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biosan
Medical–Biological
Research & Technologies

TS-DW
Thermo-shaker for deepwell plates

Operating Manual
Certificate

for version
V.2A01

Contents

1. Safety precautions

The following symbols mean:

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.

Caution! Hot surface! Platform surface becomes very hot during use. Always use protective cotton gloves to install or remove test plate when set temperature is higher than 60°C.

GENERAL SAFETY

- Use only as specified in the operating manual provided.
- Save the unit from falls and damage.
- Store and transport the unit in a horizontal position (see package label) at ambient temperatures between -20°C and +60°C and maximum relative humidity of 80%.
- 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 to the design of the unit.

ELECTRICAL SAFETY

- Connect only to the 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.
- Do not plug the unit into an ungrounded power socket, and do not use an ungrounded extension lead.
- Disconnect the unit from electric circuit before moving.
- Disconnect the external power supply from power socket to turn off the unit.
- 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 leave the operating unit unattended.
- 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 has been installed incorrectly.
- Do not use outside laboratory rooms.
- Do not check the temperature by touch. Use a thermometer.

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

Thermo-shaker TS-DW is designed for shaking deep well plates in the thermostatic regulation mode.

A distinctive feature of Biosan plate thermo-shakers is the patented two-side plate heating that allows achieving full correspondence of the set and actual temperature in the plate wells.

Features of TS-DW meet the highest expectations of users according to many parameters:

- Fast reaching of specified mixing speed and maintenance of equal amplitude of rotation throughout the Thermo-shaker block;
- Stability of maintaining the set temperature in a wide range throughout the Thermo-shaker's block surface;
- With the help of the temperature calibration function the user can calibrate the unit approx. ±6% of the selected temperature to compensate differences in the thermal behaviour of plates from different manufacturers;
- LCD display indicates set and current values of temperature, speed and time of operation;
- Quiet motor operation, compact size, prolonged service life;
- Autodiagnostics of temperature sensors, platform heater, lid heater, etc.

TS-DW was designed using the multi-system principle, which allows using it as three independent devices:

- Incubator
- Plate shaker
- Thermo-shaker

The device can be used in:

cytochemistry	for in situ reactions;
immunochemistry	for immunofermentative reactions;
biochemistry	for enzyme and protein analysis;
molecular biology	for nucleic acids isolation.

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. Warranty covers only the units transported in the original package.

3.2. Complete set. Thermo-shaker set includes:

Standard set

- TS-DW Thermo-Shaker for deep well plates ..... 1 pce
- External power supply ..... 1 pce
- Power cable ..... 1 pce
- Spare rubber belt ..... 2 pcs
- Operating Manual; Certificate ..... 1 pce

Optional accessories

- B-2E block for one deep-well plate Eppendorf® 96/1000 µl ..... on request
- B-2S block for one deep-well plate Sarstedt® Megablock 96/2200 µl ..... on request
- B-2P Block for one deep-well plate Porvair® 96/2000 µl ..... on request
- B-2A Block for one deep-well plate Axygen® 96/2200 µl ..... on request
- B-06A block for one deep-well plate Axygen® 96/600 µl ..... on request

3.3. Setup:

- place the unit upon even horizontal non-flammable surface 30 cm away from any flammable materials;
- remove protective film from the display;
- plug the external power supply into the socket at the rear side of the unit;
- connect the power cord to the external power supply.

3.4. Thermoblock installation (if thermoblock is not installed)

Caution! Thermoblock installation and replacement have to be performed only when the Power switch is turned off and external power supply is disconnect from the device.

- Choose the thermoblock; connect the plug to the contact terminal according to the scheme on Fig. 1/1 on the underside of the thermoblock. Make sure that the connector is mounted tightly.
- Align the thermoblock so that the connector pins are facing the right side of the unit.
- Secure with the four knurled screws.

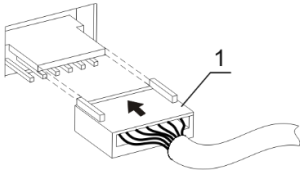

Fig. 1 Thermoblock connection

3.5. Changing blocks

- Disconnect the external power supply from the device.
- Remove the four knurled screws, lift the block without damaging the cable and disconnect the plug (fig.1/1).
- Select the new thermoblock and install it according to the point 3.4.

