GIBERTINI
PRECISION SCALES


# USER MANUAL

# MicroDens

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Use the instrument only for the purpose described in the document. Gibertini Elettronica is not responsible for damage caused by improper use of the instrument.

The results provided by the instrument depend not only on its proper functioning, but also on various other factors. It is therefore recommended that the results be verified by qualified personnel before taking any action based on them.

Index

# MICRODENS USER MANUAL

## Introduction

Thank you for choosing MicroDens, the portable precision digital density meter from Gibertini Elettronica. MicroDens is a professional instrument based on MEMS (Micro-Electro-Mechanical Systems) technology for the accurate measurement of density, specific gravity, and related parameters in industrial, winemaking, petrochemical, and laboratory applications. This manual applies to MicroDens models with firmware version 1.0.0 or later and provides all the information necessary for installation, calibration, use, and maintenance of the instrument.

### 1.1 User Responsibility

- The manual is an integral part of the product. Keep it for the entire working life of the product and make it easily accessible to all those involved in using the instrument.
- The results provided by the instrument depend not only on its proper functioning, but also on several other factors. It is therefore recommended that the results be verified by qualified personnel before taking any action.
- This document does not aim to address all safety issues associated with the use of the instrument and samples. It is the user's responsibility to establish health and safety practices and determine the applicability of regulatory restrictions.
- The instrument is intended for use by qualified and trained technical personnel. It is not intended for home use.

# Safety instructions

## 1.2 Security Message Conventions

This document uses the following security message conventions:

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE indicates a situation which, if not avoided, could result in property damage.

## 1.3 Responsibility

| Description |
|---|

- Use the instrument only for the purpose described in the document.
- Gibertini Elettronica guarantees the correct functioning of the instrument only if no modifications are made to the mechanics, electronics, or software.
- Ensure that all operators have been trained in advance to use the Instrument safely and correctly.
- Use only accessories, consumables or spare parts supplied or approved by Gibertini Elettronica.
- Ensure that the instrument is sufficiently supervised during operation.

## 1.4 Installation and use

| Description |
|---|

- Please read this document before using the Instrument.
- Please follow all suggestions and instructions in this document to ensure proper execution.

## 1.5 Specific precautions

| Description |
|---|

- RISK OF MEASURING CELL BREAKAGE Do not expose the instrument to temperatures below 0°C (32°F) when the cell contains water. Freezing causes irreversible destruction of the MEMS sensor.
  ACTION: Always empty the cell before storing in cold environments. If damaged or malfunctioning, do not continue to use the instrument.
- Do not use the instrument in conditions that could cause damage to property or personal injury.

- Before a measurement, check the chemical resistance of the wettable parts of the instrument to the samples and cleaning agents used.
- Damage to the measuring cell due to solidifying samples. Hot samples cool during measurement. If samples solidify in the measuring cell, it will no longer be possible to empty the measuring cell.
- Only measure samples with viscosity less than 50 mPa*s at room temperature.

- Each time the instrument is turned on (whether after manual or automatic shutdown), the MicroDens automatically calibrates the motorized system and empties the cell if it contains liquid. Always place the fill tube in a waste container before turning the instrument back on.

## 1.6 Precautions for samples

| Description |
|---|

- Observe and comply with national safety regulations regarding the handling of all substances associated with measurements.
- Store only the minimum required amount of sample, cleaning agents, and other flammable materials near the instrument.
- Do not spill samples/cleaners and do not leave containers uncovered.
- Remove spilled sample/cleaning agents immediately.

## 1.7 Batterie

| Description |
|---|

- Observe the correct polarity when inserting the batteries.
- Use only batteries of the same type and with the same charge level.
- Replace batteries only when the instrument is turned off.

- Do not store or use the battery at temperatures below -20°C or above 60°C.
- Do not subject the battery to mechanical stress such as pressure, bending or shock.

## 1.8 Assistance and repairs

| Description |
|---|

- Service and repair procedures can only be performed by Gibertini Elettronica or authorized personnel.
- Disassemble the measuring cell by unauthorized persons will void any warranty.

## 1.9 Disposal

| Description |
|---|

- When disposing of the instrument, please observe the legal requirements of your country.

# Package contents and first start-up

## 2.1 Package Contents

The MicroDens comes in a custom case designed to protect the instrument during transport and store it safely. The case is also ideal for taking the instrument into the field when needed.

Upon opening, you will find the following components:

| | Component | Description |
|---|---|---|
|  | Body of the instrument | The main unit of the MicroDens Digital Density Meter |
|  | Lithium battery | Rechargeable lithium battery<br>- Capacity: 2600 mAh - Battery life: up to 10 hours of continuous use<br>- Charging time: 3-4 hours<br>- The battery may be partially charged. A full charge is recommended before first use. |
|  | Filling tube | PTFE (Polytetrafluoroethylene) Filling Tube - Quantity: 2 pieces (1 use + 1 spare) - Material: Chemical resistant PTFE - Length: 150 mm - Diameter: Compatible with instrument connector - NOTE: Replace if damaged or after 1000 use cycles |
|  | USB – USB-C Cable | For charging the instrument and connecting to the PC |
| | Quick User Guide | Documentation for first start of the Instrument |
| | Calibration certificate | Document certifying factory calibration |

Please verify that all components are included in the package. If any are missing or damaged, contact your Gibertini Elettronica representative immediately.

## 2.2 First Setup

Before using the MicroDens for the first time, you need to assemble it by following these simple steps:

### 2.2.1 Installing the battery

1. Place the instrument on a flat, stable surface, with the display facing down.
2. Locate the battery compartment on the back of the instrument
3. Open the battery door by pressing the locking clip
4. Insert the lithium battery into the appropriate housing - the instrument is equipped with a directional connector that prevents the battery from being connected with the wrong polarity
5. Replace the battery compartment cover.

### 2.2.2 Plugging the filler tube

The MicroDens comes with two filling tubes: one for use and one as a spare.

1. Take one of the filling tubes provided (they are ready to use)
2. Screw the tube into the appropriate fitting on the body of the instrument
3. Make sure the tube is screwed on tightly but without over-tightening, to ensure a proper seal.

The second tube included in the package is a spare part to be kept for possible future use.

## 2.3 First start

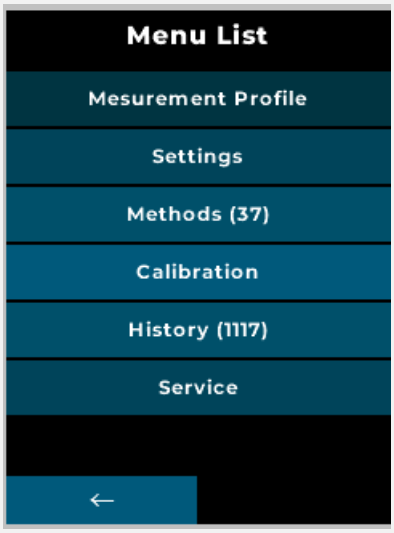
Once assembly is complete, the Instrument will turn on automatically.

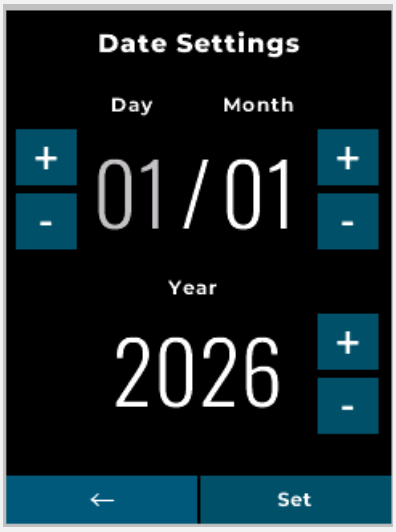
If this does not happen, press the Power button (PWR)

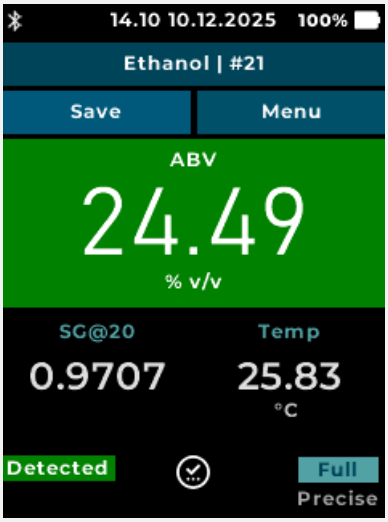
### 2.3.1 First set up

When you first start up the MicroDens, it automatically initializes. To take measurements, you can customize basic parameters, such as date, time, and measurement method, using the setup menu.

1. Language: Select your preferred language from the available list using the arrow keys and confirm with the SET key (paragraph 6.2)
   - Menu → Settings → Settings → Language
2. Date and Time: Set the current date and time: (section 6.3)
   - Menu → Settings → Settings → Date and Time → Set Date
   - Use the arrow keys to change the values
   - Press SET to confirm each value and move to the next one.
   - Confirm the final setting to complete the setup
3. Units: Check the default measurement units and change them if necessary: (paragraph 1.27)
   - Menu → Settings → Global Units
   - Select your preferred units for density and temperature



### 2.3.2 System Check

Before using the instrument for measurements, it is advisable to perform a quick check of the system:

1. Check the battery level (the battery icon should indicate a full charge)
2. Make sure the filler tube is fitted correctly

## 2.4 Preparing for the first measurement

After completing the initial setup and system verification, the MicroDens is ready for the first measurement:

1. Select an appropriate method for your sample (the "Ethanol" method is set as default)
2. Immerse the filling tube in the sample
3. Press the PUSH button to draw the sample into the measuring cell
4. The measurement will start automatically

Before performing measurements on real samples, it is advisable to practice the filling and cleaning procedure using distilled water to familiarize yourself with the operation of the instrument.

# Measuring principle

## 3.1 Definition of density

The density ( ρ ) of a sample is defined as its mass (m) divided by its volume (V):

$\rho = m/V$

Since volume changes with temperature, density is a temperature-dependent unit of measurement.

## 3.2 Measurement method system (MEMS)

The MicroDens operates on the principle of MEMS (microelectromechanical system) technology, a miniaturized and advanced version of the traditional oscillating U-tube method.

Rather than using a conventional glass tube, the MicroDens uses a silicon microcircuit with an omega-shaped channel etched into it. This microchannel is electrostatically excited to oscillate in a vacuum environment. The characteristic oscillation frequency changes depending on the density of the sample filling the microchannel.

The resonant frequency of the microchannel depends on the total mass of the oscillating system, which includes the mass of the channel itself and the mass of the sample inside it. As the sample density increases, the oscillation frequency decreases.

A platinum resistor-based temperature sensor integrated into the MEMS chip precisely measures the sample temperature directly at the measurement point, enabling automatic temperature compensation in real time.

## 3.3 Concentration

In binary mixtures, the density of the mixture is a function of its composition. Therefore, with the help of density/concentration and temperature tables, the density and temperature values of a binary mixture can be used to calculate its composition.

This procedure is also applicable to so-called quasi-binary mixtures, which contain two main components and some additional ones in concentrations very small compared to the two main components.

For example:

- Decarbonated soft drinks can be considered quasi-binary mixtures of sugar and water
- Determination of alcohol concentration in distilled spirits
- Analysis of chemical solutions such as acids, bases and solvents

The Digital Density Meter uses built-in conversion algorithms that allow you to directly display results in application-specific units, such as °Brix, °Plato, alcohol percentage, or other concentration parameters.

# MicroDens - An Overview

The MicroDens represents the latest generation of portable digital density meters, designed specifically for industrial environments by Gibertini Elettronica. This precision instrument offers reliable density and concentration measurements for a wide range of industrial, scientific, and quality control applications.

## 4.1 Main features

- High precision: Density measurements with accuracy up to ±0.0001 g/cm$^3$
- Touchscreen display: Intuitive graphical interface with 2.8" touch control
- Method storage: Over 30 customizable methods
- 5 flexible measurement modes: Precise, Fast, Manual, Slow, and Viscous
- Automatic temperature compensation
- Calculation of derived parameters
- Connectivity: Integrated Bluetooth for data transfer and printing

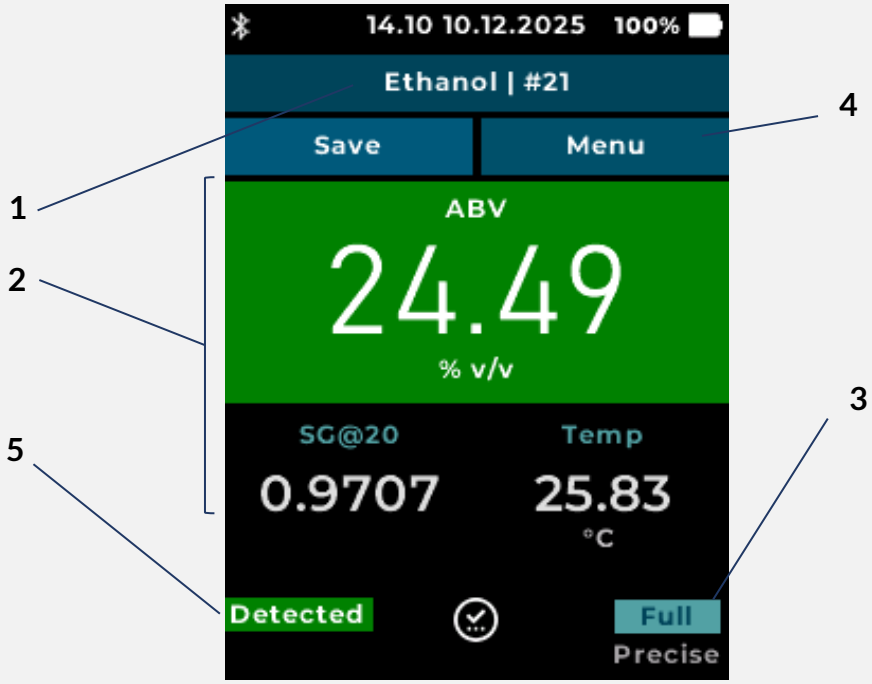
# Description of the instrument

## 5.1 Front/Rear View


| N. | Component Name | Function |
|---|---|---|
| 1 | Power button (PWR) | To turn the instrument on and off |
| 2 | Touchscreen display | 2.8" TFT color display shows results, menus and system information |
| 3 | Navigation keys | UP and DOWN buttons to navigate menus or change values |
| 4 | PUSH physical button | To activate the filling/cleaning pump |
| 5 | SET button | To confirm selections or access submenus |
| 6 | USB-C connector | For charging and communication with PC |
| 7 | Battery compartment | For battery housing |
| 8 | Sampling syringe window | To access the O-ring for the greasing procedure |
| 9 | Measuring cell | |
| 10 | Filling tube | For sample suction into the measuring cell |

