YD300
Portable Water Hardness Meter
User Manual

Apera Instruments, LLC

aperainst.com

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1. Brief Introduction

Thank you for purchasing Apera Instruments YD300 Portable Water Hardness Meter. Before using the product, please read this manual carefully to help you properly use and maintain the product. For technical support, please contact us at info@aperainst.com or +1 (614)-285-3080.

Water hardness is the total concentration of calcium ion ($Ca2^{+}$) and magnesium ion ($Mg2^{+}$) in water. The meter adopts an electrode method to measure water hardness, which has been proven to have the same accuracy as the EDTA volumetric method. This product helps solving problems existing in EDTA method such as the complexity of operation and difficulty in reading with the user-friendly electrochemical method. This meter is used for high accuracy water hardness measurements and is ideal for field tests.

Features

- Adopts 601-S 3-in-1 water hardness combination electrode which consists of: measuring electrode, reference electrode and temperature probe. At the same time, its new structure, stable electrode potential, quick response and use easily features are more welcomed by customers.
- The meter adopts an intelligent chip design, which has automatic calibration, temperature compensation (ATC), data storage; auto-lock and automatic power off, a low potential displaying function, etc.
- Eight water hardness units can be chosen upon user's preference: mmol/L, mg/L (CaCO3), mg/L (CaO), mmol/L (Boiler), mg/L (Ca), ◦fH (France Degree), ◦dH (German Degree) and ◦eH (England Degree).
- Adopts digital filtering technology to intelligently improve meter's response speed and result accuracy. A smiling face icon will appear when reading is stable.
- Equipped with B1, B2 and B3 Water Hardness calibration solutions.
- Backlit LCD display.
- IP57 waterproof design.
- Comes in a rugged carrying case equipped with all accessories.

2. Technical Specifications

2.1 Units of Water Hardness and their Conversions

mmol/L —basic unit for water hardness

mg/L ($CaCO_3$) — water hardness based on quality concentration of $CaCO_3$, also known as ppm and U.S. Degree.

mg/L (CaO) —water hardness based on quality concentration of CaO

mmol/L (Boiler) — special unit for industrial boiler water hardness measurement

mg/L (Ca) —water hardness based on quality concentration of Ca

°fH—France Degree

°dH—German Degree

°eH—England Degree

Units Conversion of Water Hardness

	mmoL/L	mg/L ($CaCO_3$)	mg/L (CaO)	mmol/L (Boiler)	mg/L (Ca)	°fH (France Degree)	°dH (German Degree)	°eH (England Degree)
mmol/L	1	100	56.1	2	40.1	10	5.6	7.0
mg/L($CaCO_3$)	1.00×10^{-2}	1	0.56	2.00×10^{-2}	4.01×10^{-1}	0.10	5.60×10^{-2}	7.00×10^{-2}
mg/L (CaO)	1.78×10^{-2}	1.78	1	3.57×10^{-2}	7.15×10^{-1}	1.78×10^{-1}	9.98×10^{-2}	1.25×10^{-1}
mmol/L (Boiler)	5.00×10^{-1}	50	28.05	1	20.05	5.00	2.8	3.50
mg/L (Ca)	2.49×10^{-2}	2.49	1.40	4.99×10^{-2}	1	2.49×10^{-1}	1.40×10^{-1}	1.75×10^{-1}
°fH (France Degree)	1.00×10^{-1}	10	5.61	2.00×10^{-1}	4.01	1	5.59×10^{-1}	6.99×10^{-1}
°dH (German Degree)	1.79×10^{-1}	17.9	10.02	3.57×10^{-1}	7.16	1.79	1	1.25
°eH (England Degree)	1.43×10^{-1}	14.3	8.01	2.86×10^{-1}	5.73	1.43	8.00×10^{-1}	1

2.2 Technical Parameters

Water Hardness

Measurement range	(0 to 10) mmol/L; (0 to 401)mg/L(Ca); (0 to 1000) mg/L(CaCO3); (0 to 100) ºfH (France Degree); (0 to 561) mg/L(CaO); (0 to 56)ºdH (German Degree); (0 to 20) mmol/L(Boiler); (0 to 70) ºeH (England Degree)
Resolution	0.01 and 0.1 water hardness units
Accuracy	±5% FS
Temp. compensation range	（5 to 50℃） automatic
Calibration Solution	B1 Calibration Solution — 2.00×10-2 mmol/L B2 Calibration Solution — 2.00×10-1 mmol/L B3 Calibration Solution — 2.00 mmol/L
Calibration Mode	(a) B1/B2 Calibration—using B1 and B2 Calibration Solution, suitable for < 2.00×10-2 mmol/L low concentration water quality, for example boiler water. (b) B2/B3 Calibration—using B2 and B3 Calibration Solution, suitable for general water quality.