4. Operation

Recommendations during operation

- Please check the deepwell plates before using, be sure that plates are heat-resistant resistant. Do not heat the deep well plates over the melting point of the material they are made of.
- It is recommended to fill wells up to 75% of the rated volume for efficient mixing.

Caution! Hot surface! Platform surface becomes very hot during use. Always use protective cotton gloves to install or remove test plate when set temperature is higher than 60°C.

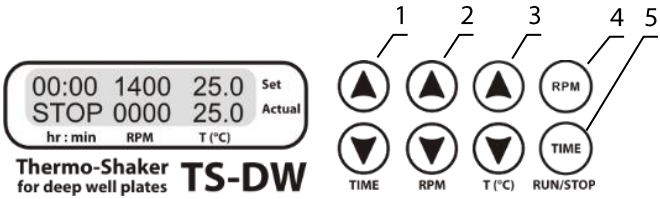

Fig. 2. Control Panel

4.1. Connect external power supply to a grounded power socket and set the power switch, located on the rear panel of the unit, to position I (ON).

4.2. The display will turn on with the upper line (Set) showing time, speed and temperature set earlier and the lower line (Actual) showing current readings of the same parameters (platform temperature °C, which automatically starts rising according to the temperature set in the upper line). The time of temperature stabilization depends on the initial temperature.

4.3. **Setting the parameters.** Use the readings in the upper line of the display (Set), while setting the required parameters. Pressing the key for more than 3 s will increase the increment rate. RPM and temperature settings can be changed during operation.

4.3.1. **Setting time (TIME).** Using the ▲ and ▼ **TIME** keys (fig. 2/1) set the required working time interval in hours and minutes (increment 1 min).

4.3.2. **Setting speed (RPM).** Using the ▲ and ▼ **RPM** keys (fig. 2/2) set the required speed (increment 10 rpm).

4.3.3. **Setting temperature (T, ºC).** Using the ▲ and ▼ **T (ºC)** keys (fig. 2/3) set the necessary temperature (increment 0.1°C).

Caution! Heating/temperature maintenance process does not stop when the timer is finished. Platform thermal regulation can be turned off only by setting the required temperature below 25 °C (the display will show OFF - T,°C - set point). In this mode, TS-DW can be used in the cold rooms as a mixing device without thermoregulation.

4.4. **Program execution.** After the thermal stabilization of the Thermo-Shaker (when the set and current temperature readings become the same):

4.4.1. Place the deep well plate on the platform and close the lid.

Caution! Do not fill the plate inside the unit.

4.4.2. Press the **RPM RUN/STOP** key (Fig. 2/4). The platform will start rotating and the timer indicator will start counting the time interval (with 1 min precision).

Note! If the rotation speed is set to zero, pressing **RPM RUN/STOP** key will start the timer but the platform will not move.

4.5. After finishing the program (after the set time elapses) the platform motion will stop and the timer will show the flashing reading STOP accompanied by the repetitive sound signal until the **RPM RUN/STOP** key is pressed.

4.6. If the working time is not set (or is reset) and the timer indicator in the upper line shows 00:00, pressing the **RPM RUN/STOP** key will start continuous operation of the device with countdown timer in the lower line (Actual) until the **RPM RUN/STOP** key is pressed again.

4.7. If required, there is possibility to restart the timer when it is running. Press the **TIME RUN/STOP** key once (Fig. 2/5) to stop the timer. Press the **TIME RUN/STOP** key again to restart the timer.

4.8. The platform motion can be stopped at any time by pressing the **RPM RUN/STOP** key. In this case, the program realization and the platform motion will stop and the timer will switch into the STOP mode saving previously set time. Press the **RPM RUN/STOP** key to repeat the operation with the same time and speed.

Caution! At the end of the set time period the platform movement is stopped automatically, but the heating can be stopped only manually by reducing the temperature using the **▼ T (°C)** key (Fig. 2/3 - lower button) till the OFF sign appears in the upper line (Set) of the display

Caution! When lid is open, the platform and lid heating surfaces will remain hot. Please, take necessary care and use protective cloth gloves at temperatures over 60°C.

4.9. After finishing the operation, set the power switch (located on the rear panel of the unit), in position O (Off) and disconnect the external power supply from electric circuit.

5. Calibration

5.1. The device is precalibrated at the factory (calibrating coefficient is 1.000) for operation with temperatures measured by a sensor in the heating block.