## 5.2 Home Page

The main screen displays all essential information relating to the measurement and status of the device




| N. | Section | Element | Description |
|---|---|---|---|
| 1 | Header | Method | Displays the measurement method (e.g. "Ethanol") |
| | | Sample ID | Shows the identifier assigned to the sample under examination |
| | | Battery symbol and perc. | Indicates the battery charge level |
| | | Current time | Displays the current time (e.g. 2.10pm) |
| | | Date | Displays the current date (e.g. 10/12/25) |
| | | Connectivity indicators | Shows the status of Bluetooth connections |
| 2 | Results display fields | Main field | Displays the value of the selected primary parameter (e.g. 24.49 v/v % ABV) |
| | | | The green background indicates that the data is stable based on the chosen measurement mode, if limits are used, the green color signals the data compliance. |
| | | Secondary fields | Density/ SG (e.g. 0.9707) |
| | | | Temperature (e.g. 25.83 °C) |
| 3 | Status bar | Mode | Indicates the active measurement mode (e.g. "Precise") |
| | | Cell state | Indicates the cell's filling status (e.g. "Full") |
| | | Central icon | Measurement status indicator |
| 4 | Key functions | Save | Save the measurement result to the internal memory |
| | | Menu | Access the device's main menu |
| 5 | Indicator/Status | Verify | SmartStabilizer Status Display: Intelligent Measurement Stabilization. |
| | | Detected | |

### 5.2.1 Navigation

To navigate through the various functions of the device:

- Use the function keys displayed at the bottom of the screen
- To save a measurement, press the "Save" button
- To access the main menu and settings, press the "Menu" button

### 5.2.2 Physical buttons and touch pad

The MicroDens features an intuitive control system that combines physical buttons and a capacitive touch pad that allows you to control the instrument simply by touching the buttons on the screen.

| Key | Function |
|---|---|
| PWR | To turn the instrument on and off. |
| UP | Allows you to scroll up through options or increase values |
| DOWN | Allows you to scroll down through options or decrease values |
| SET | Confirms the current selection or accesses the selected submenu |
| PUSH | Single physical button : activates the pump to fill or empty the measuring cell |

The integrated touchpad allows for quick and intuitive navigation through the user interface. Simply touch the on-screen buttons to:

- Select options from the menus
- Confirm or cancel operations
- Save measurement results
- Navigate between different pages and screens

The integration between physical keys and the touchpad offers flexible user experience, allowing you to interact with the instrument in the most comfortable way according to the operating situation.

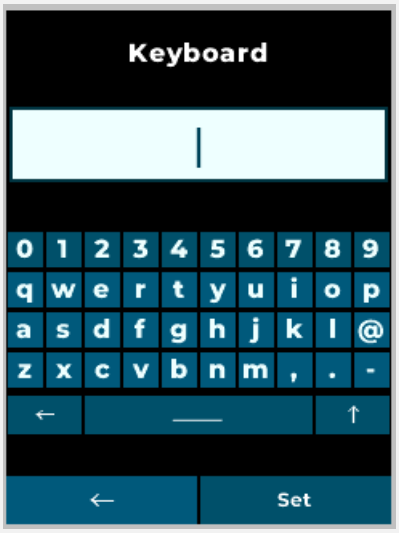
**Quick Return to the Home page**
At any point in the menu or on any firmware page, tapping the page title automatically returns you to the Home page. This shortcut is always active and allows you to quickly exit submenus or advanced functions without having to repeatedly press the Back button.

**Auto-scroll**
By briefly holding down the UP or DOWN key, the cursor automatically begins scrolling through the available options, eliminating the need to repeatedly press the key. This feature is particularly useful for quickly navigating through menus with many items or for entering characters into the virtual keyboard. Releasing the key stops scrolling immediately at the selected item.

## 5.3 Alphanumeric keyboard

When you need to enter text (e.g., a method name, sample ID), MicroDens displays the alphanumeric keyboard screen.
You can fill in the text field in two ways:

- Using the touch screen
  - Directly touch the keys with the desired letters or numbers.
  - Tap the back arrow key to delete the last character entered.
  - When the text is complete, tap Set to confirm and return to the previous screen

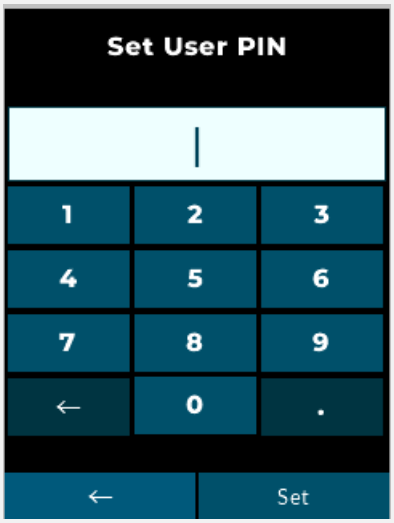



- Using the physical keys (UP/DOWN/ENTER)
  - Use the UP/DOWN keys to move the highlight to the on-screen keyboard keys.
  - Press the SET button to enter the selected character.
  - Move to the back arrow key and press SET to delete the last character.
  - Move to the Set button and press SET to confirm the entered text.

## 5.4 Numeric Pad

To enter numeric values (temperatures, limits, coefficients, PINs, etc.), the instrument displays a simplified numeric keypad.

- Using the touch screen
  - Tap the desired numbers in the correct order.
  - Use the left arrow key to delete the last digit entered.
  - Use the “.” key to enter the decimal separator when prompted.
  - Touch Set to confirm the value and return to the previous screen .




- Using the physical buttons (UP/DOWN/SET)
  - Use UP/DOWN to select the number key on the display.
  - Press SET to enter the selected digit.
  - Select the back arrow and press SET to delete the last digit.
  - Select Set and press SET to confirm the entered value.

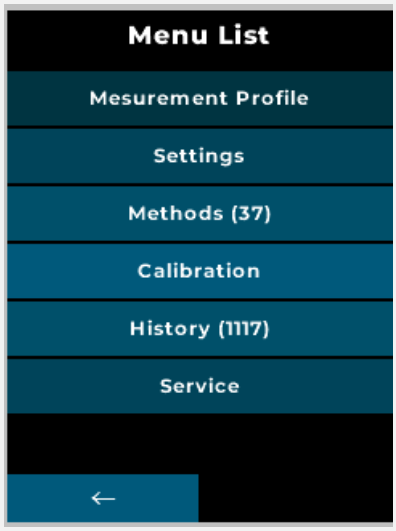
# Instrument Settings

This chapter illustrates all the available settings that allow you to customize your MicroDens portable Digital Density Meter to your specific needs and preferences.

## 6.1 Accessing the Settings Menu

To access the instrument settings:

1. From the Home Page, tap the Menu button
2. Select Settings from the main menu
3. Navigate through the settings using the arrow keys or by tapping the fields on the screen directly.
4. Press the Set button to confirm your selections




### 6.1.1 Device Information

To view the technical information of your device:

1. Tap Menu → Settings → Device Information
2. Information Available
    - Model: Model Name of the instrument
    - Firmware Version: Current software version
    - Serial Number: Unique identifier of the device
    - Hardware Version: Electronic board revision
    - Sensor Info: Sensor type
    - Sensor Serial Number

This information is required for technical support.

## 6.2 Language Setting

1. Tap Menu → Settings → Device Settings → Language
2. Use the arrow keys to select your preferred language from those available
3. Press Set to confirm your selection

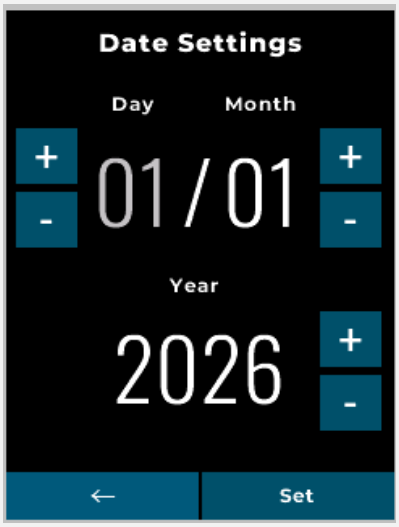
Changing the language is immediately applied to all instrument screens and menus.

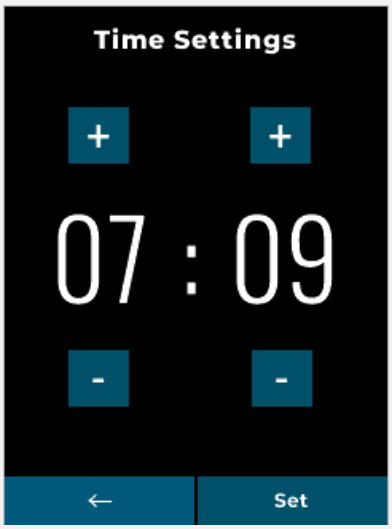
## 6.3 Date and Time Settings

The date and time information is automatically saved with each measurement and displayed in the header of the main screen.

### 6.3.1 To set the date or time:

1. Tap Menu → Settings → Device Settings → Date and Time
2. Select Set Date or Set Time then press Set
3. Enter the current date or time
4. Press Set to confirm




### 6.3.2 To set the date or time format:

1. Menu → Settings → Device Config → Date and Time
2. Select Date Format or Time Format then press Set
3. For the date format, select one of three options:
    - DD.MM.YYYY (Day.Month.Year)
    - YYYY-MM-DD (Year-Month-Day)
    - MM/DD/YYYY (Month/Day/Year)
4. For the time format, select one of two formats:
    - 24h (24-hour clock)
    - AM/PM (12-hour clock)

## 6.4 PIN protection

You can protect access to the menu with a PIN (Personal Identification Number). Once PIN protection is enabled, you can still use all the functions in the quick access area (perform measurements and checks, select methods and sample IDs, etc.) without having to enter a PIN.

### 6.4.1 To activate PIN protection / New PIN :

1. Tap Menu → Settings→ Device Settings → PIN Settings
2. Select Activate PIN then press Set
3. The default PIN "1111" will be required
4. Select New PIN then press Set
5. Enter your 4-digit PIN

### 6.4.2 To disable PIN protection:

1. Menu → Settings→ Device Settings → PIN Settings
2. enter the active PIN
3. Tap Turn Off PIN

Be sure to remember the PIN you set, as you won't be able to disable PIN protection without it. The default PIN is 1111

## 6.5 Global Units (Density and Temperature)

The MicroDens Density Meter allows you to select different Measurement Units to display density and temperature results based on your preferences or the specific requirements of your application.

### 6.5.1 Set the density unit:

1. Tap Menu → Settings → Global Units
2. Select Density Units then press Set
3. Use the arrow keys to select the desired density unit:
   - $g/cm^3$ (grams per cubic centimeter)
   - $kg/m^3$ (kilograms per cubic meter, where 1 $g/cm^3$ = 1000 $kg/m^3$)
   - lb/gal (US) (pounds per US gallon, where 1 $g/cm^3$ = 8.3454 lb/gal)
   - lb/gal (IP) (pounds per imperial gallon, where 1 $g/cm^3$ = 10.0224 lb/gal)
4. Press Set to confirm your selection

### 6.5.2 Set the temperature unit:

1. Tap Menu → Settings → Global Units
2. Select Temperature Unit then press Set
3. Use the arrow keys to select the desired temperature unit:
    - C (Celsius degrees)
    - F (Fahrenheit degrees)
    - K (Kelvin)
4. Press Set to confirm your selection

### 6.5.3 Notes on using Measurement Units

- The selected units are applied to all measurement methods and will be used to display the results on the main screen.
- The values saved in the internal memory maintain the Measurement Units selected at the time of measurement
- Changing the Measurement Units does not affect the accuracy of the measurement, but only the way the results are displayed and stored.
- The instrument's calibration includes an offset always expressed in $g/cm^3$ with an accuracy of up to five decimal places.

### 6.5.4 Common Conversion Factors

| From | TO | Conversion factor |
|---|---|---|
| $g/cm^3$ | $kg/m^3$ | × 1000 |
| $g/cm^3$ | lb/gal (US) | × 8.3454 |
| $g/cm^3$ | lb/gal (IP) | × 10.0224 |
| °C | °F | (°C × 9/5) + 32 |
| °C | K | °C + 273.15 |

Conversions are handled automatically by the MicroDens firmware; this table is provided for reference only.

## 6.6 Display Settings

### 6.6.1 Set the display brightness:

1. Tap Menu → Settings → Display
2. Select Display Brightness then press Set
3. Use the arrow keys to select the desired brightness level (from 20% to 100%)
4. Press Set to confirm your selection

### 6.6.2 Set display dimming or reduce screen brightness:

1. Tap Menu → Settings → Display
2. Select Display Dimming then press Set
3. Select a timeout option for attenuation:
    - Off (disabled - no automatic dimming)
    - 30 seconds
    - 60 seconds
    - 90 seconds
    - 120 seconds
4. Press Set to confirm your selection

When dimming is enabled, the display will automatically dim after the selected period of inactivity to conserve power. Tap any button or the screen to restore normal brightness.

### 6.6.3 Auto Stand-by

This feature allows you to set a period of inactivity after which the device automatically enters standby mode, reducing power consumption without shutting down completely.

The available options are:

- Off (disabled)
- 60 seconds
- 90 seconds
- 120 seconds
- 180 seconds

When the set time elapses without any interaction, the device goes into standby. To reactivate it, simply press a button.

### 6.6.4 Set auto power off:

1. Tap Menu → Settings → Display
2. Select Auto Power Off then press Set
3. Select a timeout option for automatic shutdown:
    - Off - Disabled (no automatic shutdown)
    - 5 minutes
    - 10 minutes
    - 15 minutes
    - 30 minutes
4. Press Set to confirm your selection

When the auto-off feature is enabled, the device will automatically turn off after the selected period of inactivity to conserve power. Press and hold the power button (PWR) for 3 seconds to turn the device back on.

## 6.7 Connections

The MicroDens supports several connection modes for data export and printing.

### 6.7.1 Export Destination Configuration

To set the destination:

1. Tap Menu → Settings → Connections → Export Destination → Destination
2. Select one of the available options:
    - None: Disable external connections (maximum power saving)
    - Bluetooth Printer: For direct printing via a compatible BLE Bluetooth printer
    - Computer: For PC data transfer via MicroDens Dongle BLE key

### 6.7.2 Connection Mode

Bluetooth printer

- Use a thermal printer compatible with Bluetooth SPP profile
- First connection requires Bluetooth pairing
- Direct printing from the quick access area or data menu

Currently, the instrument's software is designed to communicate only with the printer supplied by Gibertini. It is not possible to connect or use Bluetooth printers from other manufacturers with the MicroDens.

