Operational Manual

Portable Density Meter

LMPDM-A100

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1. Safety Measures


Read this user manual carefully before operating or servicing the instrument.


Do not disassemble or replace accessories without proper authorization to avoid compromising safety.


Do not perform charging operations in explosive or hazardous areas.


Always follow the specified operating procedures during use.


Handle the instrument with care; it is a precision device and must not be subjected to impact or rough handling.


Stop using the instrument immediately if any malfunction or failure is detected.


Only trained and qualified personnel should operate the instrument, following the manual and all relevant safety standards and regulations.


If the measuring cell contains water, do not expose the instrument to environments below 0°C to prevent freezing and damage.


Ensure the power supply is stable and meets the specified rated voltage requirements before use.


Keep the instrument away from moisture, dust, and direct sunlight to maintain optimal performance.


Regularly inspect the device for signs of wear, corrosion, or loose connections.


Store the instrument in a clean, dry, and temperature-controlled environment when not in use.

2. Introduction

Portable Density Meter LMPDM-A100 has an ergonomic design, is light weight and durable. It has U shaped vibrating measurement tube for precise measurements. Digital display to provide quick and accurate readings. Accurate density and temperature measurement helps avoid problems with both quantity and quality.

3. Features

- Rapid measurement
- Compact and light weight for easy portability
- Designed to prevent explosions, ensuring safety and reliability
- Less sample requirement
- Measures density and temperature accurately
- Used as portable as well as desktop device
- Capacitive button enables touch-sensitive and responsive user control

4. Specifications

Model No.	LMPDM-A100
Density measuring range	0 gm/cm3 to 3.0 g/ cm3
Temperature measurement range	5 ℃ to 55 ℃
Accuracy	Density: ± 0.0005 g/ cm3/ ± 0.01 g/cm3, Temperature: ± 0.2 ℃
Repeatability	Density: 0.0002 g/ cm3, Temperature: 0.1 ℃
Resolution	Density: 0.0001 g/ cm3, Temperature: 0.01 ℃
Ambient temperature	-10 ℃ to 60 ℃
Viscosity range	0.5 to 12cSt at 40 ℃
Volume of sample	2 ml
Data storage	5000 results
Working time	More than 20 hours
Explosion proof grade	Ex la IIC T4 Ga
IP level	IP67
Battery	3.7 V rechargeable lithium battery
Interface	Bluetooth
Dimensions	245 × 95 × 125 mm
Weight	650 g

5. Applications

Portable Density Meter is used to measure the density of liquids and is widely utilized in industries such as chemical, pharmaceutical, environmental monitoring, research laboratories, mining, oil, and gas.

