Grant-bio

Thermo-Shakers

PHMP, PHMP-4 & PHMP-100

Operating Manual

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1. About this edition of the manual

1.1. The current edition of the Manual applies to the following models and versions:

Model	**Version**
PHMP, thermo-shaker for microplates	V.7GW
PHMP-4, thermo-shaker for microplates	V.6GW
PHMP-100, thermo-shaker for microplates	V.2GW

2. Safety precautions

Caution! Make sure you have fully read and understood the present Operating 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 samples when the temperature is set higher than 60°C.

2.1. General safety

- The protection provided can be ineffective if the operation of the appliance does not comply with the manufacturer's requirements.
- Save the unit from shocks and falling.
- Store and transport the unit at ambient temperatures between -20°C and +60°C and maximum relative humidity of 80%.
- After transportation or storage and before connecting it to the electric circuit, keep the unit under room temperature for 2-3 hrs.
- 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.

2.2. Electrical safety

- Connect only to the mains with voltage corresponding to that on the serial number label.
- Use only the external power supply provided with this product.
- Ensure that the power plug is easily accessible during use.
- Disconnect the unit from the mains before moving.
- If liquid penetrates into the unit, disconnect it from the mains 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.

2.3. 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 has been installed incorrectly.
- Do not use outside laboratory rooms.
- Do not leave the operating unit unattended.
- Do not impede the platform motion.
- Do not check the temperature by touch. Use a thermometer.

2.4. Biological safety

- The user is responsible to carry out appropriate decontamination if hazardous material spills on or penetrates into the equipment.

3. General information

PHMP, **PHMP-4** and **PHMP-100** Thermo-Shakers are designed for shaking standard 96-well microtiter plates in the thermal regulation mode. Models **PHMP** and **PHMP-100** hold 2 plates, model **PHMP-4** holds 4 plates.

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

- Incubator for lasting incubation of micro quantities (insect, plant cell cultures, etc.) in plates.
- Plate shaker for operation in the cold room or other conditions, which do not require temperature stabilization.
- Microplate thermo-shaker for immunochemistry and molecular diagnostics, where the requirements to the result reproducibility and thus to the precise method regulation are particularly high.

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

Thermo-shaker provides:

- soft or intensive sample shaking;
- rotation speed regulation, stabilization and indication;
- even shaking amplitude throughout thermo-shaker platform;
- required operation time setting and indication;
- automatic stopping of the platform movement after the set time expires;
- current operation time indication;
- setting and indication of the required temperature;
- (**PHMP** & **PHMP-4**) fault automatic diagnostics (temperature sensor, platform heating, lid heating and other errors);
- (**PHMP** & **PHMP-4**) temperature calibration, to compensate differences in the microtest plates from different manufacturers.

The device can be used in:

Cytochemistry	for in situ reactions;
Immunochemistry	for immunofermentative reactions;
Biochemistry	for enzyme and protein analysis;
Molecular biology	for matrix analysis, DNA and RNA analyses.

The maximum guaranteed number of diagnostic cycles in the thermo-shaker mode, which require 15-30 min work in one cycle, is 7000-14000 times.

External 12V power supply is used to power the device. It makes it safe to work in the cold room, where condensation may cause leakage current from electric circuit.

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:

- PHMP / PHMP-4 / PHMP-100, Thermo-Shaker ..... 1 pce.
- External power supply ..... 1 pce.
- Power cable ..... 1 pce.
- Replacement rubber belt ..... 2 pcs.
- Operating manual, declaration of conformity .....1 copy

4.3. **Setup**.

- Place the unit upon even horizontal stable non-flammable surface 30 cm away from any flammable materials, and clear 20 cm around the device on all sides for ventilation.
- Remove the protective film from the display.
- Connect the power cable to the external power supply.
- Connect the external power supply to the socket on the rear side of the unit, and position it with easy access to the power switch and plug.

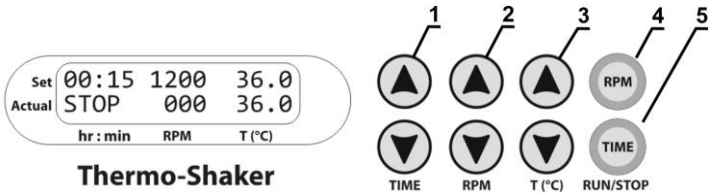


Figure 1. Control panel

5.1. **Recommendations during operation**.

- Please check the microplates before using, be sure that the microplates are heat-resistant. Do not heat the microplates over the melting point of the material they are made of.
- It is recommended to fill plate 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 samples when the temperature is set higher than 60°C.

5.2. 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).

5.3. 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 in °C that automatically starts rising according to the temperature set in the upper line). The time of temperature stabilization depends on the initial temperature.

5.4. **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. Speed and temperature can be changed during operation.

