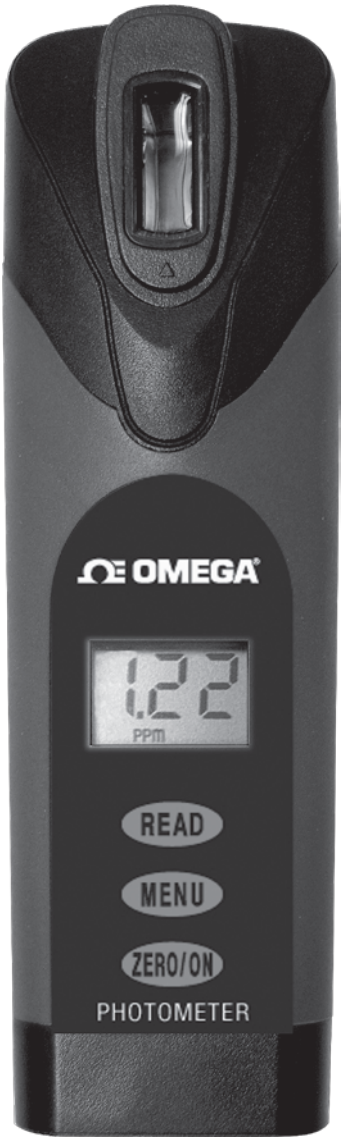
OMEGA®

User's Guide



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HHWT-12
Handheld Photometer
Direct Read Tests

OMEGA®

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OMEGA® HHWT-12

Advanced Photometer System
Instruction Manual

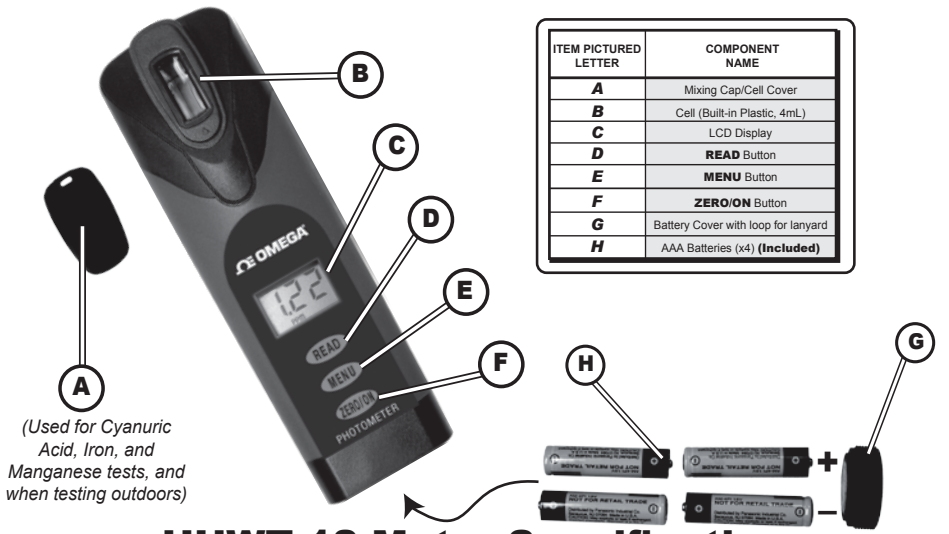
IDEAL FOR DRINKING WATER, POOLS AND SPAS, ENVIRONMENTAL, & EDUCATIONAL TESTING

This manual covers direct read tests only. For instructions and tables for HHWT-12 transmission tests consult manual M-5282 available at Omega.com/manuals

USEPA
DIN, ISO
COMPLIANT
FREE AND TOTAL
CHLORINE
(4500-CL G, DIN STANDARD
38 408 G4, ISO 7393/2)

Index:

