions, and the resulting solution pH is maintained between 6.2 and 6.5 as specified by AWWA (American Water Works Association) method 4500-Cl G. It should be understood that the USEPA does not "approve" commercial DPD delivery systems such as reagent powder pillows, tablets, dispensers, or eXact® Strip DPD delivery devices. The eXact® Strip Micro CL (DPD-1) for Free Chlorine, and the eXact® Strip Micro CL (DPD-3) or the eXact® Strip Micro CL (DPD-4) for Total Chlorine meet your reportable testing requirements because the eXact® Strip Micro CL delivers the same chemicals in identical proportions (see table below); therefore, the system is compliant. Likewise, AWWA proportions are followed as required for Total Chlorine measurements using Potassium Iodide.

Component (Free Chlorine)	AWWA 4500-Cl G	eXact® DPD-1
Anhydrous DPD sulfate	1.5%	1.5%
Anhydrous Na ₂ HPO ₄	33.4%	33.4%
Anhydrous KH ₂ PO ₄ Na ₂	64.0%	64.0%
EDTA	1.1%	1.1%

HRC**High Range Chlorine Test Procedure****MENU**
HR8

- 1 REMOVE STRIP**
Remove one (1) *eXact® Strip Micro HRC, Part No.FCL-7002* from the bottle before beginning the test. Set the strip in a dry, convenient place and recap the bottle immediately.

- 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: HR8**
Press and re-press the **MENU** button until the display shows the parameter HR8.

- 4 FILL METER WITH SAMPLE**
Rinse the **CELL** at least 3 times with the water sample you will be testing - rinsing minimizes the potential for cross-contamination from a previous test. Finally, fill cell to capacity (4ml) with the water sample.

- 5 ZERO METER***
Press the **ZERO/ON** button. The cursor will move across the display, followed by **0.0 PPM**. The sample is ready for testing.

- 6 DIP STRIP - (read carefully and follow procedure closely)**
Dip the *eXact® Strip Micro HRC, Part No.FCL-7002* 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 immediately start counting up from **1 to 120** (this extra time allows more thorough color development). At 120 sec, the cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in HR8). After testing is completed, rinse cell immediately with brush and water.

NOTE: When testing outdoors (sunlight) for best accuracy, use the Mixing Cap/Cell

CLO₂

Chlorine Dioxide Test Procedure

MENU
TR7

- 1 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.
- 2 SELECT TEST: TR7**
Press and re-press the **MENU** button until the display shows the parameter TR7.
- 3 FILL METER WITH SAMPLE**
Rinse the **CELL** at least 3 times with the water sample you will be testing - rinsing minimizes the potential for cross-contamination from a previous test. Finally, fill cell to capacity (4ml) with the water sample.
- 4 ZERO METER**
Press the **ZERO/ON** button. The cursor will move across the display, followed by **100 %T**. Sample is ready for testing.
- 5 DIP STRIP - (read carefully and follow procedure closely)**
Dip the *Glycine ReagentStrip™, Part No. CLDA-7001* 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 when the time displays 1.** The cursor will move across the display, informing you that it is about to measure the sample (ignore this result). Dip the *eXact® Strip Micro CL (DPD-1), Part No. FCLA-7001* 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 when the time displays 1.** The cursor will move across the display, informing you that it is about to measure the sample. Record result displayed (this result is automatically stored in TR7). After testing is completed, rinse cell immediately.
- 6 USE TABLE**
Find the "TR7" result in the table below to determine the Chlorine Dioxide concentration in ppm (parts per million). (Example: a "TR7" result of 65.3 (use only the 65 for the chart) equals a Chlorine Dioxide value of 1.36 ppm). Record result. After testing is completed, rinse cell immediately.

Chlorine Dioxide Table

Chlorine Dioxide results require the table below. Follow *eXact® Micro 7+ Chlorine Dioxide Test Procedure* (above) using *eXact® Strip Micro CL (DPD-1), Part No. FCLA-7001*

eXact® Strip Micro CL (DPD-1), Part No. FCLA-7001- for 4mL Samples										
%T	9	8	7	6	5	4	3	2	1	0
90	0	0	0	0.1	0.19	0.23	0.28	0.33	0.38	0.42
80	0.47	0.52	0.56	0.61	0.66	0.68	0.70	0.75	0.80	0.84
70	0.86	0.89	0.94	0.98	1.00	1.03	1.08	1.13	1.15	1.17
60	1.22	1.27	1.31	1.34	1.36	1.41	1.45	1.50	1.55	1.59
50	1.62	1.64	1.69	1.73	1.78	1.83	1.88	1.92	1.97	2.02
40	2.06	2.11	2.16	2.20	2.25	2.30	2.34	2.39	2.48	2.53
30	2.63	2.67	2.72	2.81	2.86	2.95	3.00	3.09	3.19	3.28
20	3.38	3.47	3.56	3.70	3.80	3.90	4.00	4.10	4.30	4.40
10	4.60	4.70	4.90	5.10	5.30	5.50	5.80	6.00	6.30	6.60
0	7.00	7.40	7.92	8.48	9.14	9.90	10.97	12.00	>12.00	>12.00

Rev 100311-BT

MENU **How to use Reference Standard Solution**

CL1 NOTE: The 2.0 ppm Reference Standard Solution, *Part No. FCLA-7003* can be used
TR7 for verifying the performance of the eXact® Micro 7+ Photometer.