6. Instrument Introduction

6.1 Instrument Structure

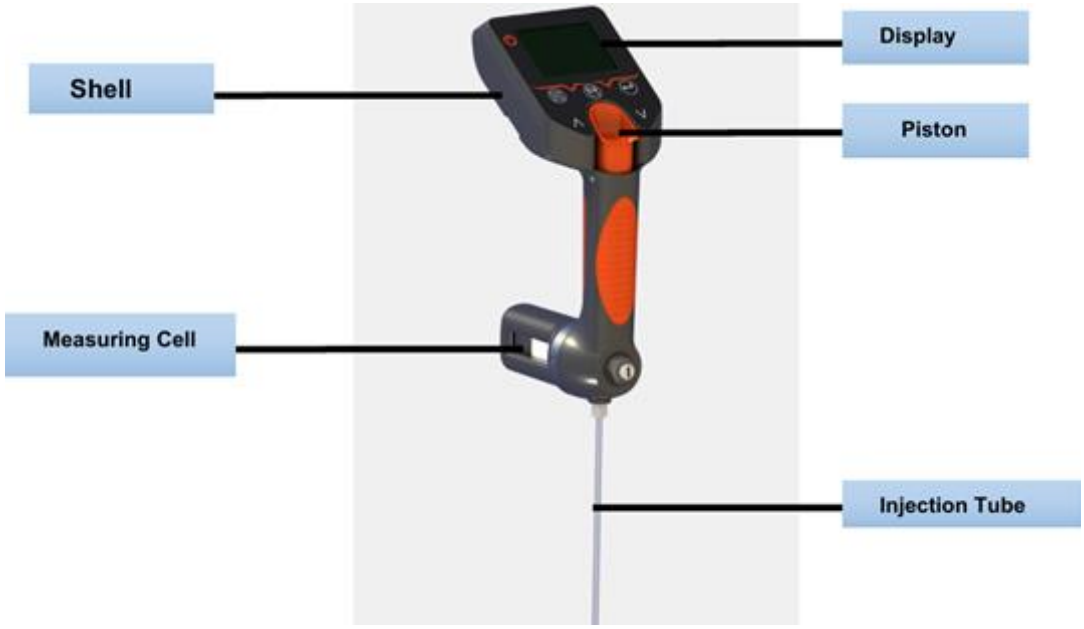

Figure-1

6.2 Key Description

Key Icon	Function
	Long press for 3s to turn on and off
	Confirm
	Main Menu/Return
	Storage
	Make option adjustments

7. Working Principle

Principle of the U-Shaped Vibrating Tube for Density Measurement:
The U-shaped vibrating tube method stands out as a highly accurate and widely recognized technique for determining the density of liquids. This method involves using a U-shaped glass tube, partially filled with the liquid sample, which is subjected to oscillation at its natural resonance frequency through piezoelectric elements or other electronic excitation systems. The oscillation frequency directly correlates with the combined mass of the tube and the liquid it contains. Since the mass of the liquid is unequivocally linked to its density (**Mass = Density × Volume**), any variations in density produce distinct and measurable changes in the oscillation frequency; denser liquids yield lower frequencies, while less dense liquids result in higher frequencies. The system is meticulously calibrated using reference standards with known densities, ensuring precise measurement of unknown samples. This method offers undeniable advantages, such as exceptional accuracy, rapid analysis, and minimal sample volume requirements. Additionally, it remains largely unaffected by factors like viscosity or color, making it exceptionally versatile across a range of applications. It is prominently employed in industries such as pharmaceuticals, food and beverage, petrochemicals, and environmental monitoring. With its remarkable repeatability and sensitivity, this technique is indispensable for quality control and research environments, and it is often integrated into automated digital density meters for streamlined, efficient operation.

8. Operations

8.1 Display description

As shown in **Figure 2,** the primary interface displayed upon booting is the measurement interface.