HHWT-12 Photometer



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

ITEM PICTURED LETTER	COMPONENT NAME
A	Mixing Cap/Cell Cover
B	Cell (Built-in Plastic, 4mL)
C	LCD Display
D	**READ** Button
E	**MENU** Button
F	**ZERO/ON** Button
G	Battery Cover with loop for lanyard
H	AAA Batteries (x4) **(Included)**

HHWT-12 Meter Specifications

Measurement Method:	Photometric
Light Source:	Light Emitting Diode (LED) with precision filter
Wavelength:	525 nm
Transmission Range:	100 - 0.00 %T
Photometric Precision:	+/- 0.1/0.01 %T
Automatic Range Selection:	See Specifications below
Display:	3-digit customized liquid crystal display with annunciators
CELL Pathlength:	20mm
Reagent System:	Utilizes patented reagent delivery system

Cell Chamber:	Custom-molded, proprietary, PET plastic fused into chamber, non-removable
Sample Required:	4mL (0.13 oz)
Operating Temperature Range:	0 - 50°C (32° - 122°F)
Power Supply:	(4) AAA alkaline batteries (Included)
Battery Life:	>2000 tests with alkaline batteries
Electromagnetic Compliance: (EMC)	Emitted Interference - EN 61326 Immunity to Interference - EN 61326
Waterproof Rating:	Exceeds IP67
Weight:	Instrument: 181 g (6.4 oz) with batteries
Dimensions:	Instrument: 5 (W) x 3 (D) x 16.75 (H) cm; (2 x 1.2 x 6.6 in)

We offer a "Green" Alternative

HHWT-12 has been designed to offer the user a more "Green" and cost-effective alternative to testing. Instead of using a 10mL water sample, *HHWT-12* 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.

HHWT-12 Specifications

Menu	Test for *	Range	Resolution	Accuracy (±%)
CL1	Free Chlorine (DPD-1) & Total Chlorine (DPD-3)	0 - 5 ppm	0.01	3 (0-1.50 ppm)
				6 (1.51-5 ppm)
NO2	Nitrite	0 - 1.8 ppm	0.01	5
NO3	Nitrate	0.12 - 30 ppm	0.01 (0.12-5.00 ppm)	20 (0-5 ppm)
				15 (5.1-20 ppm)
			0.1 (5.1-30 ppm)	20 (20.1-30 ppm)
PH4	pH	5.5 - 8.8 pH	0.01	0.4 pH
bR5	Bromine	0.1 - 12 ppm	0.01 (0.1-2.00 ppm)	16 (0.1-1.50 ppm)
			0.1 (2.1-12 ppm)	10 (1.51-12 ppm)
AL6	Total Alkalinity	1 - 320 ppm	0.1 (1-50 ppm)	10 (1-100 ppm)
				7.5 (101-200 ppm)
			1 (51-320 ppm)	11 (201-320 ppm)
TH7	Total Hardness as $CaCO_3$	4 - 300 ppm	1	19 (4-80 ppm)
				17 (81-180 ppm)
				16 (181-300 ppm)
CU8	Copper	0 - 11 ppm	0.01 (0-4.00 ppm)	2
			0.1 (4.1-11 ppm)	
HR9	High Range Chlorine	0.3 - 300 ppm	0.1 (0.3-20.0 ppm)	10 (0-50 ppm)
				7.5 (51-200 ppm)
			1 (21-300 ppm)	8 (201-300 ppm)
TR0	Transmission ** (used for other test parameters)	99.9 - 0.01 %T	0.1 (99.9-10.0 %T)	0.01
			0.01 (9.99-0.01 %T)	

R020613

* Performance verified with various salt systems and water samples with optimal water temperature at 10-40˚C / 50-104˚F.
Optimal water temperature for Total Alkalinity test is 15-40˚C / 59-104˚F.