5.2. To change the calibration coefficient, hold the **TIME RUN/STOP** key (fig. 2/5) pressed for more than 8 s to activate calibration mode. The calibration coefficient appears on the display (fig. 3/1).

5.3. **Restoring factory settings.** Set 1.000 value using the ▲ and ▼ **T (ºC)** keys (fig. 2/3) as shown on fig. 3/1 to restore the factory settings. Press the **RPM RUN/STOP** key (fig. 2/4) once to save the changes and exit the calibration mode.

Note. Coefficient value changes are recommended after the unit has reached 30°C temperature.

5.4. **Calibration procedure**.

5.4.1. Install independent sensor (0.5°C accuracy) into deep wells of installed block.

5.4.2. Set the required temperature in operation mode (e.g. 40°C).

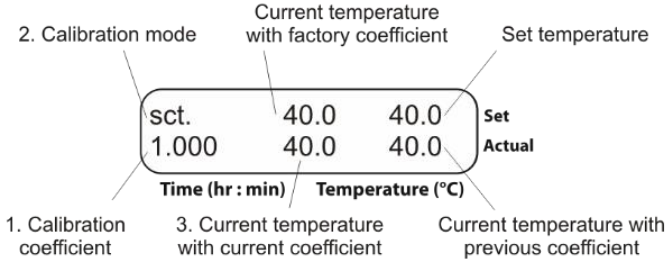

Fig. 3. Display in calibration mode

5.4.3. After the unit reaches the set temperature (when the set and current temperature readings equal), leave the unit for 30 min for thermal stabilization.

5.4.4. Let us assume that the readings of independent sensor is 39°C, but actual temperature on display is 40°C. Then it is necessary to add 1°C correction.

5.4.5. Hold **TIME RUN/STOP** key (fig. 2/5) pressed for more than 8 s to activate calibration mode. The following parameters will be shown on the display (fig. 3):

- Calibration mode indicator, currently measured plate and lid temperatures – in **Set** upper line;
- Calibration coefficient, current temperature multiplied by current coefficient, current temperature multiplied by previous coefficient – in **Actual** lower line.

5.4.6. Using the ▲ and ▼ **T (ºC)** keys (fig. 2/3), change the calibration coefficient (fig. 4/1) so that the new current temperature value (fig. 4/2) corresponds to the independent sensor temperature. In our example, the calibration coefficient will be 0.974.

Note. Calibration coefficient can be changed in range from 0.936 to 1.063, with increment of 0.001. This calibrating coefficient will correct temperature through all the operation range.

Note. Coefficient value changes are recommended after the unit has reached 30°C temperature.

5.4.7. After finishing the calibration, press the **RPM RUN/STOP** key once to save the changes and exit the calibration mode.

5.4.8. The display will show calibrated temperature as shown on fig. 5 and the unit will continue thermal stabilization according to the previously set temperature.

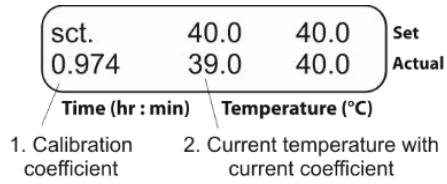

Fig. 4. Changing calibration coefficient

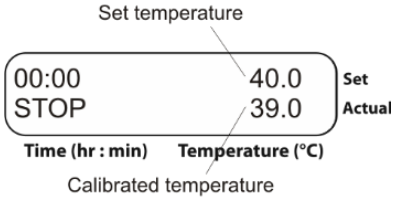

Fig. 5. Display in operation mode after calibration

6. Specifications

The unit is designed for operation in cold rooms, incubators (except CO_2 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.

6.1. Temperature specifications

Setting range	+25°C to +100°C
Control range	5°C above RT to +100°C
Setting resolution	0,1°C
Stability*, at +37°C	±0.1°C
Maintaining accuracy*, at +37°C	±0.5°C**
Uniformity over the platform*, at +37°C	±0.1°C**
Average heating speed from +25°C to +100°C	2.4°C/min
Time of platform heating from +25°C to +37°C	12 min
Temperature calibration option	
Calibration coefficient range	0.936...1.063 (± 0.063)