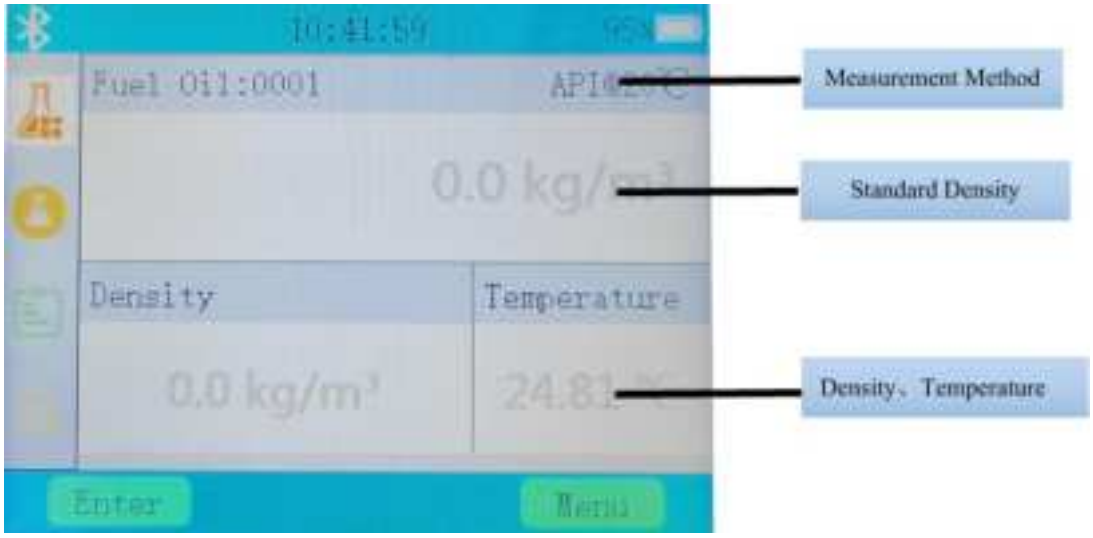

Figure-2

8.2 Preparation

1) Remove the instrument and inspect its appearance along with the pressing piston to ensure it is functioning properly.
2) To turn on the instrument, long-press the “ ” key. Ensure that the temperature display on the interface is functioning correctly. Additionally, check the U-tube sensor through the window for any foreign debris or dirt. If you find any, make sure to clean it before proceeding with measurements.
3) Verify that the power level is adequate. If the density meter indicates low power, ensure to charge it promptly.
4) To charge the density meter, first connect the USB connector of the data cable to the charger and then attach the magnetic charging head to the device's charging port. Afterward, plug the charger into a 220V (50Hz) power outlet. If the magnetic charging head is properly aligned with the charging port, the power status will be indicated on the display screen, and the charging progress will be as illustrated in **Figure 3**. The typical charging duration is approximately 3 to 4 hours. Once charging is complete, disconnect the charger from both the density meter and the power outlet before storing the device.

Figure-3

Note:

- When low battery, charge it in time to avoid affecting normal use.
- If it has not been used for more than one month, it needs to be charged for 4-6 hours.
- When the magnetic charging head meets the charging port, the charging screen " " appears, indicating that charging is normal. Otherwise, the user needs to re-plug the magnetic charging head until the charging screen " " appears.

Attention:

- The density meter must be charged in a safe place.
- A special charger for the density meter must be used for charging.

8.3 Measurement Mode

Density measurement is divided into four steps, namely Turn on, Aspirating liquid, Measuring, and Draining liquid.

Step 1: Turn on: Long-press " " key to turn on the device, press " " key to select the corresponding measurement method and sample number or name. If you do not need to select, you can measure directly, as shown in **Figure 4.**