** Measurement requires a conversion chart for value. Visit our website for more details.

About Your HHWT-12 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 HHWT-12 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, NO2, NO3, PH4, BR5, AL6, TH7, CU8, HR9, TR0. 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 200 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 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 HHWT-12 Systems against the AWWA, US EPA , DIN, and ISO reference test methods for chlorine. Studies show that the HHWT-12 System repeatedly agrees with an EPA Compliant reference method greater than 99% (R^2= 0.99948, 0 - 5.00 ppm - see back cover). The HHWT-12 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 1-Year Warranty.

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 HHWT-12 meter uses a wavelength of 525nm; and the compliance requirement is that the colorimeter wavelength is between 490 and 530nm. The HHWT-486637 (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 strip DPD delivery devices. The HHWT-486637 (DPD-1) for Free Chlorine, and the HHWT-486638 (DPD-3) or the HHWT-486670 (DPD-4) for Total Chlorine meet your reportable testing requirements because each strip 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	DPD-1
Anhydrous DPD sulfate	1.5%	1.5%
Anhydrous Na_2HPO_4	33.4%	33.4%
Anhydrous $KH_2PO_4Na_2$	64.0%	64.0%
EDTA	1.1%	1.1%

MENU
CL1

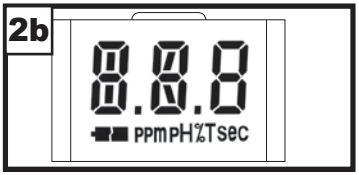
DPD-1 Free Chlorine Test Procedure

1 REMOVE STRIP

Remove one (1) ***HHWT-486637*** for Free Chlorine or ***HHWT-486626*** for Permanganate 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: 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). (Contact OMEGA for specs and details if you are planning on using **CL1** for Permanganate or Ozone measurements)

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.

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.

6 DIP STRIP AND PRESS "READ"

Dip the 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. **Remove and discard the strip after "1" on the display disappears**.

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).

DO NOT discard the sample from the Free Chlorine test if you are planning to run HHWT-486638 (Total Chlorine) Procedure. Move directly to steps 8-10 on page 7. Otherwise, rinse the cell immediately.

DPD-3 Total Chlorine Test Procedure

CL

MENU
CL1

This procedure is only valid when run as a continuation of the HHWT-486637 (DPD-1 Free Chlorine) Test Procedure located on the previous page.

8 **REMOVE STRIP**

Remove one (1) ***HHWT-486638*** from the bottle before beginning the test. Set the strip in a dry, convenient place and recap the bottle immediately.

9 **DIP STRIP AND PRESS "READ"**

Dip the ***HHWT-486638*** 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 "1" on the display disappears**. The cursor will move across the display while the meter prepares to measure the sample. This result is automatically stored in CL1 (NOTE: The Iodide added with DPD-3 will, in the presence of Combined Chlorine or Chloramines, convert into Iodine).

10 **PRESS READ AGAIN**

Press **READ** again and the meter will count down and display the next reading. If this reading matches the previous result, then record this as the Total Chlorine result. This value is automatically stored in CL1. After testing is completed, rinse cell immediately. Record the Total Chlorine as the highest value the meter displayed.

***NOTE**: Standard Method (4500-Cl G, procedure for total chlorine) requires the reading to be made after 2 minutes from the time the KI is added. For compliance testing, you must time the two minutes and then make your measurement. NOTE: From testing in our lab, water samples above 70°F (20°C), generally, reach a stabilized reading quicker then 2 minutes.

CL1: Chlorine reacts with N,N-diethyl-p-phenylenediamine as it is released from the strip to form a magenta color, directly proportional to the Chlorine concentration. (Ozone, Bromine, and Permanganate also form the color)

Test Strip (DPD-1/DPD-3/DPD-4) Interferences

Interfering Substance	Interfering Levels & Treatments
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.
Monochloramines (NH_2Cl) (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).

MENU DPD-4 (Total Chlorine or Ozone) Test Procedure

CL1

1 **REMOVE STRIP**
Remove one (1) ***HHWT-486670*** for Total Chlorine or ***HHWT-486634*** for Ozone 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: CL1**
Press and re-press the **MENU** button until the display shows the parameter **CL1**.