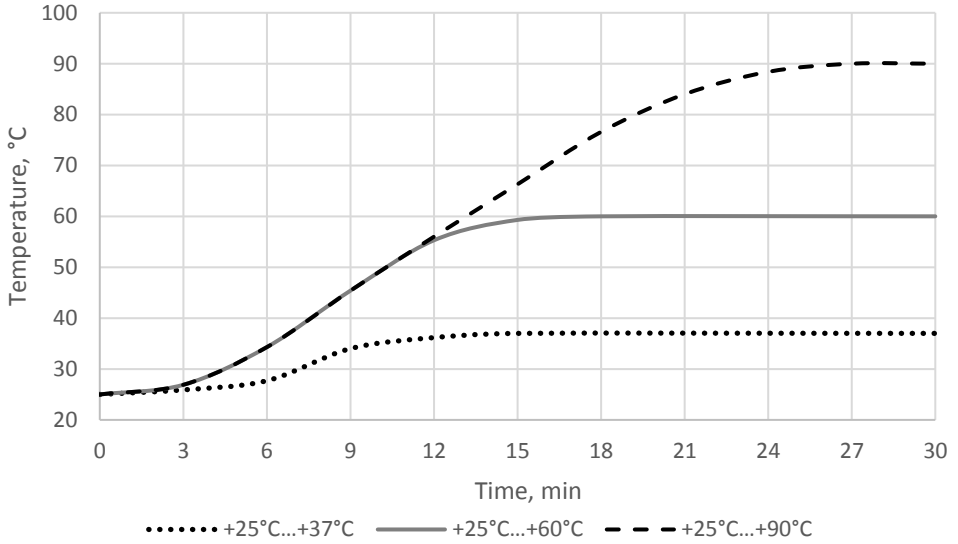

Fig. 6. Kinetics of liquid heating inside a single cell in a plate, total volume 1000 µl**

* Data for 75% filled microplates

** For **B-2E** Eppendorf thermoblock. Other block specifications are different.

6.2. General specifications

Speed range..... 250-1400 rpm
Speed setting resolution.....10 rpm
Maximal speed deviation
for 250 rpm 2%
for 1400 rpm.....0.7%
Orbit .....2 mm
Digital time setting.....1 min - 96 h
Time setting resolution .....1 min
Maximal continuous operation time.....96 h
Recommended interval between operation sessions not less than 8 hours
Display .....16x2 symbols, LCD
Dimensions ..... 240x260x160 mm
Input current/power consumption .....12 V, 4.8 A / 58 W
External power supply.....in AC 100-240 V 50/60 Hz, out DC 12 V
Weight*.....5.1 kg

Thermoblock model	Thermoblock description	Catalogue number
B-2E	for one deep-well plate Eppendorf® 96/1000 µl	BS-010159-AK
Block parameters in the Specifications section point 6.1.		
B-2S	for one deep-well plate Sarstedt® Megablock 96/2200 µl	BS-010159-CK
B-2P	for one deep-well plate Porvair® 96/2000 µl	BS-010159-EK
B-2A	for one deep-well plate Axygen® 96/2200 µl	BS-010159-FK
B-06A	for one deep-well plate Axygen® 96/600 µl	BS-010159-KK
Temperature maintenance stability**, at +37°C Temperature maintenance precision**, at +37°C Uniformity over the platform**, at+37°C		±0.1°C ±1.0°C ±0.2°C

Replacement parts	Description	Catalogue number
Rubber belt	122x6x0.6 mm	BS-000000-S18

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

* Accurate within ± 10%.

** Data for 75% filled plates

7. Maintenance

7.1. If the unit requires maintenance, disconnect the unit from the electric circuit and contact Biosan or your local Biosan representative.

7.2. All maintenance and repair operations must be performed only by qualified and specially trained personnel.

7.3. Standard ethanol (75%) or other cleaning agents recommended for cleaning of laboratory equipment can be used for cleaning and decontamination of the unit.

7.4. Rubber belt replacement:

- For maintenance of reliable operation of the device, the producer recommends to replace rubber belts after 1.5 years or 2000 hours of operation time.
- Disconnect the external power supply from the device.
- Remove 4 fixation screws on the device bottom and remove the bottom plate.
- Replace the rubber belt (Fig. 7).
- Reassemble the device.

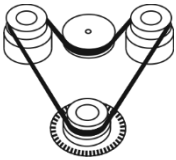

Fig. 7. Rubber belt replacement

7.5. Error codes in case of a defect.

Following error codes are shown in the lower right corner of the display (fig. 2), accompanied by a sound signal every 8 s. Press **RPM RUN/STOP** key to turn off the signal. Disconnect the unit from the electric circuit and contact Biosan or your local Biosan representative.

