PERISTALTIC PUMP
PP 500 and PP 550

Manual and User Guide

Please read this manual before operating this product

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The contents of this manual have been verified to correspond to the specifications of the device. However, deviations cannot be ruled out. Therefore, a complete correspondence between the manual and the real device cannot be guaranteed. The information in this manual is regularly checked, and corrections may be made in subsequent versions.

The visualizations shown in this manual are only illustrative.

This manual is an integral part of the purchase and delivery of equipment and its accessories and both Parties must abide by it.

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1. TECHNICAL SPECIFICATIONS

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:

0.01 – 5.6 ml/min

Speed Accuracy:

±0, 5 %

Control:

Manual via pump display; digital (trigger signal); computer (RS232, I2C)

RS232 Interface:

Operation controlling via PC; up to 8 pump cascading

Operating Panel:

4-button membrane keypad

Power:

24V DC (110/220 VAC adapter), > 30 W

Dimension:

200 x 155 x 100 mm

Weight:

1 kg

Work environment:

5 – 40 ºC

2. GENERAL INFORMATION

Peristaltic Pumps PP 500 and PP 550 are used for accurate and homogenous pumping of variety of fluids. PP 500 and PP 550 are compact, lightweight devices that can conveniently fit into most experimental setups. PP 500 and PP 550 have simple set-up design with minimum key-presses for intuitive operation.

Pump flow-rate runs between 10 and 5600 µl/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 RS232 interface.

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

The Peristaltic Pump is manufactured in two models:

1. The standard model **PP 500** with precise motor/time control. It enables parent device control or it may be used as a stand-alone device. It is intended for fluid delivery only. (Fig. 1)
2. The enhanced model **PP 550** 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 infarmation 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) ; **PP 550** is designed for both liquid and gas delivery. Up to three additional valves may be enabled for operation as an option. (Fig. 2)

Fig. 1 Model PP 500

Fig. 2 Model PP 550

3. COMPONENTS OF THE PERISTALTIC PUMP

Carefully unpack the carton. You should have received the following items, as described and shown below.

1. **Peristaltic pump PP 500 or PP 550**
2. **Power unit 24V DC (110/220 VAC adapter)**
3. **Communication cable**
4. **Plastic Norprene A-60-F tubing* and connectors -** *4+4 Luer Locks (female and male) and 6 pieces of Norprene tubing (silicone tubing not included)*
5. **This operation manual** *(printed version)*
6. **Optional Accessories** *(according to your specific order)*

Note: If any item is missing, please, contact the manufacturer. Please check the carton for any visible external damage. If you find any damage, notify the carrier and PSI immediately. The carton and all packing materials should be retained for inspection by the carrier or insurer. For customer support, please write to: **support@psi.cz**

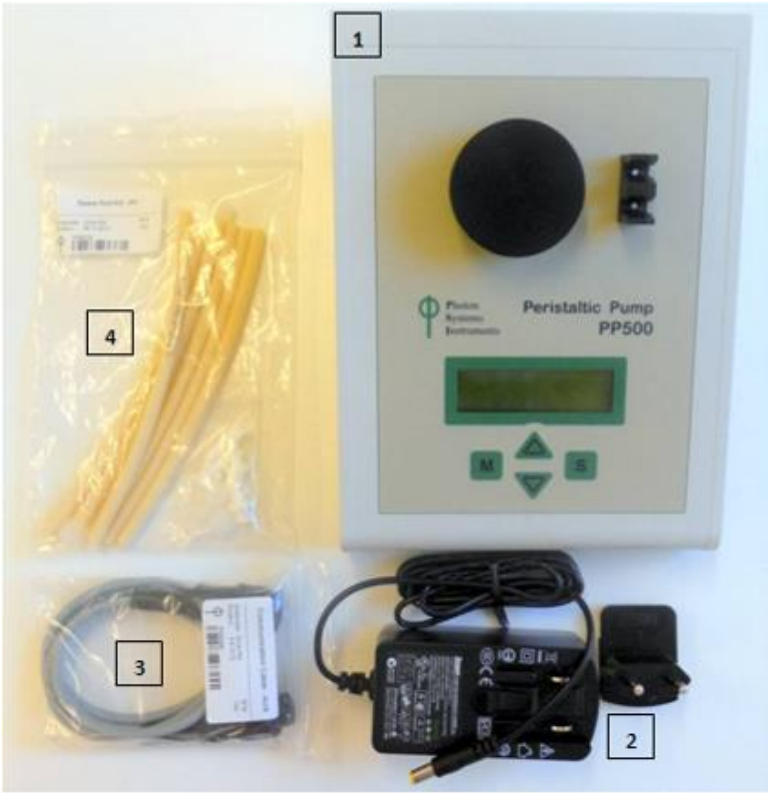

Fig. 3 Components of Peristaltic Pump

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

4. DESCRIPTION OF THE PERISTALTIC PUMP

Pump flow-rate of the peristaltic pump runs between 10 and 5600 µl/min. The speed of rotation and thus of pumping can be controlled manually via the front display. 4 button key pad is used to operate the system. Rotor rotation is clockwise or counterclockwise. Peristaltic pump rotor has four rollers.