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 **0.00 PPM**. Sample is ready for testing.

6 **DIP STRIP AND PRESS "READ"**
Dip the 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. **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. Record result displayed (this result is automatically stored in CL1 Menu).

7 **PRESS READ AGAIN**
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.
NOTE: Standard Method (4500-Cl G, procedure for total chlorine) requires the reading to be made after 2 minutes. 2 minute wait is not necessary for Ozone measurements.

MENU Nitrite Test Procedure

NO2

1 **REMOVE STRIP**
Remove one (1) ***HHWT-486623*** 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: NO2**
Press and re-press the **MENU** button until the display shows the parameter **NO2**.

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 **0.00 PPM**. The sample is ready for testing.

6 **DIP STRIP AND PRESS "READ"**
Dip the ***HHWT-486623*** 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 Meter will automatically start to count up for 360 seconds (6 minutes). After the 360 seconds, the cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in NO2 Menu). After testing, rinse cell immediately.

***NOTE: When testing outdoors (sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.

Nitrate Test Procedure

MENU
NO3

1 **REMOVE STRIP**
Remove one (1) ***HHWT-486655*** 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: NO3**
Press and re-press the **MENU** button until the display shows the parameter NO3.

4 **FILL METER WITH SAMPLE** - **See Accuracy Tip 19 on page 15**
Add sample water to the CELL and use brush to remove any zinc from previous tests. 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 **0.00 PPM**. The sample is ready for testing.

6 **DIP STRIP AND PRESS "READ"**
Dip the ***HHWT-486655*** 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 meter will automatically start to count up for 600 seconds (10 minutes). After the 600 seconds, the cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is stored in NO3 Menu). **After testing, rinse cell immediately with brush and water**.

pH Test Procedure

MENU
PH4

1 **REMOVE STRIP**
Remove one (1) ***HHWT-486639*** 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: PH4**
Press and re-press the **MENU** button until the display shows the parameter **PH4**.

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. When the display shows **0.0 PH**, the sample is ready for testing.

6 **DIP STRIP AND PRESS "READ"**
Dip the ***HHWT-486639*** 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. Record result displayed (this result is automatically stored in PH4 Menu). After testing, rinse cell immediately.

NOTE: For best results, Total Alkalinity of the sample should be 40-140 ppm.

*NOTE: When testing outdoors (sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.

Bromine DPD-1 Test Procedure

MENU bR5

1 REMOVE STRIP
Remove one (1) ***HHWT-486636*** 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: bR5
Press and re-press the **MENU** button until the display shows the parameter bR5.

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 **0.00 PPM**. The sample is ready for testing.

6 DIP STRIP AND PRESS "READ"
Dip the ***HHWT-486636*** 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. Record result displayed (this result is stored in bR5 Menu). After testing, rinse cell immediately.

Total Alkalinity Test Procedure

MENU AL6

1 REMOVE STRIP
Remove one (1) ***HHWT-486641*** 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: AL6
Press and re-press the **MENU** button until the display shows the parameter AL6.

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 **0.00 PPM**. The sample is ready for testing.

6 DIP STRIP AND PRESS "READ"
Dip the ***HHWT-486641*** 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***. NOTE: For water temperatures above 95°F/35°C (hot tubs), remove and discard the strip when the timer displays "10", countdown continues. For the hot water samples, a 10-second dip time is best. The cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in AL6 Menu). After testing, rinse cell immediately.

*NOTE: When testing outdoors (sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.

MENU
TH7

Total Hardness Test Procedure

1 **REMOVE STRIP**

Remove one (1) ***HHWT-486673*** 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: TH7**

Press and re-press the **MENU** button until the display shows the parameter **TH7**.

4 **FILL METER WITH SAMPLE**

Rinse the **CELL** 2 or 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 **0.00 PPM**. The sample is ready for testing.

