

Instructions for Use

—

MICRO-PERFUSION PUMP

MPP 102 PC



Accuracy when going to press

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1 Overview



READ Instructions for Use before using the product! **ALWAYS** follow the warnings, cautions, and notes throughout this document. If you have questions regarding the safe or correct use of the product, please contact the **American distributor:**

BASi (<https://www.basinc.com/ask>)



U.S. PHONE NUMBER +1-800-845-4246

2 Intended Use

The Micro-Perfusion Pump (Type: MPP 102 PC) is used to operate Microperfusion and Microdialysis probes during preclinical studies.



WARNING

1. **ONLY USE** pump and accessories on laboratory animals or ex-vivo setups.
2. **DO NOT** use pump and accessories on humans! This pump has **NOT** been approved for use on humans!
3. **DO NOT** use pump and accessories on household pets and other non-laboratory animals.

The pump enables easy access to the target tissue together with minimally invasive probes and delivers liquid samples as basis for analysis of the local biochemical conditions.

The pump can be operated as follows:

- PUSH / PULL operation with up to 3 probes (active introduction of perfusate with simultaneous aspiration of the dialysate).
- Only PUSH operation with up to 6 probes simultaneously.

3 Safety Information

3.1 Explanation of Symbols

Symbol	Meaning
	Order number (type designation)
	Serial number
	Date of manufacture
	Name and address of manufacturer
	Temperature limitation from X°C to Y°C
	Humidity limitation from X% to Y%
	Air pressure limit from XkPa to YkPa
	Caution, see Instructions for Use
	Protected against ingress of solid foreign objects $\varnothing \geq 2.5\text{mm}$ and larger. Not protected against splash water.
	Do not dispose pump in household waste.
	Direct current
	Polarity of the power supply (positive pole inside).
	Identifies a warning statement that warns about the possibility of injury, death, or other serious adverse reaction associated with the use or misuse of the device.
	Identifies a caution statement that warns failure to follow the instructions may lead to device misuse, malfunction, or damage.
	Identifies additional information from the manufacturer.
	Wear sterile protective gloves while operating product.
	Refer to instruction manual/booklet

3.2 General Warnings and Safety Information



GENERAL WARNING

1. **READ** Instructions for Use prior to use.
2. **DO NOT** use pump and accessories on humans! The pump and accessories have **NOT** been approved for use on humans.
3. **DO NOT** use pump and accessories on household pets or other animals that are not laboratory animals. Products are designed **ONLY** for use in laboratory animals or ex-vivo setups!
4. **ALWAYS** wear sterile disposable protective gloves when operating pump and accessories to avoid any contamination or risk of infection.
5. **ALWAYS** disinfect pump before and after each use, after any contamination, and after any contact with unclean environment or biological material (use for example Bode Sterillium to disinfect).
6. **ONLY USE** proper pumps and accessories.
7. **PROTECT** pump and power supply from moisture, splashing water, excessive exposure to heat and direct sunlight.
8. **ONLY USE** undamaged pumps.
9. **DO NOT** operate near explosives.
10. **DO NOT** operate the pump in the presence of inflammable gasses or fumes. Operation of the pump in such an environment will cause a safety hazard.
11. **DO NOT** operate pump in oxygen-enriched environment.
12. **DO NOT** open the pump housing (exception: battery compartment). Tampering with the pump housing may introduce moisture in pump housing and cause electrical malfunction or failure.
13. **DO NOT** touch moving parts of the pump head if operating pump without cover.
14. **DO NOT** insert foreign bodies (fibres, fabrics, tools etc.) into rotating parts of the pump because pump head might be destroyed. The pump head may be damaged by introduction of foreign objects, which can lead to malfunction or failure.
15. **DO NOT** use the pump if labels or symbols on the keypad are **NOT** legible anymore.
16. **DO NOT** use pumps that have been dropped or are malfunctioning. The pump must be serviced by the manufacturer before being reused. See chapter 9 "Servicing / Maintenance" for more information on returning malfunctioning pumps to the American distributor.
17. **DO NOT** dispose the pump in household waste. Return the pump to the American distributor or dispose pump at municipal waste collection points or recycling centers.
18. **ONLY USE** pump at a maximum of 2000m (6500ft) above sea level.



WARNINGS WHEN USING OTHER PUMPS AND ACCESSORIES

1. **ONLY USE** manufacturer-approved pump combinations, accessories and disposables to prevent damage to pump components.
2. **ALWAYS** read Instructions for Use of accessories.
3. **IMMEDIATELY** dispose disposable accessories (such as tubing sets, probes, perfusate bags) after every single use to prevent any contamination or risk of infection.



WARNINGS REGARDING BATTERY AND POWER-SUPPLY USE

1. **ONLY USE** manufacturer-approved batteries (see also label in the battery compartment). Non-manufacturer-approved batteries may supply incorrect voltage levels, which can reduce the pump's operational lifespan.
2. **PAY ATTENTION** to correct polarity when inserting batteries.
3. **DO NOT** use rechargeable or other batteries than specified in these instructions.
4. **DO NOT** use damaged power supplies (e.g. broken housing). Risk of electric shock.



WARNINGS REGARDING MODIFICATIONS, MAINTENANCE, REPAIRS, AND DAMAGES

1. **IMMEDIATELY STOP** operating the pump and **DISCONNECT** the power supply if you notice any of the following unusual conditions:

- Pump operates abnormally;
- Pump emits abnormal noise, smell, smoke, or sparks during operation;
- Pump generates high temperatures or electrical shocks during operation;
- Power cable, plug or housing of pump is damaged; or

2. **IMMEDIATELY STOP** operating the pump if you notice any **ERROR** message on the LCD display.

Contact the American distributor for repairs of the pump. If you continue to operate without repairing the pump, there is a potential for hazards and/or damages to both the equipment and the operator. See chapter 9 "Servicing / Maintenance" for more information on returning malfunctioning pumps to the American distributor.

3. **DO NOT** substitute parts or modify the pump. To avoid the danger of introducing additional hazards, **DO NOT** install substitute parts or perform unauthorized modifications to the pump.
4. **DO NOT** use the USB-port (used for maintenance purposes **ONLY**).
5. **ONLY** manufacturer may perform maintenance. There are **NO** user-serviceable parts inside the pump.
6. To avoid malfunctions, maintenance of the pump is **REQUIRED** annually or when the maintenance symbol is displayed. Maintenance contracts can be entered into with the

American distributor. See chapter 9 “Servicing / Maintenance” for more information on returning malfunctioning pumps to the American distributor.

MANUFACTURER NOT LIABLE FOR DIRECT OR INDIRECT DAMAGES OF THE PUMP OR PERSONS IF THE PUMP IS MISUSED OR IN CASE THESE INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.