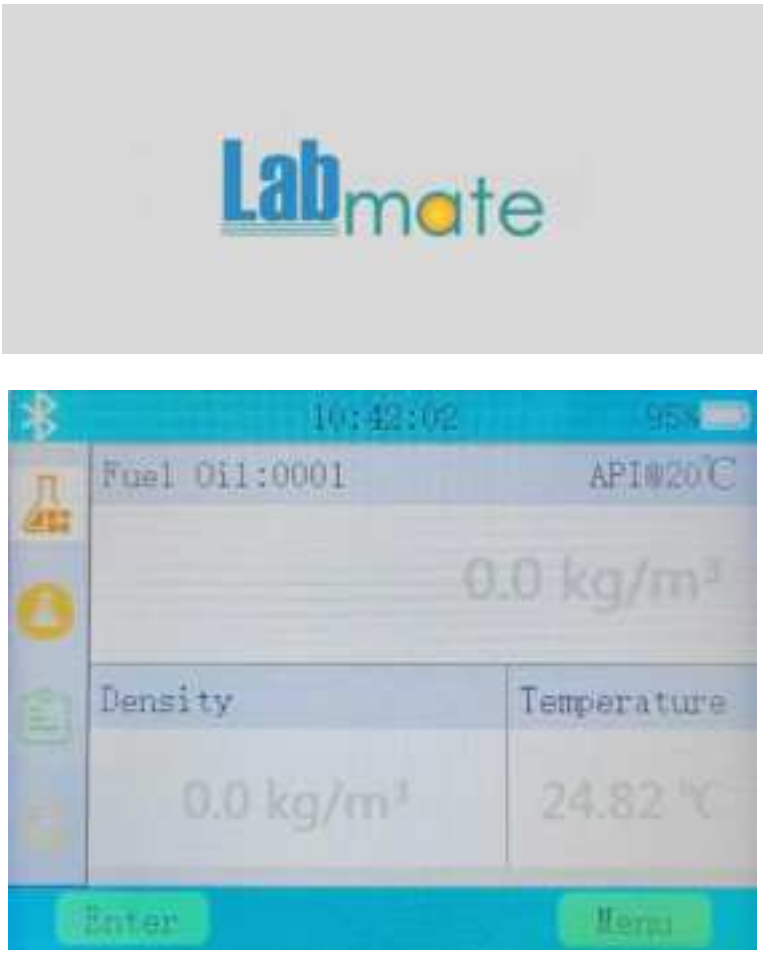

Figure-4

Step 2: Aspirating liquid: Press the piston, press it down as much as possible, insert the sampling tube into the liquid to be measured, slowly lift the piston, and suck the liquid to be measured into the measuring cell. as shown in **Figure 5**.

Figure-5

Step 3: Wait for the measurement data to be stable (judge by yourself in manual mode, the screen progress bar turns green in automatic mode), indicating that the measurement is completed. The device can be read vertically or placed flat for reading, as shown in **Figure 6**.

Figure-6

Step 4: Draining liquid: Insert the sampling tube into the waste liquid bottle, press the piston to drain the liquid, and press it several times to ensure complete drainage.
Note:

- Ensure the measuring cell is free of bubbles. If bubbles are present, multiple samples should be taken to ensure their removal.
- If the user is unable to confirm that the measuring cell is clean, they should take three consecutive samples to ensure the liquid in the measuring cell is free from contamination.
- Ensure to fill the measuring cell completely.
- To achieve optimal measurement results, it is crucial that the sample temperature closely aligns with room temperature. A deviation exceeding 15℃ will not only hinder the accuracy of your measurements but also lead to significantly extended stabilization times. Ensure your sample is properly prepared to guarantee reliable outcomes.
- If the temperature of the measured sample goes beyond the range of 0-55℃, the display will show the alarm "**T-ERR.**"
- Always clean the measuring cell after each measurement to ensure no residues are left behind, guaranteeing the accuracy and reliability of your results.
- Use an appropriate solvent to clean the measuring cell. (Such as ethanol, solvent gasoline).

8.4 Data Storage

After the data is stable, the data can be read directly, or the data can be stored. press "  " key to save the data directly. After saving, "**Save Complete**" will be displayed on the interface. The maximum number of data stored is 5000 groups, as shown in **Figure 7.**

Figure-7

8.5 Operation Completed

After use, clean the measuring cell, then long-press "  " to turn off the density meter. After drying, put the density meter into the instrument box.
Note: The users can use detergent (anhydrous ethanol, gasoline) to clean the measuring cell. During cleaning, continue to inhale and discharge the cleaning agent until the sensor is clean.

8.6 Water calibration

To ensure accurate measurement, the instrument needs to be calibrated regularly to ensure that the measurement accuracy of the instrument is not affected. Generally, we can use deionized water for instrument calibration. The specific steps are as follows:
Step 1: Follow the process in 9.1.1 Measuring cell module cleaning to clean the measuring cell.

Step 2: After powering on, press "  " to enter the menu interface, select **[Advanced Settings]**, and enter the water calibration interface.
Step 3: Inhale deionized water using the instrument to prevent bubbles. Both the deionized water and ambient temperature should be maintained between 15°C and 25°C.

Step 4: Select Start Calibration, press "  ", and the device will start water calibration. The entire water calibration process is in automatic mode, and no additional operations are required, as shown in **Figure 8**.

