Medical–Biological
Research & Technologies

PSU-10i & PSU-20i
Orbital shakers

Operating Manual

Contents

1. About this edition of the operating manual

The manual applies to following models and versions of orbital shakers:

- **PSU-10i** version V.3AW
- **PSU-20i** version V.1AW

2. 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.

GENERAL SAFETY

- Save the unit from shocks or falling.
- 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 mains.
- 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 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 external power supply is easily accessible during use.
- Disconnect the unit from the mains before moving.
- Turn off the unit by disconnecting the external power supply from the power socket.
- If liquid penetrates into the unit, disconnect it from the power socket 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 impede the platform motion.
- 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 place a load exceeding the maximum load value mentioned in the Specifications section of this Manual.

BIOLOGICAL SAFETY

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

3. General Information

Orbital shakers **PSU-10i** and **PSU-20i** are benchtop multifunctional shaking units.

Shakers are designed with direct drive brushless motor, with warranted service life of 35000 hours. Units are reliable in operation and provide stable non-stop shaking for 7 days. Shakers are equipped with a liquid crystal display that shows set and current time and speed values. Variety of platforms, wide speed range and high maximum load (3 kg for **PSU-10i** model, 8 kg for **PSU-20i** model) expand the possibilities of application of orbital shakers in different laboratories.

PSU-20i model provides three types of motion, which can be performed individually, in pairs or set in a repeated cycle.

Orbital rotational motion. Simple orbital motion with an option of shifting direction (clockwise/anti-clockwise) after set time. Adjustable speed from 20 to 250 rpm (increment 5 rpm). Time setting range 0 - 250 s or non-stop.

Reciprocal motion. Orbital rotation with changing direction of rotation. Adjustable amplitude (from 0° to 360°, increment 30°) sets the limits for this type of motion. The speed is the same as set for rotational motion (from 20 to 250 rpm). Time setting range 0 - 250 s or non-stop.

Vibro motion. Intensive mixing of samples at high speed with small amplitude - Vibro motion. Adjustable amplitude (from 0° to 5°, increment 1°) sets the limits for this type of motion. Time setting range 0 - 5 s or non-stop.

Reciprocating and Vibration motion types can be replaced with a pause.

All 3 motions are combined into a cycle (fig. 1) and can be used:

- separately;
- in combinations of two types;
- all three in one cycle.

By combining different types of rotational motion, the researcher gets unlimited options for mixing parameters. The countdown timer is used to control the operation time, with the period from 1 min to 96 hours.

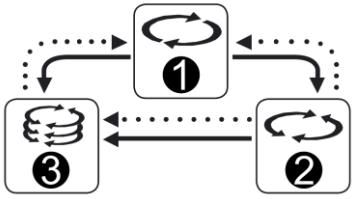

Figure 1. Innovative mixing cycle

Orbital shakers are specially designed for gentle and intensive mixing of biological and chemical compounds in a laboratory. The instrument applicable for:

Biotechnology and microbiology	For growing microorganisms and extracting biologically active material
Immunology and biochemistry	For agglutination reactions and precipitation
Molecular and cell biology	For washing of electrophoresis gels and blots
Biopharmacy and biomedicine	For cultivation and synthesis of new biological compounds

4. Getting started

4.1. **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.

4.2. **Complete set**. Package contents:

4.2.1. **PSU-10i**

- **PSU-10i** Orbital Shaker ..... 1 piece
- External power supply ..... 1 piece
- Operating Manual; Certificate..... 1 copy
- UP-12 platform ❶ .....on request
- Additional HB-200 holding bar for UP-12 platform .....on request
- Bio PP-4 platform ❷ .....on request
- P-16/88 platform ❸ .....on request
- P-12/100 platform ❹ .....on request
- P-6/250 platform ❺ .....on request