PC with MicroDens Dongle

- Connect MicroDens Dongle to PC
- Enable Bluetooth reception on your PC (MicroDens Logger / Logger Pro software)
- Export data via Menu → History → Send Data

PC-USB Direct

- Connect USB-C cable to PC
- Use terminal software or dedicated application
- Serial communication at 115200 baud, 8N1

For complete details on USB commands and communication parameters, see Appendix E—PC-USB Communication.

## 6.8 Factory Reset

Tap Menu → Settings → Factory Reset

This action resets most of the instrument's settings to their factory default values. In detail:

What is restored:

- Language: Set to the default language (usually English).
- Measurement methods: The factory default methods are restored. User-created custom methods are not deleted by the reset: they remain stored and remain available. To delete a custom method, use the dedicated function on the Menu → Methods → Delete page.
- Active method: Set to “Ethanol”.
- Sample ID: Set to running counter mode.
- Date and time formats: Date in DD.MM.YYYY format, 24-hour clock.
- Measurement mode: set to “Precise”.
- Printer: No printer associated.
- Export data format: delimiter set to semicolon (;), decimal separator set to comma.
- Measurement Units: temperature in °C, density in g/cm$^3$.
- PIN protection: disabled.
- Factory preset custom parameters, including display parameters, power saving, connections, firmware settings, data export and other general settings.

What is automatically preserved and restored:

- Device serial number
- Unique device ID
- Factory calibration
- Custom user information (e.g. operator name or notes)
- Hardware and software versions
- Saved calibration parameters, including calibration offsets accurate to five decimal places in g/cm$^3$
- Specific parameters (number of decimal places for density, alcohol and temperature)
- Active sensor parameters (software options, liquid type, sensor offset)

This data is retained to ensure operational continuity and traceability, preventing it from being deleted during the reset.

## 6.9 Methods

Methods are sets of pre-configured measurement settings that allow you to quickly switch between applications without having to manually reconfigure each parameter.

### 6.9.1 Structure of the methods

Each MicroDens method includes the following settings:

- Method Name : The method identifier (up to 10 characters, can contain letters "A-Z", digits "0-9", special characters ".", "-", "@", and spaces)
- Measurement parameters :
  - Parameter 1 : The main parameter displayed (e.g. density, °Brix, %alcohol)
  - Parameter 2 : An optional secondary parameter
- Limits : Minimum and maximum acceptable values for Parameter 1
  - Results outside these limits are highlighted with a red background.
  - Useful for immediately identifying out-of-spec samples
- Temperature Coefficient Alpha: Used to calculate density at temperatures other than the measurement temperature
- Measuring Way: Precise, Fast, Manual, Slow, Visco
- Print:
  - None: Does not print automatically
  - Data Only: Print only the essential values
  - GLP: Print a comprehensive Good Laboratory Practice compliant report, including all measurement details, date, time, instrument and calibration.

### 6.9.2 Mode (Measuring Way)

MicroDens uses advanced digital filtering algorithms to ensure accurate and stable results. Each mode implements optimized parameters to balance accuracy and speed.

Precise Mode (PRECISE)

- When to use: For measurements requiring maximum accuracy and repeatability
- Algorithm: Adaptive stability system with automatic detection of changes
- Stability Criterion: The result is stored when 20 consecutive readings remain stable within 0.5% variation
- Time: Variable (5-20 seconds) based on temperature and sample stability
- Visual indicator: Green background when stable, blue when not stable, red if out of tolerance

Fast Mode (FAST)

- When to use: For routine checks where response time is important
- Algorithm: Filtering optimized for speed while maintaining good accuracy
- Stability Criterion: The result is stored when 10 consecutive readings remain stable within 1% variation
- Time: Variable (1-5 seconds), significantly faster than Precise mode
- Visual indicator: Green background when stable, red if out of tolerance

### Manual Mode (MANUAL)

- When to use: For problematic samples or when direct operator control is required
- Algorithm: Minimal filtering with continuous real-time value display
- Storage: Press the Save button when the displayed value is deemed stable by the operator
- Time: Instant on user command
- Note: No automatic stability criteria - operator's responsibility

### Slow Mode (SLOW)

- When to use it: For moderately viscous samples such as light oils, diluted syrups or solutions with viscosity between 5-15 mPaS
- Algorithm: Same adaptive stability system as Precise mode, combined with reduced engine speed (1.8× slower than standard) and maximum engine torque (100%)
- Stability Criterion: Identical to Precise mode - result is stored when 20 consecutive readings remain stable within 0.5% variation
- Stabilization time: Variable (6-10 seconds) based on sample viscosity and temperature
- Visual indicator: Green background when stable, blue when not stable, red if out of tolerance
- Note: Reduced motor speed prevents over-agitation of the sample, ensuring more stable readings with viscous liquids

### Visco Mode (VISCO)

- When to use it: For highly viscous samples such as thick oils, concentrated syrups, honey, or solutions with viscosity greater than 15 mPaS
- Algorithm: Same adaptive stability system as Precise mode, with minimum engine speed (2.8× slower than standard) and maximum engine torque (100%)
- Stability Criterion: Identical to Precise mode - result is stored when 20 consecutive readings remain stable within 0.5% variation
- Stabilization time: Variable (6-12 seconds) based on sample viscosity and temperature
- Visual indicator: Green background when stable, blue when not stable, red if out of tolerance
- Note: Designed for the most demanding viscous samples. The very low motor speed, combined with maximum torque, ensures reliable sample handling and accurate measurements even with dense fluids.

Comparison of Measurement Modes

| Mode | Target Samples | Engine Speed | Precision | Typical Weather |
|---|---|---|---|---|
| Precise | Standard liquids | Normal | Maximum | 5-20 seconds |
| Fast | Routine checks | Normal | Good | 1-5 seconds |
| Manual | Problematic samples | Normal | At the operator's discretion | Instant |
| Slow | Moderately viscous | 1.8× slower | Maximum | 6-10 seconds |
| Visco | Highly viscous | 2.8× slower | Maximum | 6-12 seconds |

For most applications, start with Precise mode. Switch to Fast mode only if the measurement times are too long and the application allows for lower accuracy.

### 6.9.3 Predefined methods and application packages

The MicroDens comes with a set of predefined standard methods, ready to use right out of the box and designed to cover the most common applications. This base is complemented by application packages dedicated to different sectors, which can be unlocked to extend the instrument's capabilities with specific methods. The method library is therefore constantly evolving and can be expanded over time with firmware releases and the activation of new packages.

All methods, whether predefined or packaged, can be customized: modifying a method automatically generates a copy as a user method, adaptable to your needs (name, control limits, measurement settings), while the manufacturer-certified original remains available and unchanged. The actual list of methods present on your instrument can be consulted at any time via Menu → Methods.

## 6.10 Method Management

The system allows you to create custom methods and modify existing ones. The methods are divided into:

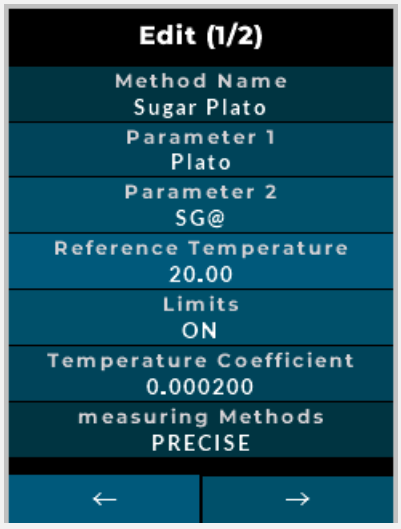
- Default methods: Provided by the system; cannot be modified or deleted
- User Methods: Created by the user or duplicated from predefined methods, fully customizable

### 6.10.1 Creating a New Method

Path: Menu → Methods → Create New

The configuration screen opens with the following settings:

1. Configurable parameters (Page 1):

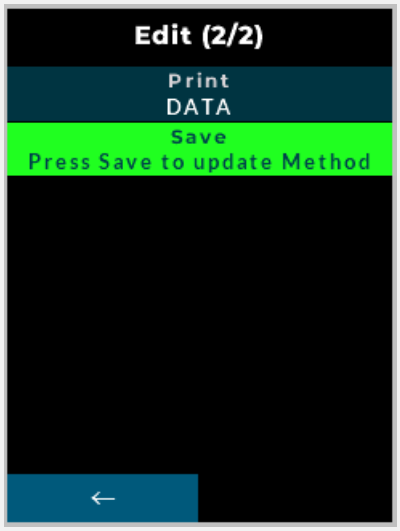



- Method Name: Enter a unique and descriptive name (max 10 characters)
- Parameter 1: Select the main parameter to display
- Parameter 2: Select the second parameter (based on Parameter 1)
- Reference Temperature: Set the reference temperature (default 20°C)
- Limits: Enable and configure upper and lower limits for quality control
- Temperature Coefficient (α): Set the thermal expansion coefficient (if applicable)
- Measuring Methods
- Tap ► to go to the next page

Configurable parameters (Page 2):

- Print Mode: Select the print mode (None, Data, GLP)

2. Once setup is complete, press Save
3. The method is saved and added to the user methods list
4. Press Back to return to the Method Management menu




The method name must be unique and cannot be the same as that of an existing method (built-in or user-defined).

All user-defined methods are displayed in the list after the built-in methods

## 6.10.2Modifying an Existing Method

Path: Menu → Methods → Edit

Procedure:

1. The complete list of methods (default + user) is displayed.
2. Scroll through the list using ◄ and ►
3. Tap the method you want to change
4. The editing screen opens with all the method parameters

| Default Method | User Method |
|---|---|
| • The system automatically duplicates the method as a new method | • The method is modified directly |
| • The original default method remains unchanged | • All changes overwrite the existing configuration |
| • You can change all parameters of the new method, including the name. | • Make the desired changes to the parameters |
| • The new method is saved in the user methods list | • Press Save to confirm the changes |

If you modify the default “Ethanol” method, the system automatically creates a new user method that you can rename and customize as you like.

### 6.10.3Deleting a Method

Path: Menu → Methods → Delete

Procedure:

1. The list of user methods is displayed
2. Scroll through the list using ◄ and ►
3. Tap the method you want to delete
4. A confirmation message appears: Title: “Delete Method” label:" *[Name] Confirm Action?* "
5. Tap OK to confirm
6. The method is permanently removed from memory
7. Tap Back to return to the Method Management menu

| Special cases | Default Methods |
|---|---|
| • *“No user methods available* " is displayed.<br>• Method currently in use: You can also delete the currently selected method for measurements (the system automatically returns to the default method) | • They can be selected for measurements<br>• They CANNOT be modified directly<br>• They do NOT appear in the delete list<br>• They CANNOT be deleted |

This protection ensures that the manufacturer's certified methods always remain available and unchanged.

### 6.10.4Complete Flow Example

Scenario: Customizing the default "Ethanol" method

1. Menu → Methods → Edit
2. Select "Ethanol" from the list
3. The system automatically duplicates the method by creating "Ethanol" (user method)
4. Change the name to "MyMet"
5. Change control limits: Min = 39.5%, Max = 40.5%
6. Press Save
7. The new method " MyMet" is now available in the methods list after the default methods.
8. The default "Ethanol" method remains unchanged

## 6.11 Assigning a Method to a Measurement

To select the method to use for measurements:

Path: Menu → Measurement Profile → Methods

or

press the touch screen near the preset method (blue button at the top of the screen, then press Methods)

Procedure:

1. The list of available methods is displayed
2. ◄ (previous page) and ► (next page) buttons
3. Tap the desired method to select it

Confirm selection:

- The selected method is displayed in the top button of the Home Page
- All subsequent measurements will use this method until a different one is selected.

Example:
If you select the "Beer DryExt" method, the Home button will show:

Beer DryExt | #127 (where #127 is the progressive measurement counter or the selected Sample ID)

The button always displays the current method along with the sample ID or the running counter, depending on the configuration.

## 6.12 Defining and Displaying Control Limits

Quality control limits allow you to automatically identify when measurement results fall outside the desired specifications.

### 6.12.1Configuring Limits

Path: Menu → Methods → Edit → [Select Method] → Limits

Procedure:

1. Select the method to add/edit limits to
2. On the method setup page, tap Limits
3. The limits configuration screen opens with two fields:
    - Upper Limit (Max): Maximum acceptable value
    - Lower Limit (Min): Minimum acceptable value
4. Tap Upper Limit and enter the desired maximum value
5. Press Set to confirm
6. Tap Lower Limit and enter the desired minimum value
7. Press Set to confirm
8. Press Back to return to the method setup page
9. Press Save to save your changes

Automatic activation: Limits are automatically activated when a value other than zero is entered for the upper or lower limit.

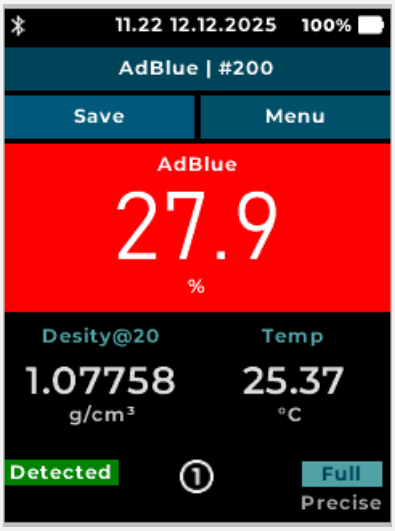
### 6.12.2To Which Parameters Do the Limits Apply ?

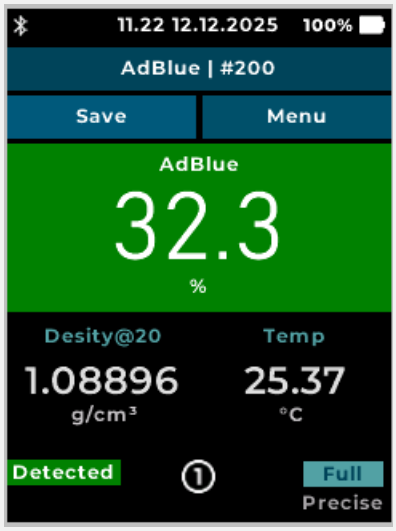
The system allows you to configure limits for both method parameters:

- Parameter 1: Limits configurable via the user interface

Quality Control:
For the final quality control of the measurement, only Parameter 1 is checked:

- If Parameter 1 is out of limit → The measurement is marked as OUT_OF_LIMITS




### 6.12.3Displaying Limits During Measurement

When taking a measurement with a method that has limits enabled:

During measurement (Home Page):

- The system automatically checks whether Parameter 1 is within the limits
- A confirmation screen appears with:
  - GREEN background if Parameter 1 is stable within limits (OK)
  - RED background if Parameter 1 is out of limits (OUT_OF_LIMITS)

### 6.12.4View in History

The measurements saved are marked according to their quality status:

In the history list:

- Green icon or "OK" indicator: Parameter 1 within limits
- Red icon or indicator "OUT_OF_LIMITS": Parameter 1 out of limits

### 6.12.5Disabling Limits

To disable the limits of a method:

1. Access the method configuration (Edit → *Select Method* → Limits)
2. Set both limits (upper and lower) to 0.0000
3. Press Save

When limits are disabled, all measurements are considered OK regardless of their value.