FRONT PANEL:

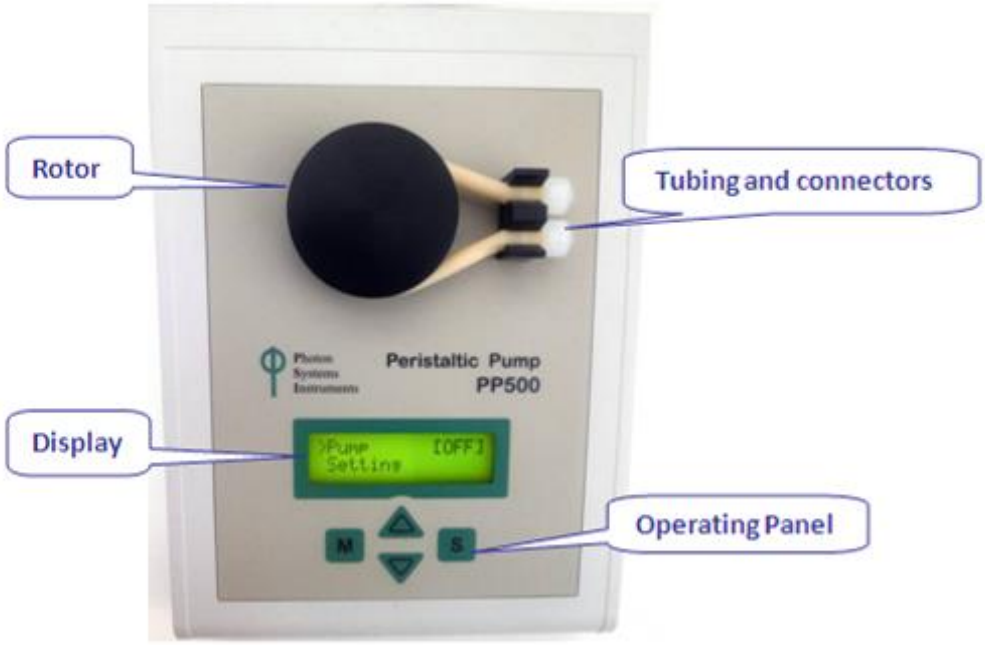

Fig. 4 Front panel

REAR PANEL:

Fig. 5 Rear panel

5. 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.

Note: 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%.

6. INSTALLATION

Peristaltic Pumps PP 500 and PP 550 can be used as stand-alone device or can be connected to other devices that will automatically based on pre-defined protocol control the operation of the Peristaltic Pump. Here we show how to perform initial set-up of the PP as separate device. For Information how to connect 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. 6 A, B, C). Place the second end of the tube into the holder (Fig. 6 C). 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. 6 D, E, F 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. 7)
- Connect the Peristaltic Pump via the power supply cord into the “POWER +24V DC” connector of the Peristaltic Pump (Fig. 8).
- 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)

