

WS100 Fluoride/pH Portable Meter Kit

Instruction Manual



APERA INSTRUMENTS (Europe) GmbH

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1 Overview

Thank you for purchasing the Apera Instruments WS100 Fluoride/pH Portable Meter Kit (Hereon after referred as the meter). This fluoride/pH combo meter is widely used for drinking water, surface water and other water treatment applications, ideal for both in-field and laboratory testing.

Before using the product, please read this manual carefully before use to help you properly use and maintain the instrument.

For technical support, please contact us at info@aperainst.de or +49 202 51988998

1.1 Basic Functions

- Automatic calibration and temperature compensation (ATC), data storage, self-diagnostics, automatic shutdown, low-battery reminder
- Adopting digital filtering and intelligence to improve the instrument's responsiveness and accuracy of measurement data, measured value display when stable "😊" Icon.
- Meets IP57 Waterproof and dustproof rating, ideal for use under harsh environment.

1.2 Features of Fluoride Measurement

- Patented structure of the 3-in-1 ion electrode contains: ion-selective electrode, reference electrode, and temperature electrode. This design generates quick stability, fast response, and is easy to use.
- no need for stirring or added reagents, directly measuring the ion concentration of fluoride in a quick and simple manner, directly measure the fluoride concentration with three different units: mg/L, ppm and pF.

1.3 Features of pH measurement

- 1-3 points of automatic calibration, with calibration icons and self diagnosis function.
- Automatic recognition of up to 12 different pH standard buffer solutions, there are three series of standard buffer solutions to choose from: U.S.A, NIST, and China.

2 Technical Parameters:

2.1 Fluoride

Measuring range	0.02 ppm to 1900 ppm
Display units	mg/L, ppm, pF
Accuracy	± 0.02 ppm or $\pm 5\%$ of reading (which ever is greater)
Temperature Compensation Range	(0-80) °C (Automatic)

2.2 pH

Measuring range	(-2.00 - 19.99) pH
Resolution	0.1/0.01 pH
Accuracy	± 0.01 pH ± 1 digit
Temperature Compensation Range	(0 - 100) °C (Automatic)

2.3 mV:

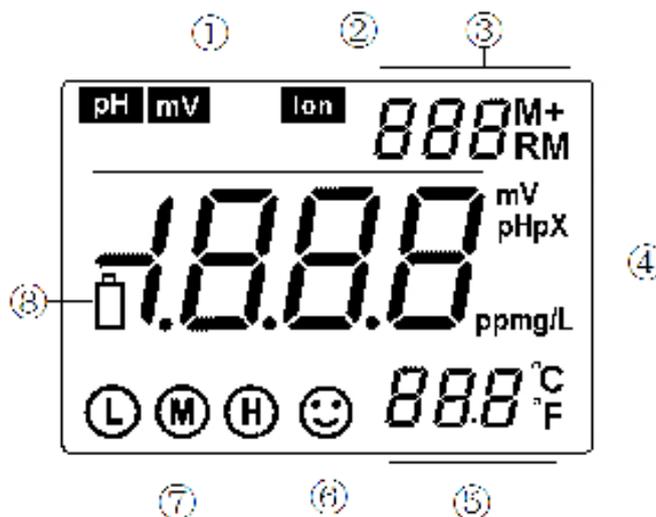
Measuring range	-1999mV ~ 0 ~ 1999mV
Resolution	1mV
Accuracy	$\pm 0.1\%$ FS

2.4 Other technical parameters:

Data Storage	800 Groups
Storage Content	Numberings, measurements, units of measurement and a temperature values
Power Supply	AA Battery (1.5VX2)
Size and Weight	Instrument:(65X120X31) mm/180g ,Suitcases:(360X270X76) mm/1.5Kg
Quality and Safety Certification	ISO9001:2000, CE
IPClass	IP57 Dustproof and waterproof

3 Instrument Description

3.1 LCD Display:



- ① — Parameter mode
- ② — Measuring value
- ③ — Measured value storage and display of numbers, symbols indicate:

M+ — Store Measured value

RM - Recall measurement values Icon

- ④ — Measurement unit
- ⑤ — Temperature measurement and unit
- ⑥ — Smiley face; icon indicates stable readings
- ⑦ — Instrument calibration indicator
- ⑧ — Low battery reminder

3.2 Operation keys

The meter has 5 operation keys in total

3.2.1  — Switch on / off key

3.2.2  — Calibration key

(a) When in the measurement mode, press this key to enter into calibration mode.