3.3 Electrical Warnings and Safety Information



WARNING

1. **ONLY** use indoors.
2. **DO NOT** exceed the operating input power, voltage, current level and signal type appropriate for the pump.
3. **CONSIDER** the general electrical safety regulations when operating electrical equipment when using the pump.
4. **ONLY USE** lithium batteries, such as manufactured by EVE, type ER26500M or by SAFT, type LSH 14, to avoid malfunction.
5. **ONLY USE** power supply of class II manufactured by Egston, type E2CFMW3 12 with 5V when using the power grid network.
6. To separate the pump from the power grid network, pull out the power supply. **DO NOT** operate the pump in a way that impedes with the separation.
7. Using other accessories than specified herein may result in increased emissions or decreased immunity to interferences of the pump.
8. Portable and mobile HF-communication equipment can affect the pump.
9. **DO NOT** place the pump directly next to or stacked with other electrical devices. In this case, the pump and its intended use must be observed.
10. **DO NOT** use the USB-port (used for maintenance purposes **ONLY**).

4 Micro-Perfusion Pump MPP 102 PC at a Glance

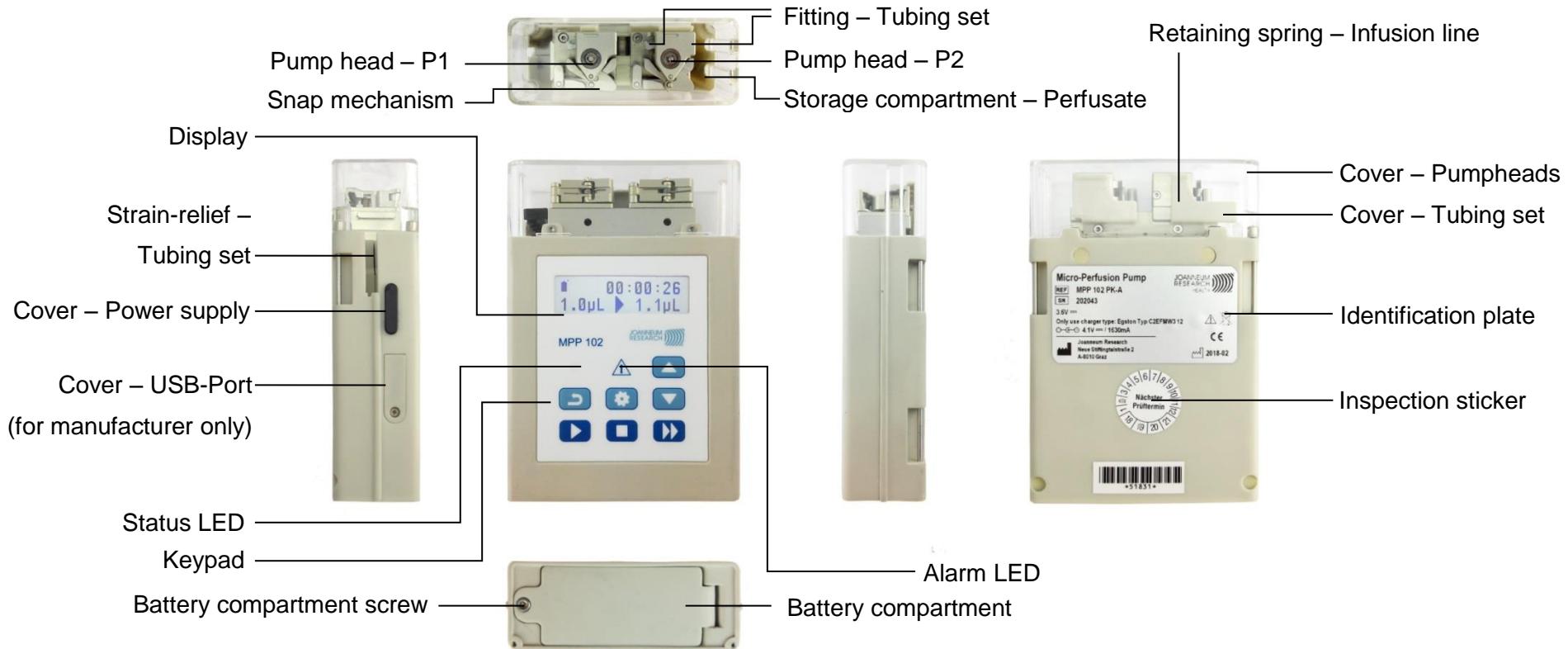


Figure 1: Overview of the Micro-Perfusion pump MPP 102 PC

5 Included Parts and Accessories

The delivered product includes the following:

- 1 Pump MPP 102 PC
- 1 Instructions for Use
- 1 Power Supply from manufacturer Egston, type E2CFMW3 12 with 5V
- 1 T10 Torx Key to remove the battery
- 1 Storage case
- Lithium Ion Battery (e.g., manufacturer EVE, type ER26500M or SAFT type LSH14, battery not included)



Figure 2: Pump and accessories as delivered

To fulfill its intended use, the pump must be operated with probe and tubing set. Using non-manufacturer-approved tubing sets may cause pump malfunction. The pump is a mobile device. Attaching the pump with fastening straps is optional.

To fulfill the product's intended use, the following additional materials are required:

- Skin disinfectants (e.g., Bode Sterillium)
- Transparent patches to fixate
- Paper towels or cellulose swabs
- Sterile gloves
- Sterile scissors and needle holders
- Dressing material

6 Pump Keypad and User Interface

6.1 Display and Keypad – Overview

The pump is keypad-operated. Operation-relevant parameters are displayed graphically on the display.

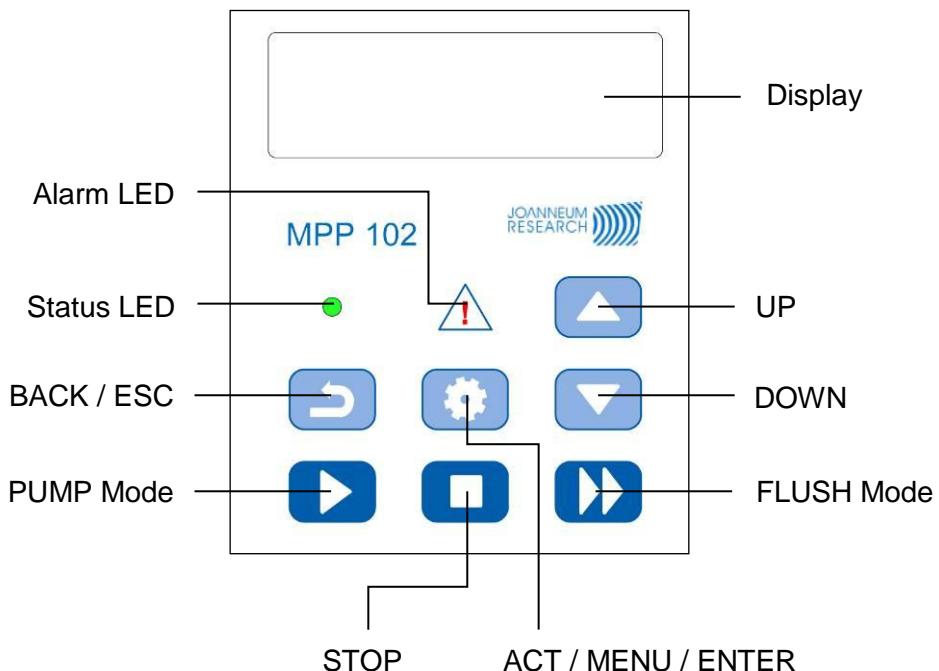


Figure 3: Overview of the controls of the pump

6.2 Display

The pump's display is the primary source of information for the user. The presentation of information is double-lined in pump / flush mode (home screen) (Figure 4a) or four-lined during the parameterization via menu (Figure 4b). The display has a backlight.