❶ **UP-12**

❷ **Bio PP-4**

❸ **P-16/88**

❹ **P-12/100**

❺ **P-6/250**

4.2.2. **PSU-20i**

- **PSU-20i** Programmable Orbital Shaker ..... 1 piece
- External power supply ..... 1 piece
- Power cord ..... 1 piece
- Four screws and a wrench ..... 1 set
- Operating Manual; Certificate ..... 1 copy
- UP-330 platform ❶ ..... on request
- Additional HB-330 holding bar for UP-330 platform ..... on request
- P-30/100 platform ❷ ..... on request
- P-16/250 platform ❸ ..... on request
- P-9/500 platform ❹ ..... on request
- P-6/1000 platform ❺ ..... on request
- UP-168 universal platform ❻ ..... on request
- FC-100, FC-250, FC-500, FC-1000, FC-2000 clamps for UP-168 ..... on request
- PP-20 flat one-level platform ❼ ..... on request
- PP-20-2 two-level platform ❽ ..... on request
- PP-20-3 three-level platform ❾ ..... on request
- PP-20-4 four-level platform ❿ ..... on request

❶ **UP-330**

❷ **P-30/100**

❸ **P-16/250**

❹ **P-9/500**

❺ **P-6/1000**

❻ **UP-168**

❿ **PP-20-4**

❾ **PP-20-3**

❽ **PP-20-2**

❼ **PP-20**

4.3. Setup:
- place the unit on the horizontal even working surface;
- remove protective film from the display;
- plug the external power supply into the 12 V socket at the rear side of the unit and position the unit so that the plug is easily accessible.

4.4. Platform installation.

4.4.1. Model **PSU-10i**. Install the platform to the moving base. Fit the pins on the underside of the platform into the holes on the moving base.

4.4.2. Model **PSU-20i**. Remove the mat from the platform, if present. Secure the platform on the moving base with four included screws. Replace the mat.

4.5. To assemble and install the optional multilevel platform **PP-20**, follow the instruction supplied with the platform.

4.6. Different clamps can be installed on the optional platform **UP-168**. For the maximum number of allowed clamps, see **Table 4** in the **Specifications** section.

5. Operation

5.1. Working with model **PSU-10i**.

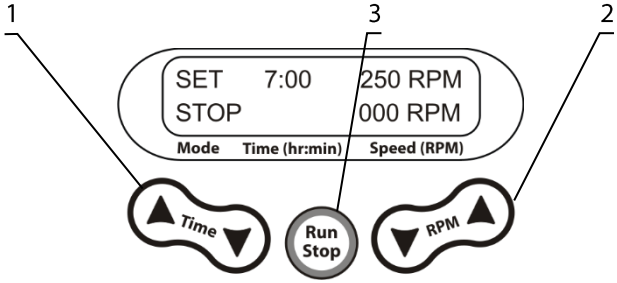

Figure 2. Control panel of PSU-10i

5.1.1. Connect the external power supply to the mains. Switch the power switch on the rear side of the unit into position **I** (on).

5.1.2. Place samples on the unit platform.

5.1.3. Set the required working time interval in hours and minutes (the increment is 1 min) using the ▼ and ▲ **Time** keys (fig. 2/1). Pressing the key for more than 2 s will increase the increment.

5.1.4. Set the required shaking speed (the increment is 10 rpm) using the ▼ and ▲ **RPM** keys (fig. 2/2). Pressing the key for more than 2 s will increase the increment. The set speed is displayed in the upper line of the display.

5.1.5. Press the **Run Stop** key (fig. 2/3). The platform starts rotation, indication RUN appears on display and the timer in the lower line of the display starts counting the time interval.

5.1.6. After the timer reaches the set time, the platform motion will stop and the flashing indication STOP, accompanied by the repetitive sound signal, will appear in the lower line of the display. Press the **Run Stop** key to shut down the signal.

5.1.7. The unit can be stopped before the set time elapses if necessary by pressing the **Run Stop** key. Press the **Run Stop** key to repeat the operation with the same working time and speed.

