Grant bio

Densitometer
DEN-1

Operating instructions

For version V.1GW

Contents

1. Safety

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.
- The unit should not be used if dropped or damaged.
- After transportation or storage keep the unit under room temperature for 2–3 hrs before connecting it to the electric circuit.
- Use only cleaning and decontamination methods recommended by the manufacturer.
- Do not make modifications in design of the unit.

ELECTRICAL SAFETY

- Connect only to a external power supply unit with voltage corresponding to that on the serial number label.
- Use only the external power supply unit provided with this product.
- Ensure that the power switch and external power supply unit are easily accessible during use.
- Disconnect the unit from the external power supply unit before moving.
- If liquid penetrates into the unit, disconnect it from the external power supply unit and have it checked by a repair and maintenance technician.

DURING OPERATION

- Do not operate the unit in environments with aggressive or explosive chemical mixtures.
- Do not operate the unit if it is faulty or has been installed incorrectly.
- Do not use outside laboratory rooms.

The **Select** and **Install** buttons are used 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 recalibration will be needed.

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

Densitometer DEN-1 is designed for solution turbidity measurement in the range of 0.3 - 5.0 McFarland units ($100x10^6$ - $1500x10^6$ cells/ml). DEN-1 is capable of measuring solution turbidity in a wider range (5.0 - 15.0 McFarland units) however, it is important to be aware that in this case the standard deviation values increase.

Densitometer DEN-1 is used for determining the concentration of cells (bacterial, yeast cells) in the fermentation process, for the 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 substance concentration.

The operation principle is based on optical density measurement with digital result representation in McFarland units.

The unit is calibrated at the factory and saves calibration data when 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 bioMerieux, Lachema, etc.) and the standards prepared in the laboratory can be used for calibration. Table 1 shows the data provided by the McFarland standard manufacturer bioMerieux.

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	150×10^6 cells/ml	0.125
1	$4.80\ 10^{-5}$ mol/l	300×10^6 cells/ml	0.25
2	$9.60\ 10^{-5}$ mol/l	600×10^6 cells/ml	0.50
3	$1.44\ 10^{-4}$ mol/l	900×10^6 cells/ml	0.75
4	$1.92\ 10^{-4}$ mol/l	1200×10^6 cells/ml	1.00
5	$2.40\ 10^{-4}$ mol/l	1500×10^6 cells/ml	1.25

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

**Values correspond to optical densities of bacterial suspensions. The $BaSO_4$ 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 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.

3.2 The DEN-1 set includes:

Standard set

Densitometer DEN-1 .....1 piece
D16 adapter for tubes with external diameter 16 mm .....1 piece
External power supply unit.....1 piece
Operating Manual; Declaration of Conformity.....1 copy

Optional accessories

DENMCF STDS calibration kit for glass tubes 16 mm in diameter.....on request
DENMCF 18 STDS calibration kit for glass tubes 18 mm in diameter.....on request

3.3. Set up:

Place the unit on the horizontal even working surface.

Plug the external power supply unit into the 12 V socket at the rear side of the unit (fig.1/❷).

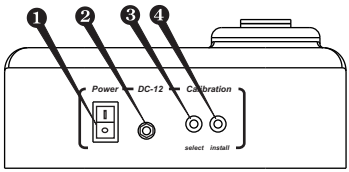

Fig.1 Rear panel

3.4. Calibration

The device is pre-calibrated at the factory for operation with the glass tubes 18 or 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 being switched off.

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

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.

To perform calibration:

3.4.1. Switch ON (position **I**) the unit with the **Power** switch (Fig.1/❶) on the rear panel.

3.4.2. Press the **Select** button (fig.1/❸) on the rear panel (use a thin pin of maximum diameter 2 mm for pressing the **Select** and **Install** buttons). A flashing "0.5" indication will be shown on the display, showing that the unit is ready to save calibrations value of the first point 0.5 McF.

Note! Shake the tube with the standard solution, if necessary (it is recommended to use a vortex mixer, 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.2/❶).

3.4.4. Press the **Install** button using a pin (fig.1/❹). First point “0.5” will be saved in the unit memory and the next calibration value will be displayed (flashing 1.0 indication will be displayed).

Note! It is recommended to 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 in 0.5 - 5.0 McF unit range).