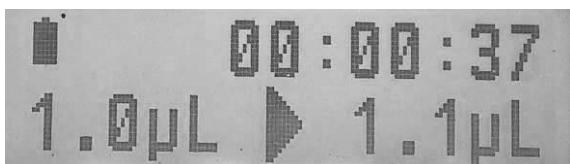


Figure 4a: Home screen: Double-lined display during pump / flush mode

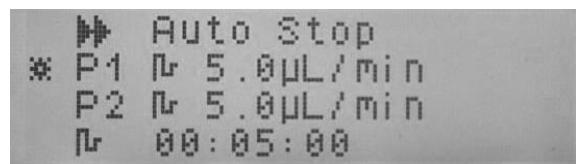


Figure 4b: Four-lined display during parameterization via menu

6.3 Keypad and Functions

Control element	Name	Function
	Status LED	Describes the current status during operation.
	Info LED	Indicates notification for the operator.
	ACT/ SET/ ENTER	Long pressing (> 3s) in standby awakens the pump. Long pressing (> 3s) in home screen selects the menu. Short pressing confirms the selected input or selection.
	UP	Increases the numerical value or navigates through the menu. By sequentially pressing and the keypad lock can be activated / deactivated.
	DOWN	Decreases the numerical value or navigates through the menu.
	BACK/ ESC	Resets the input without saving and switches to the previous menu. Can be used to activate the parameter overview.
	START	Short pressing starts the pump mode, when being confirmed with
	FLUSH	Short pressing starts the flush mode, when being confirmed with Long pressing (> 3s) starts the second flush mode, stored in the menu, when being confirmed with afterwards.
	STOP	Stops the pump and flush mode, when being confirmed with

6.4 Display Symbols and Functions

Symbol	Name	Function
	Keypad lock	Keypad lock active. The keypad lock can be activated / deactivated by sequentially pressing the buttons and .
	Operated on power grid	Pump is operated by power grid supply.
	Battery full	Sufficient battery capacity available.
	Battery half full	More than half of the battery capacity consumed.
	Low battery	Insufficient battery capacity. In addition, the message " Battery Confirm " is displayed and an acoustic signal is emitted.
	ACT	Displays the current selection of the menu. In addition, the symbol is requesting to confirm the selected parameters with .
	Choice	Displays the current choice of the menu before the new selection is made.
	Maintenance pending	Maintenance interval exceeded or critical operating condition. Pump must be serviced by the manufacturer.
	PUMP MODE	Pump operates in pump mode.
	FLUSH MODE	Pump operates in flush mode.
	Second FLUSH MODE	Pump operates in second flush mode (a second flow rate can be set).
	STOP	Pump is stopped.

6.5 Messages and Meaning

The pump interacts with the user in three (3) ways to indicate informational and/or error messages:

- Status and info LED - permanent or intermittent visual signal
- Acoustic signaler - acoustic signal
- Informational and/or error messages on the display - words or symbols

Info on display	Function	Status LED Info LED	Acoustic signal
„Init-Phase FW: X.X“	Initialization / Self check	flashing green	-
-	Ready to use / Operating pump function ok	Steady green light or flashing light during operation	-
-	Key press	-	Single tone
Pump Error Pump1	Motor or gear of pump head P1 without function.	flashing orange	10s interval until error is confirmed by user.
Pump Error Pump2	Motor or gear of pump head P2 without function.	flashing orange	10s interval until error is confirmed by user.
RTC Error Confirm	Date or time is set to default or backup battery on the board is empty.	flashing orange	10s interval until error is confirmed by user.
Battery Confirm	Battery is almost empty.	flashing orange	10s interval until error is confirmed by user.
Undervoltage Confirm	Rated voltage for operation with power supply was undercut.	flashing orange	10s interval until error is confirmed by user.
Reboot Confirm	Info after power failure and restart (e.g. low battery).	flashing orange	10s interval until error is confirmed by user.
Power Error Confirm	Power supply without voltage.	flashing orange	10s interval until error is confirmed by user.
Temperature Confirm	Internal temperature is above 41°C.	flashing orange	10s interval until error is confirmed by user.
Service Confirm	Service due to operating hours counter.	flashing orange	10s interval until error is confirmed by user.

6.6 Menu Structure, Settings and Navigation

6.6.1 Parameter Overview

To prevent unintended changes of parameters, all parameters can be displayed even without deactivating the keypad lock. For this, the button  must be pressed briefly on the home screen.

Afterwards the following overview is displayed and can be navigated using the keys  and  (settings cannot be changed).

```

P1 ► 1.0µL/min
P2 ► 1.0µL/min
P1 ►► 5.0µL/min
P2 ►► 5.0µL/min
►► 00:05:00
►► Auto Stop
P1 ↵ 5.0µL/min
P2 ↵ 5.0µL/min
↵00:05:00
↵Auto Stop
Tubing Adj 0%
Keylock Auto
Lock Timeout 60s
Light Permanent ON
Brightness 70%
LCD Contrast 0
Buzzer Value 3
Clock hh:mm:ss
Date yyyy:mm:dd
P1 ↵ in 3000h
P2 ↵ in 3000h
Serial No xyz

```

Figure 5: Overview of parameters

6.6.2 Menu for Setting the Parameters

Parameterization of the pump is performed from the home screen by long (> 3s) pressing the  button. Afterwards, the following overview is displayed and can be navigated using buttons  and :

```

✿ P1 ► 1.0µL/min
P2 ► 1.0µL/min
P1 ►► 5.0µL/min
P2 ►► 5.0µL/min
►► 00:05:00
►► Auto Stop
P1 ↵ 5.0µL/min
P2 ↵ 5.0µL/min
↵00:05:00
↵Auto Stop
Tubing Adj 0%
Keylock Auto
Lock Timeout 60s
Light Permanent ON
Brightness 70%
LCD Contrast 0
Buzzer Value 3
Clock hh:mm:ss
Date yyyy:mm:dd
Parameter Reset
Serial No xyz

```

Figure 6: Menu items for setting the parameters

Symbol  indicates the current selection in the menu. The individual menu items can be accessed by pressing the  button again and can then be parameterized. The following settings of the pump can be parameterized:

Display	Function
P1 ► 1.0µL	Adjusts the flow rate in pump mode of the pump head P1 from 0.1 to 10µl/min
P2 ► 1.0µL	Adjusts the flow rate in pump mode of the pump head P2 from 0.1 to 10µl/min
P1 ►► 5.0µL	Adjusts the flow rate in flush mode of the pump head P1 from 0.1 to 10µl/min.
P2 ►► 5.0µL	Adjusts the flow rate in flush mode of the pump head P2 from 0.1 to 10µl/min.
►► 00:05:00	Sets the duration of the flush mode in hh:mm:ss.
►► AUTO STOP	Sets the next steps of the pump after the flush mode is finished: <ul style="list-style-type: none"> • "Auto Pump" - Automatic change from flush to pump mode. • "Confirm Pump" - After pressing , change from flush to pump mode. • "Auto Stop" - Pump stops automatically. • "Confirm Stop" - After pressing  the pump stops.
P1 ▶ 5.0µL	Adjusts the flow rate in second flush mode of the pump head P1 from 0.1 to 10µl/min (if available).
P2 ▶ 5.0µL	Adjusts the flow rate in second flush mode of the pump head P2 from 0.1 to 10µl/min (if available).
▶ hh:mm:ss	Sets the duration of the second flush mode in hh:mm:ss (if available).
▶ AUTO STOP	Sets the next steps of the pump after the second flush mode is finished: <ul style="list-style-type: none"> • "Auto Pump" - Automatic change from flush to pump mode. • "Confirm Pump" - After pressing , change from flush to pump mode. • "Auto Stop" - Pump will stop automatically. • "Confirm Stop" - After pressing  the pump stops.
Tubing Adj 0%	Sets a correction factor for pump and flush mode for pumping head P1 and P2 from -99 to 100% (limited by maximum speed of the motor). Is used to adapt to alternative tubing sets. In this case, the correction factor is visible on the packaging of the tubing set under "Tubing adj XX%".