- 1** **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.
- 2** **SELECT TEST: TR7**
 Press and re-press the **MENU** button until the display shows the parameter **TR7**.
- 3** **RINSE AND FILL CELL WITH DISTILLED OR DEIONIZED WATER**
 Rinse the **CELL** at least 3 times with distilled or deionized water - rinsing minimizes the potential for cross-contamination from a previous test. Finally, fill cell to capacity (4ml) with the distilled or deionized water.
- 4** **ZERO METER***
 Press the **ZERO/ON** button. The cursor will move across the display followed by **100 %T**. Press the **READ** button. After 20 second countdown, the cursor will move across the display followed by **100 %T**. If result is not **100 %T**, repeat Step 4 by pressing the **ZERO/ON** button again. Press **READ**. If result is **100 %T**, meter is ready for standard testing. Discard water from cell. Gently shake the meter to remove any excess water. **NOTE:** This step is very important for accurate verification of photometer performance.
- 5** **FILL CELL WITH 2.0 PPM REFERENCE STANDARD SOLUTION**
 Fill cell to capacity (4ml) with the **2.0 ppm Reference Standard Solution, Part No. FCLA-7003**. Discard this sample and refill the **CELL** with fresh 2.0 ppm Reference Standard Solution.
- 6** **PRESS "READ"**
 Press **READ**, to start the **20 SECOND** countdown timer. After 20 seconds, the cursor will move across the display while the meter prepares to measure the sample. Record the displayed result below (this result is automatically stored in TR7). Do not discard solution. Continue with Step 7.
- 7** **REPEAT STEP 6 ABOVE FOR CL1 MENU**
 Press and re-press **MENU** button until **CL1** appears on the display. Press **READ** and, after 20 seconds, record result displayed below. The 2.0 Reference Standard result for Micro 7+ Meters with serial number 5000 and higher deviates from the certified value listed on the bottle (2.00 ppm ± 0.10 ppm). Instead, you should expect a value of 13.0% ± 1.3% in the TR7 Menu and 2.20 ppm ± 0.2 ppm in the CL1 Menu. Record your results in the chart below for later reference. After meter performance verification is complete, immediately empty the cell and rinse it with clean water.

Serial Number of Meter for Data below _____ (see back of meter)

Date of meter purchase _____ (warranty valid for 2 years)

DATE	TR7C	L1	DATE	TR7C	L1

NOTE: When testing outdoors (sunlight) for best accuracy, use the Mixing Cap/Cell

eXact® Micro 7+ Tips For Best Accuracy

1. Become familiar with the meter and the different tests by reading the instructions carefully.
2. The Free Chlorine, Combined Chlorine, and Total Chlorine reagents are compliant for meeting USEPA (4500-Cl G); ISO 7393/2; and German DIN 38408 G4-2 requirements.
3. Observe the dip time (*as required for the test*) for accurate results.
4. Test immediately after filling the **CELL** with water sample when testing for oxidizers such as Chlorine.
5. Be sure the **CELL** is filled to capacity (4ml).
6. Sample water that may splash out of the **CELL** during movement of the eXact® Strip Micro will not affect accuracy, as long as the cell is over 50% full at end of test.
7. Rinse the **CELL** with clean water immediately after completing the test. (*Several reagents will stain or coat the **CELL** wall if allowed to remain*)
8. Just before testing, rinse the sample **CELL** with the sample water several times to get a representative sample. (*Use deionized or distilled water for rinsing if you have a limited amount of sample*).
9. Store the meter and all test materials out of direct sunlight and away from chemical storage areas.
10. Minimize exposure of meter and test reagents to heat above 38°C (100°F).
11. Dry the outside of the meter when testing is complete or before storage of the meter.
12. Each eXact® Strip Micro is valid for **ONLY** one test. Discard strip after single use in regular refuse that is inaccessible to children and pets.
13. Each bottle of eXact® Strip Micro contains the quantity of strips notated on the bottle. Due to the strip slitting 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.
14. Each table supplied has a unique revision number located in the bottom right corner of the table. It is recommended that you visit www.sensorex.com at least every 6 months to check for any updated revisions of the manual.
15. The eXact® Micro 7+ Meter is not compatible for use with DPD-1, DPD-3, and DPD-4 powder pillows, tablets, and liquids available from other manufacturers. Accurate results can only be guaranteed by using genuine eXact® Micro strips or reagents.
16. Our lab testing with the Micro 7+ meter has shown that zeroing and measuring of the sample normally does not require any cell cover for accurate results, even in full sunlight.
17. Remove batteries when meter is not used for more than a month (Warranty Requirement).
18. It is recommended that Pool and Spa samples for oxidizers (such as Chlorine) be taken 18 inches below the surface as follows: submerge meter with open cell facing down 18 inches, and then turn meter upright at that depth to fill the cell. Remove meter from water with the sample for testing.

eXact® Micro 7+ Meter Error 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 Sensorex technical support by phone at **714-895-4344** or via e-mail at support@sensorex.com.