### 6.12.6Default Limits

The manufacturer's default methods have preconfigured limits based on technical specifications. When you duplicate a default method, the limits are automatically copied to the new user method and can be freely modified.

Important Notes

- The limits apply to the units shown on the display (taking into account any active conversions)
- If you change the unit of measurement for Parameter 1, the limits must be updated accordingly
- The limits are permanently saved with the method and applied to all subsequent measurements
- Limit checking occurs in real time during measurement
- Measurements outside the limits are still saved (they are not rejected), but marked for traceability

# 6.13 Offset

## 6.13.1Purpose

Each method has an Offset field: a correction value that can be set manually and independently for each method, which is automatically added to Parameter 1 in every measurement performed using that method.
It is a fine-tuning tool available to the operator, which allows—when deemed appropriate—the reading of Parameter 1 to be aligned with a reference value. The correction is limited to the individual method and does not alter the instrument's calibration in any way.
The field is optional: if left at 0, the method operates without any correction. The offset is set in the unit of measurement displayed for Parameter 1 and can be positive or negative.

## 6.13.2Difference from Calibration (Water / Standard)

It is important not to confuse the two functions which operate at different levels:

| | Calibration (water / standard) | Method offset |
|---|---|---|
| What it affects | the measuring cell (the entire instrument) | only Parameter 1 of the specific method |
| Scope | global, applies to all methods | limited to that method |
| When to use it | to bring the cell back to true value (e.g., distilled water) | to align a specific product with the laboratory reference |

Calibration keeps the cell "true" and should not be used to correct for the bias of a single product (you would throw off all other measurements). The method offset applies the correction exactly where it's needed, without affecting the cell calibration. The two levels are independent and add up.

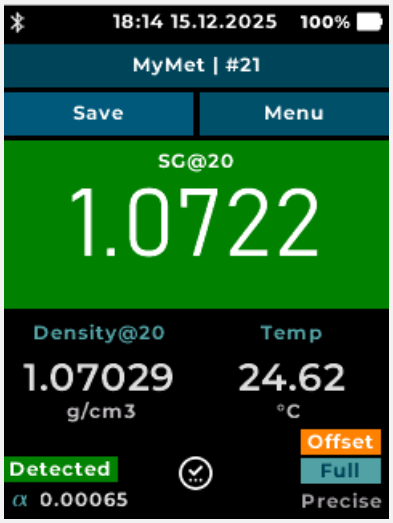
## 6.13.3How To Set it Up

- Open Menu → Methods → Edit (or create a new method) and select the desired method.
- On page 1 of the editor, select the Offset option.
- Enter the offset value using the numeric keypad (as an absolute value) and confirm with SET.
- Select the sign on the screen that appears:
  - Add (+) → the offset is added to the result;
  - Subtract (−) → the offset is subtracted from the result.
- Go back and save the method.

The offset is entered in the unit of measurement currently displayed for Parameter 1. If you leave the value at 0, the offset is disabled and the method behaves exactly as before.

The change takes effect immediately: if you modify the offset of the active method and save, the correction is applied immediately to subsequent measurements, without having to restart the instrument or reselect the method.

### 6.13.4The “Offset” Badge on the HomePage




When a measurement is in progress with a result displayed on the screen and the active method has a non-zero offset, the “Offset” indicator appears on the Home Page. This serves to remind the operator that the displayed value includes an offset correction. The indicator disappears when the chamber is empty or if no offset is set for the method.

(Similarly, the temperature coefficient α indicator appears when the method applies an α correction.)

- The offset affects only Parameter 1; Parameter 2 remains unchanged.
- The offset is a property of the method: each method has its own, and it is saved along with the method.
- Use the offset only when you have a reliable laboratory reference for the product: an incorrect offset will skew all measurements for that method.

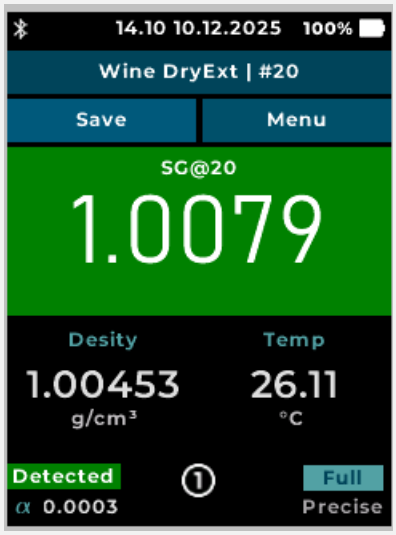
## 6.14 Double reading methods

Some MicroDens methods, such as BeerQuick, Beer DryExt, and Wine DryExt, use a two-reading, correlated procedure to calculate advanced parameters (alcohol, true/dry extract, attenuation, etc.). The first reading records the sample "as is"/OG, the second reading is performed on a linked sample (fermentation or distillate), and the results are automatically combined using a unique sample ID.

### 6.14.1Operating principle

With the first reading, the instrument measures the density of the product (e.g., beer wort, grape must, finished beer, finished wine) and saves the value along with a sample ID, date, and time.
With the second reading, the instrument measures the density of the related sample (e.g., fermenting beer/wine or distillate) and uses the pair of readings associated with the same ID to calculate all the parameters required by the method.

### 6.14.2Common operational flow



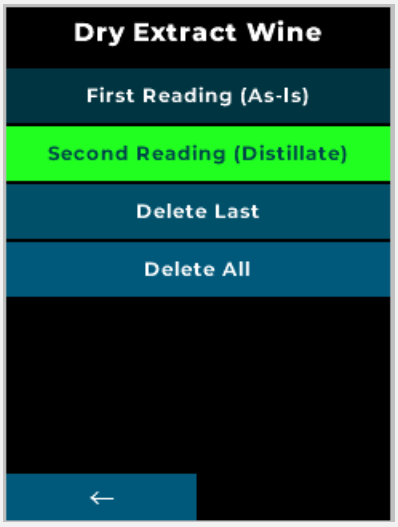

1. First Reading (First Reading / As -Is)
   - Select the special method (BeerQuick, Beer DryExt or Wine DryExt).
   - Prepare the sample according to the method instructions (degassing, filtration, if necessary, temperature close to 20 °C).
   - Perform the measurement as a normal measurement.
   - When the value is stable, the top left button displays Save: pressing it saves the reading as the first reading with a unique sample ID.
2. Rinse the instrument and prepare for the second reading
   - Flush and rinse the measuring cell according to the recommended cleaning procedures.
   - Prepare the sample for the second reading (fermenting beer, beer distillate, wine distillate) from the same batch as the first reading, if you intend to proceed immediately.

**Quick Access to the Reading Selection from the Home Page**
When a dual-reading method is active (Wine DryExt, Beer DryExt, or BeerQuick), an icon displaying the current reading number (1 or 2) appears on the Home Page. Tapping this icon opens the reading type selection page directly, allowing the operator to quickly switch between the first and second readings without having to navigate through the menu.

3. Non-consecutive reading management
   Using these methods does not require the two readings to be performed one after the other, but it is possible, for example:
   - perform and save all the first readings of a batch (must, wines, finished beers) during the day;

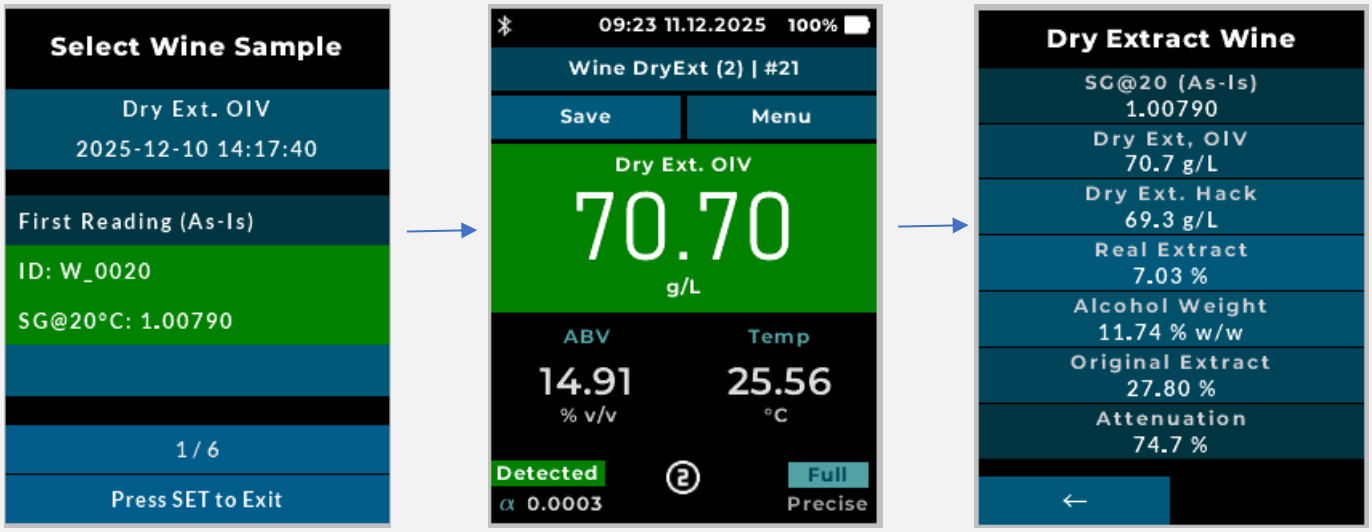
- Later you can recall the saved IDs and proceed with the second readings (intermediate fermentations, distillates) by associating them with the corresponding first readings.
  The first readings remain available until they are manually deleted or exceed the set validity period (default 30 days).

4. Access to the reading management menu (Select button)
   - When you re-enter one of these methods with the Empty Tank, the button that normally shows Save is replaced by Select.
   - Pressing Select opens the reading management menu, which typically contains:
     - First Reading (As -Is): to record a new first reading or repeat it.
     - Second Reading (Fermentation / Distillate): to perform a second reading by associating it with an already saved ID.
     - Delete Last: to delete the last reading (As-Is)
     - Delete All: to delete all saved readings for that method.




This behavior of the Save → Select button is specific to double-read methods and is the only exception to the standard operation.

5. Second Reading
   - From the management menu, choose Second Reading.
   - The Instrument displays the list of available sample IDs related to the first saved readings.
   - Select the ID that corresponds to the batch you want to complete and confirm.
   - Fill the cell with the sample for the second reading, wait for stabilization and press Save.
   - The instrument automatically associates the new reading with the selected ID and calculates all derived parameters.



### 6.14.3Viewing Results

After the second reading, each double reading method presents:

- a main page with key parameters (e.g. ABV and real extract for BeerQuick, real extract and alcohol for Beer DryExt, dry extract and alcohol for Wine DryExt);
- a dedicated results page with all the parameters calculated for that application (reconstructed OG, apparent or dry extract, attenuations, density difference, alcohol by volume and weight, etc.).
    - To access the results page, touch the screen corresponding to the parameter 1 (green) value

Pairs of readings linked by the same sample ID are stored and can be exported via BLE for analysis or traceability.
See the section on BLE export specifications for these methods.

## 6.15 Sample IDs

Sample IDs allow you to label and track your measurements, making it easier to identify and organize your data.

### 6.15.1Sample ID Characteristics:

- You can define up to 250 different sample IDs
- Each ID can contain up to 10 characters
- Allowed characters: letters "A-Z", digits "0-9", special characters ".", "-", "@" and spaces

The MicroDens offers two types of counters to automatically number measurements:

#### 6.15.1.1 Custom IDs:

- Insert a sequence of "@" characters into the sample ID where you want the counter
- Example: "Tank@@ PV1" in measurement becomes

  "Tank01 PV1", "Tank02 PV1", "Tank03 PV1", etc.

- The number of "@" characters determines the number of digits in the counter (@@ = 2 digits, @@@ = 3 digits)
- The counter will reset to 1 when a new sample ID is selected

#### 6.15.1.2 Counter ID:

- A Counter ID activates a special 4-digit counter
- This counter continues to count even when you change the sample ID.
- It only resets after reaching the maximum value

Use custom IDs when you want to track different batches or samples separately. Use the “Counter” ID when you want to maintain a continuous sequential numbering system regardless of the sample.

#### 6.15.2.1 Creating a new sample ID:

1. Press Menu→ Measurement Profile → Sample ID → Custom
2. Press New ID
3. Enter the sample ID name using the keyboard (include "@" if you want a counter)
4. Press Finish to confirm
5. Press Back repeatedly to return to the main screen

#### 6.15.2.2 Deleting a Sample ID:

1. Press Menu → Measurement Profile → Sample ID → Custom
2. Select the sample ID to delete
3. Press Delete ID
4. Press Yes to confirm the deletion
5. Press Back repeatedly to return to the main screen

You cannot delete a sample ID that is currently in use. First select another sample ID, then proceed with the deletion.

### 6.15.3Assigning a Sample ID

To use a specific sample ID for measurements:

1. Press Menu→ Measurement Profile → Sample ID → Custom
2. Press "Select ID"
3. Select the desired sample ID from the list
4. Press Set to confirm
5. Press Back to return to the main screen

The selected Sample ID will appear in the main screen header and will be used for all subsequent measurements until a different one is selected.

## 6.16 Data storage and management

The MicroDens automatically stores measurements in internal memory, allowing you to recall and analyze them later.