Display	Function
KEYLOCK Auto	Sets the keypad lock: <ul style="list-style-type: none"> • "Auto" - Automatic keypad lock. • "Manual" - Manual keypad lock.
Lock Timeout 60s	Time (15 to 600s) that elapses until keypad lock is active.
LIGHT: PERMANENT	Sets the display illumination : <ul style="list-style-type: none"> • "Permanent On" - Constantly turned on. • "Permanent Off" - Constantly turned off. • "Energy Saving" - Turns off automatically after 10 seconds.
Brightness 70%	Adjusts brightness from 20 to 100%.
LCD Contrast 0	Adjusts contrast from -10 to 10.
Buzzer Value 3	Adjusts volume of the info signal from 0 (off) to 3 (loud). Informational and/or error messages are always set to volume 3.
Clock hh:mm:ss	Sets the time in hh:mm:ss.
Date yyyy:mm:dd	Sets the date in yyyy:mm:dd.
Parameter Reset	Resets all parameters to default values (except date and time).
Serial No xyz	Displays serial number.

7 Preparing for Operation

7.1 General Information for Operating the Pump

7.1.1 Safety of User

Consider the general electrical safety regulations when operating electrical equipment when using the pump.

7.1.2 Control of Maintenance

Refer to Chapter 9.

7.1.3 Wipe Disinfection

Refer to Chapter 10.

7.2 Preparing the Pump

Check Contents Upon Delivery:

*Despite careful packaging, transport damage can occur. After unpacking, the pump should be checked for completeness according to these instructions. **DO NOT** operate a damaged pump!*



CAUTION

Let the pump and all accessories get acclimatized for at least 2 hours to temperature and humidity level before use in order to avoid the formation of condensation caused by sudden changes in temperature or high humidity. Slow adjustment to room temperature is recommended before use.

- **Unpacking:** Remove the pump from its packaging over a secure base (e.g. table).
- **Identification:** Document any relevant information (e.g. serial number of the pump, lot numbers of disposable components, etc.).
- **Open the battery compartment** with a T10 Torx key.
- **Insert battery** (refer to Figure 7 to Figure 9): Open the battery compartment cover, check for correct polarity and insert new batteries, EVE - ER26500M or SAFT - LSH 14. Then close the battery compartment cover. The batteries can be obtained from the American distributor.



CAUTION

Using other types or rechargeable batteries than specified herein may lead to malfunctions, or in the worst case, may cause damage to the pump and thus a hazard to operators.



Figure 7: Open the battery compartment with a T10 Torx key.



Figure 8: Insert a new battery according to the polarity. The battery removal strip underneath the battery facilitates easier removal.



Figure 9: Insert battery with pressure against the spring, positioning battery removal strip, and then closing the battery compartment cover with a T10 Torx key by securing the battery compartment screw.

- If pump is powered with battery, the display shows the symbol for battery operation (■).



CAUTION

Upon being turned on, the battery level may temporarily display incorrect information for a few minutes before resetting to the correct level.

- Alternatively, the pump can be operated via power supply from the manufacturer Egston, type - E2CFMW3 12 with 5V. For this purpose, remove the moisture protection jack and connect the power supply. If the pump is supplied with power, the display shows the power grid operation (⊕) symbol. When the power supply is no longer needed and disconnected, insert the moisture protection jack again so that moisture penetration is prevented.



CAUTION

The use of other power supplies than specified herein, can lead to malfunctions and in the worst case, cause damage to the pump and thus cause hazards to users.



Figure 10: Alternative operation of the pump via power supply

- Switching on the pump:** After inserting the battery, the pump switches on automatically. If the pump is on standby, long (> 3s) pressing of the button will turn on the pump. When starting, the firmware version is shown.
- Adjusting time:** The menu item **Clock hh:mm:ss** allows adjusting the time.
- Adjusting flow rate:** The flow rate can be adjusted via menu item **P1 ► 1.0µL** for pump head P1 or **P2 ► 1.0µL** for pump head P2. After starting the pump mode the elapsed time since the start is displayed in hh:mm:ss. This timer continues to run even during battery replacement.
- Adjusting flush rate:** In order to vent the tubing set the pump can be operated with an increased flow rate. Therefore, the flush rate can be changed via menu item **P1 ►► 5.0µL** for pump head P1 or **P2 ►► 5.0µL** for pump head P2. The duration of the flush mode can be set via menu item **►► 00:05:00** in hh:mm:ss. After starting the flush mode, the remaining is displayed in hh:mm:ss. Additionally, the next step of the pump after the flush mode is finished can be chosen:
 - "Auto Pump" – Automatic change from flush to pump mode.
 - "Confirm Pump" – After pressing change from flush to pump mode.
 - "Auto Stop" – Pump will stop automatically.

- "Confirm Stop" – After pressing  the pump stops.
- **Correction factor for tubing set:** Flow rates can be adjusted via the menu item **Tubing Adj 0%** by a correction factor for both pump heads in %. This factor increases or decreases the previously determined flow. Flow rates depend on type or material of tubing set used.

7.3 Preparing and Connecting the Accessories



CAUTION

READ Instructions for Use of available tubings, probes and accessories to avoid contamination.

- **UM_US_a-dOFM_v1-0** (or higher)
- **UM_US_cOFM_v1-0** (or higher)



Joanneum Research continuously expands its assortment of tubing sets, probes, and accessories. Please contact the American distributor for detailed information and newest components.

7.3.1 Installing Pump Tubing and Perfusate Bag

1. Unpack tubing set and perfusate bag.
2. Remove red protection cap of perfusate bag by turning it counter clock wise.
DO NOT remove injection port.