Temperature

Measurement Range	0-60℃ (32 -140ºF)
Resolution	0.1℃
Accuracy	±0.5℃

Other Technical Parameters

Data Storage	99 sets
Stored Content	serial number, measurement, units, temperature and calibration points
Power	Two AA Batteries（1.5V×2）
Dimension and Weight	Meter：(65×120×31)mm/180g; Carry Case： (255×210×50)mm/790g
Quality and Safety Certificate	ISO9001:2015, CE, RoHS

Working conditions

Working Temperature	5-35℃ (41-95ºF)
Working Humidity	≤85%
Waterproof Rating	IP57 Waterproof and Dustproof

3. Meter Instructions

3.1. LCD Display

① — Water hardness reading; adopts a modular form to express e.g. $2.00^{10^{-1}}$ means 2.00×10^{-1}.

② — Measurement units; appears by following order: mmol/L, mg/L($CaCO_3$), mg/L(CaO), mmol/L(Boiler), ºfH , ºdH , ºeH and mg/L(Ca).

③ — Measurement stable reading icon; When icon is flashing—measurement is not stable; When icon is not flashing—measurement is stable.

④ — Calibration solution indication icon, for example B1 flashing means should calibrate with B1 solution.

⑤ — Low voltage icon, remind user to change batteries.

⑥ — Temperature value and its units.

⑦ — **M+**— icon for storing measurements, **RM**— icon for recalling measurements; The digit on the left side of icon indicates the storage serial number.

⑧ — Calibration icon, **Cal 1** means first point calibration, **Cal 2** means second point calibration.

3.2. Keypad

This meter has a total of five operating keys.

ON OFF	Power button
MODE	Button to control backlight; short press this button to turn on backlight, Long Press this button (press time > 2 seconds) to enter parameter setting mode
CAL	Calibration button, press this button to enter meter's calibration mode.
UNIT READ	Button for unit switch and confirmation, when in measurement mode, press the button to change measurement unit; When in parameter setting, press the button to confirm change in settings.
M+ RM	Button for storing and recalling measurement data. Short press this button to store measurement data, Long press this button to recall stored measurement data. In parameter setting, the button can change digit or ON/OFF status.

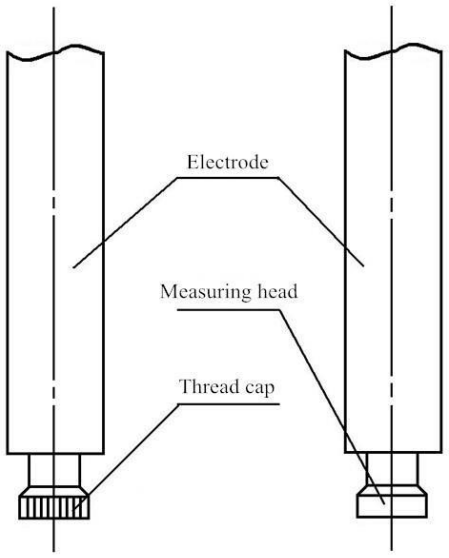
4. Operation

4.1. Preparation

4.1.1. Electrode's Activation

(a) For first-time use — see picture (4-1), shake electrode with force to let the inner solution of electrode fall into the measuring head compartment; there should NOT be any bubbles within the measuring head. Pour a small amount of soaking solution into the soaking solution vial, and soak the electrode for 30 minutes.

(b) Regular Usage — The activation time only takes 10 to 15 minutes for a frequently used electrode. As long as the reading is stable, users can start to perform calibration and measurements (please note that the readings without electrode being immersed in solutions are random).



Picture(4-1) Thread cap and measuring head

4.1.2 Pour B2 and B3 calibration solution into the corresponding vials of "B2" and "B3".

4.1.3 Choose meter's calibrating methods, resolution, water hardness units and other measurement parameters.

4.2. Notes During Measurement Preparations

4.2.1 When using, shake the electrode with force to make the inner solution of electrode fall into the compartment of the measuring head. There shouldn't be any air bubbles in the measuring head.

4.2.2 When soaking or calibrating electrode, the calibration vial should be placed in the black metal pedestal to avoid spills.

4.3. Meter's Calibration: (take B2/B3 calibration method and mmol/L unit as an example)

4.3.1 Power on the meter. Press CAL , Cal 1 and B2 icons appear and are flashing at the same time, indicating the meter enters 1st point calibration; the calibration solution is B2, see picture (4-2).