(b) When in the parameter setting mode, press this  key to change the number or ON/OFF state.

3.2.3 — Function key

(a) When in pH measuring mode, short press to change measurement parameters, long press this key to enter into parameter setting mode P1, P2, P3

(b) When in Conductivity measuring mode, press this key to enter into parameter settings mode P1, P2, P3

(c) When in Fluoride measuring mode, press this  key to enter into parameter setting mode P1, P2, P3

3.2.4 — Backlight and enter key

(a) When in the measuring mode, short press (< 1.5s) to turn the backlight display on or off;

- (b) When in the calibration mode or the parameter setting mode, press this key to confirm, and to make the meter enter into measuring state;
- (c) When in pH measuring mode, press this key to change resolution simultaneously:
0.01→0.1 pH
- (d) When in Conductivity measuring mode, press this key to change parameter simultaneously: TDS→SAL→RES→COND.
- (e) When in Ion measuring mode, press this  key to change parameter mode simultaneously: mg/L → ppm → pX

3.2.5— The combination key of memory storage and recall memory.

- (a) When in the measurement mode, short press this button (< 1.5s) to save the measuring data. Long press this button(> 2s) to display the stored measuring data.
- (b) When in the parameter setting mode, press this button to change the unit % → mol → g/cm³ → g/L or turn the meter ON/OFF.

3.3 Memory Storage, Recall Memory, and Clear Memory:

3.3.1 Memory Storage

While in the measurement mode, when the measuring data is stable and the smiley face icon appears, short press  key (< 1.5s), LCD will display “ M+ ” icon and a storage serial, and meanwhile storing all of the measuring information. It can store up to 300 groups.

3.3.2 Display measuring information :

(a) While in the the measurement mode, long press  (> 2s), meter will display the last stored information, and the storage number and “RM” icon will appear in the lower right corner of the LCD, and the complete measuring information.

Again short press  or  meter will in turn display all the measuring data, Hold  or  to quickly check the measuring data.

(b) In the data displaying mode (there are “ RM ” and storage number in the upper right corner of the LCD), press  key to return to the measuring mode.

3.3.3. Clear the stored measuring information: In the data displaying mode, press the  key for 5 seconds, LCD will appear **CLr** for 2 seconds. It means that all the storage has been eliminated and returns to measuring mode.

4 Fluoride concentration measurement

4.1 Preparation

- 4.1.1 Press  key to start connect F501 -fluoride ion electrode; the meter automatically switches to the fluoride concentration measurement mode.
- 4.1.2 Hold  to change fluoride concentration unit from mg/l, ppm to pX, release the button after selection.
- 4.1.3 Activate the electrode in 19.00mg/L calibration solution for about 10-20 minutes (as long as the smiley face icon stays stably on the screen) before calibration and measurement.
(Please note that the display value during activation is random).

4.2 Calibration

- 4.2.1 Press , LCD displays " 0.19 mg/L ", and LCD top right corner **CAL** and the bottom left **L** will be flashing, indicating that the meter has entered the 1th point calibration mode and the calibration solution is 0.19 mg/l; Rinse the fluoride-ion electrode in distilled or deionized water and shake off the excess water; dip the electrode into 0.19 mg/L calibration solution, stir gently and let it stand still. When measuring value is stable and  icon stays on screen, then press  key again, **End** and **19.0 mg/L** will be displayed after a seconds. While LCD top right corner **CAL** and bottom left corner **H** flashing, indicating the meter has entered the 2nd calibration mode and the calibration solution is 19.00 mg/L.
- 4.2.2 Dry the fluoride-ion electrode with clean tissue paper, dip into 19.00 mg/L Calibration solution, stir gently and let it stand still, when the reading is stabile and  stays on screen, then press  after a few seconds **End** shows up, indicating the end of calibration; LCD left corner shows two-point calibration icons **L** and **H**; The instrument automatically enters measuring mode.

