

YD300

Portable Water Hardness Meter Instruction Manual



APER A INSTRUMENTS (Europe) GmbH

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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.de Apera Instruments reserves the right to update the content of this manual without giving prior notices.

We call the total concentration of calcium ion (Ca^{2+}) and magnesium ion (Mg^{2+}) in water sample to be the hardness of water. This is an important index for water quality. This meter adopts an electrode method to test water hardness, which has been proven to have the same accuracy as the EDTA volumetric. This product helps solving problems 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.

1.1 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 (CaCO_3), 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.
- Meter's circuit board adopts SMT film-covering technology to improve the meter's production reliability.
- 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 (CaCO₃): water hardness based on quality concentration of CaCO₃, 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 measuring
 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

2.2.1 Water Hardness

Measuring range	(0 ~ 10) mmol/L; (0 ~ 401) mg/L(Ca); (0 ~ 1000) mg/L (CaCO ₃); (0 ~ 100) °fH (France Degree); (0 ~ 561) mg/L (CaO); (0 ~ 56) °dH(German Degree); (0 ~ 20) mmol/L (Boiler); (0 ~ 70) °eH (England Degree)
Resolution	0.01 and 0.1 water hardness units
Accuracy	±5% FS
Temp. compensation range	(5 ~ 50°C) (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.

2.2.2 Temperature

Measuring Range	0 ~ 60°C (32 – 140°F)
Resolution	0.1°C
Accuracy	±0.5°C

2.2.3 Other Technical Parameters

Data Storage	99 groups
Content Storage	serial number of measuring value, measuring value, units, temperature and calibration way
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	ISO9001:2000 and CE

2.2.4 Working conditions

Ambient Temperature	5 ~ 35°C (41 ~ 95°F)
Ambient Humidity	≤ 85%
IP Grade	IP57 Waterproof and Dustproof

3 Meter Instructions

3.1 LCD Display



- ① — Measuring Water Hardness reading; adopts a modular form to express, such as $200^{10^{-1}}$ means 2.00×10^{-1} .
- ② — Measuring units; appears by following order: mmol/L, mg/L(CaCO₃), mg/L(CaO), mmol/L(Boiler), °fH, °dH, °eH and mg/L(Ca).
- ③ — Measuring stable reading icon; When icon is flashing—measuring value is not stable; When icon is not flashing—measuring value 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 five operating keys:

	Power button
	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
	Calibration button, press this button to enter meter's calibration mode.
	Button for unit switch and confirmation, when in measuring mode, press the button to change measurement unit; When in parameter setting, press the button to confirm change in settings.
	Button for storing and recalling measuring data. Short press this button to store measuring data, Long press this button to recall stored measuring data. In parameter setting, the button can change digit or ON/OFF status.

4 Operation Procedure

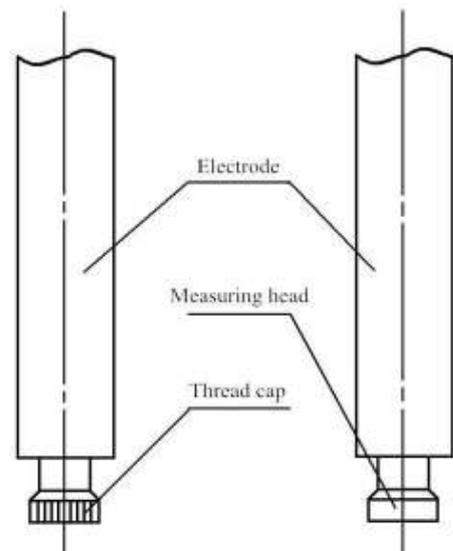
4.1 Measurement Preparations

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 activation solution into the soaking solution cup, and soak the electrode for at least 2 hours.
- (b) Normal Usage — the activation time only takes half an hour for a frequently used electrode. As long as the reading is stable (please note that the readings at the moment are random), users can start to perform calibration and measurements.

4.1.2 Pour small amounts of B2 and B3 calibration solution into the corresponding test cups of "B2" and "B3".

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



Picture(4-1) Thread cap and measuring head

4.2 Considerations during Measurement Preparations

- 4.2.1 When using, shake the electrode with force to make the inner solution of electrode into the compartment of measuring head. There should not be any bubbles present in the measuring head.
- 4.2.2 When soaking or calibrating electrode, the test cup should be placed in the black base to avoid spills.

