Instruction Guide

Peristaltic Pump
PP 600

**PHOTON
SYSTEMS
INSTRUMENTS**

Please read the Guide before operating this product

**Peristaltic Pump
PP 600**

PHOTON
SYSTEMS
INSTRUMENTS

TABLE OF CONTENTS

1   INFORMATION BEFORE USING PERISTALTIC PUMP

Read this manual carefully before operating the device. If you are not sure about something in the manual, contact the manufacturer for clarification.

⚠️	By accepting the device, the customer agrees to follow the instructions in this guide.

Always follow corresponding manuals while working with the Peristaltic Pump or doing the maintenance.

It is forbidden to interfere with the hardware or software of the Peristaltic Pump in any way without previous agreement with the manufacturer.

The following table presents basic highlight symbols used in this manual:

Symbol	Description
⚠️	Important information, read carefully.
ℹ️	Complementary and additional information.

Tab. 1 Used symbols.

2   TECHNICAL SPECIFICATION

Number of rollers	4
Number of channels	1
Rotor rotation	Clockwise or counterclockwise
Tubing	Norprene A-60-F tubing 6 – 4 mm
Flow-Rate range	0.2 ml/min – 50 ml/min
Speed accuracy	±0.5 %
Control	Manual via pump display; digital (trigger signal); computer (USB, I2C)
USB interface	Operation controlling via PC; up to 8 pump cascading
Operating panel	4-button membrane keypad
Power	12 VDC (110/220 VAC adapter), > 30 W
Dimension	250 x 213 x 120 mm
Weight	2.4 kg
Operating conditions	+5 to +40 °C
Warranty	1-year parts and labor

3 GENERAL INFORMATION

Peristaltic Pump PP 600 is used for accurate and homogenous pumping of variety of fluids. PP 600 is compact, lightweight device that can conveniently fit into most experimental setups. PP 600 has simple set-up design with minimum key-presses for intuitive operation. Pump flow-rate runs between 0.2 and 50 ml/min. The speed of rotation and thus of pumping can be controlled manually via the pump display, digitally via a trigger signal, or by a PC via USB interface.

The fluid delivery occurs with minimum sheer so the potential damage to the biological material is minimal.

The Peristaltic Pump PP 600 is equipped with four channels for liquid delivery and one gas valve that can be used for regulation of CO_2 inflow into the culture (this feature can be used for pH-stat or chemostat cultivation, for more information see – Photobioreactor FMT 150 manual; chapter Peristaltic Pump Installation). It is designed to be used with the parent device only (for example Photobioreactor FMT 150). Up to three additional valves may be enabled for operation as an option.

3.1 DEVICE DESCRIPTION

The system is operated using 4-button keypad (Fig. 1 - A2). Rotor rotation is clockwise or counterclockwise (Fig. 1 - A3). Peristaltic pump rotor has four rollers.

Fig. 1 PP 600 front and rear panel.

A) Front side: 1) Display. 2) Operating panel. 3) Rotor. 4) Tubing and connectors. B) Rear side.

3.2 COMPONENTS OF THE PERISTALTIC PUMP

Standard version of the PP 600 package consists (Fig. 2):
- Peristaltic pump.
- Power unit 12 VDC (110/220 VAC adapter) with power cable.
- Communication cable.
- USB cable.
- Plastic Norprene A-60-F tubing* and connectors – 4 + 4 Luer Locks (female and male) and 5 pieces of Norprene tubing (silicone tubing not included).
- Operating manual (printed version).
- Other Accessories or Optional Features (according to your specific order).

Fig. 2 Components of the Peristaltic Pump.

A) Power cable. B) Power adapter. C) Communication cable. D) Norprene tubing. E) Luer Locks. F) USB cable.

* Norprene tubing offers good mechanical properties under a wide range of operating temperatures. Highly durable, Norprene tubing is resistant to fatigue, ozone, ultraviolet, acids, alkalis, water, and most oils and lubricants.

4 CARE AND MAINTENANCE

- Loosen the tubing when pump is not used. The tubing can get deformed and subsequently lose elasticity if compressed for a prolonged period.
- Keep the tubing and rotor clean. If any solvent (including water) spills on any part of the device, clean the solvent. Certain solvents, such as strong detergents and acids, can permanently damage the pump.
- Change tubing immediately if it is visibly worn and the elasticity is reduced.
- Use only compatible tubing that came with the unit or substitute tubing of the same size. (Norprene tubing 6 – 4mm, silicone tubing 6 – 4 mm).
- There are no user-serviceable parts inside the pump. Unauthorized modification or repair will void the warranty.

Norprene tubing has very good mechanical properties. After a month of continuous use, the volume of pumped fluid differs by an average of 0.9 %.