4.3 Sample Measuring

4.3.1 Rinse the fluoride-ion electrode in distilled or deionized water and dap off excess water with clean tissue; soak into solution, stir gently and let it stand still; get the readings when measuring vaule is stable and 😊 stays on screen.

4.3.2 Hold  to show Fluoride concentrations in different units, release after selection.

4.3.3 Short press  key, the meter enters the **mV** mode and displays the mV value of the fluoride ion concentration.

4.4 Parameter Settings

Table (4-3)

Symbol	Parameter sets the project	Code	Parameters
P1	Temperature unit selection		°C °F
P2	Backlight display time setting	<i>bl</i>	0-1-3-6 min
P3	Auto power off time setting	<i>AL</i>	0-10-20 min
P4	Restore to factory default settings		OFF-ON

4.4.1 Temperature units ° c/°f selection (P1)

Long Press  to enter P1, remaining operations see section 5.4.5

4.4.2 Backlight display time setting (P2)

In P1, long press  to enter P2, remaining operations see section 5.4.6

4.4.3 Auto-off time setting (P3)

In P2, press  to enter P3, remaining operations see section 5.4.7

4.4.4 Restore factory default (P4)

In P3, press  to enter P4, remaining operations see section 5.4.8

4.5 Special Notes

4.5.1 The meter does not automatically recognize calibration solutions. Please make sure to use correct solution according to the displayed reminders "0.19 mg/L " or " 19.00 mg/L ".

4.5.2 The calibration solution can be easily polluted, especially for low concentration solution (0.19 mg/l). Please pay attention to avoid contamination otherwise a large measuring error will occur. Replace the solution after 4~5 times of use.

4.5.3 When test solution in the order from low-concentration to high-concentration, the electrode does not need to be rinsed, just shake off or dry the excess solutions with clean tissue. If it's from high-concentration to low-concentration, you need to rinse the electrode with distilled or deionized water, otherwise it will affect the accuracy significantly.

4.5.4 Typically the meter needs to be calibrated before use. But when requirement of accuracy is low, calibration is not necessary. Or try the electrode in the calibration solution, if the error is very small, calibration is not necessary.

4.5.5 According to the theory of Isothermal measurements of ion-selective electrode, the smaller the difference of temperature between test solution and the calibration solution, the higher the measuring accuracy is. Typically, temperature difference between test solution and calibration solution should $\leq \pm 15^{\circ}\text{C}$; for high accuracy measurement, the temperatures should be the same.

4.5.6 When test is completed, dry electrode and store with the cap on.

4.5.7 When the meter is functioning abnormally, please set P4 as "ON" to restore the meter to factory default mode, and then perform calibration and measurements again.

5 pH Measurement

5.1 Preparing the Meter

5.1.1. Connect the 201T-S pH Electrode to the meter; loosen the cap of the storage bottle of electrode; screw off the storage bottle; Press  to turn on meter.

5.2 Meter Calibration

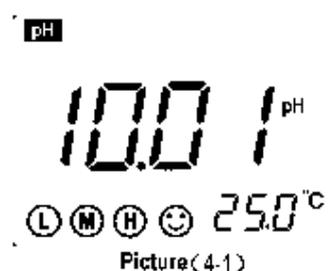
5.2.2. Use distilled water to rinse off electrode and then dry it with clean tissue, then soak it into the pH7.00 buffer solution, stir the electrode gently and let it stand still,

5.2.1. Press  to enter calibration mode, LCD displays C1, indicating the  first point of calibration; Wait for a stable reading  and to appear and stay, then press 

again, the LCD will show a blinking **7.00 pH**, indicating the 1st point of calibration is completed; a stable pH value and a blinking **C2** will be displayed, indicating the first point calibration has been finished and the meter enters the second point of calibration.

5.2.3. Rinse the pH electrode in distilled water and dry it, then soak it into the pH4.00 buffer solution, stir the electrode gently and let it stand still, waiting for a stable reading and a smiley face icon to appear and stay, then again press , the LCD will show a blinking **4.00 pH**, a stable pH value and a blinking **C3** will be displayed, indicating the second-point calibration has been finished and the meter enters the third-point calibration.