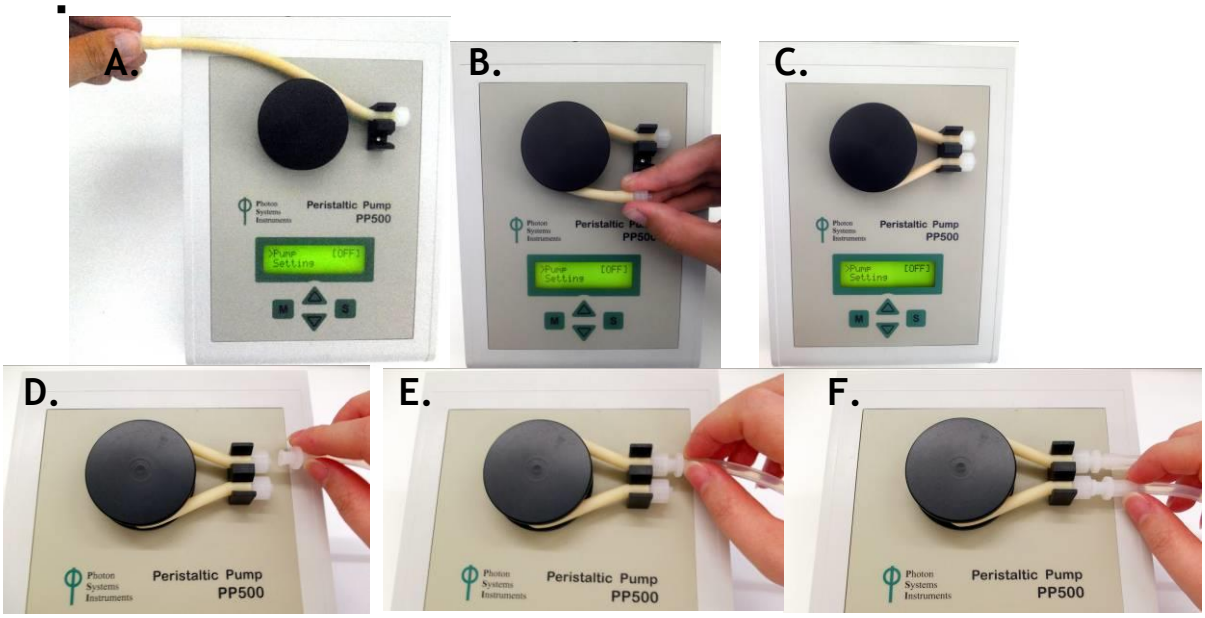

Fig. 6 Assembly of the peristaltic pump

A, B, C) Placement of the plastic tubing (Norprene tubing 6-4mm) around the rotor., D, E, F) Adapter is attached to the silicone tubing and connected with the tubing of the peristaltic pump.

Fig. 7 Basic configuration of Peristaltic Pump

Fig. 8 Power cord connection of peristaltic pump

7. OPERATION INSTRUCTIONS

To switch the pump **ON**, press the **"S"** key shortly.

- **MANUAL CONTROL VIA THE PUMP KEYPAD (Fig. 9)**

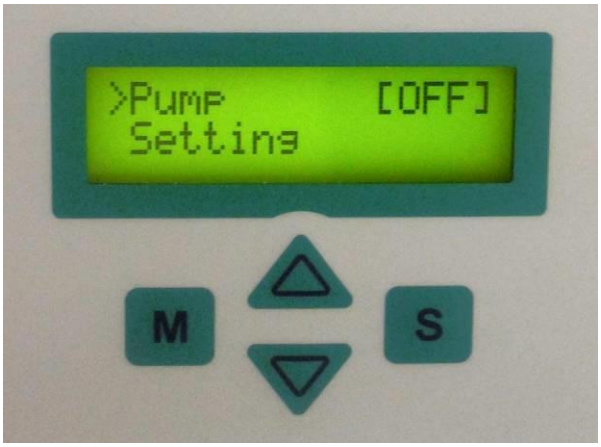

Fig. 9 Display and keypad

- 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. 10).