5 INSTALLATION

Peristaltic Pump PP 600 can be used as stand-alone device or can be connected to other devices that will automatically control the operation of the Peristaltic Pump. Here we show how to perform initial set-up of the PP as a separate device. For information on connecting the pump to the Photobioreactor FMT 150, please read Photobioreactor manual, chapter Peristaltic Pump Installation.

Follow the instructions below to install and operate the peristaltic pump:

- First assemble and connect the Peristaltic pump with power. Connect the Norprene plastic tubing with the provided Luer Lock connectors (male). Ensure that the end of the tubing is pushed all the way to the end of the Luer Lock fitting. If the connection with Luer Locks is not tight, small air leak may occur during operation of the PP resulting in the pump not working properly.
- Insert one end of the tube in the holder and wind the tube as shown in the figure below around the rotor (Fig. 4 A, B). Place the second end of the tube into the holder. Ensure that the end of the tubing is pushed all the way to the end of the Luer Lock fitting. If this is not done small air leak may occur resulting in the pump not working properly.
- Attach provided female Luer Lock connector to the silicone tube and connect it to the peristaltic pump as shown in Fig. 4 C, D. Again, ensuring that the tubing is pushed all the way to the end of the Luer Lock connector.
- Now connect one end of the silicone tube to the bottle with the desired fluid (make sure it is tightly sealed bottle otherwise you can experience problems with the suction fluid.
- The other end of silicone tubing place into the waste container (volume of liquid in the bottle with the desired fluid should match the volume of waste container to avoid overflow and cause possible damage to the pump).
- Now is Peristaltic pump assembled for its first use and for example calibration of flow or first test of Peristaltic Pump (Fig. 5).
- Connect the Peristaltic Pump via the power supply cord into the POWER connector of the Peristaltic Pump (Fig. 3).
- Now set the rotor rotation so that was sucked desired fluid and drain direction into a waste container **Setting → Rotate [RIGHT/LEFT]**: Use this command to change the direction of rotor rotation. Use **S** key to set right or left rotor rotation.
- Now set the flow rate and other parameters according Operation Instruction (next chapter).

Fig. 3 Power cord connection to the PP 600.

Fig. 4 Assembly of the Peristaltic Pump.

A, B) Placement of the Norprene tubing around the rotor. C, D) Connection of the silicone tubing with tubing of the PP 600.

Fig. 5 Basic configuration of PP 600.

6   OPERATION INSTRUCTIONS

To switch the pump ON, press **MAIN** on the rear side of the pump.

Manual control via the pump keypad (Fig. 6):
- Use the **S** key (below the digital display) to confirm.
- Use the **M** key (below the digital display) to return.
- **UP/DOWN** key: Use it to attain the desired value (add/subtract) or to move up/down in the menu tree (Fig. 7).
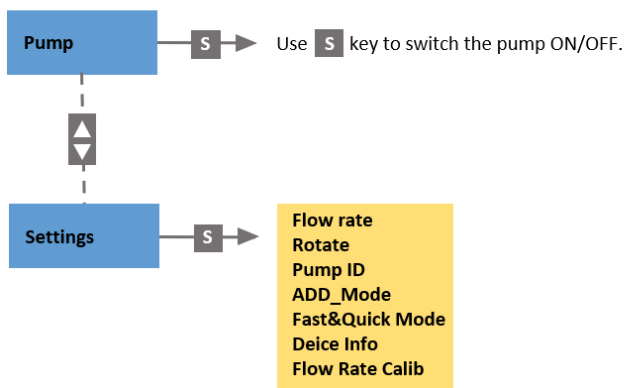

Fig. 6 Display and keypad.

Fig. 7 Menu tree.

7   COMMAND EXPLANATION

Pump [ON/OFF]:
Press **S** key to switch the Peristaltic Pump **ON/OFF**.

Setting → Flow Rate:
Use this command to set the speed of rotation (flow-rate). Press ↑ key to increase the speed; press ↓ key to decrease the speed.
The flow-rate range is 200 µl/min – 50,000 µl/min. For increase or decrease rotation uses short or long press:

Range	Short press	Long press
200 – 1,000 µl/min	1 µl/min	50 µl/min
1,000 – 10,000 µl/min	10 µl/min	500 µl/min
10,000 – max. value µl/min	100 µl/min	5,000 µl/min

Setting → Rotate [RIGHT/LEFT]:
Use this command to change the direction of rotor rotation. Use **S** key to set right or left rotor rotation.

Setting → Pump_ID [0 - 7]:
The device construction enables cascading of up to 8 pumps sequentially in a row. Use this command to set the communication address for a particular pump used. The address of each of the pumps must be unique. Each address can serve different pump operation mode. Use ↑ and ↓ keys to set communication address numbered from 0 to 7.

⚠	Important note for connection with PBR: The pump must be correctly identified for its proper function. Therefore, avoid connecting more Peristaltic Pumps with the same communication address to one appliance.