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

5.4.2. **Setting speed (RPM).** Use the ▲ and ▼ **RPM** keys (fig. 1/2) to set the required speed (increment 10 rpm).

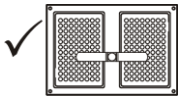
5.4.3. **Setting temperature (T, ºC).** Use the ▲ and ▼ **T, ºC** keys (fig. 1/3) to set the necessary temperature (increment 0.1°C).

Caution! Heating 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 in top right corner). In this mode, thermo-shaker can be used in the cold rooms as a mixing device without thermoregulation. Settings can be changed during operation.

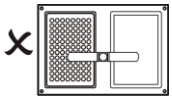
5.5. After the thermal stabilisation of the unit (i.e. when the set and current temperature readings become the same), open the lid and place the covered microplates on the platform:

- PHMP: Pull up the centre knob of the push-down clip, place the microplates, replace the clip and push down on it.
- PHMP-4: Lightly pull the side clips away from centre with one hand and place the microplate with another.
- PHMP-100: Loosen the centre screw by rotating it counter-clockwise. Rotate the clip by 90 degrees. Place the microplates, rotate the clip and fasten the screw clockwise.

Note. For **PHMP** and **PHMP-100**, load only pairs of microplates for best fixation:



Correct loading



Wrong loading

Caution! Do not fill or uncover the microplates directly inside the unit.

5.6. Press the **RPM RUN/STOP** key (fig. 1/4). The platform will start rotating and the timer indicator will start counting up 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.

5.7. 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.

5.8. 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.

5.9. If required, there is possibility to restart the timer when it is running. Press the **TIME RUN/STOP** key once (fig. 1/5) to stop the timer. Press the **TIME RUN/STOP** key again to restart the timer.

5.10. The platform motion can be stopped at any time by pressing the **RPM RUN/STOP** key. The program stops and the timer switches 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 automatcally, but the heating can be stopped only operating instructionsly by reducing the temperature using the **▼ T, °C** key (fig. 1/3 - lower key) till the OFF sign appears in the upper line (Set) of the display

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

5.11. 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.

Note. Current section is applicable only for **PHMP** and **PHMP-4**

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

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

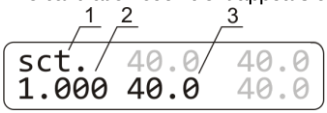


Figure 2. Display in calibration mode: 1. Calibration mode indicator; 2. Calibration coefficient; 3. Temperature with current coefficient

Note. Values marked in grey on figures 2 and 3 are not used in calibration and are meant for service engineers.

6.3. **Restoring factory settings.** Set 1.000 value using the ▲ and ▼ **T, °C** keys as shown on fig. 2/1 to restore the factory settings. Press the **RPM RUN/STOP** key once to save the changes and exit the calibration mode.

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

6.4. **Calibration procedure**.

6.4.1. Install an independent sensor with 0.5°C accuracy into a celll of the microplate.

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

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

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

6.4.5. Hold the **TIME RUN/STOP** key pressed for more than 8 s to activate calibration mode (fig. 2).

6.4.6. Using the ▲ and ▼ **T, °C** keys, change the calibration coefficient (fig. 3/1) so that the new temperature value (fig. 3/2) 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 (±0.063), 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.

6.4.7. Press the **RPM RUN/STOP** key once to save the changes and exit the calibration.

6.5. The display will show calibrated temperature as shown on fig. 4/1 and the unit will continue thermal stabilization according to the previously set temperature.

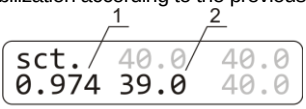


Figure 3. Changing the coefficient: 1. Calibration coefficient; 2. Temperature with current coefficient

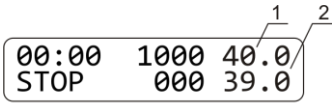


Figure 4. Display after calibration: 1. Set temperature; 2. Current calibrated temperature

7. 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.

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

Model	**PHMP**	**PHMP-4**	**PHMP-100**
Temperature setting range	25°C ... 60°C		25°C ... 100°C
Temperature control range	5°C above RT[1] ... 60°C		5°C above RT[1] ... 100°C
Temperature setting resolution	0.1°C		
Temperature stability	±0.1°C		
Temperature uniformity at 37°C	±0.25°C		±0.2°C
Temperature calibration option	Yes		No
Two-side heating of the microplate	Yes		
Heat up time	12 min, from 25°C to 37°C; 35 min, from 37°C to 60°C		60 min, from 25°C to 100°C
Orbit	2 mm		
Speed setting range	250–1200 rpm (increment 10 rpm)		
Digital time setting range	1 min - 96 hrs / non-stop		
Maximum continuous operation[2]	168 hrs		
Display	16x2 characters, LCD		
Maximum height of plates	18 mm		
Platform dimensions (WxD)	250x150 mm	290x210 mm	250x150 mm
Number of microplates	2	4	2
Dimensions	270x260x125 mm	380x390x140 mm	270x260x125 mm
Weight[3]	6.1 kg	8.8 kg	5.9 kg
Working current	DC 12 V, 3.3 A	DC 12 V, 4.15 A	DC 12 V, 5 A
Power consumption	40 W	50 W	60 W
External power supply	input AC 100-240 V 50/60 Hz, output DC 12 V		