Error code	Description
ERR 1	Lower plate heat sensor error
ERR 2	Upper lid heat sensor error
ERR 3	PCB plate error
ERR 4	PCB plate error
ERR 5	Upper lid heating error
ERR 6	Upper lid overheating

8. Warranty and Claims. Registration

8.1. The Manufacturer guarantees the compliance of the unit with the requirements of Specifications, provided the Customer follows the operation, storage and transportation instructions.

8.2. The warranted service life of the unit from the date of its delivery to the Customer is 24 months. For extended warranty register the unit, see p. 8.5.

8.3. Warranty covers only the units transported in the original package.

8.4. If any manufacturing defects are discovered by the Customer, an unsatisfactory equipment claim shall be compiled, certified and sent to the local distributor address. To obtain the claim form, visit section **Technical support** on our website at link below.

8.5. Extended warranty. For **TS-DW**, a *Premium* class model, one year of extended warranty is available free of charge after registration, during 6 months from the date of sale. Online registration form can be found in section **Warranty registration** on our website at the link below.

8.6. Description of the classes of our products is available in the **Product class description** section on our website at the link below.

Technical support	**Warranty registration**	**Product class description**
biosan.lv/en/support	**biosan.lv/register-en**	**biosan.lv/classes-en**

8.7. 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	TS-DW, Thermo-shaker for deepwell plates
Serial number	
Date of sale	

9. EU Declaration of conformity

EU Declaration of Conformity

Unit type	Thermo-shakers
Models	**TS-100, TS-100C, TS-DW, PST-60HL, PST-60HL-4, PST-100HL**
Serial number	14 digits styled XXXXXXYYMMZZZZ, 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	LVS EN 61326-1: 2013 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements. LVS EN 61010-1: 2011 Safety requirements for electrical equipment for measurement, control, and laboratory use. General requirements. LVS EN 61010-2-010: 2015 Particular requirements for laboratory equipment for the heating of materials. LVS EN 61010-2-051: 2015 Particular requirements for laboratory equipment for mixing and stirring.

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

Signature	Signature
Svetlana Bankovska Managing director	Aleksandr Shevchik Engineer of R&D
19.07.2016. Date	19.07.2016 Date

HOW TO CHOOSE
A PROPER SHAKER, ROCKER, VORTEX

biosan
Medical–Biological Research & Technologies

Sample volume 10^3 ... 10^2 ml
Erlenmeyer flasks and Cultivation flasks

Sample volume 10^1 ml
Petri dishes, vacutainers and tubes up to 50 ml

Sample volume 10^0 ... 10^{-3} ml
PCR plates, microtest plates and Eppendorf type tubes

PSU-20i, Orbital Shaker

ES-20/60, Orbital Shaker–Incubator

Applications:
Microbiology
Extraction
Cell cultivation

PSU-10i, Orbital Shaker

ES-20, Orbital Shaker–Incubator

MR-12, Rocker–Shaker

Multi RS-60, Programmable rotator

Multi Bio RS-24, Programmable rotator

Applications:
Microbiology
Extraction
Cell cultivation
Hematology

Bio RS-24, Mini–Rotator

V-1 plus, Vortex

NEW

RTS-1 and RTS-1C, Personal bioreactors

MSV-3500, Multi Speed Vortex

MR-1, Mini Rocker–Shaker

Applications:
Agglutination
Gel staining/ destaining

Multi Bio 3D, Mini Shaker

Applications:
Agglutination
Extraction
Blot hybridisation
Gel staining/destaining

PST-60HL-4, Thermo–Shaker

PST-100HL, Thermo–Shaker

TS-DW, Thermo–Shaker for deep well plates

PST-60HL, Thermo–Shaker

NEW

Applications:
ELISA Analysis
Genomic Analysis
Hybridization
Immunology

Applications:
Nucleic acid Analysis
Molecular Analysis
Protein Analysis
Genomic Analysis

MPS-1, Multi Plate Shaker

PSU-2T, Mini–Shaker

NEW

CVP-2, Centrifuge vortex for PCR plates

TS-100, TS-100C, Thermo–Shakers

V-32, Multi-Vortex

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