

HCA1 Chlorine Plus Photometer System

Instruction Manual



Ideal for the measurement of Free and Total Chlorine in Drinking Water, Waste Water, Environmental or other clear water samples



ELECTRO-CHEMICAL DEVICES
ECDI.com



Parts Order/Reorder Information

Part#	Description
1000040-1	Meter, case and 2 bottles test strips, Free chlorine and total Chlorine
1000040-2	Meter, case and 2 bottles of test strips, Free chlorine
1000040-3	Meter, case and 2 bottles of test strips, Total chlorine
1000040-4	Meter, case and 2 bottles of test strips, Chlorine Dioxide
1000040-5	Meter, case and 2 bottles of test strips, High Range chlorine
1000040-6	Meter, case and 2 bottles of test strips, Ozone
1000040-7	Meter, case and 2 bottles of test strips, Peracetic Acid
9250500	Plastic case
1000570	HCA1 meter only
9260100	100 Test Strips Free Chlorine, 0.01-11.0 ppm
9260101	100 Test Strips Total Chlorine, 0.01-11.0 ppm
9260102	100 Test Strips Chlorine Dioxide, 0.01-12.0 ppm and 100 Glycine Sample Conditioning Strips
9260103	50 Test Strips High Range Chlorine, 1-300 ppm
9260104	100 Test Strips Ozone, 0.01-11.0 ppm
9260105	100 Test Strips Peracetic Acid, 0.01-9.0 ppm

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HCA1 Chlorine Plus Specifications

Measurement method:	Photometric
Light source:	Light Emitting Diode (LED)
Wavelength:	525 nm
Transmission Range:	0.0 – 100%
Photometric precision:	± 0.1/0.01 %T
Display:	3 digit LCD with annunciators
Cell path length:	20 mm
Cell Chamber:	Molded PET plastic, non-removable
Sample requirement:	4 ml
Temperature range:	0 - 50°C
Power Supply:	(4) AAA alkaline batteries, not included
Battery Life:	>2000 tests with alkaline batteries
Electromagnetic Compliance:	Emitted Interference, EN 61326 Immunity to Interference, EN61326
Waterproof rating:	Exceeds IP67
Weight:	Instrument, 140 g (5 oz)
Dimensions:	W x D x H, 5 x 3.5 x 16.5 cm 2 x 1.4 x 6.375 in

HCA1 Range and Accuracy

Menu	Test	Range	Resolution	Accuracy
CL1	Free Chlorine, DPD-1 Total Chlorine, DPD3	0.01-3.00 ppm	0.01	3 %
		3.01-5.99 ppm	0.01	7%
		6.00-11.00 ppm	0.1	14%
O3	Ozone	0.01-5.99 ppm	0.01	8%
		6.0-9.0 ppm	0.1	16%
Cd4	Chlorine dioxide	0.01-5.00 ppm	0.01	8%
		5.0-12.0 ppm	0.1	8%
PA5	Peracetic Acid	0.01-5.00 ppm	0.01	8%
		5.0-9.0 ppm	0.1	9%

HCA1 General Information

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 HCA1 Chlorine Plus 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, bR2, O3, Cd4, PA5, HP6, PH7, 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). This feature is menu specific and does not apply to all parameters.

Accuracy and Calibration

All tests have been calibrated using certified reference standards and standard analytical spectrophotometric methods. The algorithm in the software of the HCA1 Chlorine Plus System mirrors the AWWA, US EPA, DIN, and ISO reference test methods for chlorine. Studies show that the HCA1 Chlorine Plus System, with the HCA1 Strip Micro CL (DPD-1), repeatedly agrees with an EPA Compliant reference method greater than 99% ($R^2 = 0.9989$, 0 - 6.0 ppm - see page 12). The HCA1 Chlorine Plus 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. For verification of photometer

calibration, the Ready Snap® 3 Calibration Verification Standard part #490903) is available for purchase.

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 Chlorine Plus meter uses a wavelength of 525nm; and the compliance requirement is that the colorimeter wavelength is between 490 and 530nm. The HCA1 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 HCA1 Strip DPD delivery devices. The HCA1 Strip Micro CL (DPD-1) for Free Chlorine, and the HCA1 Strip Micro CL (DPD-3) or the HCA1 Strip Micro CL (DPD-4) for Total Chlorine meet your reportable testing requirements because the HCA1 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.