5.1.8. If the working time is not set (or is reset) and the Time indicator on display shows OFF, pressing the **Run Stop** key will start continuous operation of the unit until the **Run Stop** key is pressed.

5.1.9. The platform motion can be stopped at any time by pressing the **Run Stop** key. In this case, the program realization and the platform motion will stop and the unit will switch into the STOP mode.

5.1.10. After finishing the operation, switch the power switch on the rear side of the unit into position **O** (off) and disconnect the external power supply from the mains.

5.2. Working with model **PSU-20i**.

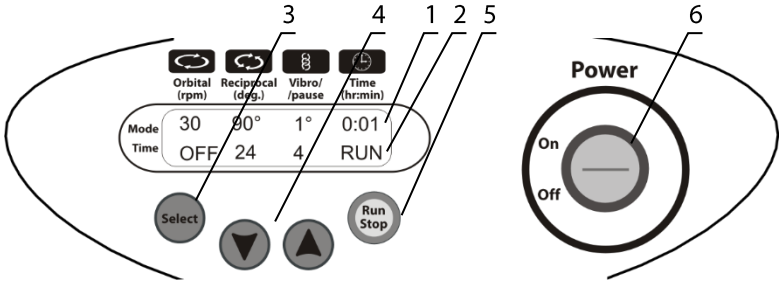

Figure 3. Control panel of PSU-20i

5.2.1. Connect the external power supply to the mains and switch on the **Power** switch (fig. 3/6).

5.2.2. Place samples on the unit platform.

5.2.3. Set the appropriate program and operation time (see section **6. Program Setting**) according to the methodical prescriptions.

5.2.4. Press the **Run Stop** key (fig. 3/5) to start the program. The platform motion starts, the indication RUN (fig. 3/2) and the changing time values are shown on the display.

5.2.5. If the operation time is set, the unit stops after the set time interval expires. Flashing indication STOP appears on the display, and an audible signal starts, indicating the end of operation. Press the **Run Stop** key to stop the signal.

5.2.6. If the operation time is not set and the timer indicator (fig. 3/1) shows OFF, pressing the **Run Stop** key causes the unit to operate continuously until the **Run Stop** key is pressed again.

5.2.7. The rotator can be stopped at any time during operation before the set time expires if necessary by pressing the **Run Stop** key.

5.2.8. Press the **Run Stop** key to repeat the set program.

5.2.9. At the end of operation switch off the unit using the **Power** switch and unplug the external power supply from the mains.

6. Program setting

Note. This section is only for model **PSU-20i**.

6.1. The program consists of cycles. Each cycle includes up to three different types of platform motion (Orbital, Reciprocal and Vibro) set one after another with the duration from 0 to 250 seconds for Orbital and Reciprocal motion types and from 0 to 5 seconds for Vibrating motion.

6.2. It is necessary to set speed, amplitude, time for each motion type and the overall operation time.

6.3. Press the **Select** key (fig. 3/3) to choose the parameter to change. Each pressing of the **Select** key consecutively activates the parameters. The active parameter is flashing. Use the ▼ and ▲ keys (fig. 3/4) to set the necessary value. Pressing the key for more than 2 s increases the speed of value change.

6.4. Saving the program does not require additional operations, because the microprocessor saves the last parameter changes as the working program automatically.

6.5. If the time for a motion is set to 0 s (indication OFF), this type of motion will be skipped in the cycle.

6.6. It is possible to set a pause instead of Reciprocal (0–250 s) or Vibro (0–5 s) motion. For a pause, set the amplitude of Reciprocal or Vibro motion to zero and set the time for this motion, which will be the time of pause duration. During the operation, the platform will not move in this mode but the time will be counted down.

6.7. The timer (fig. 3/1) is used to control the overall operation time. The timer can be set for the period from 1 min to 96 hours (timer increment 1 min)

Note. The set time cannot be changed during operation.

