

DEN-1 Densitometer Suspension turbidity detector



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1. Safety Precautions

The following symbol means:



Caution: Make sure you have fully read and understood the present Manual before using the equipment. Please pay special attention to sections marked by this symbol.

GENERAL SAFETY

- Use only as specified in the operating manual provided.
- Save the unit from shocks and falling.
- After transportation or storage, keep the unit under room temperature for 2-3 hrs before connecting it to the electric circuit.
- Before using any cleaning or decontamination methods except those recommended by the manufacturer, check with the manufacturer that the proposed method will not damage the equipment.
- Do not make modifications in design of the unit.

ELECTRICAL SAFETY

- Connect only to an external power supply with voltage corresponding to that on the serial number label.
- Use only the external power supply provided with this product.
- Ensure that the power switch and external power supply are easily accessible during use.
- Disconnect the unit from the external power supply before moving.
- If liquid penetrates into the unit, disconnect it from the external power supply and have it checked by a repair and maintenance technician.
- Do not operate the unit in premises where condensation can form. Operating conditions of the unit are defined in the Specifications section.

DURING OPERATION

- Do not operate the unit in environments with aggressive or explosive chemical mixtures. Please contact manufacturer for possible operation of the unit in specific atmospheres.
- Do not operate the unit if it is faulty or was installed incorrectly.
- Do not use outside laboratory rooms.
- Use the **Select** and **Install** buttons only for calibration of the unit according to p. 3.4. Do not press the buttons in other cases, as this can cause calibration reset and may require recalibration.

BIOLOGICAL SAFETY

- It is the user's responsibility to carry out appropriate decontamination if hazardous material is spilt on or penetrates into the equipment.

2. General Information

DEN-1 densitometer has been designed for solution turbidity measurement in the range of 0.3 - 5.0 McFarland units (1×10^6 - 15×10^6 cells/ml). DEN-1 is capable of measuring solution turbidity in a wider range (5.0 - 20.0 McFarland units) however, it is necessary to remember that in this case the standard deviation values increase.

DEN-1 densitometer is used for determining concentration of cells (bacterial, yeast cells) in the fermentation process, for detection of susceptibility of microorganisms against antibiotics, for identification of microorganisms with various test systems, for measuring optical density at fixed wavelength and for quantitative evaluation of dissolved substance concentration.

The operation principle is based on optical density measurement with digital presentation of the results in McFarland units.

The unit is calibrated at the factory and saves calibration data when being switched off. However, it can be calibrated by 2-6 points in 0.5 - 5.0 McFarland unit range if necessary. Both commercial standards (e.g. produced by *Prolab*, *Lachema*, *bioMerieux*, etc.) and the standards prepared in the laboratory can be used for calibration.

Table 1. Interpretation of McFarland Standard results into corresponding numeric values of bacterial suspension concentration and their optical density at 550 nm.

McFarland Standard	Composition	Interpretation	
	Concentration BaSO ₄	Bacterial concentration*	Theoretical optical density at 550 nm**
0.5	2.40×10^{-5} mol/l	1.5×10^6 cells/ml	0.125
1	4.80×10^{-5} mol/l	3×10^6 cells/ml	0.25
2	9.60×10^{-5} mol/l	6×10^6 cells/ml	0.50
3	1.44×10^{-4} mol/l	9×10^6 cells/ml	0.75
4	1.92×10^{-4} mol/l	12×10^6 cells/ml	1.00
5	2.40×10^{-4} mol/l	15×10^6 cells/ml	1.25

* Bacterial concentration depends on microorganism size. The numbers represent an average value valid for bacteria. For yeasts, which are larger, these numbers should be divided by about 30.

** Values correspond to optical densities of bacterial suspensions. The BaSO₄ solutions optical density values differ, because the particle size and form differ from those of bacteria and light is diffracted differently.

3. Getting started

3.1. Unpacking

Remove packing materials carefully and retain them for future shipment or storage of the unit.

Examine the unit carefully for any damage incurred during transit. The warranty does not cover in-transit damage.

Warranty covers only the units transported in the original package.

3.2. Complete set. Package contents:

Standard set

- DEN-1 Densitometer, suspension turbidity detector..... 1 pce.
- External power supply 1 pce.
- Operating Manual, Certificate..... 1 copy
- A-16 adapter for tubes 16 mm in diameter 1 pce.