[1] Room temperature.
[2] Recommended interval between operation sessions is not less than 1 hours
[3] Accurate within ±10%

8. Ordering information

8.1. Models and versions available

Model	Version
PHMP, thermo-shaker for 2 microplates	V.7GW
PHMP-4, thermo-shaker for 4 microplates	V.6GW
PHMP-100, high-temperature thermo-shaker for 2 microplates	V.2GW

8.2. To inquire about or order replacement parts, contact Grant or your local Grant representative.

8.2.1. Replacement parts

Replacement part
Rubber belt, 122x0.6x6 mm

9. Guarantee and service

9.1. **Guarantee**. When used in laboratory conditions and according to these working instructions, this product is guaranteed for TWO YEARS (excluding replacement parts) against faulty materials or workmanship.

9.2. **Service**. There are no user-serviceable parts inside the unit, except as defined below. For all remaining maintenance and repairs, return the unit to our service department in the UK or, in other countries, to our distributor.

9.3. **Cleaning & Disinfection**.

9.3.1. **Cleaning the outside parts**. Use mild soap and water with a soft cloth or sponge for cleaning the exterior. Rinse remaining washing solution with distilled water. Wipe dry the excess water with clean, soft cloth or sponge. This maintenance operation is performed by the user.

9.3.2. **Disinfecting the exterior plastic and metal parts.** Use 75% ethanol or DNA/RNA removing solution. After disinfecting it is necessary to wipe the surfaces dry. This maintenance operation is performed by the user.

9.3.3. **Autoclave**. The unit itself and its accessories are not autoclavable.

9.4. **Rubber belt replacement**. For maintenance of reliable operation of the device, the manufacturer recommends to replace rubber belts after 1.5 years or 2000 hours of operation time. To replace the belt:

- 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. 5).
- Reassemble the device.

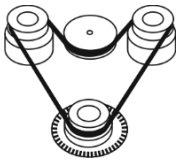


Figure 5. Rubber belt replacement

9.5. **Error codes in case of a defect (PHMP & PHMP-4)**. Some malfunctions trigger an error code to appear on display, accompanied by a sound signal every 8 s. Press **RPM RUN/STOP** key to turn off the signal. Error code format is letters ER and a number from 1 to 4. Disconnect the unit from the electric circuit and report the error code to our service department in the UK or, in other countries, to our distributor.

EU Declaration of Conformity

All the products covered by this Manual comply with the requirements of the EU harmonised legislation verified using the following standards

Low Voltage Directive (2014/35/EC) for Electrical safety.	LVS EN 61010 Part 1 LVS EN 61010 Part 2-010 LVS EN 61010 Part 2-051
EMC directive (2014/30/EC) for Electromagnetic compatibility	LVS EN 61326-1
RoHS Directive (Directive 2011/65/EC including 2015/863) for Hazardous substances	LVS EN 50581

UK Declaration of Conformity

All the products covered by this Manual comply with the requirements of UK statutory requirements verified using the following standards.

Electrical Equipment (Safety) Regulations 2016	BS EN 61010 Part 1 BS EN 61010 Part 2-010 BS EN 61010 Part 2-051
Electromagnetic Compatibility Regulations 2016	BS EN 61326-1
The Restriction of the Use of Certain Substances in Electrical and Electronic equipment Regulations 2012	BS EN 50581

Waste Electrical and Electronic Equipment (WEEE)

All the products covered by this Manual are marked with the crossed-out wheelie bin symbol indicating they must not be disposed of with unsorted waste. Safe recycling of WEEE helps conserve natural resources and protect human health.

Grant Instruments complies fully with the UK Waste Electrical & Electronic Equipment (WEEE) regulations 2013. We are a member of the B2B compliance scheme (Scheme Approval Number WEE/MP3338PT/SCH), which handle our WEEE obligations on our behalf. Grant Instruments have been issued with a unique registration number by the Environmental Agency, this reference number is WEE/GA0048TZ.

For information regarding WEEE collections in the UK please contact our B2B Compliance Scheme directly on 01691 676 124 or **www.b2bcompliance.org.uk**

In the EU, Grant Instruments complies with WEEE Directive 2012/19/EU.
Contact your local equipment supplier for WEEE collections.

REACH Regulations

This product does not contain any Substances of Very High Concern (SVHCs) at greater than 0.1% that have to be identified in accordance with Regulation (EC) No 1907/2006 and therefore does not have an entry in the SCIP database.

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