6 **DIP STRIP AND PRESS "READ"**

Dip the ***HHWT-486673*** 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 cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in TH7 Menu). After testing, rinse cell immediately and use brush to remove any residual from previous test.

MENU
CU8

Copper Test Procedure

1 **REMOVE STRIP**

Remove one (1) ***HHWT-486632*** 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: CU8**

Press and re-press the **MENU** button until the display shows the parameter **CU8**.

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 **0.00 PPM**. The sample is ready for testing.

6 **DIP STRIP AND PRESS "READ"**

Dip the ***HHWT-486632*** 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 20** (this extra time allows more thorough color development). At 20 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 CU8 Menu). After testing, rinse cell immediately.

***NOTE: When testing outdoors (sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.

HR High Range Chlorine Test Procedure

MENU HR9

1 REMOVE STRIP

Remove one (1) ***HHWT-486672*** 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: HR9

Press and re-press the **MENU** button until the display shows the parameter HR9.

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 ***HHWT-486672*** 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 HR9 Menu). After testing, rinse cell immediately with brush and water.

For complete instructions on HHWT-12 Transmission Test Procedures with Tables, consult manual M-5282 available at Omega.com/manuals

TR Transmission Test Procedure

MENU TR0

1 REMOVE STRIP

Remove one (1) test strip, part number is dependent upon the test being run, 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: TR0

Press and re-press the **MENU** button until the display shows the parameter **TR0**. Tests listed on page 17 will require the use of a conversion chart available on our website.

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 **100 %T**. The sample is ready for testing.

6 DIP STRIP AND PRESS "READ"

Dip the ***Test Strip (or add Reagent)*** into the **CELL** 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 after "1" on the display disappears***. The cursor will move across the display while the meter prepares to measure the sample. Record result displayed (this result is automatically stored in TR0). After testing is completed, rinse cell immediately.

*NOTE: When testing outdoors (sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.

How to use Reference Standard Ampoules

MENU
CL1

NOTE: The Reference Standard, *Part No. HHWT-486602*, can be used for verifying the performance of the *HHWT-12 and HHWT-11 meters*.

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: CL1**

Press and re-press the **MENU** button until the display shows the parameter **CL1**.

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 **0.00 PPM**. Discard this water sample followed by a quick shake of the meter to empty the CELL of the remaining water drops.

5 **BREAK OPEN REFERENCE STANDARD AMPOULE**

Break open one Reference Standard Ampoule, ***Part No. HHWT-486602***, in a safe manner by gripping with a paper towel. NOTE: Do not break open at poolside or around children or pets. DO NOT CONSUME SOLUTION.

6 **RINSE AND FILL CELL WITH REFERENCE STANDARD**

Take the plastic pipette supplied, squeeze the bulb to expel air, dip the pipette tip to the bottom of the ampoule, and release the bulb slowly to fill the pipette. Transfer the pipette's liquid to the photometer CELL. Discard this sample with a quick shake of the meter to empty the CELL. Use the pipette to refill the CELL with the Reference Standard.

7 **PRESS "READ"***

Press READ to start the 20 SECOND countdown. After 20 seconds, the cursor will move across the display while the meter prepares to measure the sample. Verify the displayed value against the "Assigned Value" provided below. If your result is outside the Acceptable Value range, discard the Reference Standard sample in the CELL and repeat Steps 6 and Step 7. If you continue to obtain results outside the Acceptable Value range, call for technical support.

*NOTE: When testing outdoors (sunlight), for best accuracy, use the Mixing Cap/Cell Cover when Zeroing and Reading the sample.

Assigned Value for HHWT-486602 (lot 505) Solution

Parameter	Desired Value (ppm)	Acceptable Value (ppm)
Free Chlorine	1.35	1.28 - 1.42

NOTE: Values reflect current concentrations as found at time of manufacture and may change with consecutive lots.

R020113

HHWT-12 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 and Bromine (Ozone can be measured in CL3 MENU).