Picture (4-2)

4.3.2 Rinse the electrode in distilled/deionized water and shake off excess water; insert the electrode into B2 calibration solution and gently stir the electrode for a few seconds and let it stand still; Wait for the reading to fully stabilize (about 2 minutes).

Picture (4-3)

4.3.3 Then press CAL to confirm calibration, "**2.00×10-1mmol/L**" icon starts flashing (see picture (4-3), indicating 1st point calibration will be finished after approximately 20 seconds. During the icon flashing, do NOT press any key.

NOTE: The reading may be temporarily stable in about 30 seconds, but we recommend waiting about 2 minutes for the reading to get fully stabilized before pressing CAL to confirm calibration. This practice will significantly improve the accuracy of calibration.

4.3.4 Then B3 and Cal 2 icons will appear and start flashing, indicating the meter enters 2nd point calibration mode; the calibration solution is B3.

4.3.5 Rinse the electrode in distilled/deionized water and shake off excess water; insert it into B3 calibration solution; stir the electrode for a few seconds and let it stand still. Wait for the reading to fully stabilize (about 2 minutes).

Picture (4-4)

4.3.6 Press (CAL) button to confirm the 2nd point calibration, "**2.00 and mmol/L**" icon starts flashing (see picture (4-4)); calibration will be finished after approximately 20 seconds. During the icon flashing, do NOT press any key. The meter then returns to measurement mode.

4.3.7 **To verify the calibration quality:** Rinse the electrode in distilled/deionized water and shake off excess water; then put it into the B2 solution, stir for a few seconds and let it stand still; take the reading after ☺ appears and stays; The reading should be close to 2.00 ±0.25×10-1 mmol/L. Otherwise, please repeat the calibration process (4.3.1 to 4.3.3).

4.4 Notes in Meter's Calibration

4.4.1 For first time use, the new electrode is recommended to be calibrated **two times**. When inserting the probe into calibration solutions for the first time, sometimes there will be a large deviation in the reading, even showing an unchanging "1.00×10^3mmol/L" (indicating an overflow display); this is normal and can be corrected in the second time of calibration.

4.4.2 The two-point calibration method is recommended for the best water hardness accuracy; a calibration curve will be established after two-point calibration is performed. Therefore, the correct values will be displayed only after calibration.

4.4.3 Because the meter does not have automatic recognition for the calibration solutions, user must place electrode into the right calibration solution according to B1 / B2 / B3 icons flashing on the LCD. If the wrong calibration solution is used, the meter would generate significant inaccuracy while testing samples. You will need to repeat calibration if this happens.

4.4.4 Because B1, B2 and B3 calibration solutions are no buffers. They are easy to be contaminated. This is especially the case for the low concentration B1 solution. These solutions generally can be used **4 to 5 times** before replacement. Users need to pay attention to ensure the solutions do not get contaminated.

4.5 Take Measurement

Pour your sample solution into the #1 or #2 sample vial (bottle). Rinse electrode with distilled/deionized water and shake off excess water; insert the probe into sample solution, stir gently and let it stand still; when ☺ icon appears and stays, take the reading. Press (M+ RM) to save the measurement data. As shown in picture (4-5), calibrating method is B2 and B3, temperature of solution is 25.0℃, water hardness measurement is 2.88×10-1, unit is mmol/L, press (UNIT READ) to switch to other units.

Picture (4-5)

4.6 Notes during Measurement Taking

4.6.1 Electrode must be rinsed thoroughly with distilled/deionized water before measuring. The container for diluted and concentrated solutions should be separated. When testing, try to test diluted solution first and then test concentrated solution.

4.6.2 Generally, calibration is necessary before every test, but if interval between tests is short, then calibration is not necessary; To test if the meter is due for calibration, simply insert the electrode in one of the calibration solutions and wait for a stable reading. If the reading is within the stated error range, then it is unnecessary to recalibrate.

4.6.3 When testing boiler water, users should choose B1/B2 calibration method, and add Ionic Strength Buffer (TISAB) into B1, B2 calibration solution and soaking solution. Otherwise, it will cause a significant measurement error; the proportion is add 50.4mg ACS grade Sodium Bicarbonate ($NaHCO_3$) per 100mL solution.

4.6.4 According to the isothermal measurement principle, the closer the test sample's temperature is to the calibration solution's, the higher the accuracy of the measurement. So this principle is recommended to follow when conducting tests. For general testing, the temperature discrepancy between calibration solution and sample solution should be less than 15°C; for high accuracy testing, the temperatures of calibration solution and sample solution should be consistent.