6.8. Table below shows different cycle variants:

Nr.	Orbital	Reciprocal	Vibro
1	On	On	On
2	On	Off	On
3	On	Pause	On
4	On	Off	Off
5	On	Pause	Off
6	On	Off	Pause
7	On	Pause	Pause

Nr.	Orbital	Reciprocal	Vibro
8	On	On	Off
9	On	On	Pause
10	Off	On	On
11	Off	Pause	On
12	Off	On	Pause
13	Off	Off	On
14	Off	Off	Off

6.9. Further examples illustrate program setting for four different cycle variants.

6.9.1. **Orbital motion.** Set the speed (fig. 4/**A,** 20–250 rpm) and time (fig. 4/**B**, 1–250 s) of Orbital motion. Turn off Reciprocal motion (fig. 4/**C**) by setting time of the cycle to zero (OFF). Turn off Vibro motion (fig. 4/**D**) by setting time of the cycle to zero (OFF).

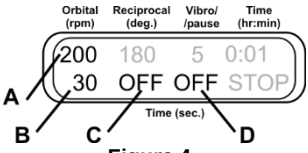

Figure 4.

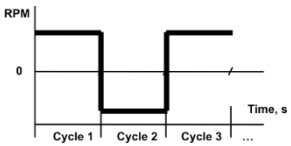

Figure 5.

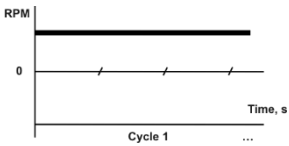

Figure 6.

Note: The unit is programmed to change the rotation direction each time when a motion timer is started, i.e. if the Orbital motion time is set to 30 s then the direction of orbital rotation will be changed every 30 s (fig. 5).

If Orbital motion time is set to 0 s, shaker will perform simple orbital rotation in one direction (fig. 6). In this mode, Reciprocal and Vibro motion cannot be added to the cycle.

6.9.2. **Orbital + Reciprocal + Vibro motion.** Set the speed (fig. 7/**A**, 20–250 rpm) and time (fig. 7/**D**, 1–250 s) of Orbital motion. Set the amplitude (fig. 7/**B**, 0–360°) and time (fig. 7/**E**, 1–250 s) for Reciprocal motion. It is performed at the same speed as the Orbital motion (fig. 8). Set the amplitude (fig. 7/**C**, 0–5°) and time (fig. 7/**F**, 1–5 s) for Vibro motion.

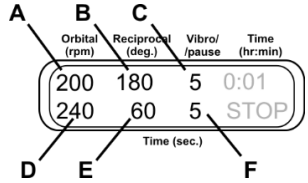

Figure 7.

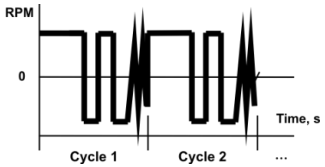

Figure 8.

6.9.3. **Orbital + Reciprocal + Pause.** Set the speed (fig. 9/**A**, 20–250 rpm) and time (fig. 9/**D**, 1–250 s) of Orbital motion. Set the amplitude (fig. 9/**B**, 0–360°) and time (fig. 9/**E**, 1–250 s) for Reciprocal motion. It is performed at the same speed as the Orbital motion. Set the amplitude (fig. 9/**C**) of Vibro motion to zero. Set the time for Vibro motion (fig. 9/**F**, 1–5 s), this is the time of pause duration (fig. 10).

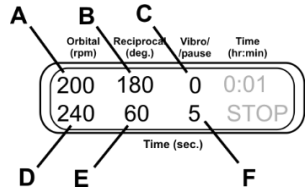

Figure 9.

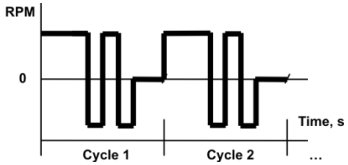

Figure 10.