5. Be sure the **CELL** is filled to capacity (4mL), especially for pH and Total Alkalinity.

6. Rinse the **CELL** with clean water immediately after completing each test. Some reagents may stain the CELL if not rinsed shortly after use. Other reagents including Cyanuric Acid, Chloride, and Calcium Hardness may coat the CELL wall. It is recommended, after these tests, to use the Cell Cleaning Brush with water to clean the CELL.

7. 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*).

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

9. Minimize exposure of meter and test reagents to heat above 32°C (90°F).

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

11. When running a DPD-1 Free Chlorine test **AFTER** a Total Chlorine DPD-3, a Total Chlorine DPD-4, or a HR Chlorine test, rinsing is very important to remove residual KI, which may interfere.

12. Each test strip 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 test strips 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. The HHWT-12 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 OMEGA strips or reagents (*reorder information on page 17*).

15. Our lab testing with the HHWT-12 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.

16. Remove batteries when meter is not used for more than a month (Warranty Requirement).

17. 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.

18. For Nitrate tests, the cell should be cleaned after each experiment with brush and distilled water. This is very IMPORTANT. If any zinc dust is adhering to the cell wall, it will affect the results. Finally, wash the sample three to four times before the measurement starts.

HHWT-12 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 Omega technical support in the USA at (800) 872-9436.

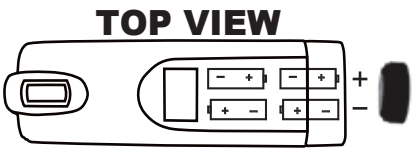
LCD Message	Description	Corrective Action
HI	In READ mode: test sample concentration is above the measurement range (test specific).	Dilute and retest.
LO	In READ mode: test sample concentration is below the measurement range (test specific).	Sample value is below measurement range.
LO	In ZERO mode: 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. 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 especially recommended after you run a test that is using turbidity or precipitation chemistry for analysis (Calcium Hardness and Cyanuric Acid).

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.



Strip Reagent Reorder Information

Strip Micro (4mL) Reagent Specifications - For use with HHWT-12

No.	PARAMETER	PART NO.	# OF TESTS	DETECTION RANGE	CHEMISTRY
	Reference Standard	HHWT-486602	10	N/A	N/A
1	Alkalinity, Total	HHWT-486641	100	1 - 320 ppm	Alizarin Red S + Citrate
2	Bromine (DPD-1)	HHWT-486636	100	0.1- 12 ppm	DPD
3	Chlorine, Free (DPD-1)	HHWT-486637	100	0 - 5 ppm	DPD
4	Chlorine, High Range	HHWT-486672	50	0.3 - 300 ppm	KI + Buffer
5	Chlorine, Total (DPD-3)**	HHWT-486638	100	0 - 5 ppm	KI
6	Chlorine, Total (DPD-4)	HHWT-486670	100	0 - 5 ppm	DPD + KI
7	Copper (Cu^{+2})	HHWT-486632	50	0 - 11 ppm	Biquinoline
8	Hardness, Total (as $CaCO_3$)	HHWT-486673	50	4 - 300 ppm	Phthalein Purple
9	Ozone (DPD-4)	HHWT-486634	100	0 - 5 ppm	DPD + KI
10	Permanganate (DPD-1)	HHWT-486626	100	0 - 5 ppm	DPD
11	pH	HHWT-486639	100	5.5 - 8.8 pH	Phenol Red
12	Nitrate (as NO_3^-)	HHWT-486655	50	0.12 - 30 ppm	Zinc Reduction
13	Nitrite (as NO_2^{-2})	HHWT-486623	50	0 - 1.8 ppm	Chromotropic Acid
14	Chloride (as NaCl) II*	HHWT-481657	25	0 - 290 ppm	Silver (ppt)
15	Chlorine Dioxide (DPD-1)*	HHWT-486633	100	0 - 10 ppm	DPD
16	Chromium (VI)*	HHWT-486614	50	0 - 1.7 ppm	Diphenylcarbazide
17	Cyanuric Acid II*	HHWT-481652	60	0 - 90 ppm	Melamine (ppt)
18	Glycine (used for Chlorine Dioxide)	HHWT-484014	50	N/A	Glycine
19	Hydrogen Peroxide LR*	HHWT-486616	50	0 - 2 ppm	DPD + PO4 + MoO4 + KI
20	Hydrogen Peroxide MR*	HHWT-486648	50	0 - 20 ppm	DPD + MoO4 + KI + acid
21	Hydrogen Peroxide HR*	HHWT-486676	100	0 - 1500 ppm	DPD + KI
22	Iodine (DPD-1)*	HHWT-486627	100	0 - 12 ppm	DPD
23	Total Iron, TPTZ (Fe^{+2}/Fe^{+3})*	HHWT-486650	50	0.02 - 4.5 ppm	TPTZ + PP
24	LR Total Hardness (as $CaCO_3$)*	HHWT-486630	100	0 - 100 ppm	Phthalein Purple
25	Manganese*	HHWT-486606	24	0 - 1.3 ppm	PAN + Cyanide
26	Peracetic Acid (DPD-4)*	HHWT-486674	100	0 - 5 ppm	DPD + KI
27	Phosphate*	HHWT-486814	50	0.03 - 4.2 ppm	Molybdate Method
28	Sulfate*	HHWT-486608	50	0 - 220 ppm	Barium (ppt)
29	Sulfide (as H2S)*	HHWT-486646	50	0 - 9 ppm	Nitroprusside
30	Turbidity*	None	N/A	7 - 800 NTU	Turbidity