4.6.5 The sensor membrane of the electrode might become turbid after usage, which is a normal phenomenon.

4.6.6 During usage, if you find the PVC sensor membrane in the electrode measuring head is seriously concave, please first screw it loose, then screw it tight, and then shake it forcefully for several times to eliminate the air bubble, which should solve the problem.

4.6.7 When the concentration of sample solution is greater than 1.00×10mmol/L, Er icon will display on the left-bottom corner, reminding users to dilute the sample solution 10 times before testing; then multiple the readings by 10 to get the real readings.

4.7. Electrode Storage

When measurement is finished, electrode should be stored in the protection cap after rinsing in distilled/deionized water. No solution is needed in the protection cap.

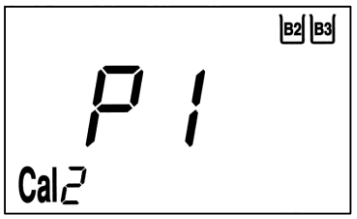
5. Meter's Parameter Settings

5.1. Parameter Setting Table

Prompt	Parameter setting items	Parameter
P1	Calibration Method Setting	B1 B2 ----- B2 B3
P2	Resolution Setting	0.01-0.1
P3	Temperature Unit Setting	℃-℉
P4	Activity Compensation Setting	OFF-On
P5	Automatic Backlight Setting	OFF-On
P6	Automatic Power Off	OFF-On
P7	Default Setting	OFF-On

5.2. Calibration Method Setting (P1)

Press MODE button (> 2 seconds), meter enters calibration method setting state P1, LCD display as picture (5-1), press M+ RM button to switch from B1 B2 and B2 B3 calibration methods, press UNIT READ to confirm and return to measurement mode. Default setting is B2 B3 .



picture(5-1)

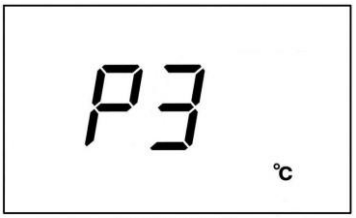
5.3. Measurement Resolution Setting (P2)

Press MODE button under the P1 setting, meter enters measuring resolution setting P2. LCD display as picture (5-2), press M+ RM button to change resolution between 0.01 and 0.1; press UNIT READ button to confirm and return to measurement mode. Default setting is 0.01.

picture(5-2)

5.4. Temperature Unit Setting (P3)

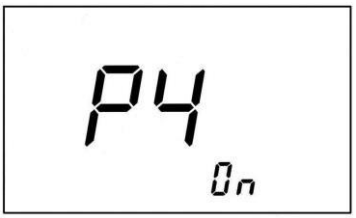
Press MODE button under the P2 setting, meter enters temperature unit setting state P3. LCD display as in picture (5-3), press M+ RM button to change temperature units between ℃ and ℉, UNIT READ button to confirm and return to measurement mode; default setting is ℃



picture(5-3)

5.5. ON/OFF Setting of Activation Compensation (P4)

Press MODE button under the P3 state, meter enters ON/OFF setting of activation compensation state P4. Picture (5-4) shows default setting state is ON. Press M+ RM button to change activation compensation button between OFF and ON, press UNIT READ button to confirm and return to measurement mode. When choosing ON, this means display value has activation compensation within measurement range of high concentration 4.00 to 10.0mmol/L; and display value does not have activation compensation when choosing OFF. Default setting is ON.



picture(5-4)

5.6. ON/OFF Setting of Background Light (P5)

Press MODE button under the P4 setting, the meter enters ON/OFF setting of backlight automatic power off setting P5. LCD display as in picture (5-5). Press M+ RM button to choose ON or OFF, press UNIT READ button to confirm and return to measurement mode. The default setting is ON. When choosing ON, the backlight automatically turns off after 8 minutes. When choosing OFF, the backlight automatic power off function is canceled.

picture(5-5)

5.7. ON/OFF Setting of Meter Automatic Shutoff (P6)

Press MODE button under the P5 setting, meter enters setting of automatic power off state P6. LCD display as in picture (5-6). Press M+ RM button to choose ON or OFF,

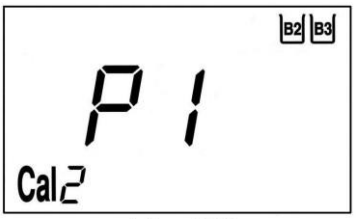
picture(5-6)

press UNIT/READ button to confirm and return to measurement mode.

The default setting is ON. When choosing ON, the automatic power off function is activated; the meter will power off automatically after 10 minutes if no operation; when choosing OFF, automatic power off function is cancelled.