5.2.4. Rinse the pH electrode in distilled water and dry it, then soak it into the pH 10.01 buffer solution, stir the electrode gently and let it stand still,, waiting for a stable reading and a smiley face icon to appear and stay, then again press , the LCD will show a blinking **10.01 pH**. A stable reading and **L M**



H calibration icons will be displayed, see picture (4-1), indicating the three-point calibration has been finished and the meter automatically returns to measuring mode.

5.2.5. Notes

- (a) This meter can perform one-point, two-point or three-point automatic calibrations. After the first point calibration (see item 5.2.2.), press  to confirm one-point calibration and return to measuring mode. The indication icon **M** standing for one-point calibration will appear on the lower left corner of LCD. When the requirement of accuracy is $\leq \pm 0.1\text{pH}$, users can perform a one-point calibration with the pH7.00 buffer solution.
- (b) After the second-point calibration, (see item 5.2.3.), press  to confirm two-point calibration and return to measuring mode. The indication icon **L and M** for two-point calibration will appear on the lower left corner of LCD. User can choose pH4.00 and pH7.00 to calibrate if the measurement is within the acidity range and choose pH7.00 and pH10.01 to calibrate if within the alkalinity range.
- (c) Users should perform a three-point calibration to reach a more accurate measurement if the measuring range is wide, or if the electrode has been used for long or has aging phenomenon. If it's a new electrode, a three-point calibration is necessary to adjust the meter's slope to match the pH electrode.

5.3 Sample Test

Soak the pH electrode into the sample solution after rinsing and drying, hold the electrode still. Take the readings when the smiley face icon shows up and stays on screen (indicates a stable reading).

pH isothermal measurement principle

According to the theory of Isothermal measurements, the smaller the difference of the temperatures between test solution and the calibration solution, the higher the measuring accuracy is. Typically, temperature difference between test solution and calibration solution should $\leq \pm 15^{\circ}\text{C}$; for high accuracy measurement, the temperatures should be the same.

5.4 Parameter Settings

5.4.1. pH measuring parameter setting (Chart (5-1))

Chart (5-1)

Prompt	Parameter Setting Items	Code	Parameters
P1	pH buffer solution series selection	SOL	USA(U.S.A series) NIS (NIST series) CH (China series)
P2	Purified water pH temperature compensation setting	PU1	OFF-On
P3	Ammonia added purified water pH temperature compensation setting	PU2	OFF-On
P4	Temperature unit setting		°C °F
P5	Back light display time setting	BL	0-1-3-6min
P6	Auto power off setting	AC	0-10-20min
P7	Restore to Factory Default		OFF-On

5.4.2. pH buffer solution series selection (P1)

(a) Press  key, meter enters P1 mode: see picture (4-2).



(b) Press  or  key to choose buffer solution series:

USA (Europe & U.S.A series) — 1.68, 4.00, 7.00, 10.01 and 12.45 pH

n 15 (NIST series) — 1.68, 4.01, 6.86, 9.18 and 12.45 pH

LA (China series) — 1.68, 4.00, 6.86, 9.18 and 12.46 pH

(c) Press  key to enter next parameter setting or press  key to confirm and return to measuring mode.

5.4.3. Purified water pH temperature compensation setting (P2)

(a) Short press  key in the mode P1, the meter enters mode P2, see picture (4-3).

(b) Press  or  to choose **ON** or **OFF**.

(c) Press  key to enter next parameter setting or press  key to confirm and return to measuring mode.

(d) The default setting is “ OFF ”.



Note: A PU-1 icon will appear in the upper right corner of the LCD if purified water temperature compensation function is set by the user.

5.4.4. Ammonia added purified water pH temperature compensation setting (P3)

(a) Short press  key in mode P2 to enter mode P3, see picture (4-4).

(b) Press  or  key to choose **ON** or **OFF**

(c) Press  to enter next parameter setting or press  key to confirm and return to measuring mode.

(d) The default setting is “ OFF ”.



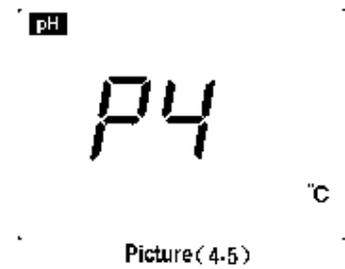
Note: A PU-2 icon will appear in the upper right corner of the LCD if purified water temperature compensation function is set by the user.