### 6.16.1Memory capacity and organization:

- Capacity to store up to 2,000 measurements
- Circular buffer system (when memory is full, new measurements automatically overwrite older ones)
- Data stored for each measurement:
  - Date and time of measurement
  - Name of the method used
  - Sample ID
  - Value of the first parameter (with name and unit of measurement)
  - Value of the second parameter (with name and unit of measurement)
  - Measuring temperature (with unit)
  - Quality indicator (parameters within limits)
  - Device serial number

### 6.16.2Viewing stored data:

1. From the main menu, select History
2. Select Data List to access your stored measurements
3. Use the arrow keys (Up/Down) to scroll through the measurements:
   - Up Arrow: Shows the previous (oldest) measurement
   - Down Arrow: Shows the next (most recent) measurement
4. The information displayed includes:
   - Sample ID (header)
   - Date and time of measurement
   - Name of the method used
   - Measured parameters (e.g. Density, Concentration) with values and units
   - Temperature at the time of measurement
   - Counter: indicates the current position in "X/Y" format (e.g. "1/2000")
5. Color code:
   - GREEN background: parameters within tolerance limits (valid measurement)
   - RED background: parameters outside tolerance limits (attention required)

The measurements are sorted chronologically (the most recent one is displayed first, index 1)
The system always retains the most recent data if the maximum capacity is exceeded
Data access is optimized for read speed (direct, zero-cache access)

### 6.16.3Memory alert

When memory reaches maximum capacity, the system may display a warning. It is recommended to periodically export important data to a PC or printer to maintain a complete measurement history.

# Measurement

This chapter describes measurement procedures using the MicroDens portable density meter, from sample preparation to viewing and saving results.

## 7.1 Pre-Measurement Checks

Before starting a measurement, make sure that all the following conditions are met:

### 7.1.1 Configuring the Instrument

Method selected correctly

- Verify that the method displayed in the top-center button of the Home Page matches the type of sample you are measuring.
- Changing the method: Home → Measurement Profile → Methods

I D Sample configured (optional)

- If you need to uniquely identify the sample, make sure the correct ID is set
- Visible in the top-center button [Method Name] | [ID or #Counter]
- To configure: Home → Measurement Profile → Sample ID

Calibration valid

- Check last calibration date (Menu → Calibration → Calibration History)
- Daily Verification with ultrapure water at 20°C ± 2°C is recommended ( Use WaterCalibration method)

### 7.1.2 Sample and Temperature Verification

Instrument operating range: -10°C to +60°C (sample temperature inside the measuring cell)

The system continuously monitors the temperature and displays an error message if the value goes out of the operating range

### 7.1.3 Tank Full Warning

The system monitors the sample residence time in the measuring cell. After 5 minutes with the cell full, the system shuts down and a warning message is automatically displayed.

Why is it important to rinse:

- Avoid contamination of the measuring cell
- Prevents deposits and encrustations

- Ensures accuracy of subsequent measurements
- Protects the internal parts of the instrument

What to do when the message appears:

1. Press OK to automatically unload the cell
2. Press Exit to keep the cell filled and continue viewing the data.

### 7.1.4 Samples Chemical Compatibility

Before introducing the sample into the cell:

- Check the chemical resistance of the wettable parts of the instrument
- Consult the safety data sheets (SDS) of the sample
- Check compatibility with the cleaning agents you intend to use

WARNING - Dangerous Samples

Flammable samples (Ethanol, IPA, Acetone, etc.):

- Ensure adequate ventilation of the work area
- Keep sources of ignition away (flames, sparks, hot surfaces)
- Use in non-ATEX classified areas (the instrument is not Ex certified)

Corrosive samples (Acids, Bases):

- Check material compatibility
- Use appropriate PPE (chemical gloves, glasses, gown)
- Prepare neutralizers (bicarbonate for acids, citric acid for bases)

Toxic samples:

- Work under a hood or in a ventilated area
- Use appropriate PPE according to SDS
- Prepare emergency spill kits

High viscosity samples (Oils, syrups):

- Check instrument tolerance with sample datasheets
- Check filling accuracy (absence of air bubbles)
- Use PRECISE mode for best results

### 7.1.5 Material Preparation

Cleaning solvents
Prepare the appropriate solvents for cleaning the cell:

- Deionized/ultrapure water: For aqueous samples
- Isopropyl alcohol (IPA) or 96% ethanol: For oily samples or after aqueous samples
- Acetone: For stubborn residues (always follow with IPA and water)
- Filtered compressed air: For final drying

Typical cleaning sequence:

1. Rinse with appropriate solvent (2-3 cycles)
2. Rinse with IPA (optional, to remove traces of water)
3. Drying with compressed air or waiting for natural evaporation

Sample quantity

- Minimum volume: ~1 mL (for complete cell filling)
- Recommended volume: 5-10 mL (for ease of injection and subsequent cleanup)

Accessory Instruments

- Used sample collection containers
- Containers for cleaning solvents

### 7.1.6 Instrument Status

Before you begin, check:

Battery level

- Battery icon on the Home Page
- Charge the instrument if level < 10%

Empty and clean measuring cell

- Make sure the cell is completely empty
- Check for any visible residue or deposits
- If necessary, perform cleaning followed by several cycles of aspiration and release with air to help eliminate residual drops of both the previous sample and the washing liquid.

## 7.2 Sample filling

The MicroDens uses an optimized motorized syringe system to ensure precise liquid filling:

1. Immerse the filling tube in the sample
2. Lightly press the PUSH button to activate the syringe piston
3. The instrument automatically draws the required amount of sample (approximately 1 ml)

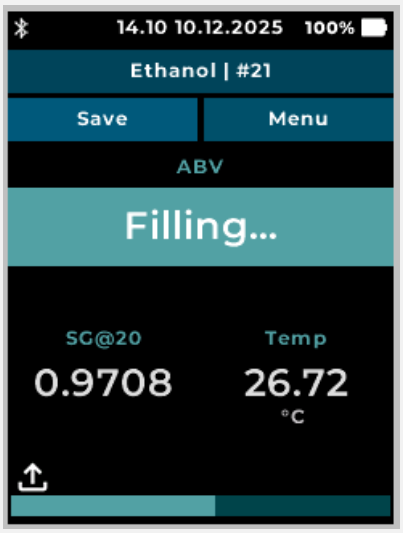
The system has been specially calibrated to ensure optimal filling of the measuring cell.

4. After reading, press the PUSH button again to release the sample. Make sure you have a waste container handy.

This completes the measurement cycle from the filling phase to the sample release after analysis.

## 7.3 Taking a measurement

Once the measuring cell is filled, the measurement proceeds automatically:




1. Verify that all conditions indicated in section 7.1 are met
2. Fill the sample as described in section 7.2
3. The measurement starts automatically and the instrument sets the motor speed and analyses the data according to the selected measurement mode (Precise, Fast or Manual, Slow or Viscous)
4. During the measurement, a progress bar is displayed indicating the progress of the analysis.
5. Once the measurement is complete, the screen turns green when the result stabilizes, indicating that the analysis is ready.

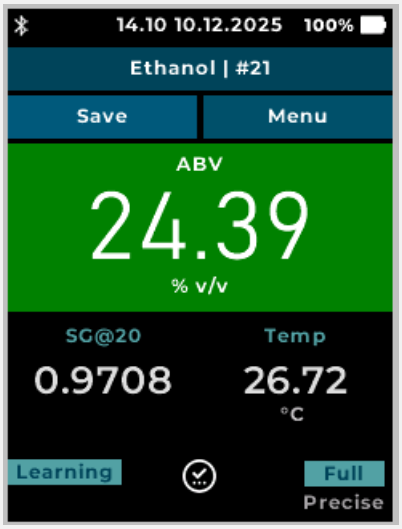
### 7.3.1 Interpretation of the results

The MicroDens offers several features for easy interpretation of results:

- Background color : Results that fall within the limits defined in the method are displayed with a green background.
- Multiple units : Depending on the selected method, the instrument displays up to three parameters simultaneously (e.g. density, SG and temperature).
- Stability : To ensure accurate results, the instrument applies stability criteria based on the selected measurement mode.

## 7.4 SmartStabilizer - Intelligent Measurement Stabilization

The SmartStabilizer is an integrated software system that speeds up and stabilizes measurements by automatically recognizing the sample's condition and optimizing the displayed result. The SmartStabilizer is active by default and requires no manual intervention from the operator.



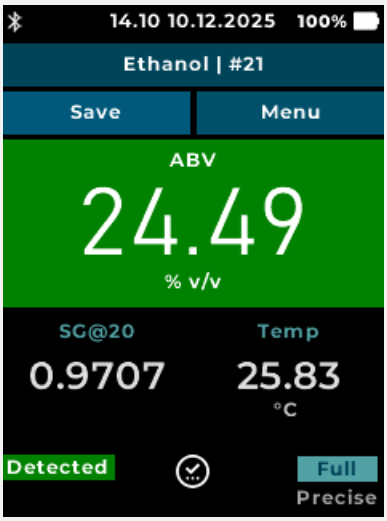

How it works

- Learning (Verification): During the initial phase of each measurement cycle, the system analyzes the first readings to eliminate any fill contamination, assesses stability by comparing consecutive values, and verifies repeatability to confirm the sample's stability. During this phase, the display shows "Learning" or "Detected"

- Detected: Once the sample is identified, the SmartStabilizer displays “Detected” and the displayed value is considered stable for storage.

Advantages

- Faster measurements: sample recognition and rapid stabilization.
- Greater accuracy: automatic filtering of noise and contamination.
- Repeatability: Multiple measurements of the same sample produce consistent results.
- Clear operator guidance: "Learning" and "Detected" messages are displayed.




## 7.5 Best practices for accurate measurements

To ensure accurate reading and prevent cross-contamination between samples, it is essential to follow these operating practices:

- Never pour the measured sample back into its original container: after passing through the measuring cell, the sample may contain residual traces of previous samples or have been exposed to contamination. Always dispose of the analyzed sample in a separate container designated for waste.
- Perform at least 3 rinses when changing samples: Before taking a measurement on a new sample, rinse the measurement cell by aspirating and expelling the new sample for at least 3 consecutive cycles. This ensures that any traces of the previous sample are completely removed and guarantees that the measurement is taken on an uncontaminated sample.

These simple precautions significantly improve measurement repeatability and reduce systematic errors due to contamination.

## 7.6 Liquid release after measurement and cleaning

After reading the result on the display and saving or sending the measurement (BLE), we recommend expelling the liquid into a container, preferably glass, by placing the outlet tube at an angle so that it touches the wall of the container. This facilitates the flow of the liquid.

It is essential to clean the measuring cell after each measurement session:

1. Immerse the fill tube in a container with suitable cleaning liquid
2. Press the PUSH button and fill the system with the appropriate solvent
3. Press the PUSH button again to release/eject the cleaning liquid into a waste container
4. Repeat the rinsing process several times until the system is completely clean.

For samples that are difficult to remove, use a series of appropriate solvents or a cleaning solution specifically designed for that type of sample. For more details, refer to the chapter on maintenance and cleaning.

## 7.7 Special considerations for different sample types

### 7.7.1 Viscous samples (up to 50 mPa s)

- The motor syringe system is designed to handle even moderately viscous samples
- Allow for longer stabilization time
- Use “Slow” or “Visco” measurement mode for more accurate results
- Clean thoroughly after each measurement to avoid residues

### 7.7.2 Volatile samples

- Fill quickly to minimize evaporation
- Use "Fast" mode if appropriate
- Consider cooling the sample slightly before measuring
- Avoid exposing the sample to air for prolonged periods.

## 7.8 Automatic Piston Unstick

The Piston Unstick function automatically attempts to free the piston if it becomes stuck inside the measuring cell. Blockage can occur if the instrument is left unused for a long time, if the O-ring loses lubrication, or if sample residue crystallizes around the piston.

How to access
From the main menu, access the Service Menu and select the Piston Unlock item.

On the confirmation screen, press OK to start or cancel to go back
The instrument automatically performs a progressive sequence of 13 cycles divided into 4 phases.

The motor operates at maximum torque (100%) and at reduced speed to ensure maximum unlocking force.

The display shows the phase, the current cycle and the overall progress in real time.

Upon completion, the instrument performs a zero-calibration verification

The result is displayed on the screen:

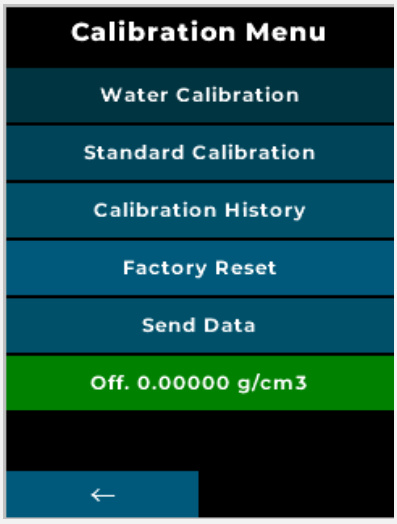
- Green background “Unlocking completed! Lubricate O-ring." → It is recommended to lubricate the O-ring as soon as possible.
- Red background — "Unlock FAILED! Manual service required." → Turn off the instrument and perform manual maintenance on the O-ring. If the problem persists, contact Gibertini Elettronica support.

The procedure is safe and can be performed even if the piston is not actually locked
Upon completion, the engine parameters (torque and speed) are automatically reset to their default values. No external connection (dongle, PC) is required.

# Checks and Calibration

This chapter describes the procedures for checking and calibrating your MicroDens, ensuring that measurements are accurate and reliable. Performing these checks regularly is essential to maintaining optimal instrument performance.

From the Calibration Menu page, you can access all the instrument's calibration and reset functions.




- Water Calibration; Allows you to calibrate with water, setting the density of pure water as the reference.
- Standard Calibration: Allows calibration with certified standard solutions (e.g. hydroalcoholic solutions or solutions of known density) .
- Calibration History: Displays a list of the latest calibrations performed with date, time, and results.
  This is useful for traceability and for verifying the instrument's stability over time.
- Factory Reset: Restores the factory calibration parameters .
- Send Data: Allows you to export calibration data (history, offset, parameters) to a PC or printer via the configured connections.
  It is designed for calibration reports, audits, or quality archiving.
- *Off. 0.00000 g/cm³* :Displays the density sensor calibration offset.
  The item becomes active after a calibration procedure and allows, if necessary, a fine -adjustment of the offset.

**Purpose of Calibration**
Under normal operating conditions, it is not necessary to recalibrate the instrument: calibration procedures serve primarily as a periodic check of proper operation.
**When should calibration be performed?**
If operating conditions require it, such as use in specific environments or matrices
To maintain accuracy over time, it is generally sufficient to properly clean the measuring cell and wetted parts according to the procedures outlined in the maintenance section.

## 9.1 Calibration with Water

Water calibration should be performed when daily monitoring indicates significant deviation, or periodically as part of routine maintenance.