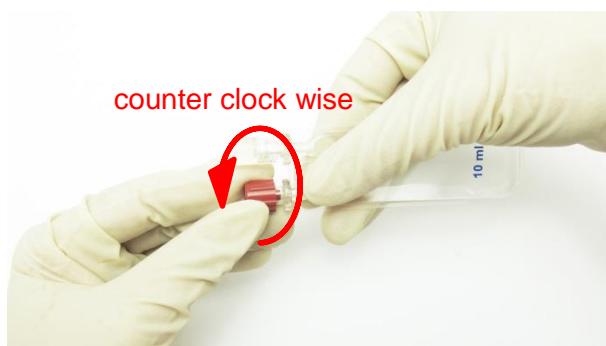


Figure 11: Remove red protection cap from the perfusate bag

3. Connect perfusate bag with the push tubing by turning the luer-connector clock wise.

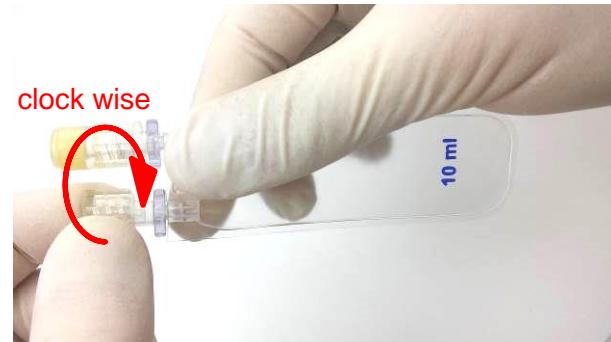


Figure 12: Connecting the perfusate bag via luer-connector with the push tubing

Fill the perfusate bag with a (sterile) syringe via the injection port (details see instructions for use of the perfusate bag).



Figure 13: Filling the perfusate bag via injection port



CAUTION

- **DO NOT** pierce perfusate bag with the needle. Risk of contamination.
- **DO NOT** use aggressive fluids (alcohols, acids, bleaches, etc.) and hot fluids (>45°C) as perfusate.

4. Open the cover of the pump heads.

5. Insert tubing:



CAUTION

If using a perfusate bag, the tubing must be inserted in pump head P2 (right module).

a. Open pump head by pulling the snap mechanism (PUSH).

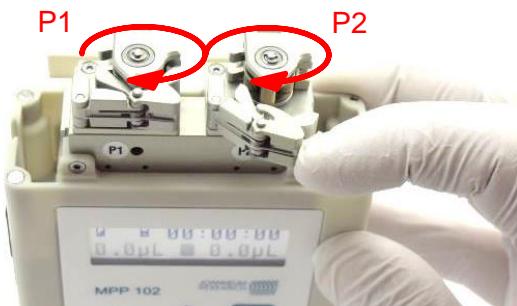


Figure 14: Opening of pump head using the snap mechanism.

b. Insert tubing using **clockwise rotation** on the pump head: insert the tubing into the left spring mounted fitting (viewed from the front side of the pump) of pump head, pull slightly forward, and insert the tubing afterwards into the right fitting.

c. Close pump head.



Figure 15: Inserting the tubing into the pump module

d. Insert tubing at the rear side of the pump in the retaining springs and place the strain relief of the tubing set (with cavity showing up and inside) into slot located on the left side of the housing.



Figure 16a: Tubing is fixed with retaining springs in the pump.

b: Tubing with strain relief is placed into the slot located on the left side of the pump.



CAUTION

- **DO NOT** use tools to insert the tubing set into the pump.
- When inserting the tubing, make sure that each of the individual tubings (if multichannel tubings are used) are parallel to the pump head and not twisted or crossed, because this can lead to incorrect flow rates.

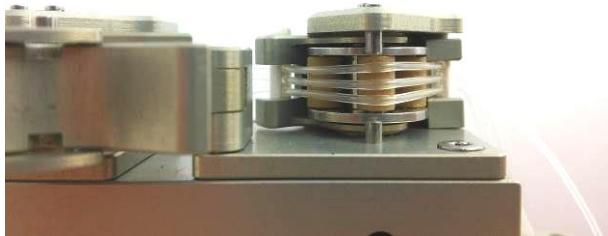


Figure 17a: Tubing set inserted **CORRECTLY**



b: Tubing set inserted **INCORRECTLY**

6. Insert tubing in second pump head as described above.
7. Close pump head.
8. Place Tubing set in the slot of the pump with fixed strain relief (avoid pinched tubing).



Figure 18: Tubing set placed in the slot of the pump with fixed strain relief

9. Insert connected perfusate bag into the right storage compartment.



Figure 19: Perfusate bag placed in the right storage compartment.

10. Confirm whether tubing and perfusate bag are placed well and everything is safely stowed.
11. Replace the cover of the pump heads. **AVOID** pinching of tubing to prevent alterations to flow rate.



Figure 20: Cover for pump heads

7.3.2 Flushing the System

Before starting with the actual sampling process, the tubing must be filled with perfusate. This can be best performed by using an increased flow rate at a maximum of 10 μ l/min in the flush mode (for details refer to Chapter 7.4.5 Flush Mode).

Take care to ensure that the entire tubing set is completely filled with perfusate. Remove visible air bubbles using flushing mode until the tubing is free of any air bubbles.

7.3.3 Connecting the Push Tubing

Connect the inserted probe(s) with a luer-connector or other appropriate connectors to the channel(s) of the push tubing.

7.3.4 Operation of the Overall System

Now, fluid samples from the tissue can be collected with required flowrate (For details on how to set the flow rate or on handling of the pump during operation, refer to Chapter 7.4.4 Pump Mode).). However, probe's or tubing set's maximum period of use **MUST** be considered.

7.4 Starting the Overall System

7.4.1 Switching on the Pump or Awaking it from Standby Mode

1. After inserting the battery, the pump switches on automatically.
2. Self-Check: In case of malfunction or defect, pump generates informational messages.
3. Long pressing (> 3s) of ACT/ SET/ ENTER when pump is on standby mode, awakes the pump.

7.4.2 Locking / Unlocking the Pump

To avoid unauthorized access, the pump features a keypad lock. An active keypad lock is displayed by the symbol (🔒).

By sequentially pressing and the key lock can be activated / deactivated.

- The menu item **KEYLOCK Auto** specifies the characteristics of the keypad lock: "Auto" - automatic keyboard lock and "Manual" - Manual keyboard lock.
- The menu item **Lock Timeout 60s** time can be set from 15 to 600 seconds, which must elapse until the automatic keypad lock is activated.

7.4.3 Home Screen and Navigation

1. The double-lined home screen displays the selected flow rates of the two pump modules P1 and P2, the operating time, the battery status, and the status of the pump. Through the use of the following symbols, the operating mode is displayed: Stop (■), pump mode (▶) or flush mode (▶ or ▷).

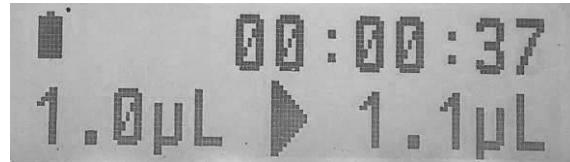


Figure 21: Home screen: Double lined display during pump / flush mode

2. Parameterization of the pump is carried out from the home screen by long (> 3s) pressing the button. Afterward, an overview (refer to 6.6.2 Menu for Setting the Parameters) is displayed and can be navigated using the buttons and .
3. The symbol indicates the current selection in the menu. The individual menu items can be accessed by pressing the button again and then be parameterized (e.g. flow rates).
4. The button resets the input without saving the settings and switches to the previous menu. Furthermore, pressing the button can be used to activate the parameter overview.