Optional accessories

- CKG16 calibration kit for glass tubes 16 mm in diameter.....on request
- CKG1802 calibration kit for glass tubes 18 mm in diameter.....on request

3.3. Set up:

- Plug the external power supply into the 12 V socket at the rear side of the unit (fig.1/2).
- Place the unit on the horizontal even working surface;

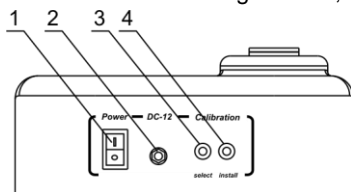


Fig. 1. Rear panel

3.4. Calibration

The device is precalibrated at the factory for operation with the glass tubes 16 mm in external diameter (see the label on the bottom side of the unit) at temperature range from +15°C to +25°C and saves calibration data when switched off.



Note!

To work with other type tubes (e.g. with different outer diameter or bottom shape or different material, e.g. transparent plastic tubes) it is necessary to perform calibration in the specified tubes, using adapters, if necessary.

Perform calibration in the following sequence from the lower calibration value to the higher values: 0.5, 1.0, 2.0, 3.0, 4.0, and 5.0. Use at least 2 points for calibration.

- 3.4.1. Switch ON (position **I**) the unit with the **Power** switch (Fig.1/1) on the rear panel.
- 3.4.2. Press the **Select** button (fig.1/3) on the rear panel. A flashing “0.5” appears on the display, indicating that the unit is ready to measure calibration value of the first point, 0.5 McF.



Note! Use a thin pin of maximum diameter 2 mm for pressing the **Select** and **Install** buttons.



Note! Shake the tube with the standard solution, if necessary. It is recommended to use vortex, e.g. Personal Vortex V-1 plus, for shaking.

- 3.4.3. Insert the tube with the standard solution, corresponding to the calibration point value, into the socket of Densitometer (fig.2/1).
- 3.4.4. Press the **Install** button (fig.1/4). First point “0.5” value is saved in the unit memory and the next calibration point appears, flashing 1.0 indication on the display.



Note! Calibrate as many points as possible to obtain precise results. The minimum requirement is to calibrate 2 points closest to the working range limits (e.g. 0.5 and 5.0 for operation within 0.5 - 5.0 McF unit range).

- 3.4.5. Repeat steps 3.4.3 - 3.4.4 until the calibration is completed (one to five times, as many times as many points the chosen calibration curve has).
- 3.4.6. If a standard for a step is not available, press the **Select** button to skip to the next calibration point.
- 3.4.7. After setting the last standard value “5.0” or skipping through it, the unit exits the calibration mode automatically. The unit is ready for operation.



Note! If pressing the **Install** button during the calibration process does not cause switching to the next standard value, it means that the standard currently inserted in the densitometer socket has lower turbidity value than the previous standard. The inserted standard solution turbidity does not correspond to the required value (try vortexing or shaking the standard, or replace it).

- 3.5. **Reset to factory calibration.** To reset the calibration of the unit to factory settings, ensure that you are in the working mode and the socket of the unit is empty. Press and hold **Install** key for 5 seconds. The unit displays a dot “.”, then changes it to “0.0”. The unit is now reset.
- 3.6. Switch off the unit using the **Power** switch (position **O**). Disconnect the external power supply from electric circuit.

4. Operation

Recommendation during operation

- Keeping the unit switched on for 15 min before starting the operation for the operation mode stabilization is recommended.
- If flat-bottomed tubes are used, the solution level should be higher than 7 mm from a tube bottom; if round-bottomed tubes are used, the level should be higher than 12 mm from a tube bottom.
- Check if the **A-16** adapter is in the socket (Fig. 2/1). The device is calibrated for operation with the glass tubes 16 mm in external diameter. Refer to p. 3.4. when using different tubes.

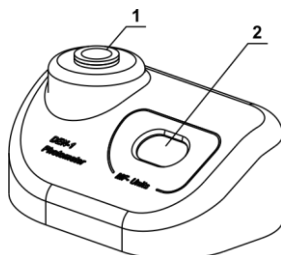


Fig. 2. Front panel

- 4.1. Connect the external power supply to electric circuit.
- 4.2. Switch ON the unit using the **Power** switch (Fig.1/1) on the rear panel (position I).
- 4.3. The following indication can appear on the display (fig.2/2):
 - “**0.0**” means that the unit is calibrated and ready for operation (if no any tube inserted);
 - “**CC**” (flashing) means that the unit is not calibrated. Calibrate the unit.
 - “**EE**” means that operator error message. Switch OFF the unit and then switch ON again.
- 4.4. Shake the tube with the solution (it is recommended to use vortex, e.g. Personal vortex V-1 plus, for shaking) and insert it into the socket (fig.2/1). The McFarland value for the solution appears on the display (fig.2/2).
- 4.5. Glass and transparent plastic tubes (16 or 18 mm in external diameter) can be used for work with DEN-1 densitometer. An adapter must be used for work with tubes, which are 16 mm in external diameter.