Materials needed:

- Ultra-pure water (bi-distilled or deionized)
- Water temperature: 15-30°C (59-86°F)

Procedure:

1. Clean the measuring cell thoroughly
2. Rinse the cell until all detergent residue is removed.
3. Enter Menu → Calibration → Water Calibration
4. When you open the page, the Instrument automatically displays:
    - The current temperature of the liquid
    - The theoretical density value of water is automatically calculated based on the detected temperature
    - The field to display the measured density (initially empty)
    - The calibration offset (which will be calculated after the measurement)
5. Fill the cell with ultra-pure water at a temperature between 15-30°C
6. Press the PUSH button to start sample aspiration
7. Wait for the data to stabilize:
    - During the measurement, the temperature and density values measured are updated in real time on the display.
    - Once the measurement is complete, the Offset field turns green when the value is within the manufacturing tolerance, red if it is out of tolerance.
8. To save the new calibration, tap Save
9. To reject the calibration and exit without changes, tap Cancel
10. Tap Back repeatedly to return to the Home Page

Calibration with water permanently changes the instrument's calibration offset. Be sure to use ultra-pure water of the appropriate quality to avoid systematic errors in subsequent measurements.

## 9.2 Calibration with Hydroalcoholic Reference Solution

Calibration with a hydroalcoholic reference solution is an advanced procedure recommended for:

- Accredited laboratories requiring certified traceability
- Metrological validation according to specific industry regulations
- Periodic verification of the instrument's linearity across the entire measurement range
- Critical applications where maximum accuracy is required
- Compliance with international standards (e.g. ISO 17025, GLP/GMP)

This procedure uses a certified hydroalcoholic solution (ethanol in water) with a certified and traceable density or specific gravity value at 20°C.

### 9.2.1 Necessary Materials

- Certified hydroalcoholic solution: e.g. 40.00% vol ethanol in water (or other certified concentration)
- Certificate of Analysis: With specific gravity value at 20°C (SG20) and stated uncertainty
- Solution Temperature: Between 18-22°C for greater accuracy
- Clean container for standard solution

The required value is the Specific Gravity at 20°C (SG20), defined as the ratio of the density of the solution at 20°C to the density of water at 20°C.

### 9.2.2 Performing a Calibration with Hydroalcoholic Solution

Procedure:

1. Preparation:
    - Clean the measuring cell thoroughly
    - Bring the standard solution to stable room temperature (18-22°C)
    - Have the standard certificate with the declared SG20 value available
2. Opening the page and inserting SG20:
    - Enter Menu → Calibration → Standard Calibration
    - When opening the page, the instrument requires the insertion of the SG20 value (Specific Gravity at 20°C) of the reference solution.
    - Consult the certificate provided with the standard and enter the value of SG20 using the numeric keys
    - Press SET to confirm the entered value
3. Calibration mask display:
    - After confirming the value of SG20, the calibration page opens showing:
        - The current temperature of the sensor
        - The reference SG20 value entered
        - The field for the measured concentration (% vol alcohol)
        - The field for the measured density
        - The calibration offset (which will be calculated after the measurement)
4. Measurement:
    - Fill the cell with the certified hydroalcoholic solution
    - Press the PUSH button to start sample aspiration
    - Perform multiple priming cycles
    - Wait for the data to stabilize:
        - During the measurement the values are updated in real time
        - The stability indicator shows when the measurement is complete
        - The Offset field turns green when the calibration is valid, red if it is out of tolerance.
5. Check and save:
    - Check the displayed values:
        - Temp: Measured temperature of the sample
        - %vol: Measured alcohol concentration (should correspond to the value declared on the certificate, e.g. ~40%)
        - Dens: Density measured by the sensor at 20°C
        - Ref: Reference density (calculated from the entered SG20 value)
        - Offset: Difference between measured density and reference density

6. Check that the values are consistent:
    - The measured concentration should be close to that declared on the certificate (e.g. 40.0% vol ±0.1%)
    - The offset should be contained (green background = within manufacturing tolerances)
7. To save the calibration press Save; to reject it press Cancel

### 9.2.3 Recommendations for Calibration with Hydroalcoholic Solution

Before calibration:

- Store the standard in a tightly closed container to avoid evaporation of alcohol.
- Do not use expired or improperly stored standards
- Verify that the SG20 value on the certificate is clearly legible

## 9.3 Resetting Factory Calibration

If you want to cancel all calibrations performed and restore the instrument to its original calibration:

Procedure:

1. Press Menu → Calibration → Factory Reset
2. Press Yes to reset the instrument to Factory Calibration

## 9.4 Exporting Calibration Data

The MicroDens automatically records all calibrations performed (with water, with hydroalcoholic solution and factory resets) in a history that can be consulted and exported for documentation and traceability.

### 9.4.1 To view your calibration history:

1. Tap Menu → Calibration → Calibration History
2. Scroll through the list with the arrow keys to view previous calibrations
3. For each calibration the following are shown: date, time, type of calibration, applied offset, temperature

### 9.4.2 To export calibration data:

Before exporting, configure the destination in Menu → Settings → Connections → Export Destination by choosing Bluetooth Printer or PC.

- Print to Bluetooth Printer: From the Calibration menu, select Print Calibrations to print a complete report
- Export to PC: Connect the MicroDens BLE Dongle to your PC, then from the Calibration menu select Export Calibrations to transfer the data

The calibration report includes: instrument serial number, dates and times of all calibrations, offset values applied, type of calibration performed, and operator (if configured).

# Measurement Data Management

This chapter describes how to view, export, print, and delete measurement data stored in the MicroDens density meter. The instrument automatically saves each measurement to non-volatile memory, allowing you to review it at any time.

Measurement data are automatically stored in the MicroDens density meter's internal memory. The data memory can hold up to 2000 data sets, organized in a circular buffer. When the memory is full, new measurements will automatically overwrite the oldest data sets.

## 10.1 Memory Capacity and Organization

Data memory features:

- Total capacity: Up to 2000 storable measurements
- Storage system: Circular buffer (when the memory is full, new measurements automatically overwrite the oldest ones, starting from the oldest)
- Auto Save: Every completed measurement is automatically saved
- Non-volatile memory: Data remains saved even after the instrument is turned off

Contents of each stored measurement.
Each saved record contains the following complete information:

Identification:

- Unique progressive number of measurements
- Full date and time (year, month, day, hour, minute, second)
- Sample ID
- Method Name

Measured values:

- Parameter 1: Value, name and unit of measurement (e.g. 40.0 %vol, Concentration)
- Parameter 2: Value, name and unit of measurement (e.g. 0.9352 g/cm$^3$, Density)
- Temperature: Value and unit of measurement (e.g. 20.55 °C)

Quality information:

- Measurement stability indicator
- Indicator of compliance with the limits set in the method
- Instrument serial number

All of this information is saved exactly as it appears on the display at the time of measurement, ensuring full traceability of the results.

## 10.2 Accessing the History Menu

The History menu provides access to all the functions for managing stored data. The number in parentheses indicates how many measurements are currently stored in memory.
Path: **Menu → History (xxx)**
Where xxx is the total counter of stored measurements (e.g. "History (127)" indicates 127 saved measurements).
The following functions are available from the History menu:

- Data List: View stored measurements
- Export Data: Export all measurements to PC
- Print Last (or Export Last): Prints or exports the last measurement (the name changes depending on the configured destination)
- Delete Last: Deletes the last measurement
- Delete All: Clears all measurements

### 10.2.1Viewing Stored Data

To consult the measurements saved in the memory:
Path: Menu → History (xxx) → Data List
Procedure:

1. Touch Menu on the Home Page
2. Select History (xxx) - the number in brackets shows how many measurements are stored
3. Select Data List
4. The most recent measurement is displayed
5. Use the arrow keys (UP/DOWN) to scroll through the measurements:
    - Down Arrow: Most recent measurement
    - Up Arrow: Oldest measurement
6. The display shows for each measurement:
    - Sample ID (in header)
    - Date and time of measurement
    - Method used
    - Parameter 1: Name, value and unit (e.g. Density: 0.9352 g/cm$^3$)
    - Parameter 2: Name, value and unit (e.g. %vol: 40.0 %vol)
    - Temperature: Value and unit (e.g. Temp.: 20.5 °C)
    - Position: Current Index / Total (e.g. 5/127)
7. Values within the limits are displayed with a green background, those outside the limits with a red background.
8. Tap Back to return to the History menu

Measurements are always sorted from newest to oldest, so when you open the Data List, the most recent measurement is displayed automatically.

### 10.2.2Export Destination Configuration

Before you print or export, you need to set up the appropriate destination.
Path: Menu → Settings → Connections → Export Destination
Available options:

1. None: Disable printing and exporting (maximum power saving)
2. Bluetooth Printer: To print to a Bluetooth thermal printer
3. PC: To export data via Bluetooth to your computer

Procedure:

1. Tap Menu → Settings → Connections → Export Destination
2. Select your desired destination:
    - Bluetooth Printer: If you want to print the measurements
    - PC: If you want to export data to your computer
3. Tap Back to confirm your choice

The destination you select determines which option appears in the History menu:

- When the destination is a Bluetooth printer: The “Print Last” option appears
- When the destination is a PC: The “Export Last” option appears

## 10.3 Data Printing

### 10.3.1Print the most recent measurement:

Procedure:

1. Menu → History (xxx) → Print Last
2. A confirmation message appears: "Print Last - Confirm operation?"
3. Tap OK to confirm or Cancel to exit
4. If confirmed, the Instrument sends the data to the printer
5. A status message appears:
    - Success: "Successfully printed"
    - Error: Reason is indicated (e.g., "Printer not connected," "Bluetooth not active")
6. Tap OK to close the message

### 10.3.2Print Formats

The print size depends on the settings configured in the measurement method used.

There are three modes:

1. None: Does not print automatically after measurement
2. Data Only: Essential printout containing:
    - Measurement number
    - Date and time
    - Sample ID
    - Method Name
    - Values of the two parameters with Measurement Units
    - Temperature
3. GLP (Good Laboratory Practice): Complete printout compliant with laboratory regulations, containing:
    - All information about "Data Only" mode
    - Instrument serial number
    - Firmware version
    - Date and status of the last calibration
    - Operator ID (if configured)
    - Measurement quality indicators

## 10.4 Exporting Data to PC

### 10.4.1Export Prerequisites

Before exporting data, check:

1. BLE destination configured on PC (see paragraph 6.7.1 - BLE Destination Configuration)
2. MicroDens BLE Dongle connected to the computer's USB port
3. Legacy Software installed on your PC:
    - Excel Application: To export data directly to Excel format
    - Logger Pro Application: To view real-time graphs and analyze historical data

### 10.4.2Exporting the Last Measurement

To export only the most recent measurement via BLE.
Procedure:

1. Make sure the MicroDens BLE Dongle is connected to your PC
2. Start receiving applications on the PC (MicroDens Excel or MicroDens LoggerPro)
3. On the MicroDens, tap Menu → History (xxx) → Export Last
4. Confirm the operation by tapping OK
5. Please wait for completion (" *Exporting...* ")
6. When finished, it displays " *Exported successfully* "
7. Tap OK to close

On PC:
The application automatically receives the data and displays or saves it according to the configured settings.

### 10.4.3Export All Measurements

To export the entire history of stored measurements.
Procedure:

1. Make sure the MicroDens BLE Dongle is connected to your PC
2. Start receiving applications on the PC
3. On the MicroDens, tap Menu → History (xxx) → Export Data
4. Confirm the operation: " *Data Export - Confirm operation?* "
5. Tap OK to start the transfer
6. Please wait for completion (may take a few minutes with many measurements)
7. Export progress is displayed with the number of records transmitted
8. At the end: " *Exported successfully* "
9. Tap OK to close

Exported data:
The complete export includes:

- All measurements stored
- Calibration history (date, type, offset, operator)
- System data (serial number, firmware version, settings)

The application allows you to:

- With Excel Application: Save directly in .xlsx format with data organized in columns

- With Logger Pro Application: View time graphs, export to different formats, apply filters and statistical analysis

### 10.4.4Exported Data Format

Each measurement is exported with the following format:

MEAS:Date_Time,Method,Sample_ID,Value1,Parameter1,Unit1,Value2,Parameter2,Unit2,Temperature,Temp_Unit,Status,Device SN,#Counter

Exported fields:
1. Date and Time: YYYY-MM-DD_HH:MM:SS format
2. Method Name: E.g. "Ethanol", "Beer DryExt(2)", "Wine"
3. Sample ID: Sample identifier
4. Parameter Value 1: Numeric value with dynamic decimals
5. Name of Parameter 1: E.g. "Density", "SG@20°C", "TAV"
6. Unit Parameter 1: E.g. "g/cm³", "SG", "%vol"
7. Parameter Value 2: Numeric value with dynamic decimals
8. Parameter 2 Name: E.g. "Concentration", "ABV", "°Plato"
9. Unit Parameter 2: E.g. "%vol", "%wt", "°P"
10. Temperature Value: Measuring temperature
11. Temperature Unit: Ex. "°C", "°F"
12. Status: OK or OUT_OF_LIMITS
13. Serial Number: Serial number of the device
14. Progressive Counter: Unique measurement number

Example of exported line (delimiter ;):

MEAS:2025-10-02_14:35:22;Ethanol;SAMPLE01;0.9352;Density;g/cm³;40.0;%vol;%vol;20.5;°C;OK;MD12345678;#127

## 10.5 Automatic Export during Measurement

When the BLE target is configured on PC and the MicroDens Dongle is plugged in and connected, the behavior of the Save button changes:

IMPORTANT:
- By pressing Save at the end of a measurement, the data is automatically exported via BLE to the PC
- The measurement is NOT saved in the device's internal memory
- This allows for immediate data transfer without taking up memory

Conditions for automatic exports:
1. BLE destination set to PC (Menu → Settings → Connections → Export Destination → Destination)
2. MicroDens Dongle connected to the computer's USB port
3. Active PC reception application (Excel or Logger)
4. BLE connection established (Bluetooth connected icon on display)

Procedure:
1. Perform the measurement normally
2. When finish, press Save

3. The device automatically transmits data via BLE
4. The display briefly shows: " *Exporting...* "
5. Upon completion: " *Data sent successfully* "
6. Tap OK to return to the main screen

The application immediately receives the measurement and displays/saves it according to the configured settings.

Advantages of automatic exports:
- Instant transfer without additional steps
- Saving internal memory
- Data available on PC in real time

Base Size:
MEAS:YYYY-MM-DD_HH:MM:SS, Method,SampleID,Param1,Name1,Unit1,Param2, Name2,Unit2,Temp,Unit_T,Status,Serial,#Counter

### 10.5.1Export Requirements

To receive data via BLE:
1. BLE must be connected to the MicroDens Dongle Key receiving device
2. Destination must be configured on PC (not Printer)
3. The data is automatically transmitted upon completion of the measurement

- Technical Notes
- The extended export is transmitted immediately after the basic measurement
- The device's serial number is included in the base measurement

## 10.6 Data Deletion

Deleting data is irreversible. Be sure to export important data before deleting it from your device's storage.