7.4.4 Pump Mode

1. The flow rate can be adjusted via menu item **P1 ▶ 1.0 μL** for pump head P1 or **P2 ▶ 1.0 μL** for pump head P2. After starting the pump mode, the elapsed time since the start is displayed in hh:mm:ss. This timer continues to run even during battery replacement.
2. Flow rates can be adjusted for pump head P1 and P2 from 0.1 to 10 μL/min, using the buttons and and confirmed using .
3. Short pressing of starts the pump mode when being confirmed with .
4. Short pressing of stops the pump mode when being confirmed with .

7.4.5 Flush Mode

1. The flush rate can be adjusted via menu item for pump head P1 **P1 ▶▶ 5.0 μL** or **P2 ▶▶ 5.0 μL** for pump head P2.
2. Flush rates can be adjusted for pump head P1 and P2 from 0.1 to 10 μL/min using the buttons and and confirmed, using .
3. The menu item **▶▶ 00:05:00** sets the duration of the flush mode in hh:mm:ss.

4. The menu item ►► **AUTO STOP** sets the next steps of the pump after the flush mode is finished:
 - "Auto Pump" - Automatic change from flush to pump mode.
 - "Confirm Pump" - After pressing , change from flush to pump mode.
 - "Auto Stop" - Pump will stop automatically.
 - "Confirm Stop" - After pressing , the pump stops.
5. Short pressing of  starts the flush operation when being confirmed with 
6. Long pressing (> 3s) of  starts, if available, the second flush mode, stored in the menu, when being confirmed with .
7. This second flush mode can be parameterized as follows:

Analog to Chapter 7.4.5 Flush Mode using the menu item **P1 $\text{L} \text{r} 5.0 \mu\text{L}$** , **P2 $\text{L} \text{r} 5.0 \mu\text{L}$** , **$\text{L} \text{r} \text{hh:mm:ss}$** and **$\text{L} \text{r} \text{AUTO STOP}$** .

7.4.6 Correction Factor for Tubing Set

The menu item **Tubing Adj 0%** sets a correction factor for pump and flush mode for pump head P1 and P2 from -99 to 100% (limited by maximum speed of the motor). This is necessary in case alternative tubing systems of different materials are used.

7.4.7 Setting the Time

1. The menu item **Clock hh:mm:ss** allows setting the time in hh:mm:ss .
2. By pressing the buttons  and , hours, minutes and seconds can be changed.
3. Pressing the button  changes from hours to minutes and seconds and finally confirms the time.

7.4.8 Setting the Date

1. The menu item **Date yyyy:mm:dd** allows setting the date in yyyy:mm:dd .
2. By pressing the buttons  and , year, month and day can be changed.
3. Pressing the button  changes from year to month and day and finally confirms the date.

7.4.9 Displaying the Serial Number

The menu item **Serial No xyz** displays the serial number.

7.4.10 Setting the Volume of the Informational Signals

The menu item **Buzzer Value 3** adjusts volume of the informational signal from 0 (off) to 3 (loud). By pressing the buttons  and , the volume can be changed if afterwards confirmed by pressing . Informational and/or error messages always resound with volume 3.

7.4.11 Informational and/or error Messages

Informational and/or error messages are made visible by the flashing orange LED indication, acoustic signal and symbols shown in the display (refer to 6.4).

Long pressing (> 3s) of  allows a repeated view of active Informational and/or error messages. For details refer to Chapter 6.5.

7.4.12 Parameter Reset

The menu item **Parameter Reset** resets all parameters to default values (except date and time).

7.5 Recurring Activities During Operation

7.5.1 Changing the Perfusate Bag

The perfusate bag can be changed easily during use:

1. Stop the pump to avoid air bubbles from entering the system. The tubing set must remain in the pump and may only be removed after completion of the study.
2. When changing the perfusate bag, a new one should already be prepared. Before changing a perfusate bag, a new perfusate bag should be readily available and ready for replacement.
3. Open the cover of the pump heads and remove the empty perfusate bag.
4. Loosen the luer-connector from the empty perfusate bag and screw it onto the new empty bag.
5. Fill the new perfusate bag with a syringe avoiding the infusion of air bubbles.
6. Insert the new perfusate bag in the right storage compartment of the pump and close the cover again.
7. Start pump again.



CAUTION

Maintain a sterile operating environment during the perfusate bag-changing process. The luer-connector must be removed in one operation from the empty perfusate bag and attached to the new one.

7.5.2 Changing the Battery

During longer studies, it may be necessary to change the battery. If the battery runs out, it will be indicated on the display of the pump by the info “**Battery Confirm**” and indicated by an acoustic signal and an orange flashing LED. Change the battery as soon as possible to avoid wrong flow rates.

1. To change the battery, open its compartment using a T10 Torx key.
2. Insert a new battery according to the polarity. The battery removal strip underneath the battery facilitates later removal.

3. Insert the battery with pressure against the spring, position battery removal strip and then close the battery compartment with the T10 Torx key by securing the battery compartment screw.
4. If the battery is replaced and the pump is not supplied from a power supply unit, the message "Reboot Confirm" appears after inserting a new battery. This message has to be confirmed.
5. If the pump is supplied with battery, the symbol for battery operation (■) is displayed.



Figure 22: Inserting the new battery

ONLY USE the following batteries:

Manufacturer: EVE Type: ER26500M

Voltage: 3.6V

Capacity: 6500mAh

Manufacturer: SAFT Type: LSH14

Voltage: 3.6V

Capacity: 5800mAh



CAUTION

Using batteries of other types or rechargeable batteries than specified herein, may lead to malfunctions and may cause damage to the pump.

7.5.3 Operating the Pump on Power Supply

Alternatively, the pump can be operated using a power supply from the manufacturer Egston, type E2CFMW3 12 operated with 5V:

1. Remove the moisture protection of the jack and connect the power supply.
2. If the pump is supplied with power, the display shows the symbol for power grid operation (✚).
3. When the power supply is no longer needed and disconnected, insert the moisture protection jack again so that moisture penetration is prevented.



CAUTION

Using other power supplies than recommended herein can lead to malfunctions, or may cause damage to the pump.

7.6 Removing the Pump

After completion of the study, remove pump as follows:

1. Deactivate keypad lock by sequentially pressing the buttons  and .
2. Short pressing of  and sub sequential pressing of  stops the pump.
3. To remove the pump, loosen the luer-connector between tubing and probe and remove the pump.
4. This will allow the optional fastening straps to be removed and the pump can be prepared for the next study (see Chapter 10).



WARNING

DISPOSE all single-use products (e.g. probes, tubing, and perfusate bag) according to routine regulations to prevent reuse or contamination with biological material.