6.9.4. **Vibration + Pause.** Turn off Orbital motion by setting time of Orbital motion below zero (fig. 11/**D**, OFF). Set the amplitude of Reciprocal motion (fig. 11/**B**) to zero. Set the time for Reciprocal motion (fig. 11/**E**, 1–250 s), this is the time of pause duration. Set the amplitude (fig. 11/**C**, 0–5°) and time (fig. 11/**F**, 1–5 s) for Vibro motion. See figure 12 for process visualization.

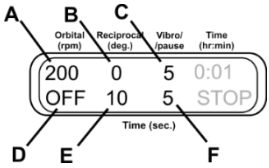

Figure 11.

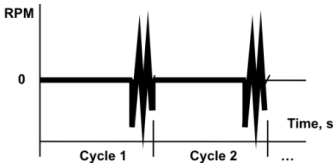

Figure 12.

7. Specifications

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

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

Model	PSU-10i	PSU-20i
Orbital rotation		
Speed control range	50-450 RPM	20-250 RPM
Increment	10 RPM	5 RPM
Time setting range	-	0-250 s per cycle
Reciprocal motion		
Amplitude range	-	0-360°
Increment	-	30°
Time setting range	-	0-250 s per cycle
Vibro motion		
Amplitude range	-	0-5°
Increment	-	1°
Time setting range	-	0-5 s per cycle
General specifications		
Digital time setting	1 min – 96 h or non-stop	
Increment	1 minute	
Maximum continuous operation time[1]	168 hours	
Orbit	10 mm	20 mm
Device dimensions w/o platforms, WxDxH	255x255x100 mm	410x410x130 mm
Input current	12 V, 470 mA	12 V, 3.2 A
Power consumption	5.7 W	40 W
External power supply	input AC 100-240 V, 50/60 Hz, output DC 12 V	
Weight[2]	3.4 kg	11.7 kg

Table 1. Maximum load on a platform

Model PSU-10i

Speed	Load
Below 250 rpm	3 kg
250 – 350 rpm	2 kg
350 – 450 rpm	0.5 kg

Model PSU-20i

Speed	Load
Below 150 rpm	8 kg
150 – 200 rpm	5 kg
200 – 250 rpm	2.5 kg

[1] Recommended interval between operation sessions not less than 8 hours

[2] Accurate within ±10%.

Table 2. Optional accessories for PSU-10i

Optional accessories	Description	Catalogue number
UP-12	Universal platform with bars and non-slip rubber mat (285x215 mm)	BS-010108-AK
Bio PP-4	Flat platform with non-slip silicone mat (255x255 mm, work area 230x230 mm)	BS-010116-AK
P-12/100	12 clamps for 100 ml flasks (250x190 mm)	BS-010108-EK
P-6/250	6 clamps for 250 ml flasks (250x190 mm)	BS-010108-DK
P-16/88	Spring holder for 88 of 10 to 50 ml tubes	BS-010116-BK
HB-200	Additional holding bar for UP-12	BS-010108-FK

Table 3. Optional accessories for PSU-20i

Optional accessories	Description	Catalogue number
UP-330	Universal platform (345x430x105 mm)	BS-010145-AK
HB-330	Additional holding bar for UP-330	BS-010145-BK
P-30/100	30 clamps x 100 ml flasks (360x400 mm)	BS-010135-BK
P-16/250	16 clamps x 250 ml flasks (360x400 mm)	BS-010135-CK
P-9/500	9 clamps x 500 ml flasks (360x400 mm)	BS-010135-AK
P-6/1000	6 clamps x 1000 ml flasks (360x400 mm)	BS-010135-DK
UP-168	Universal platform for different clamps	BS-010135-JK
FC-100	Clamp for 100 ml flask for UP-168 (ø 65 mm)	BS-010126-HK
FC-250	Clamp for 250 ml flask for UP-168 (ø 85 mm)	BS-010126-JK
FC-500	Clamp for 500 ml flask for UP-168 (ø 105 mm)	BS-010126-LK
FC-1000	Clamp for 1000 ml flask for UP-168 (ø 130 mm)	BS-010126-IK
FC-2000	Clamp for 2000 ml flask for UP-168 (ø 166 mm)	BS-010126-IK
PP-20	One-level platform with non-slip rubber mat (480x380 mm)	BS-010126-BK
PP-20-2	Two-level platform with non-slip rubber mats (480x380x170 mm)	BS-010126-CK
PP-20-3	Three-level platform with non-slip rubber mats (480x380x340 mm)	BS-010126-DK
PP-20-4	Four-level platform with non-slip rubber mats (480x380x510 mm)	BS-010126-EK