### 10.6.1Deleting the Last Measurement

History Menu (with confirmation)
Path: Menu → History (xxx) → Delete Last
Procedure:

1. Tap Menu → History (xxx) → Delete Last
2. A confirmation message appears: "Delete Last - Confirm action?"
3. Tap OK to confirm the deletion or Cancel to exit without deleting.
4. If confirmed:
    - It says "Deleting..."
    - At the end: "Successfully deleted"
5. The counter in the History menu is updated automatically (e.g. from 127 to 126 measurements)

### 10.6.2Deleting All Measurements

To completely clear data memory:
Path: Menu → History (xxx) → Delete All
Procedure:

1. Tap Menu → History (xxx) → Delete All
2. A confirmation message appears: "Delete All - Confirm operation?"
3. Read the warning message carefully
4. Tap OK to confirm the deletion or Cancel to exit without deleting.
5. If confirmed:
    - It says "Deleting..."
    - At the end: "Successfully deleted"
    - All 2000 memory locations are cleared
6. The counter in the History menu resets to 0: "History (0)"
7. Tap Back to return to the main menu

This operation permanently deletes ALL stored measurements. Data cannot be recovered after deletion.

## 10.7 Accessories Software

To make the most of the data export and analysis functions, dedicated software applications for PC are available that interface with the MicroDens via the BLE Dongle:

- Application for direct export to Excel: Allows you to automatically save data in Excel format (.xlsx) with an organization optimized for analysis
- Logger Pro application with graphs: Allows real-time viewing of measurements with customizable graphs, statistical analysis and process monitoring

For information on the availability and acquisition of these accessory software, contact your Gibertini Elettronica sales representative or visit www.gibertini.com

# Maintenance and cleaning

This chapter describes the maintenance and cleaning procedures necessary to ensure optimal operation and a long life for your MicroDens portable Digital Density Meter.

## 11.1 Cleaning the measuring cell

Regular cleaning of the measuring cell is essential for obtaining accurate results and preventing cross-contamination between different samples. A proper cleaning procedure is especially important when measuring samples with different chemical or physical properties.

### 11.1.1General cleaning principles

- Immediate cleaning: Clean the measuring cell immediately after use to prevent residues from drying or adhering to the cell walls.
- Two-Stage Procedure: For most applications, a two-stage cleaning procedure is recommended, first using a solvent specific to the sample being measured, followed by a second solvent for the final rinse.
- Chemical Compatibility: Use only solvents that are compatible with all wettable materials in the instrument, which include the silicon MEMS measuring cell, Pyrex glass, PTFE tubing, NBR (nitrile rubber) O-rings, and POM (acetal resin) components.

### 11.1.2Standard cleaning procedure

1. Emptying the cell:
    - Direct the fill tube into a suitable waste container
    - Press the PUSH button to activate the pump and empty the cell
2. First cleaning phase:
    - Immerse the fill tube in the first cleaning solvent (specific to the sample type)
    - Press the PUSH button to draw the solvent into the cell
    - Wait 5-10 seconds to allow the solvent to dissolve the residue
    - Press the PUSH button again to expel the solvent
    - Repeat this cycle 3-5 times, depending on the nature of the sample.
3. Second cleaning phase (rinsing):
    - Immerse the fill tube in the second cleaning solvent
    - Press the PUSH button to draw the solvent into the cell
    - Wait briefly (2-3 seconds)
    - Press the PUSH button again to expel the solvent
    - Repeat this cycle 2-3 times to ensure a thorough rinse.
4. Drying (when necessary):
    - For aqueous samples, a final rinse with ethanol or isopropanol can facilitate drying.

## 11.2 Cleaning frequency

The cleaning frequency depends heavily on the application and the type of samples analyzed.

### 11.2.1Sample replacement (for similar samples)

For samples that are very similar to each other (e.g., different batches of the same product):

- Empty the measuring cell with the initial sample
- Rinse at least 3 times with the next sample before measuring it.
- Perform a thorough cleaning at the end of the measurement series

### 11.2.2Cleaning after each measurement (for different samples)

Perform a thorough cleaning after each measurement when:

- The samples have different chemical properties
- The samples are immiscible with each other
- Samples are difficult to remove from the measuring cell
- You move from one product to another

## 11.3 Cleaning protocols specific to sample type

The following table provides detailed recommendations for cleaning the measuring cell based on the type of sample being measured. These protocols have been developed to ensure effective residue removal and prevent interference with subsequent measurements.

### 11.3.1Table of cleaning protocols by sample category

| Champion Category | First solvent | Second solvent | Recommended cycles | Specific notes |
|---|---|---|---|---|
| Low concentration aqueous solutions | Deionized water | Ultra-pure water | 3 cycles first solvent, 2 cycles second | Suitable for solutions with concentrations <5% |
| Highly concentrated aqueous solutions | Warm water (30-40°C) | Ultra-pure water | 5 cycles first solvent, 3 cycles second | For solutions with concentrations >5% |
| Alcohol and alcoholic beverages (low alcohol) | Deionized water | Ultra-pure water | 3 cycles first solvent, 2 cycles second | For beers, wines and low-alcohol drinks |
| Alcohol and alcoholic beverages (high strength) | 40% ethanol | Ultra-pure water | 3 cycles first solvent, 3 cycles second | For high-proof spirits and liqueurs |
| Sugar solutions | Hot water (40-50°C) | Ultra-pure water | 5 cycles first solvent, 3 cycles second | Hot water is essential to dissolve the sugar residues |
| Light petroleum products | Toluene or hexane | Ethanol or isopropanol | 4 cycles first solvent, 3 cycles second | Use in a well-ventilated area |
| Lubricants and heavy petroleum products | Toluene or naphtha | Acetone followed by isopropanol | 5 cycles of first solvent, 3+2 cycles of second solvents | Double rinsing is essential to remove all residues |
| Dilute inorganic acids | Deionized water | Ultra-pure water | 5 cycles first solvent, 3 cycles second | Make sure all the acid has been removed |
| Concentrated inorganic acids | Dilute acid of the same species | Deionized water followed by ultra-pure water | 5 cycles of first solvent, 3+2 cycles of second solvents | CAUTION : Dilute gradually, never add water directly to concentrated acid |
| Basics | Acidulated water (pH ~4) | Ultra-pure water | 5 cycles first solvent, 3 cycles second | Acidulated water neutralizes alkaline residues |

| Champion Category | First solvent | Second solvent | Recommended cycles | Specific notes |
|---|---|---|---|---|
| Hydrogen peroxide | Deionized water | Ultra-pure water | 4 cycles first solvent, 3 cycles second | Avoid organic solvents that may react with peroxide residues |
| Dairy products | Diluted Enzyme Detergent | Warm water followed by ultra-pure water | 3 cycles of first solvent, 3+2 cycles of second solvents | Do not use alcohol for the final rinse, it may cause protein precipitation. |
| Edible oil products | Dishwashing detergent solution | Warm water followed by isopropanol | 4 cycles of first solvent, 3+2 cycles of second solvents | The detergent emulsifies the oils, the isopropanol removes water and residual detergent |
| Saline solutions | Warm water | Ultra-pure water | 4 cycles first solvent, 3 cycles second | Make sure all salts are completely dissolved |
| Solutions with methanol | Deionized water | Ultra-pure water | 3 cycles first solvent, 2 cycles second | For concentrations <50%; for concentrations >50%, use diluted methanol as the first solvent |
| Low concentration isopropanol | Deionized water | Ultra-pure water | 3 cycles first solvent, 2 cycles second | |
| High concentration isopropanol | 30% isopropanol | Ultra-pure water | 3 cycles first solvent, 3 cycles second | |
| High-fructose corn syrups | Hot water (50°C) | Ultra-pure water | 5 cycles first solvent, 3 cycles second | High temperature is essential to completely dissolve viscous residues |

## 11.4 Advanced cleaning protocols for special cases

### 11.4.1Highly viscous samples

For samples with high viscosity (up to 50 mPa s):

1. Empty the cell as much as possible
2. Use a specific heated solvent (30-50°C, depending on compatibility)
3. Increase the contact time between the solvent and the cell (15-30 seconds per cycle)
4. Perform at least 6-8 cleaning cycles with the first solvent
5. Follow with 3-4 rinse cycles with the second solvent/water

### 11.4.2Samples with insoluble residues

In case of residues that are difficult to remove:

1. Fill the cell with the appropriate primary solvent
2. Leave to act for 2-3 minutes
3. Empty and repeat the process if necessary
4. If the problem persists, consult Gibertini Elettronica technical support

### 11.4.3Long-term storage protocol

If the instrument will not be used for more than a week:

1. Perform a thorough cleaning as described above
2. Run a final cycle with ultra-pure water
3. Empty the cell completely
4. Leave the cell empty and dry during storage

## 11.5 Important warnings on chemical compatibility

- NEVER mix incompatible solvents (e.g. concentrated acids with bases or organic solvents)
- NEVER use solvents that may damage the wettable materials of the instrument:
  - Avoid using acetone and strong ketones which may damage Viton O-rings and POM components
  - Do not use aggressive aromatic organic solvents (such as benzene) which may deteriorate nitrile rubber parts
  - Avoid the use of chlorinated hydrocarbons which can damage PTFE and Viton components.
  - Do not use concentrated oxidizing acids (such as nitric acid > 40%) which could compromise the integrity of the metal parts
- NEVER use concentrated caustic solutions (NaOH > 20%) without the gradual dilution procedure
- Take special care when handling concentrated acids (especially $H_2SO_4$ > 70%), always diluting gradually
- Comply with all local regulations for the disposal of used solvents.
- If in doubt about the compatibility of a solvent with MicroDens materials, always consult the Gibertini documentation or support first.

## 11.6 O-ring maintenance

The O-ring in the suction system is designed to last a long time under normal operating conditions. It is lubricated at the factory during instrument testing. However, after some time (approximately 9–12 months), it is recommended that you perform maintenance on the O-ring.

### 11.6.1O-ring maintenance procedure

1. Access the maintenance menu:
   - Tap Menu and select Service
   - Select "Clean Pump"
2. When the warning message appears, read the instructions carefully and tap OK to proceed.
3. The Instrument will automatically retract the piston to the maintenance position
4. At this point, you can access the O-ring through the intake piston window

   First you need to remove the battery door, and then the screw that holds the maintenance door.

5. Take the brush bottle and lubricate the outer edge of the O-ring with a small amount of grease.

6. Close the device

7. Once the procedure is complete, turn the instrument back on, which will automatically perform a piston position initialization and calibration process.

## 11.7 Cleaning the housing and display

To keep your MicroDens in top condition:

1. Use a soft cloth moistened with ethanol or warm water to clean the housing.
2. If necessary, you can use a mild detergent (pH < 10)
3. To clean the display, you can use a soft, slightly damp cloth - the display is protected by a scratch-resistant polycarbonate layer that makes it resistant to daily use.
4. Do not use aggressive solvents that may damage the display or housing

## 11.8 Replacing the battery pack

The MicroDens uses a battery pack designed to provide long operating life. There is no specific indicator that indicates when replacement is necessary. Replacement should only be done when you notice a significant reduction in operating time compared to the original performance.

### 11.8.1Replacement Instructions:

- If the instrument frequently shuts down unexpectedly
- If the battery life of the instrument is visibly reduced compared to normal performance
- If the instrument does not turn on despite an adequate charging period

### 11.8.2Procedure for replacing the battery pack

1. Turn off the instrument before replacing the battery pack
2. Gently unclip the battery compartment on the back of the instrument display
3. Replace with new battery pack - the instrument is equipped with a directional connector that prevents connecting the battery with incorrect polarity
4. Reassemble all parts in reverse order

- Use only one battery pack of the same type and with the same charge level
- Make sure the inside of the instrument is completely dry
- The battery compartment cover must always be closed when using the instrument

### 11.8.3Charging the batteries

The MicroDens is equipped with rechargeable batteries that ensure long periods of operation in the field. To properly charge the batteries:

1. Connect the supplied USB-C cable to the port on your device
2. Connect the other end to a wall charger or a computer's USB port
3. While charging, a charging indicator will appear on the display.

Do not use the instrument to take measurements while it is charging. This could affect the accuracy of the measurements.

It is recommended to charge the instrument when not in use, such as overnight or during periods of inactivity. A full charge takes approximately 3-4 hours and provides 10 hours of battery life under constant use.

For optimal energy management, you can enable power saving mode from your Settings , which reduces the display brightness and automatically turns off the device after a period of inactivity.

## 11.9 Software update

Your Gibertini Elettronica representative will inform you when a new software update is available for your MicroDens.

IMPORTANT : Make sure your instrument's batteries are fully charged before starting a software update.

### 11.9.1Update procedure:

1. Connect the MicroDens to your PC using the USB-C cable
2. Make sure the MicroDens instrument is turned on (there is no need to set any procedure on the instrument, it is sufficient that it is turned on and connected to the PC)
3. Download Script Runner [1] software and follow the on-screen instructions and those provided by Gibertini Elettronica to complete the update process.
4. The Instrument will automatically restart after the update is complete.

[1] MicroDens Script Runner is the desktop application dedicated to the secure distribution of update packages to MicroDens devices. It allows you to select the officially released file, verifies integrity and compatibility, checks connectivity (USB or BLE), then sequentially executes the transfer, scheduling, and reboot phases, guiding the operator step by step. During the update, it displays a progress bar and real-time event log, blocks unauthorized operations (disconnection, forced shutdown), and, upon completion, generates a summary of the results.

Do not disconnect the instrument or interrupt the process while the software is being updated. The update procedure ensures the consistency of the data and the custom settings currently saved on the device. However, we recommend that you export and save all important data (methods, sample IDs, custom parameters, measured data, etc.) before performing a software update.

## 11.10 Storage of the Instrument

Before storing the instrument for a long period:

1. Clean the measuring cell thoroughly as described in section 11.1
2. For storage of less than one day, you can fill the measuring cell with ultra-pure water or a suitable solvent
3. For long-term storage, make sure the cell is completely dry
4. Store the instrument in a cool, dry environment
5. Avoid exposure to extreme temperatures, high humidity, or direct sunlight

Proper maintenance and cleaning of your MicroDens Digital Density Meter will ensure accurate measurements and a long instrument life. By following the procedures described in this chapter, you can keep your instrument in optimal condition and prevent potential problems.

# Maintenance and repair

## 11.11 Maintenance performed by an authorized service technician

The instrument does not require periodic maintenance. However, optional services are available upon request from your local Gibertini Elettronica representative.