Note!

Calibrate the unit each time the tube type (e.g., a tube with different outer diameter, bottom shape or material, i.e. transparent plastic tubes) is changed.

- 4.6. After finishing the operation, switch OFF the unit using the **Power** switch (position O). Disconnect the power supply from electric circuit.

5. Specifications

The unit is designed for operation in cold rooms, incubators and closed laboratory rooms at ambient temperature from +4°C to +40°C in a non-condensing atmosphere and maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.

- 5.1. Light source.....LED
- 5.2. Wavelength $\lambda = 565 \pm 15$ nm
- 5.3. McFarland unit range 0.3 - 20.0 McF
- 5.4. Display resolution 0.1 McF
- 5.5. Accuracy, of the full scale..... $\pm 3\%$
- 5.6. Measurement time 1 s
- 5.7. Sample volume, minimum 2 ml
- 5.8. External diameter of tube 16 mm (using adapter A-16) or 18 mm
- 5.9. Display LED
- 5.10. Dimensions 165x115x75 mm
- 5.11. Input current/power consumption 12 V, 80 mA / 1 W
- 5.12. External power supply
.....input AC 100-240 V 50/60 Hz, output DC 12 V
- 5.13. Weight*..... 0.7 kg

Replacement parts	Description	Catalogue number
A-16	Adapter for tubes 16 mm in external diameter	BS-050102-AK

Optional accessories	Description	Catalogue number
CKG16	Calibration kit for glass tubes 16 mm in diameter. Latex particles.	BS-050102-BK
CKG1802	Calibration kit for glass tubes 18 mm in diameter. Barium sulphate BaSO ₄ .	BS-050102-GK

Biosan is committed to a continuous program of improvement and reserves the right to alter design and specifications of the equipment without additional notice.

* Accurate within $\pm 10\%$.

6. Maintenance

- 6.1. If the unit requires maintenance, disconnect the unit from the electric circuit and contact Biosan or your local Biosan representative.
- 6.2. All maintenance and repair operations must be performed only by qualified and specially trained personnel.
- 6.3. Standard ethanol (75%) or other cleaning agents recommended for cleaning of laboratory equipment can be used for cleaning and decontamination of the unit.

7. Warranty and Claims

- 7.1. The Manufacturer guarantees the compliance of the unit with the requirements of Specifications, provided the Customer follows the operation, storage and transportation instructions.
- 7.2. The warranted service life of the unit from the date of its delivery to the Customer is 24 months (excluding the consumables, i.e. calibration kits). Contact your local distributor to check availability of extended warranty.
- 7.3. Warranty covers only the units transported in the original package.
- 7.4. If any manufacturing defects are discovered by the Customer, an unsatisfactory equipment claim shall be compiled, certified and sent to the local distributor address. Please visit www.biosan.lv, Technical support section to obtain the claim form.
- 7.5. The following information will be required in the event that warranty or post-warranty service comes necessary. Complete the table below and retain for your records.

Model	DEN-1 Densitometer, Suspension turbidity detector
Serial number	
Date of sale	

8. EU Declaration of Conformity

EU Declaration of Conformity

Unit type	Densitometers
Models	DEN-1, DEN-1B
Serial number	14 digits styled XXXXXYYMMZZZZ, where XXXXXX is model code, YY and MM – year and month of production, ZZZZ – unit number.
Manufacturer	SIA BIOSAN Latvia, LV-1067, Riga, Ratsupites str. 7/2
Applicable Directives	EMC Directive 2014/30/EU LVD Directive 2014/35/EU RoHS2 2011/65/EU WEEE 2012/19/EU
Applicable Standards	<u>LVS EN 61326-1: 2013</u> Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements. <u>LVS EN 61010-1: 2011</u> Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements.

We declare that this product conforms to the requirements of the above Directives



Signature

Svetlana Bankovska
Managing director

19.07.2016.

Date



Signature

Aleksandr Shevchik
Engineer of R&D

19.07.2016

Date

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