3.4.5. Repeat steps 3.4.3 - 3.4.4 until the calibration is completed (1-5 times, i.e. as many times as many points the chosen calibration curve has).

3.4.6. If a standard is not available, press the **Select** button for the next calibration value to be displayed.

3.4.7. After installing the last standard value “5.0” or skipping it (the **Select** button), the unit exit 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 currently inserted in the densitometer socket standard has lower turbidity value than the previous standard. The reason is that the inserted standard solution turbidity does not correspond to the required value (the standard needs to be shaken or replaced).

3.4.8. After finishing the calibration switch OFF the unit using the **Power** switch (position O). Disconnect the external power supply unit from electric circuit.

3.5 Installation of adapter D16

An adapter D16 must be used for work with tubes which have external diameter 16 mm.

Insert the adapter into the tube socket (fig.2/❷), perform calibration.

4. Operation of DEN-1

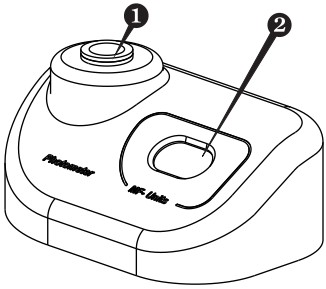

Fig.2 Front panel

Recommendation during operation

- Keeping the unit switched on for 15 min before starting the operation for the operation mode, stabilisation 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.

4.1. Connect the external power supply unit to electric circuit.

4.2. Switch ON the unit using the Power switch (Fig.1/❶) on the rear panel (position I).

4.3. The following indication may be shown on the display (fig.2/❷):
- "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 a vortex mixer, e.g. Vortexer PV-1, for shaking) and insert it into the socket (fig.2/❶). The McFarland value for the solution will be shown on the display (fig.2/❷).

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! The unit must be calibrated each time a tube type (e.g. with different outer diameter, bottom shape or different material [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. Maintenance

Cleaning

The cases can be cleaned with a damp cloth after disconnection. Do not use solvents. Before using any decontamination or cleaning method except that recommended, check with our Service Department, or in other countries with our distributor, that the proposed method will not damage the equipment.

6. Specifications

The product is designed for operation indoors in a laboratory at altitudes up to 2000m, with ambient temperature from +4°C to +40°C and maximum relative humidity 80% for temperatures up to 31°C decreasing linear ly to 50% relative humidity at 40°C.

- Light source .....LED
- Wavelength .....λ = 565 ±15 nm
- McFarland unit range .....0.3–15.0 McF
- Display resolution .....0.1 McF
- Accuracy, of the full scale.....± 3%
- Measurement time .....1 sec
- Sample volume.....2 ml minimum
- Recommended external diameter of tube.....18 mm or 16 mm (when using D16 adapter)
- Display.....LED
- Dimensions .....165x115x75 mm
- Input current/power consumption.....12 V, 80 mA / 1 W
- External power supply unit ..... input AC 100–240 V 50/60 Hz, output DC 12 V
- Weight * .....0.7 kg

* Accurate within ±10%.

Replacement parts	Description
D16	Adaptor for tubes 16 mm in external diameter

Optional accessories	Description
DEN MCF STDS	Calibration kit for glass tubes 16 mm in diameter
DEN MCF 18 STDS	Calibration kit for glass tubes 18 mm in diameter

Grant is committed to a continuous programme of improvement, specifications may be changed without notice.

7. Guarantee and Service

7.1 Guarantee

When used in laboratory conditions and according to these working instructions, this product is guaranteed for TWO YEARS against faulty materials or workmanship.

7.2 Service

For service, return for repair to our Service Department in the UK or, in other countries, to our distributor.

Declaration of Conformity

Manufacturer:	BIOSAN LTD. Ratsupites 7, build.2, Riga, LV-1067, Latvia
Equipment name/type number:	DEN-1
Description of Equipment:	Densitometer
Directive:	EMC Directive 2004/108/EC Low Voltage Directive 2006/95/EC

Applied Standards	
Harmonized Standards:	EN 61326-1: Electrical equipment for measurement, control and laboratory use EMC requirements General requirements EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements

I declare that this apparatus conforms to the requirements of the above Directive(s)

Dated 06.09.2011

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