Components (Free Chlorine)	AWWA 4500-Cl G	HCA1 DPD-1
Anhydrous DPD sulfate	1.5%	1.5%
Anhydrous Na ₂ HPO ₄	33.4%	33.4%
Anhydrous KH ₂ PO ₄	64.0%	64.0%
EDTA	1.1%	1.1%

About the Photometric Cell

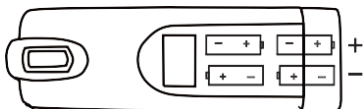
The built-in **CELL** is transparent plastic and, when filled to the top, contains 4ml. The sturdy **CELL** design will last for over 20,000 readings. Scratches on the **CELL** will not interfere or compromise the accuracy of the readings because of its fixed position. For best accuracy, rinse cell with 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 especially recommended after you run a test that is using turbidity or precipitation chemistry for analysis.

Installing the 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.
3. Replace the battery cover. Be sure to tighten the cover securely. Do not over tighten. This is necessary for meter to be waterproof.
4. Dispose of the used batteries in accordance with your local regulations.
5. Press ZERO/ON button to confirm the meter turns on. The meter is now ready for operation.
6. Meter will not work if battery orientation is incorrect.



MENU CL1 DPD-1 Free Chlorine Test Procedure

1. **Remove (1) Micro CL (DPD-1) Strip** from the bottle before beginning the test. Place it in a dry convenient place and recap the test strip bottle.
2. **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. **Press and re-press the MENU button** until the display shows the parameter CL1.
4. **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. **Press the ZERO/ON button.** The cursor will move across the display followed by 0.00 PPM. Sample is ready for testing.
6. **Dip the HCA1 Strip Micro CL (DPD-1)** 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 (approx. 2 strokes/Sec). Remove and discard the strip after “1” on the display disappears. When testing outdoors (in sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.
7. 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 Menu).

NOTE: N,N-diethyl-p-phenylenediamine (DPD) also reacts to form a magenta color with Ozone, Total Chlorine, Permanganate, Iodine, and other oxidizers.

MENU CL1 DPD-4 Total Chlorine Test Procedure

1. **Remove (1) Micro CL (DPD-4) Strip** from the bottle before beginning the test. Place it in a dry convenient place and recap the test strip bottle.
2. **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. **Press and re-press the MENU button** until the display shows the parameter CL1.
4. **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. **Press the ZERO/ON button.** The cursor will move across the display followed by 0.00 PPM. Sample is ready for testing.
6. **Dip the HCA1 Strip Micro CL (DPD-4) 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 (approx. 2 strokes/Sec). Remove and discard the strip after “1” on the display disappears. When testing outdoors (in sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.
7. 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 Menu).
8. **Press READ again** and the meter will count down and display the next Total Chlorine result. If this reading matches the previous result, then record this as Total Chlorine value (this result is stored in CL1). After testing is completed, rinse cell immediately. Record the Total Chlorine as the highest value the meter displayed.

MENU O3 Ozone Test Procedure

1. **Remove (1) Micro O3 (DPD-4) Strip** from the bottle before beginning the test. Place it in a dry convenient place and recap the test strip bottle.
2. **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. **Press and re-press the MENU button** until the display shows the parameter O3.
4. **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. **Press the ZERO/ON button.** The cursor will move across the display followed by 0.00 PPM. Sample is ready for testing.
6. **Dip the HCA1 Micro Strip O3 (DPD-4) 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 (approx. 2 strokes/Sec). Remove and discard the strip after “1” on the display disappears. When testing outdoors

(in sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.

7. The cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in O3 Menu). After testing is completed, rinse cell immediately.

MENU Cd4 Chlorine Dioxide Test Procedure

1. **Remove (1) Micro Strip Cd (DPD-1) and (1) Micro Glycine Strip** from the bottles before beginning the test. Place them in a dry convenient place and recap the test strip bottles.
2. **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. **Press and re-press the MENU button** until the display shows the parameter **Cd4**.
4. **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. **Dip the Micro Glycine Strip** 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 (approx. 2 strokes/Sec). Remove and discard the strip after "1" on the display disappears. The cursor will move across the display while the meter prepares to measure the sample. Ignore the result.
6. **Press the ZERO/ON button**. The cursor will move across the display followed by 0.00 PPM. Sample is ready for testing.
7. **Dip the HCA1 Micro Strip Cd (DPD-1)** 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 (approx. 2 strokes/Sec). Remove and discard the strip after "1" on the display disappears. When testing outdoors (in sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.
8. The cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in Cd4 Menu). After testing is completed, rinse cell immediately.

MENU PA5 Peracetic Acid Test Procedure

1. **Remove (1) Micro PA (DPD-4) Strip** from the bottle before beginning the test. Place it in a dry convenient place and recap the test strip bottle.
2. **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. **Press and re-press the MENU button** until the display shows the parameter **PA5**.