5.4.5. Temperature unit °C/°F setting (P4)

(a) Short press **MODE** key in mode P3 to enter mode P4, see picture (4-5).

(b) Press **CAL** or **M+ / RM** key to choose temperature unit: °C or °F.

(c) Press **MODE** key to enter into next parameter setting or press **ENTER** key to confirm and return to measuring mode.



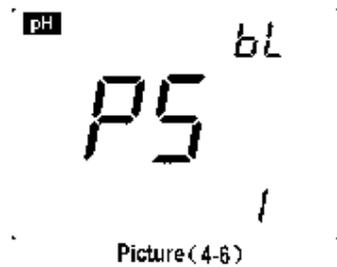
5.4.6. Backlight display time setting (P5)

(a) Short press **MODE** key in mode P4 to enter mode P5, see picture (4-6).

(b) Press **CAL** or **M+ / RM** key to choose the time of back light auto power off: 0 min, 1 min, 3 min or 6 min. The back light display function will be closed if choosing a 0min.

(c) Press **MODE** key to enter into next parameter setting or press **ENTER** key to confirm and return to measuring mode.

(d) The producer setting for P5 is 1min.



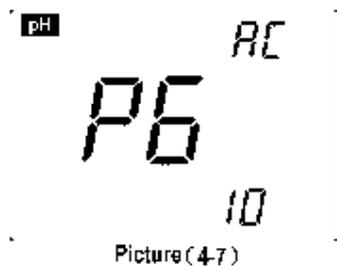
5.4.7. Auto power off time setting (P6)

(a) Short press **MODE** key in mode P5 to enter into mode P6, see picture (4-7).

(b) Press **CAL** or **M+ / RM** key to choose the time: 0min, 10min or 20min. The auto power off function will be closed if choosing 0min.

(c) Press **MODE** key to enter into next parameter setting or press **ENTER** key to confirm and return to measuring mode.

(d) The producer setting for P6 is 10min.



5.4.8. Restore to producer setting (P7)

(a) Short press **MODE** key in mode P6 to enter into mode P7, see picture (4-8).

(b) Press **M+ / RM** or **CAL** key to choose "ON", means that all



the pH measuring parameters have been restored to the factory default setting.

5.5 Special Notes

5.5.1. The frequency that you need to calibrate your meter depends on the tested samples, performance of electrodes, and the requirement of the accuracy. For high-accuracy measurements ($\leq \pm 0.02\text{pH}$), the meter should be calibrated before test every time; For ordinary-accuracy measurements ($\geq \pm 0.1\text{pH}$), once calibrated, the meter can be used for about a week or longer. In the following cases, the meter must be re-calibrated before testing:

- a) The electrode hasn't been used for a long time or a new electrode is connected.
- b) After measuring strong acid ($\text{pH} < 2$) or strong base ($\text{pH} > 12$) solutions.
- c) After measuring fluoride-containing solution and strong organic solution
- d) There is a significant difference between the temperature of the test sample and the temperature of the buffer solution that is used in the last calibration.

5.5.2. The soaking solution contained in the supplied protective bottle is used to maintain activation in the glass bulb and junction. Loosen the capsule, remove the electrode and rinse in distilled water before taking a measurement. Insert the electrode and tighten the capsule after measurements to prevent the solution from leaking. If the soaking solution is turbid or moldy, replace the KCL solution (Product# AI1107).

5.5.3. For calibration accuracy, the pH of the standard buffer solution must be reliable. The buffer solution should be refreshed often, especially after heavy use. We recommend 10-15 times of use before replacing the pH buffers.

5.5.4. Always keep the meter clean and dry; especially around the socket connecting the meter and electrode, otherwise it may lead to inaccurate measurements or a damaged probe/meter. To clean, dry them with medical cotton and rubbing alcohol if the connectors appear dirty.

5.5.5. The sensitive glass bulb at the front of the combination electrode should not come in contact with hard surfaces. Scratches or cracks on the electrode will cause inaccurate readings. Before and after each measurement, the electrode should be rinsed with distilled water and dried. If a sample sticks to the electrode or it's contaminated, the electrode should be thoroughly cleaned using a soft brush with soap water and then rinsed with distilled water.

After that, soak it in the KCL solution again for 6 hours.