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

4.3.1 Press ,  and **Cal 1** icons appear and are flashing at the same time, indicating the meter enters first 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 it to remove excess water; insert the electrode into B2 Calibration solution and gently stir the electrode for a few

seconds and let it stand still.  appears and stays,

press , the “2.00×10⁻¹ mmol/L” icon starts flashing (see picture (4-3)), indicating 1st point calibration will be



Picture (4-3)

finished after approximately 20 seconds;  and **Cal 2** icons appear and start flashing, indicating the meter enters 2nd point calibration mode; the calibration solution is B3.

4.3.3 Rinse the electrode in distilled/deionized water and shake it to remove excess water, insert it into B3 calibration solution. stir the electrode for a few seconds and let it stand still;  appears and stays, press

 button, the “2.00 and mmol/L” icon starts flashing (see picture (4-4)); calibration will be finished after approximately 20 seconds; the meter then go back to measuring mode.



Picture (4-4)

4.3.4 Rinse the electrode in distilled/deionized water and shake it to remove excess water; then put it into the **B2** solution, stir for a few seconds and let it stand still; take reading  after appears and stays; The reading should be equal or less than $2.00 \pm 0.25 \times 10^{-1}$ mmol/L. Other wise, please repeat the calibration process (section 4.3.1 to 4.3.3).

4.4 Notes in Meter's Calibration

- 4.4.1 For first time use, the new electrode needs 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 “ 1.00×10^3 mmol/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 the **B1**, **B2**, **B3** icons flashing on the LCD. If the wrong calibration solution is used, the meter would generate significant inaccuracy while testing samples. User will need to repeat calibration if this happens.
- 4.4.4 Because B1, B2 and B3 calibration solutions have no buffer, 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 Sample Testing

Rinse electrode with distilled/deionized water and shake it to remove excess water; insert the probe into sample solution, stir gently and let it stand still; when ☺ icon appears and stays, take the reading. As shown in picture (4-5), calibrating method is B2 and B3, temperature of solution is 25.0°C, measuring value is 2.88×10^{-1} , unit is mmol/L, press  to switch to other units.



Picture (4-5)

4.6 Notes during Sample Test

- 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 also 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 solutions, 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 $1.00 \times 10 \text{ mmol/L}$, an **Er** icon will

display in 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 within the protection cap after rinsed in distilled/deionized water.

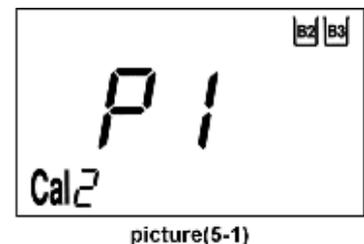
5 Meter's Parameter Settings

5.1 Parameter Setting Table

Prom pt	Parameter setting items	Parameter
P1	Calibration Method Setting	
P2	Resolution Setting	0.01-0.1
P3	Temperature Unit Setting	°C - °F
P4	Activity Compensation Setting	OFF-On
P5	Automatic Backlight Setting	OFF-On
P6	Automatic Power Off	OFF-On
P7	Default Setting	OFF-On

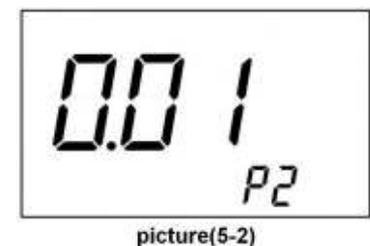
5.2 Calibration Method Setting (P1)

Press  button (> 2 seconds), meter enters calibration method setting state P1, LCD display as picture (5-1), press  button to switch from  and  calibration methods, press  to confirm and return to measuring mode. Default setting is .



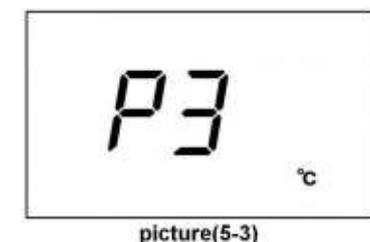
5.3 Measurement Resolution Setting (P2)

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



5.4 Temperature Units Setting (P3)

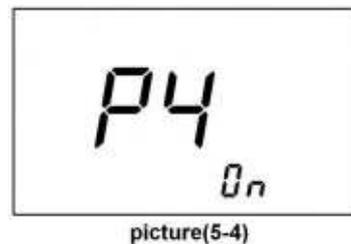
Press  button under the P2 setting, meter enters temperature unit setting state P3. LCD display as in picture (5-3), press .



button to change temperature units between °C and °F,  button to confirm and return to measuring mode; default setting is °C.