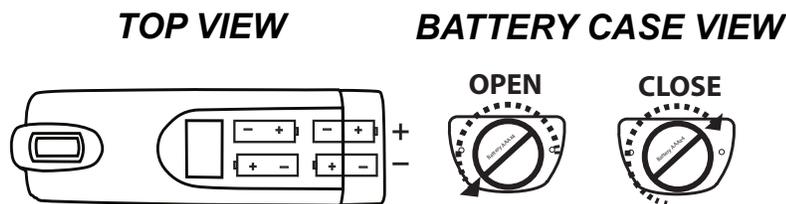
LCD Message	Description	Corrective Action
HI	In READ mode: test sample concentration is above the measurement range FREE CHLORINE .	For FREE CHLORINE - Use High Range test (Part Number FCLA-7002).
LO	In READ mode: test sample concentration is below the measurement range (test specific).	Sample value 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, the meter will read "LO".	Dilute sample, filter sample, or clean cell. One of these options should fix the problem.
ER	Excessive stray light detected. Normally this does not occur, even when testing in sunlight.	Place the LIGHT BLOCKING CAP 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.

About The Built-In Cell

The built-in **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 recommended.

To Install/Replace "AAA" Batteries:

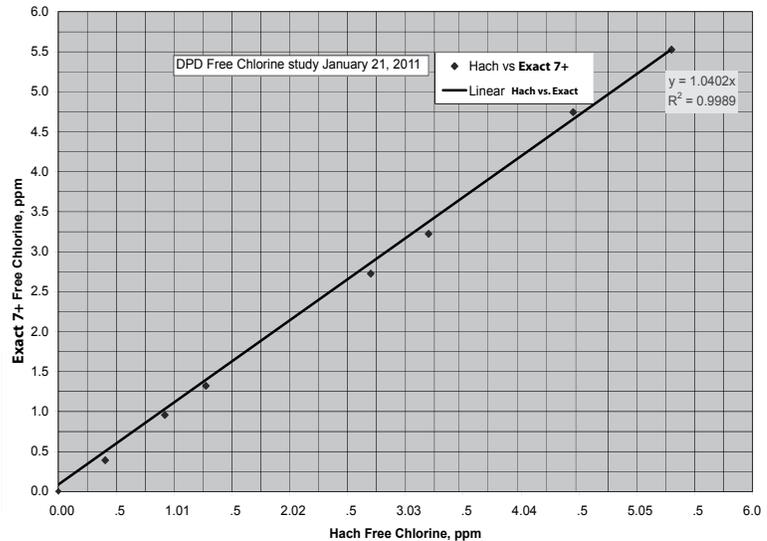
1. Unscrew the O-ring sealed battery cover counter-clockwise. Use proper sized pliers if necessary. Do not disturb the sealing O-ring. Batteries are not included.
2. Remove the used batteries and install 4 new AAA batteries following the diagram for correct polarity (see diagram). We recommend high quality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



eXact® Strip Micro DPD-1 Accuracy

Free Chlorine results are compared using the **eXact® Strip Micro CL (DPD-1)** with the eXact® Micro 7+ Meter in Menu CL1 and Hach® DR890 Colorimeter in Program 9 and Program 12 using Hach® powder pillows.

DR890	Micro 7+
0.00	0.00
0.41	0.39
0.920	.96
0.79	0.73
1.28	1.32
2.70	2.73
3.20	3.22
4.45	4.75
5.30	5.53



Meter	Menu	Range (PPM)	Resolution
Micro 7+	CL1	0.00 to 5.99	0.01
		6.0 to 11.00	.1
DR890	Program 9	0.00 to 2.200	.01
	Program 12	0.0 to 11.00	.1

Hach® is a registered trademark of Danaher Corporation

eXact® Colorimeter 2-Year Limited Warranty

Registration of your eXact® colorimeter must be received within 30 days from date of purchase to activate the warranty. The eXact® colorimeter 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. Sensorex 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 Sensorex by phone (714-895-4344) or email (support@sensorex.com) to describe the problem and obtain a return authorization number (RMA#) before returning the photometer to Sensorex. Damage caused by improper packing of the photometer for return shipment to Sensorex will not be covered by the warranty. Customer is responsible for shipping charges to Sensorex. Sensorex 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 by completing registration card below and faxing or e-mailing the completed card to 714-894-4839 (fax) or e-mail (support@sensorex.com).



Liquid Analytical Solutions

www.sensorex.com

Warranty Registration

Product / Model No. : _____

Serial No. :

(located on label on side of transmitter)

Date of Purchase. :

D D M M Y Y Y Y

SOLD BY: _____

Title: _____ First Name: _____ Last Name/Surname: _____

Address: _____

City: _____ State: _____ Zip/Postal Code: _____ Country: _____

Telephone: _____ Fax: _____ E-mail: _____