5.5.6. An electrode be used for a long time, or measured solution which contains a polluting solute easily for the sensitive bulb, or a substance resulting in jam at the junction, the electrode will be getting passivated, its sensitivity will decrease and its response is getting slow, the reading are not correct. Users could adopt the following methods to clean in various cases:

- (a) Electrodes that have been used over a long period of time will become aged. Submerge the electrode in 0.1mol/L hydrochloric acid for 24 hours, then rinse the electrode in distilled water, then submerge it in 3M KCL soaking solution for 24 hours.
- (b) The method to prepare 0.1mol/L hydrochloric acid: dilute 9mL hydrochloric acid in distilled or deionized water to 1000mL. For serious passivation, submerge the bulb in 4% HF (hydrofluoric acid) for 3-5 seconds, and rinse it in distilled water, then submerge it in the 3M KCL soaking solution for 24 hours to renew it.

Clean contaminated glass bulb and junction (please refer to Table-8)

Table-8 Clean contaminated glass bulb and junction

Contamination	Cleaning Solutions
Inorganic metal oxide	Dilute acid less than 1mol/L
Organic lipid	Dilute detergent (weak alkaline)
Resin macromolecule	Dilute alcohol, acetone, ether
Proteinic haematocyte sediment	Acidic enzymatic solution (saccharated yeast tablets)
Paints	Dilute bleach, peroxide

- 5.5.9. The lifespan period for the 201T-S pH Electrode is about 1-1.5 year, but its life will be shortened if the meter is used incorrectly or is not well maintained. be sure to replace the electrode once it has aged or tested inaccurately
- 5.5.10. When an abnormal reading appears during calibration or measurement, please set P7 to “ON” to restore the meter to Factory Default settings, then re-calibrate the meter before measurement.

5.6 Self-diagnose Information

When using the meter, the following icons might appear. This is the meter’s self-diagnose information, which helps users identify problems occurring with the meter or the electrode when using:

- 5.6.1. The stable icon of -2.00 pH or 19.99 pH — this icon appears when the value has surpassed the measuring range. There will also appear such signs when the electrode is not well connected with the meter or when the electrode is not immersed into the solution. This is a normal phenomenon.
- 5.6.2. “Err1” — Abnormal electrode zero potential (<-60mV or >60mV)
- 5.6.3. “Err2” — Abnormal electrode slope (< 85% or >105%)

When “Err1” or “Err2” appears, the meter can not work properly, please take the following steps to check and fix the problem:

- (a) Check if the electrode bulb has air bubble, if has, please shake the electrode with force for a few times to eliminate the air bubble inside the sensor.
- (b) Check the quality of buffer solution, if it is expired or contaminated. If so, please replace with new ones.

(c) Set the meter to factory default mode then recalibrate it.

If the meter still cannot recover to the normal state after doing the above steps, please replace a new pH electrode.

6 mV Measurement

6.1 Sample Test

6.1.1. Press  key to turn on, and short press  to switch to **mV** mode;

6.1.2. Connect the ORP probe (Product# AI1315, sold separately), soak it into sample solution, stir gently and let it stand still. Get the readings when the smiley face ion appears and stay on the screen.

7 Complete Kit

- WS100 Fluoride/pH meter
- 201T-S 3-in-1 plastic pH/ATC electrode
- F501 Fluoride combination electrode
- pH standard buffer solution (pH4.00, pH7.00 and pH10.01, 50mL)
- Fluoride calibration solution (0.19mg/L and 19mg/L, 50mL)
- Screw driver
- 3x Spare AA batteries
- Operation manual
- Carrying case

8 Warranty

We warrant this instrument to be free from defects in material and workmanship and agrees 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** from the delivery (a **six-month** limited warranty applies to probes). This warranty does not apply to defects resulting from actions such as misuse (violation of the instructions in this manual or operations in the manner not specified in this manual), accidental damage, improper maintenance, or unauthorized repairs. Warranty period is the time limit to provide free service for the products purchased by customers, not the service life of the tester or probe.

9 Appendix 1. Fluoride Concentration Conversion Table

mol/L	pF	mg/L	ppm
1×10^{-3}	3.00	19.00	19.00
1×10^{-4}	4.00	1.90	1.90
1×10^{-5}	5.00	0.19	0.19

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