Table 4. Maximum number of clamps on UP-168 platform for PSU-20i

Clamp	Count
FC-100	23
FC-250	13
FC-500	9
FC-1000	6
FC-2000	4

8. Maintenance

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

9. Warranty and Claims. Registration

9.1. The Manufacturer guarantees the compliance of the unit with the requirements of Specifications, provided the Customer follows the operation, storage and transportation instructions.
9.2. The warranted service life of the unit from the date of its delivery to the Customer is 24 months (excluding optional accessories listed in Tables 2 and 3). For extended warranty, see **9.5**.
9.3. Warranty covers only the units transported in the original package.
9.4. 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.
9.5. Extended warranty. For **PSU-10i** and **PSU-20i**, the *Premium* class models, 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.
9.6. Description of the classes of our products is available in the **Product class description** section on our website at the link below.

Technical support

biosan.lv/en/support

Warranty registration

biosan.lv/register-en

Product class description

biosan.lv/classes-en

9.7. 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	PSU-10i & PSU-20i, Orbital Shaker
Serial number	
Date of sale	

10. EU Declaration of Conformity

EU Declaration of Conformity

Unit type	Rockers, shakers, rotators, vortexes
Models	**MR-1, MR-12;** **3D, Multi Bio 3D, PSU-10i, PSU-20i, MPS-1, PSU-2T;** **Bio RS-24, Multi Bio RS-24, Multi RS-60;** **V-1 plus, V-32, MSV-3500**
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 61010-2-051: 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

Edition 1.-3.01 – March 2017

how to choose
A PROPER SHAKER, ROCKER, VORTEX

biosan
Medical–Biological Research & Technologies

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

PSU-20i, Orbital Shaker

ES-20/80, Orbital Shaker-Incubator

Applications:
- *Microbiology*
- *Extraction*
- *Cell cultivation*

PSU-10i, Orbital Shaker

ES-20, Orbital Shaker-Incubator

Applications:
- *Agglutination*
- *Gel staining/destaining*

MR-12, Rocker-Shaker

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

Multi Bio RS-24, Programmable rotator

Multi RS-60, Programmable rotator

Bio RS-24, Mini-Rotator

Applications:
- *Microbiology*
- *Extraction*
- *Cell cultivation*
- *Hematology*

V-1 plus, Vortex

RTS-1 and RTS-1C, Personal bioreactor

MSV-3500, Multi Speed Vortex

MR-1, Mini Rocker-Shaker

Multi Bio 3D, Mini Shaker

Applications:
- *Agglutination*
- *Extraction*
- *Blot hybridisation*
- *Gel staining/destaining*

Applications:
- *Nucleic acid Analysis*
- *Molecular Analysis*
- *Protein Analysis*
- *Genomic Analysis*

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

PST-100HL, Thermo-Shaker

PST-60HL-4, Thermo-Shaker

TS-DW, Thermo-Shaker for deep well plates

PST-60HL, Thermo-Shaker

Applications:
- *ELISA Analysis*
- *Genomic Analysis*
- *Hybridization*
- *Immunology*

MPS-1, Multi Plate Shaker

PSU-2T, Mini-Shaker

CVP-2, Centrifuge vortex for PCR plates

TS-100, TS-100C, Thermo-Shakers

V-32, Multi-Vortex

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