8 Trouble Shooting

Error	Cause of error	Trouble shooting
Error message "Pump Error Pump1"	<ul style="list-style-type: none"> Pump head 1 blocked Tubing blocked Motor blocked Encoder broken Motor / gears broken 	<ul style="list-style-type: none"> Open pump head - check for any blockages – close pump head Contact American distributor
Error message "Pump Error Pump2"	<ul style="list-style-type: none"> Pump head 2 blocked Tubing blocked Motor blocked Encoder broken Motor / gears broken 	<ul style="list-style-type: none"> Open pump head - check for any blockages – close pump head Contact American distributor
Error message "RTC Error Confirm"	<ul style="list-style-type: none"> Date / Time are set to default or backup battery on the board is empty 	<ul style="list-style-type: none"> Set Time / Date Send pump to American distributor for battery replacement
Error message "Battery Confirm"	<ul style="list-style-type: none"> Low Battery 	<ul style="list-style-type: none"> Insert new battery
Error message "Temperature Confirm"	<ul style="list-style-type: none"> Internal temperature above 41°C Too long in operation Room temperature to high 	<ul style="list-style-type: none"> Remove pump and replace with a new one Contact American distributor Check room temperature
Error message "Reboot Confirm"	<ul style="list-style-type: none"> Message after reboot of the pump (e.g. low battery) 	<ul style="list-style-type: none"> Renew battery Or confirm if just changed
Error message "Power Error Confirm" + maintenance symbol	<ul style="list-style-type: none"> Rated voltage for operation with power supply is insufficient Power grid failure Power supply is not connected to the power grid (only to pump) 	<ul style="list-style-type: none"> Exchange power supply Check power grid Connect the power supply to the power grid
Pump cannot be turned on	<ul style="list-style-type: none"> Wrong / broken battery Power supply unit broken Keypad broken 	<ul style="list-style-type: none"> Exchange battery Exchange power supply Contact American distributor
Error message "Service Confirm"	<ul style="list-style-type: none"> Operating hours achieved 	<ul style="list-style-type: none"> Contact American distributor

Error	Cause of error	Trouble shooting
No flow rate	<ul style="list-style-type: none"> • Tubing set inserted incorrectly • Perfusate bag filled insufficiently • Tubing disconnected • Pump head not closed 	<ul style="list-style-type: none"> • Check tubing set • Check level of perfusate bag • Check snap mechanism of the pump head • Close pump head
Decreased flow rate	<ul style="list-style-type: none"> • Incorrect tubing set • Tubing adjustment wrong or not determined • Incorrect settings • Tubing disconnected • Pump head not closed 	<ul style="list-style-type: none"> • Check tubing set • Check settings • Check snap mechanism of the pump head • Close pump head
Increased flow rate	<ul style="list-style-type: none"> • Incorrect tubing set • Tubing adjustment wrong or not determined • Incorrect settings 	<ul style="list-style-type: none"> • Check tubing set • Check settings
Air bubble within the system	<ul style="list-style-type: none"> • Air suction • System not tight 	<ul style="list-style-type: none"> • Check connectors • Remove air bubbles from the system
Leakage of liquids	<ul style="list-style-type: none"> • System not sufficiently fastened 	<ul style="list-style-type: none"> • Check connectors • Check correct insertion of the tubing set in the pump head
Parameters already set by the user are set repeatedly to default after rebooting.	<ul style="list-style-type: none"> • Memory (EPROM) broken 	<ul style="list-style-type: none"> • Contact American distributor

9 Servicing / Maintenance

DO NOT perform maintenance work or service of any part of the pump. In order to ensure optimum function the **pump should be inspected at least every 12 months or when service is indicated on the display**.

The menu item "P1 in 16h" or "P2 in 16h" displays the remaining operating hours. In this case both pump modules would require maintenance within 16 hours. If, due to increased operating hours, maintenance activities are necessary to be performed before the end of 12 months, this is indicated by the [!] symbol. The message "**Service Confirm**" will also be displayed.

In case the 12 months expired (refer to the inspection sticker on the backside of the pump, also shown in Figure 23) or when the [!] symbol is indicated on the display send the pump to the American distributor for maintenance work or service.

Maintained pumps can be identified by the inspection sticker on the back of the device. **DO NOT** exceed the date on the sticker:



Figure 23: Inspection sticker

Send the pump to the American distributor within the storage case.



CAUTION

DO NOT use dropped pumps or malfunctioning pumps. The pump must be checked by the manufacturer before being reused.

To avoid data loss during servicing, parameters and settings must be recorded and stored by the user before the manufacturer services or repairs the product.

Safety Check

An annual safety check by the manufacturer Joanneum Research must be performed to guarantee the pump's electrical safety.



CAUTION

Maintenance and repairs must be performed by the manufacturer Joanneum Research or by authorized and qualified professionals only. For further informations to Service or Maintenance contact the American distributor:

BASi (<https://www.basinc.com/ask>)



U.S. PHONE NUMBER +1-800-845-4246

DAMAGE CAUSED TO THE PUMP BY USER OR ANY NON-AUTHORIZED THIRD PARTY MAY VOID MANUFACTURER'S WARRANTY. BATTERIES OR ANY PROBLEM THAT IS CAUSED BY ABUSE OR MISUSE ARE NOT COVERED. ALSO, CONSEQUENTIAL AND INCIDENTAL DAMAGES ARE NOT RECOVERABLE UNDER THIS WARRANTY. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

10 Cleaning and Disinfection

Pump

Clean and disinfect the pump before and after every single use. If necessary, cleaning and disinfection can also be carried out during an ongoing study.



CAUTION

Before cleaning, remove batteries from the pump and dispose properly. **DO NOT** autoclave or immerse pump in liquids.

Recommendation for cleaning the pump:

- Lint-free cotton cloth
- Alcoholic cleaner (> 70%), non-abrasive for wipe and spray disinfection



CAUTION

Other cleaners may affect the plastic housing of the pump.

Power Supply

Recommendation for cleaning the power supply:

- Lint-free cotton cloth
- Alcoholic cleaner (> 70%) , non-abrasive for wipe and spray disinfection



CAUTION

To avoid the risk of electric shock, unplug power supply before cleaning and disinfection and let it dry completely before reuse.

11 Storage and Transportation

The pump must be sufficiently stored before transportation. Transport the pump in its original packaging (storage case) to avoid damages to the pump while transporting.



Figure 24: Storage case

ALWAYS store the pump in the designated storage case. **REMOVE** the batteries from the battery compartment while storing the pump.

Store the pump in a suitable place. For safe storage and safe transport, the following thresholds are recommended:

- Temperature: -30°C to +70°C
- Humidity: 10% to 95%, non-condensing
- Air Pressure: 70 to 106kPa

Unless stated otherwise on accessories' packaging, store accessories under the same conditions as the pump.

AVOID formation of condensation caused by sudden changes of temperature or high humidity. A slow adjustment to room temperature is recommended before use.

12 Technical Data

Micro-Perfusion Pump

Type: MPP 102 PC

Field of application: Microdialysis and Microperfusion

Adjustable Flow Rates: 0.1 - 10 μ l/min flow rate (with an accuracy of \pm 20%)
(depends on tubing used – use JR precalibrated tubing to ensure sufficient accuracy)

Resolution:	0.1 μ l/min	at 0.1 – 2.0 μ l/min flow rate
	0.2 μ l/min	at 2.0 – 5.0 μ l/min flow rate
	0.5 μ l/min	at 5.0 – 10.0 μ l/min flow rate

Power Supply:

Lithium Battery, Type: EVE ER26500M, Baby, 3.6V, 6500mAh, or SAFT LSH 14.

Typical operating time (with a new battery): up to 48 hours at 1.0 μ l/min and up to 24 hours at 10 μ l/min.