Any parts damaged as a result of the instrument being dropped are excluded from the warranty

## 11.12 Repair performed by an authorized representative

If your instrument needs repair, please contact your local Gibertini Elettronica representative, who will take care of the necessary steps. If your instrument needs to be returned, please request an RMA (Return Material Authorization) number. It should not be sent without the RMA and the completed "Instrument Repair Safety Declaration." Make sure it is clean before returning it.

Contact your local Gibertini Elettronica representative from the Gibertini Elettronica website in the "Contact Us" section ( https://www.gibertini.com ).

Instruments contaminated with radioactive materials, infectious agents, or other harmful substances that pose a health risk may not be returned.

# Appendix A: Technical Data

## A.1: Specifications

| | |
|---|---|
| **Measuring range** | |
| Density | 0.600-1.200 g/cm$^3$ |
| Temperature (sample) | -10 +65 °C (14-149 °F) |
| Viscosity | 0-50 mPa s (0-5 mPa s calibrated) |
| **Accuracy** | |
| Density | 0.0001 g/cm$^3$ |
| Temperature | 0.1 °C (0.2 °F) |
| **Repeatability sd** | |
| Density | 0.00005 g/cm$^3$ |
| Temperature | 0.1 °C (0.2 °F) |
| **Resolution** | |
| Density | 0.00001 g/cm$^3$ |
| Temperature | 0.01 °C (0.1 °F) |
| Minimum sample volume | 1 ml |

## A.2: Instrument data and operating conditions

| | |
|---|---|
| Dimensions (L x W x H) | 320 mm x 100 mm x 65 mm |
| Weight | 380 g (battery pack and filling tube included) |
| **Diet** | |
| Battery type | Battery Pack LI-POL 3.7 volts 2500 mA |
| Battery life | 10 hours continuous use - 100 hours standby |
| **Room temperature** | |
| Storage temperature | max. 55 °C (131 °F) with batteries<br>max. 70 °C (158 °F) without batteries |
| Air humidity | 5-90% relative humidity, non-condensing |
| | |
| Interfaces | Bluetooth®, USB-C |
| Data memory | 2000 sets of measured data / 30+ measurement methods |

## A.3: Materials

| | |
|---|---|
| Stainless steel, epoxy glue, Pyrex glass, silicone | measuring cell (MEMS) |
| Steel | syringe piston |
| ABS | Plastic body of the instrument and doors |
| Fr-4 | Printed circuits |
| PTFE | filling tubes, sensor input adapter |
| NITRILE RUBBER | filling syringe gasket |
| Viton | Sensor O-ring |
| POM acetal resin | Syringe Room |
| Polycarbonate | Touch pad |

# Appendix B: Density of Water

| Temperature [°C] | Density [g/cm$^3$] | Temperature [°C] | Density [g/cm$^3$] |
|---|---|---|---|
| 0 | 0.99984 | | |
| 1 | 0.99990 | 21 | 0.99799 |
| 2 | 0.99994 | 22 | 0.99777 |
| 3 | 0.99996 | 23 | 0.99754 |
| 4 | 0.99997 | 24 | 0.99730 |
| 5 | 0.99996 | 25 | 0.99705 |
| 6 | 0.99994 | 26 | 0.99679 |
| 7 | 0.99990 | 27 | 0.99652 |
| 8 | 0.99985 | 28 | 0.99624 |
| 9 | 0.99978 | 29 | 0.99595 |
| 10 | 0.99970 | 30 | 0.99565 |
| 11 | 0.99961 | 31 | 0.99534 |
| 12 | 0.99950 | 32 | 0.99503 |
| 13 | 0.99938 | 33 | 0.99471 |
| 14 | 0.99925 | 34 | 0.99438 |
| 15 | 0.99910 | 35 | 0.99404 |
| 16 | 0.99894 | 36 | 0.99369 |
| 17 | 0.99878 | 37 | 0.99333 |
| 18 | 0.99860 | 38 | 0.99297 |
| 19 | 0.99841 | 39 | 0.99260 |
| 20 | 0.99821 | 40 | 0.99222 |

# Appendix C: Main temperature compensation coefficients α

| Substance | Temperature range [°C] | α • 10$^3$/°C |
|---|---|---|
| Waterfall | 15 - 30 | 0.23 |
| Ethanol | 0 - 30 | 1.09 |
| m-xylene | 0 - 30 | 0.99 |
| p-xylene | 15 - 30 | 1.02 |
| Glycerine | 15 - 30 | 0.49 |
| Chloroform | 0 - 30 | 1.26 |
| Carbon tetrachloride | 0 - 30 | 1.22 |
| Toluene | 0 - 30 | 1.07 |
| Benzene | 6 - 30 | 1.21 |
| Methanol | 6 - 30 | 1.18 |
| Acetone | 0 - 30 | 1.42 |
| Bromobenzene | 0 - 30 | 0.91 |
| Cyclohexane | 0 - 30 | 1.20 |
| Isopropanol | 0 - 30 | 1.06 |
| n-nonane | 0 - 30 | 1.08 |

# Appendix D : Measurement Parameters

This appendix provides a complete list of all measurement parameters supported by the MicroDens. The table includes available Measurement Units, typical ranges, and key applications for each parameter.

## D.1: Basic Parameters

| Parameter | Unit of Measurement | Typical Range | Description |
|---|---|---|---|
| Temperature | °C, °F, K | 0-50°C | Temperature of the measured sample |
| Density | g/cm³, kg/m³, lb/gal | 0.6-1.2 g/cm³ | Absolute density at measurement temperature |
| Density@T | g/cm³, kg/m³, lb/gal | 0.6-1.2 g/cm³ | Density compensated at reference temperature |
| Specific Gravity (SG) | Dimensionless | 0.6-1.2 | Ratio between sample density and water density at reference temperature |

## D.2: Alcohol Parameters

| Parameter | Unit of Measurement | Typical Range | Description |
|---|---|---|---|
| Alcohol % v/v | % vol | 0-100% | Alcohol content by volume at 20°C |
| Alcohol % w/w | % weight | 0-100% | Percentage of alcohol by weight |
| US Proof Alcohol | °Proof | 0-200 | American scale; double the value of % v/v |
| ABV | % vol | 0-100% | Alcohol By Volume (% v/v) |
| ABW | % weight | 0-100% | Alcohol By Weight (% w/w) |

## D.3: Sugar and Extract Parameters

| Parameter | Unit of Measurement | Typical Range | Description |
|---|---|---|---|
| Brix | °Brix | 0-35 | Percentage of sucrose in aqueous solution |
| Plato | °Plato | 0-35 | Extract content in the must; g of extract in 100g of solution |
| Babo/ KMW | °Babo | 0-30 | Measuring the sugar content in the must |
| Öchsle | °Oe | 0-150 | German scale for the specific gravity of must |
| Baumé | °Well | 0-30 | Hydrometric scale for solutions heavier than water |
| Fructose | % w/w | 0-50% | Concentration of fructose in aqueous solution |
| Glucose | % w/w | 0-40% | Glucose concentration in aqueous solution |
| Sucrose | % w/w | 0-35% | Concentration of sucrose in aqueous solution |
| Invert Sugar | % w/w | 0-30% | Concentration of invert sugar in solution |

# Appendix E: PC-USB-C MicroDens Communication

The MicroDens features a USB-C communication interface that allows direct connection to a PC for real-time monitoring, advanced configuration, and data downloading. This feature is particularly useful for laboratories requiring integration with LIMS systems, automated quality control applications, or for developers looking to create custom software.
Communication occurs via a standard serial protocol, making integration simple and compatible with any programming language or terminal software. The system implements an intuitive text-based command protocol, designed to be easily readable by both humans and machines.
The USB-C interface provides power to the device during use, eliminating internal battery drain during extended monitoring or data acquisition sessions.

## Connection Parameters

### Serial Port Configuration

| Parameter | Value |
|---|---|
| Speed (Baud Rate) | 115200 bps |
| Data Bits | 8 |
| Equality | None (N) |
| Stop Bits | 1 |
| Flow Control | Nobody |
| Format | 8N1 |

## Available User Commands

### Device Information

| Command | Description | Example Use | Answer | Access |
|---|---|---|---|---|
| firm | Firmware Version | firm | v2.1.5 | R |
| hwrd | Hardware Version | hwrd | RevA1 | R |
| sern | Serial Number | sern | MD123456 | R |
| user | User Information | user =Operator Mario | Quality Control Lab | R/W |
| devn | Device Number | devn | 12345 | R |

### Live Measurement Data

| Command | Description | Example Use | Answer | Notes |
|---|---|---|---|---|
| temp | Current Temperature | temp | 11.45pm | Real time |
| val1 | Main Parameter | val1 | 0.99823 | Density/concentration |
| val2 | Secondary Parameter | val2 | 12.34 | If configured |
| lock | Stability State | lock | 1 | 1=stable, 0=unstable |
| meth | Active Method | meth | Density@20°C | Method Name |
| which | Quality Result | which | OK | OK/OUT_OF_LIMITS |
| live | Full Display Data | live | 52.49,ABV,% v/v,0.9286,SG@20„29.00, C ,Ethanol,OK,1,2025-05-31_14:22:51 | CSV format |

Manage Saved Measurements

| Command | Description | Response Format | Notes |
|---|---|---|---|
| mcnt | Measurement Counting | 42 | Total number |
| last | Last Measurement | 2025-05-31_14:07:26,Ethanol,#006,52.68,ABV,%v/v,0.92820,SG@20,,28.02, ° C,OK,#23 | Full format |
| mean | Measurement List | P1/23,2025-05-31_14:07:26,Ethanol,#006,52.68,ABV,%v/v,0.92820,SG@20,,28.02, ° C,OK,#23 | Automatic pagination |

Method Management

| Command | Description | Response Format | Notes |
|---|---|---|---|
| mtot | Total Methods | 15 | Defaults + User |
| musr | User Methods | 3 | Custom only |
| mact | Detailed Active Method | P1/15:Density@20°C,DENSITY,G_CM3,TEMPERATURE,CELSIUS,20.0,0.000001,PRECISE | Automatic pagination |
| mall | Compact Method List | P:Density@20°C,P:Water@4°C,U:MyMethod1,U:MyMethod2 | P=default, U=user |
| mfll | Complete Methods List | P:Density@20°C,P:API Gravity,P:Brix Solution,U:Lab Method 1 | Detailed |

Calibration History

| Command | Description | Response Format | Notes |
|---|---|---|---|
| ccnt | Calibration Counting | 5 | Total number |
| clst | Last Calibration | 2025,01,10,09,15,30,WATER,SUCCESS,0.000012,23.2 | Full details |
| call | Calibration List | P1/5:W\|250110\|0.000012 | Automatic pagination |

Legend "Live" Format

| Element | Meaning | Example |
|---|---|---|
| 52.59 | Parameter Value 1 (dynamic decimals) | 52.5900 |
| ABV | Parameter Name 1 | Alcohol By Volume |
| % v/v | Unit Parameter 1 | Volume percentage |
| 0.9284 | Parameter Value 2 (dynamic decimals) | 0.9284 |
| SG@20 | Parameter Name 2 | Specific Gravity @20°C |
| (empty) | Parameter Unit 2 | No unit |
| 28.42 | Temperature (2 fixed decimals) | 28.42°C |
| °C | Temperature Unit | Degrees Celsius |
| Ethanol | Active Method Name | Current method |
| OK | Quality Status | OK/OUT_OF_LIMITS |
| 1 | Valid Cache | 1=valid, 0=invalid |
| 2024-12-01_14:30:45 | RTC Timestamp | Current date-time |

Legend Format "meas"/"last"

| Element | Meaning | Example |
|---|---|---|
| P1/5 | Current/Total Page | Measurement 1 of 5 |
| 2024-12-01_14:30:45 | Timestamp Measurement | Save date-time |
| Ethanol | Method Name | Method used |
| #001 | Sample ID | Sample ID |
| 52.59 | Parameter Value 1 | With dynamic decimals |
| ABV | Parameter Name 1 | Parameter type |
| % v/v | Unit Parameter 1 | Unit of measurement |
| 0.9284 | Parameter Value 2 | With dynamic decimals |
| SG@20 | Parameter Name 2 | Parameter type |
| (empty) | Parameter Unit 2 | No unit |

| Element | Meaning | Example |
|---|---|---|
| 28.42 | Temperature | 2 fixed decimals |
| °C | Temperature Unit | Degrees Celsius |
| OK | Quality Status | Within/outside limits |
| 324 | Counter Measurement | Progressive number |

Legend Format "mact"

| Element | Meaning | Example |
|---|---|---|
| Ethanol | Method Name | Name of the active method |
| 5 | Param1 ID | ID of the first parameter |
| 4 | Param2 ID | ID of the second parameter |
| 0.000000 | Offset | Calibration offset (6 decimal places) |
| 0.000000 | Alpha Coeff | Temperature coefficient (6 decimal places) |
| 20.0 | Ref Temp | Reference temperature (1 decimal place) |
| 0 | Measure Mode | 0=PRECISE, 1=FAST, 2=MANUAL |
| 1 | Print Mode | 0=NONE, 1=DATA, 2=GLP |
| 1 | Is Predefined | 1=default, 0=custom |
| 0.000 | Param1 Min Limit | Minimum limit parameter 1 (3 decimal places) |
| 100,000 | Param1 Max Limit | Maximum limit parameter 1 (3 decimal places) |
| 1 | Param1 Has Limits | 1=limits active, 0=disabled |
| 0.000 | Param2 Min Limit | Minimum limit parameter 2 (3 decimal places) |
| 3,000 | Param2 Max Limit | Maximum limit parameter 2 (3 decimal places) |
| 1 | Param2 Has Limits | 1=limits active, 0=disabled |

Full format :
Name,Param1ID,Param2ID,Offset,Alpha,RefTemp,MeasMode,PrintMode,IsPredefined,P1Min,P1Max,P1HasLimits,P2Min, P2Max,P2HasLimits

Legend Format Calibrations

| Element | Meaning | Example |
|---|---|---|
| P1/5 | Page 1 of 5 total | Automatic counter |
| W | Water calibration | Calibration with water |
| R | Reference calibration | Calibration with standards |
| 250110 | Date YYMMDD | January 10, 2025 |
| 0.000012 | Calibration Offset | 6 decimal places precision |

Pagination System
The data list commands (meas, call, mact) use an automatic paging system that facilitates sequential downloading:
Standard Response Format
All lists follow the format: P[page]/[total]:[data]
Examples:
P1/42:... = Page 1 of 42 total
P15/42:... = Page 15 of 42 total
P42/42:... = Last page (42 of 42)

Pagination Behavior
- Each call returns one entry
- The counter advances automatically with each call
- Once the last page is reached, it restarts from P1/tot
- Each command maintains its own independent counter