4. **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. **Press the ZERO/ON button.** The cursor will move across the display followed by 0.00 PPM. Sample is ready for testing.
6. **Dip the HCA1 Micro Strip PA (DPD-4)** 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 (approx. 2 strokes/Sec). Remove and discard the strip after “1” on the display disappears. When testing outdoors (in sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.
7. The cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in PA5 Menu). After testing is completed, rinse cell immediately.

MENU HR8 High Range Chlorine Test Procedure

1. **Remove (1) Micro HR Strip** from the bottle before beginning the test. Place it in a dry convenient place and recap the test strip bottle.
2. **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. **Press and re-press the MENU button** until the display shows the parameter **HR8.**
4. **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. **Press the ZERO/ON button.** The cursor will move across the display followed by 0.00 PPM. Sample is ready for testing.
6. **Dip the HCA1 Micro Strip HR** 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 (approx. 2 strokes/Sec). Remove and discard the strip after “1” on the display disappears. When testing outdoors (in sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.
7. The meter will begin counting up for 120 seconds, at the end of which 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 Menu). After testing is completed, rinse cell immediately.

HCA1 Micro CL (DPD-1, -4) Strip Interferences


Interfering Substance	Interference Level and treatment
Acidity	If sample has acidity above 150mg/L CaCO ₃ test may not develop full color. Neutralize to pH 6.0 to 7.0 with 0.5N sodium hydroxide.
Alkalinity	If sample has alkalinity above 200mg/L CaCO ₃ test may not develop full color. Neutralize to pH 6.0 to 7.0 with 0.5N sulfuric acid.
Bromine & Bromamines, Br ₂	Color similar to free chlorine reaction at all levels.
Chlorine Dioxide, ClO ₂	Color similar to free chlorine reaction at all levels.
Copper, Cu ⁺²	Color development is reduced above 10 ppm (mg/L).
Iodine, I ₂	Color similar to free chlorine reaction at all levels.
Manganese, oxidized (Mn ⁺⁴ , Mn ⁺⁷) or Chromium, oxidized (Cr ⁺⁶)	See AWWA procedure 4500-CL F, 1(d) for removal of interferences.
Monochloramine (NH ₂ Cl) (applies to DPD-1 only)	Monochloramine interferences are known to occur in free chlorine DPD methods. This interference is dependent on temperature and Monochloramine concentration.
Ozone, O ₃	Color similar to free chlorine reaction at all levels.
Peroxides	Interference is possible.
pH	Typical pH samples of potable water with a pH of 6.0 to 9.0 are OK. If outside this range adjust to pH 6.0 to 7.0 using acid (0.5N Sulfuric acid) or base (0.5N Sodium hydroxide).

HCA1 Chlorine Plus Tips for Best Accuracy

1. Become familiar with the meter and the different tests by reading the instructions carefully.
2. The Free 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** when testing for oxidizers.
5. Be sure the **CELL** is filled to capacity (4ml).
6. Rinse the **CELL** with clean water immediately after completing the test. (*DPD will stain the **CELL** wall if allowed to remain in the **CELL***)
7. Just before testing, rinse the sample **CELL** with the sample water several times to get a representative sample. Store the meter and all test materials out of direct sunlight and away from chemical storage areas.

8. Minimize exposure of meter and test reagents to heat above 32°C (90°F).
9. Dry the outside of the meter when testing is complete or before storage of the meter.
10. When running a DPD-1 Free Chlorine test **AFTER** a Total Chlorine DPD-4, or a HR Free Chlorine test, rinsing is very important to remove residual KI, which may interfere.
11. Each HCA1 Strip Micro is valid for **ONLY** one test. Discard strip after single use in regular refuse that is inaccessible to children and pets.
12. Each bottle of HCA1 Strip Micro contains, at minimum, the quantity of strips notated on the bottle. Due to the strip slitting process, you may find one or two extra 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 incorrect results.
13. The HCA1 Chlorine Plus Meter is not compatible for use with DPD-1, DPD-3, and DPD-4 powder pillows, tablets, or liquids available from other manufacturers. Accurate results can only be guaranteed by using genuine HCA1 Micro strips or reagents (*reorder information below*).
14. Lab testing with the Chlorine Plus meter has shown that zeroing and measuring of the sample normally does not require any cell cover for accurate results, except in sunlight. To obtain optimal accuracy when testing with the meter outdoors (sunlight), use the Mixing Cap/Cell Cover when zeroing and reading the sample.
15. Remove batteries when meter is not used for more than a month (Warranty Requirement).

HCA1 Chlorine Plus Meter Messages

Message	Description	Corrective Action
Hi	In READ mode: test sample concentration is above the measurement range (test specific).	Dilute and retest. Dilution Kit available
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 remedy 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.
	Low battery indication.	Replace the batteries.