Setting → ADD_Mode [ON/OFF]:
→ ADD_Run Time: X hour, Y min, Z sec [state]
→ ADD_Period: X hour, Y min, Z sec [state]

ADD_Mode is a chemostat mode that serves for periodically repeated inflow of medium to the culture. Periodic intervals are set in the command ADD_ Period. Duration of medium inflow is set in the command ADD_Run Time.

Press **S** key shortly to activate/deactivate chemostat mode (ADD_Mode). Use long press **S** for switching between ADD_Period and ADD_Run Time modes. Use ↑ and ↓ keys to set desired time values.

The time range for ADD_Period is from 2 minutes to 24 hours; time steps are 1 min / 10 min (key short press / key long press). Maximum duration in ADD_Run Time mode is 10 seconds; time steps are 1 sec / 10 sec (key short press / key long press). Rotation speed corresponds to the value set in the mode Setting → Flow Rate.

If ADD_Mode is active, then the Pump Control Indicator (in the main menu) reads: Pump [C: ON/OFF]. ON/OFF status indicates whether the pump motor is switched on or switched off.

⚠	ADD_Mode is a master mode and claims priority over the communication cable control and/or over the Pump Control Indicator (in the main menu). Therefore, if the Peristaltic Pump is to be controlled by the Photobioreactor or other external equipment, ADD_Mode must be deactivated.

Setting → Fast&Quick Mode [RIGHT/LEFT/STOP]:
This mode provides a convenient way to pump the fluid at maximum possible speed without setting the flow rate.
Press ↑ key to activate the peristaltic pump rotation in the right direction. Press ↓ key to activate the peristaltic pump rotation in the left direction. Use **S** key to stop the pump rotation.

ℹ	If the Peristaltic Pump is to be controlled by a parent device (Photobioreactor), Fast&Quick Mode must be deactivated.

Setting → Device Info:
This menu provides information on:
- Firmware version number: 3.0.1.4.
- Date of firmware compilation: Jan 23, 2018.
- Device Type: PP600.
- Build Number: 152.
- Firmware ID: PP600.
- Output module: [No_Module/Included] (Refers to valve control module.).

Setting → Flow Rate Calibration:

Is used if you want to pump exact volume of liquid in a given time, e.g., 5,000 µl/60 s.

Use this command to calibrate flow rate. Press **S** key to start calibration. Calibration is running for 60 seconds, when the pump sucks the water. Then adjust the volume of liquid that flowed during the 60 s. Confirm by **S**. (Example of calibration: Take the vessel with water and put the tube of a peristaltic pump that sucks in water and at the other end of the tubing (waste) place the pre-weighed beaker. After 60 seconds reweigh beaker with water and difference set on the pump). For calibration set the basic configuration of Peristaltic Pump (Fig. 5). You can set volume from 1 – 100,000 µl/min.

> The Peristaltic Pump can be controlled by the trigger signal or by commands via I2C bus and USB communication interfaces. These commands are provided to customers on demand only (please write to support@psi.cz).

8 WARRANTY TERMS AND CONDITIONS

- This Limited Warranty applies only to the Peristaltic Pump. It is valid one year from the date of shipment.
- If at any time within this warranty period the instrument does not function as warranted, return it and the manufacturer will repair or replace it at no charge. The customer is responsible for shipping and insurance charges (for the full product value) to PSI. The manufacturer is responsible for shipping and insurance on return of the instrument to the customer.
- No warranty will apply to any instrument that has been (i) modified, altered, or repaired by persons unauthorized by the manufacturer; (ii) subjected to misuse, negligence, or accident; (iii) connected, installed, adjusted, or used otherwise than in accordance with the instructions supplied by the manufacturer.
- The warranty is return-to-base only, and does not include on-site repair charges such as labor, travel, or other expenses associated with the repair or installation of replacement parts at the customer's site.
- The manufacturer repairs or replaces faulty instruments as quickly as possible; the maximum time is one month.
- The manufacturer will keep spare parts or their adequate substitutes for a period of at least five years.
- Returned instruments must be packaged sufficiently so as not to assume any transit damage. If damage is caused due to insufficient packaging, the instrument will be treated as an out-of-warranty repair and charged as such.
- PSI also offers out-of-warranty repairs. These are usually returned to the customer on a cash-on-delivery basis.
- Wear & Tear Items (such as sealing, tubing, padding, etc.) are excluded from this warranty. The term Wear & Tear denotes the damage that naturally and inevitably occurs as a result of normal use or aging even when an item is used competently and with care and proper maintenance.

9 TROUBLESHOOTING AND CUSTOMER SUPPORT

In case of troubles and for customer support, please, write to support@psi.cz or contact your local distributor.

10 LIST OF PICTURES