5.8. ON/OFF Setting of Restore to Default Setting (P7)

Short press MODE button under the P6 setting, meter enters ON/OFF setting of restoring to default setting P7. The default setting is OFF, LCD display as in picture (5-7), press M+/RM button to switch ON and to choose to go back to default settings; then after 2 seconds, it enters the measurement mode. P1 to P6 now are all restored to default setting and the calibration data is erased.



picture(5-1)

6. Data Storage/Recall/Deletion

6.1 Store Measurement Data

6.1.1 In measurement mode, short press M+/RM button after reading is stabilized, a serial number and **M+** icon appear on the LCD, indicating this measurement has been stored under this number, measurement information including serial number, measurement, units, temperature and calibration method, as in picture (6-1) showing the measurement with serial number 28.

Picture (6-1)

6.1.2 LCD will display the serial number and **M+** icon of the last measurement; as in picture (6-2), 16 M+ indicates that meter has already stored 16 groups of measurements. The meter can store up to 99 groups of measurements.

picture(6-2)

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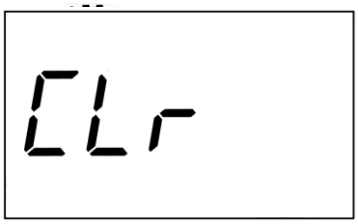
6.1.3 When memory storage is full, press M+/RM button again, CLr icon will appear on the LCD, as the picture (6-3) showing, at that time press M+/RM button and meter will clear the original 99 groups information, and new measurement can be stored. If pressing UNIT/READ button, meter will keep the original 99 sets of data and return to measurement mode.



picture(6-3)

6.2 Recall Measurement Data

In measurement mode, Long press M+/RM button (> 2 seconds), meter will recall last stored values, short press M+/RM button consecutively, meter will display measurement with serial number sequentially.

picture(6-4)

6.3 Clear Stored Measurement Data

In measurement mode, press and UNIT/READ button together, meter displays flashing CLr; at this time, short press M+/RM button, meter will clear all stored measurement data and return the meter to measurement mode; if short press UNIT/READ button, meter will keep original measurement data and return to measurement mode.

7. What's in the Kit

Item	Quantity
YD300 water hardness meter	1
601-S water hardness/temp. electrode	1
AA alkaline batteries (1.5V)(installed)	2
100mL hardness calibration solution (B1, B2 and B3)	1 for each
20ml empty vials	6

10ml protecting bottle	1
Metal pedestal	1
Water hardness soaking solution (50ml)	1
Carrying case	1
User manual	1

8. Warranty

We warrant this instrument to be free from defects in material and workmanship and agree to repair or replace free of charge, at option of APERA INSTRUMENTS, LLC, any malfunctioned or damaged product attributable to responsibility of APERA INSTRUMENTS, LLC for a period of TWO YEARS (SIX MONTHS for the water hardness electrode) from the delivery.

This limited warranty does not cover any damages due to:

Transportation, storage, improper use, failure to follow the product instructions or to perform any preventive maintenance, modifications, combination or use with any products, materials, processes, systems or other matter not provided or authorized in writing by us, unauthorized repair, normal wear and tear, or external causes such as accidents, abuse, or other actions or events beyond our reasonable control.

9. Appendix： Error Message and Troubleshooting

Error	Possible Reasons	Troubleshooting	Operation
Measured value unstable, flashing ☺	Electrode is not activated	Activate the electrode for 30 minutes	See 4.1.1.
	Bubble in the measuring head	Shake the electrode forcefully to the remove the bubble	See 4.1.1.
	Very few or contaminated reference solution	Replace the electrode	
	Sensor membrane invalidated	Replace the electrode	
1. Display incorrect values in calibration solution after calibration.	Calibration solution invalidated	Replace the calibration solution	See 4.4.4.
	Incorrect calibration steps	Return to the factory default setting and calibrate again	See 5.8.
2. The sample measurement error is significant. 3. Abnormal reading	Sensor membrane invalidated	Replace the electrode	
Display Er	Solution concentration ≥10mmoL/L	Dilute the solution 10 times before measuring	See 4.6.7.
	Electrode is not fully inserted into solution	Let the electrode fully immersed into sample solution	
Display freezes at 1.00×103	Electrode is not properly connected with meter	Make sure the connection of electrode and meter is correct	
Membrane becomes turbid and white	Wear and tear	Normal	See 4.6.5.
Membrane becomes concave	Negative pressure within the electrode	Loosen the measuring head and tighten it again.	See 4.6.6.

APERA INSTRUMENTS, LLC

Address: 6656 Busch Blvd, Columbus Ohio 43229

Tel: 1-614-285-3080

Email: info@aperainst.com

Website: aperainst.com