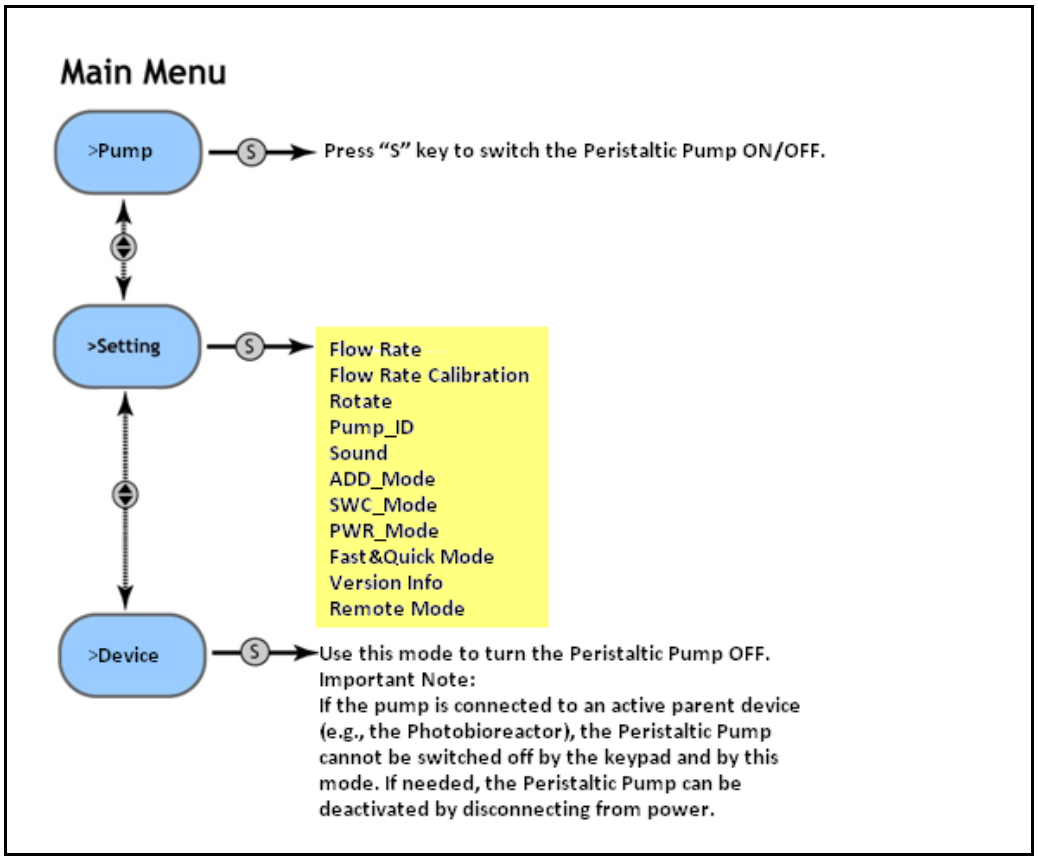

Fig. 10 Menu tree

8. 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. Short press will increase or decrease rotation by approximately 1µl/min. Long press will increase or decrease rotation by approximately 100µl/min. The flow-rate range is 10µl/min – 5600µl/min.

Setting → Flow Rate Calibration:

Is used if you want to pump exact volume of liquid in a given time, e,g, 500 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 60s. 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. 11). You can set volume from 1 – 100 000µl/min.

Fig. 11 Basic configuration of Peristaltic Pump for flow rate calibration

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 → Sound [ON/OFF]:

This command serves for activation / deactivation of pump beeping sound. Use **"S"** key to switch ON/OFF the beeping sound.

Setting → ADD_Mode [ON/OFF]:

→ ADD_Period: X hour, Y min, Z sec [state]

→ ADD_Regulation: 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 Regulation.

Press **"S"** key shortly to activate / deactivate chemostat mode (ADD_Mode). Use long press **"S"** for switching between ADD_Period and ADD_Regulation 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_Regulation 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.

Warning:

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 → SWC_Mode [ON/OFF]:

Please note that this mode is only for technical support and is not used for standard operation.

SWC_Mode is a control mode for the Peristaltic Pump motor via external signal on the communication connector. Open-collector signal provides ground and activates the Peristaltic Pump motor. Ground signal disconnection deactivates the Peristaltic Pump motor. Again, rotation speed corresponds to the value set in the mode Setting → Flow Rate.

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

Warning:

SWC_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, SWC_Mode must be deactivated!

Important Note:

At one time, EITHER ADD_Mode OR SWC_Mode can be active. The two modes cannot run simultaneously.

Setting → PWR_Mode [ON/OFF]:

Please note that this mode is only for technical support and is not used for standard operation.

PWR_Mode deactivates Peristaltic Pump power feeding if the external master device (for instance, Photobioreactor) is turned off or disconnected.

If PWR_Mode is active, then the Device Control Indicator (in the main menu) reads: Device[C:ON/OFF].

If the Peristaltic Pump detects an external parent device (for instance, after the communication cable was inserted into the pump and the Photobioreactor), the Device Control Indicator (in the main menu) reads: Device[*C:ON/OFF]. When the Photobioreactor is turned off or the communication cable is disconnected, the Peristaltic Pump switches off automatically.

Important Note:

Be aware that when the parent device is active, the Peristaltic Pump is active as well (unless disconnected from power).

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.

Important Note:

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

Setting → Version Info

This menu provides information on:

- Software version number: 2.0.1.7.
- Date of software compilation: May 3, 2013
- Output module: [No_Module/Included] *(Refers to valve control module.)*
- Output module: AX BX CX DX *(Refers to valve status: 0 = OFF; 1 = ON.)*

Setting → Remote Mode

This safety mode deactivates the Peristaltic Pump keypad against error miss-use.

Use long press **"M"** key to reactivate pump keypad functioning (the display indicates: EXIT [HOLDMENU]).

Device [ON/OFF]

Use this mode to turn the Peristaltic Pump OFF.

Important Note:

If the pump is connected to an active parent device (e.g., the Photobioreactor), the Peristaltic Pump cannot be switched off by the keypad and by this mode. If needed, the Peristaltic Pump can be deactivated by disconnecting from power.

Additional Notes:

The Peristaltic Pump can be controlled by the trigger signal or by commands via I2C bus and RS232 communication interfaces. These commands are provided to customers on demand only (*please write to : support@psi.cz).*

9. WARRANTY TERMS AND CONDITIONS

- This Limited Warranty applies only to the Peristaltic Pump PP 500 and PP 550. 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.

10. LIST OF PICTURES

*For customer support, please write to: **support@psi.cz***