* Results utilize the TR (Transmission) meter function and require the use of a conversion table. See respective test procedures for more information and tables.
** Total Chlorine DPD-3 Test requires Free Chlorine DPD-1 (HHWT-486637) to be run first. R041613

Consult manual M-5282 for complete instructions on Transmission Test procedures and required tables.

NOTE: Because most of our products are test strips or use reagents that have little or no hazard in the quantity sold, MSDS sheets are not supplied with the test.

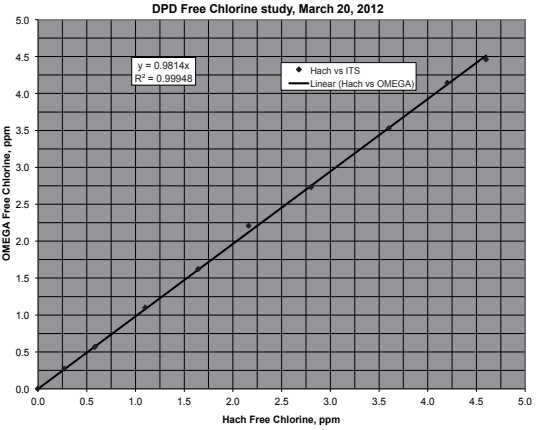
If your required procedure is not listed in this manual, please see the back page for our contact information.

To ensure optimal performance, store your test strips in a cool, dry place away from excess heat (below 100°F / 38°C), moisture, and oxidizers such as Chlorine and Bromine.

HHWT-486637 (DPD-1) Accuracy

Free Chlorine results are compared using the ***HHWT-486637 (DPD-1)*** with the HHWT-12 Meter in Menu CL1 and Hach® DR890 Colorimeter in Program 9 and Program 12 using Hach® powder pillows.

DR890	HHWT-12
0.00	0
0.27	0.27
0.58	0.57
1.10	1.10
1.64	1.62
2.16	2.21
2.8	2.73
3.6	3.53
4.2	4.14
4.6	4.46



Meter	Menu	Range (PPM)	Resolution
HHWT-12	CL1	0 to 5.00	0.01
DR890	Program 9	0.00 to 2.20	0.01
	Program 12	0.0 to 11.0	0.1

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NOTES

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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M-5099/0413