Power supply of manufacturer Egston, type - E2CFMW3 12 with 5V, 1500mA

Rated Data of Pump:	Nominal voltage: 3.6V
	Current Rating: 200mA ==
	Polarity: 

Display: LCD with backlight

Dimensions: 130 x 92 x 34.5mm

Total Weight: 295g excl. battery and accessories.

Ambient Operating Temperature: 5 to 40°C

Operating condition: indoor use only; up to 2000m / 6500ft above sea level.

Permissible Relative Humidity During Operation: 20 to 80%

Delivery: Storage case with foam inserts, Micro - Perfusion Pump MPP 102 PC, Instruction for Use, batteries, power supply and Torx T10 key to remove the battery.

13 Identification Plate and Symbols

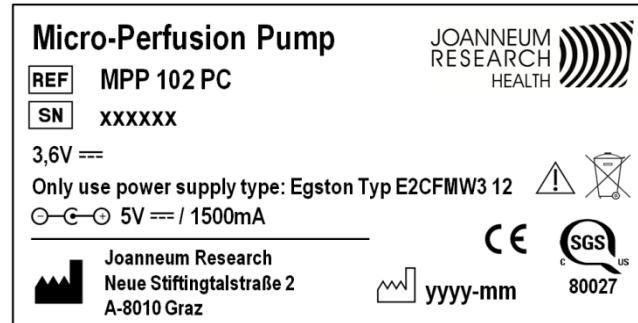


Figure 25: Identification plate on the back of the pump

Symbol	Meaning
REF	Order number (type designation)
SN	Serial number
	Date of manufacture
	Name and address of manufacturer
	Identifies a caution statement that warns failure to follow the instructions may lead to device misuse, malfunction, or damage.
	Do not dispose pump as household waste.
	Direct current
	Polarity of the power supply (positive pole inside).

14 Limited Warranty

All equipment sold by Joanneum Research (“Company”) is warranted to be free from defects in both materials and workmanship for a period of one (1) year unless otherwise specified. Parts and accessories (excluding batteries) are covered by a 90-day limited warranty unless otherwise specified. Batteries are not covered under this warranty. Any stated warranties are in effect from the date of sale. Joanneum Research reserves the right to repair, replace or refund (less cost of shipping) any item(s) requiring warranty service. The customer is responsible for return shipping costs and required to contact Joanneum Research prior to shipping the item(s) back.

To obtain the benefits of this warranty, proof of rebuild by Joanneum Research (such as a copy of repair record, invoice or canceled check) must be submitted if requested by Joanneum Research. This warranty is void if:

- (a) the equipment has been damaged by negligence, accident or mishandling, or has not been operated in accordance with the procedures described in the Instructions for Use; or
- (b) the equipment has been altered or repaired by any company or entity other than Joanneum Research or adaptations or accessories have been made or attached to the equipment which, in the determination of Joanneum Research shall have affected the performance, safety, or reliability of the equipment. **NO OTHER WARRANTY EXPRESSED OR IMPLIED, INCLUDING MERCHANTABILITY, APPLIES TO THE EQUIPMENT, NOR IS ANY PERSON OR COMPANY AUTHORIZED TO ASSUME ANY OTHER WARRANTY.** Joanneum Research does not assume any responsibility for any consequential damages occasioned by the equipment, or inconvenience or interruption in operation.

Exclusions

- Parts and accessories are covered for 90 days.
- Batteries are excluded from this warranty.
- International orders are excluded from this warranty.
- This Limited Warranty does not cover normal wear and tear of the product or costs related to the removal, installation, or troubleshooting of the customer’s electrical systems. This warranty does not apply to and Joanneum Research will not be responsible for any defect in or damage to:
 - The product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment or the use of unauthorized accessories;
 - The product if repairs have been done to it other than by Joanneum Research or its authorized service centers (hereinafter “ASCs”);
 - The product if it is used as a component part of a product expressly warranted by another manufacturer; or
 - The product if its original identification (tamper tag, trade-mark, serial number) markings have been defaced, altered, or removed.

WARNING Limitations On Use

Please refer to your Instructions for Use for limitations on uses of the product.

Return Material Authorization Policy

Before returning a product, you must call the American distributor

BASi (<https://www.basinc.com/ask>)



U.S. PHONE NUMBER +1-800-845-4246

to obtain a Return Material Authorization (“RMA”) number and the correct factory “Ship To” address. Products must also be shipped prepaid. Product shipments will be refused and returned at your expense if they are unauthorized, returned without an RMA number clearly marked on the outside of the shipping box, if they are shipped collect, or if they are shipped to the wrong location. When you contact Joanneum Research to obtain service, please have your Instructions for Use ready for reference and be prepared to supply the following information:

1. Your product serial number,
2. A copy of your dated proof of purchase,
3. Information about the installation and use of the unit, and
4. Information about the failure and/or reason for the return.

Return Procedure

1. Package the unit safely, preferably using the original box and packing materials. Ensure that the product is shipped fully insured in the original packaging or equivalent. This warranty will not apply where the product is damaged due to improper packaging.
2. Include the following:
 - a. The RMA number supplied by Joanneum Research clearly marked on the outside of the box.
 - b. A return address where the unit can be shipped. Post office boxes are not acceptable.
 - c. A contact telephone number where you can be reached during work hours.
 - d. A brief description of the problem.
3. Ship the unit prepaid to the address provided by your Joanneum Research customer service representative.
4. The customer must notify Joanneum Research of a return with seven days of receiving the item. The customer will be responsible for return shipping costs and a 15% restocking fee.

Customers are responsible for the freight cost of returning the equipment to Joanneum Research. Joanneum Research will pay for the return of the serviced equipment by UPS ground shipment. Customers are responsible for expedited method of shipping.

Disclaimer

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY PROVIDED BY COMPANY IN CONNECTION WITH YOUR COMPANY PRODUCT AND IS, WHERE PERMITTED BY LAW, IN LIEU OF ALL OTHER WARRANTIES, CONDITIONS, GUARANTEES, REPRESENTATIONS, OBLIGATIONS AND LIABILITIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONNECTION WITH THE PRODUCT, HOWEVER ARISING (WHETHER BY CONTRACT, TORT, NEGLIGENCE, PRINCIPLES OF MANUFACTURER'S LIABILITY, OPERATION OF LAW, CONDUCT, STATEMENT OR OTHERWISE), INCLUDING WITHOUT RESTRICTION ANY IMPLIED WARRANTY OR CONDITION OF QUALITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE TO THE EXTENT REQUIRED UNDER APPLICABLE LAW TO APPLY TO THE PRODUCT SHALL BE LIMITED IN DURATION TO THE PERIOD STIPULATED UNDER THIS LIMITED WARRANTY. IN NO EVENT WILL COMPANY BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, COSTS OR EXPENSES HOWEVER ARISING WHETHER IN CONTRACT OR TORT INCLUDING WITHOUT RESTRICTION ANY ECONOMIC LOSSES OF ANY KIND, ANY LOSS OR DAMAGE TO PROPERTY, ANY PERSONAL INJURY, ANY DAMAGE OR INJURY ARISING FROM OR AS A RESULT OF MISUSE OR ABUSE, OR THE INCORRECT INSTALLATION, INTEGRATION OR OPERATION OF THE PRODUCT.

15 Notes

**MICRO-PERFUSION PUMP
MPP 102 PC**



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