Figure-8

Step 5: After the water calibration is completed, the device will display the calibration value, as shown in **Figure 9**.

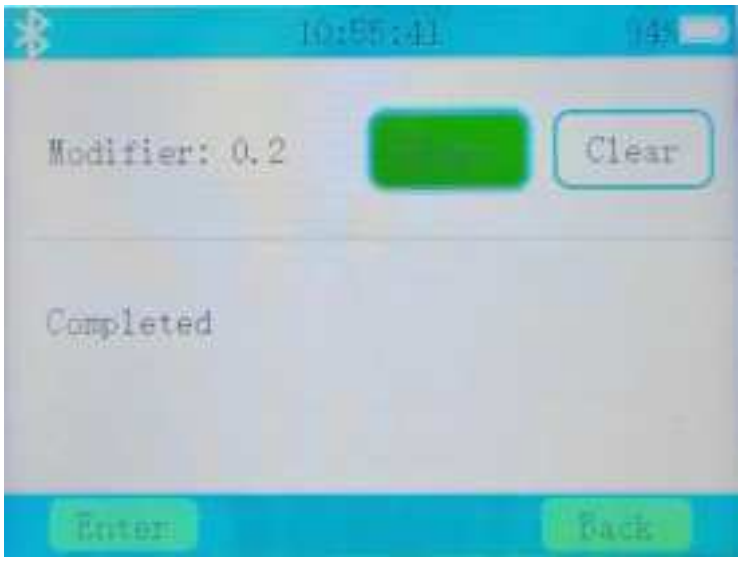

Figure-9

Step 6: If the users need to remove the calibration value, you can choose to reset the calibration and press "  " to remove the calibration value.

Note:

- **During the calibration process, if "Calibration failed: Density ER2-1**" appears, it means that there are bubbles in the measuring cell, or it has not been cleaned.
- **During the calibration process, if "Calibration failed: Temperature ER1-1**" or "Calibration failed: Temperature ER1-2" appears, it means that the liquid temperature in the measuring cell exceeds the set range.

9. Maintenance

9.1 Cleaning

Instrument cleaning can be divided into measuring cell module cleaning, piston cleaning, and shell and display cleaning.

9.1.1 Measuring cell module cleaning

For maintaining the long-term accuracy of measurement results, it's essential to clean the measurement cell module with an appropriate solvent before and after each use. Failing to thoroughly clean the measurement cell may lead to the accumulation of waste liquid and residue, which can compromise the accuracy of the results. Depending on the specific application, it might also be necessary to clean the cell between individual measurements.

The cleaning steps are as follows:

1) Place the injection tube into a suitable container for sample waste liquid.
2) Press the piston to empty the measuring cell.
3) Fill the measuring cell with a suitable solvent.
4) Press the piston multiple times to allow the solvent to circulate multiple times in the measuring cell.
5) Press the piston to empty the measuring cell.
6) Let it be for 10 minutes to dry the measuring cell.

9.1.2 Piston cleaning

When measuring liquids with high viscosity or impurities, some of these substances may remain trapped inside the piston and cannot be completely discharged. To prevent contamination of other liquids being measured, it is important to clean the piston at this point.

The cleaning steps are as follows:

1) Pull the piston button outward, pull out part of it, and then rotate it 45° counterclockwise to pull out the piston, as shown in **Figure 10**.

Figure-10

2) Pull out the upper part of the piston, put it into the cleaning agent, and clean it with a brush, as shown in **Figure 11**.

Figure-11

3) Wipe all parts clean and assemble and reset.
4) Install and reset the piston. The installation method is shown in **Figure 12**.

Figure-12

9.1.3 Housing and display cleaning

Use a soft cloth dampened with a little water or alcohol to clean the case and display.

9.2 Instrument storage

Clean the measuring cell module as described in 9.1.1 Measuring cell module cleaning before storing the instrument for a long period. This stops waste liquids from collecting in the measuring cell, which could lead to imprecise measurements.