5.5 ON/OFF Setting of Activation Compensation (P4)

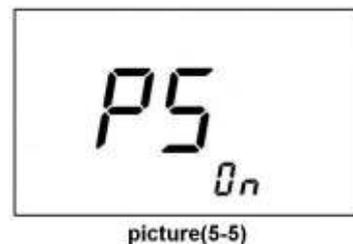
Press  button under the P3 state, meter enters ON/OFF setting of activation compensation state P4. Picture (5-4) shows default setting state is ON. Press  button to change activation compensation button between OFF and ON, press



 button to confirm and return to measuring mode. When choosing ON, this means display value has activation compensation within measuring 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.

5.6 ON/OFF Setting of Background Light (P5)

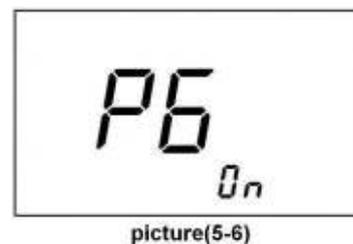
Press  button under the P4 setting, the meter enters ON/OFF setting of backlight automatic power off setting P5. LCD display as in picture (5-5). Press  button to choose ON or OFF, press



 button to confirm and return to measuring 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.

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

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



confirm and return to measuring 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, means automatic power off function is cancelled.

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

Short press  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  button to switch ON and to choose to go back to default settings; then after 2s, it enters the measuring mode. P1 to P6 now are all restored to default setting and calibration point restored to the theoretical state.



6 Storage/ Recall and Eliminate of Measuring Information

6.1 Store Measuring Data

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



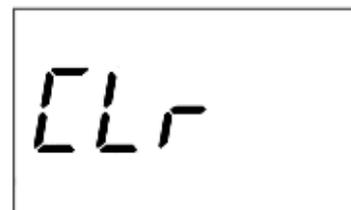
Picture (6-1)

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)

6.1.3 When memory storage is full, press  button again **CLR** icon will appear on the LCD, as the picture (6-3) showing, at that time press  button and meter will clear the original 99 groups information, and new measuring value can be stored. If pressing  button, meter will keep the original 99 groups measurements, and restore to measuring mode.



picture(6-3)

6.2 Recall Measuring Data

In measuring mode, Long press  button (> 2 seconds), meter will recall last stored values, short press  button consecutively, meter will display measuring value with serial number sequentially.



picture(6-4)

6.3 Clear Stored Measuring Data

In measuring mode, press  and  button together, meter displays flashing **CLR**; at this time, short press  button, meter will clear all stored measuring data and return the meter to measuring mode; if short press  button, meter will keep original measuring data and return to measuring mode.

7 Meter's Complete Kit

7.1	Model YD300 water hardness meter	1set
7.2	Model 601-S water hardness electrode	1pc
7.3	AA cell (1.5V)(installed)	2pc
7.4	100mL hardness calibration solution (B1, B2 and B3)	1btl/each
7.5	20ml test cup	6pcs

7.6	10ml protecting bottle	1pc
7.7	Test cup pedestal	1pc
7.8	Water hardness activation solution(50ml)	1btl
7.9	Carring case	1pc

8 Additional Accessories

- 8.1 Model 601-S water hardness electrode
 - 8.2 Water hardness calibration solution (B1, B2 and B3); Specs: 250 mL/btl and 100mL/btl
 - 8.3 Water hardness activation solution
 - 8.4 20 ml test cup
 - 8.5 Test cup pedestal
-

9 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 (Europe) GmbH, any malfunctioned or damaged product attributable to responsibility of APERA INSTRUMENTS (Europe) GmbH for a period of TWO YEARS (SIX MONTHS for the probes) 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.

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Appendix : Error Message and Troubleshooting

Error	Possible Reasons	Troubleshooting	Operation
Measured value unstable, flashing 	Electrode is not activated	Activate the electrode for 1 hour	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 several times of calibration. 2.The sample measurement error is significant. 3.Abnormal display.	Calibration solution invalidated	Replace the calibration solution	See 4.4.6.
	Incorrect calibration steps	Return to the factory default setting and calibrate again	See 5.8.
	Sensor membrane invalidated	Replace the electrode	
Display <i>Er</i>	Solution concentration $\geq 10\text{mmol/L}$	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 1.00×10^3	Electrode is not properly connected with meter	Make sure the connection of electrode and meter is correct	
Membrane becomes turbid and white	Long time usage	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.