

## OPERATION AND MAINTENANCE MANUAL

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# AMPTS<sup>®</sup> III

Anaerobic batch fermentation test systems



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The latest version of this manual can always be provided upon request:  
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## GENERAL INFORMATION

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Before operating the AMPTS III (hereafter referred to as “the instrument”, “the system” or “the equipment” interchangeably) from BPC Instruments AB (hereafter referred to as “BPC Instruments”, “BPC”, “Bioprocess Control” or “BPC Instruments AB” interchangeably), carefully read this operator manual for the instrument, any separate instructions for other equipment used together or in conjunction with the instrument, as well as the safety instructions for any and all chemicals used in the process of utilising the instrument.

### Safety Information

When performing experiments with the instrument, always use protective eyewear, gloves, and lab coat. Always make sure there is adequate ventilation and take proper precautions when handling electrical devices near water or explosive gases. Make sure to tie back any hanging objects, such as hair and clothing, when working near rotating or other moving parts.

Do not modify the instrument without the prior consent of the manufacturer. BPC Instruments AB do not assume responsibility for any errors due to equipment modification.

Do not clean or service the instrument while it is running.

Do not expose the instrument to mechanical vibrations or high frequency radio transmissions.

Never operate the instrument in a way it was not intended.

Never operate the instrument or let anyone else operate it without proper training.

Never use the instrument outside or in environments with parameters outside of the instruments recommended range.

Never connect additional electrical equipment not supplied by BPC Instruments AB for the express purpose of using with the instrument. This is true even if the connections can mate.

Always back-up important data to an external device.

Always keep the instrument level and on a flat and stable surface. Failing to do so can, among other things, generate an erroneous gas reading.

Always make sure all safety guards are in place and working before operating the instrument.

Always make sure that all parts are functioning properly immediately after start-up.

Always keep the instrument clean.

Always make sure to have access to relevant chemicals before starting an experiment.

Always dispose of parts and chemicals according to applicable rules in the country of usage.

Periodic maintenance of the instrument and its various accessories is essential. Always make sure they are in working condition. If service or spare parts are required, please visit <https://webshop.bpcinstruments.com> or contact BPC Instruments AB directly or one of its representatives.

Always make sure to connect the power supply so that it is easy to remove from the mains power outlet and so it doesn't risk becoming damaged.

Always make sure that the gas outlet of the Flow Cell Unit (FCU) is able to release pressure in the event of pressure build-up inside of the instrument. Do not obstruct or block it.

Always wait 60 seconds between powering the system on and off. This will allow for the operating system to shut down properly and for the capacitors to properly cycle.

Always use deionized water to minimise the risk of residue or rust forming on the inside of the FCU.

## Limited Warranty

The product warranty provided with the instrument corresponds to the stipulations in Orgalime S 2012, unless otherwise agreed upon with BPC Instruments AB. BPC Instruments AB reserves the right to correct any possible errors, mistakes, changes, updates, technical data or otherwise relevant information in this manual or any other documents, where applicable by law.

## Electrical Safety

Compliance is required with respect to voltage, frequency and current requirements indicated on relevant parts. Improper operation, damage to the equipment, fire or otherwise undesired effects might be caused by connecting to a different power source. There are no user-serviceable parts in the equipment, unless otherwise agreed upon with BPC Instruments AB.

## Before Getting Started

Read this manual before installing and using the instrument. In addition, keep this instruction manual for future reference and make sure it is easily available for people who regularly use the system.

## Contact Information

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## Chapter 01: Overview

The Automatic Methane Potential Test System III (AMPTS III) is the next generation of the well-established analytical platform for conducting anaerobic batch fermentation tests developed by BPC Instruments. This new system comes with the best features of the previous generation and a series of improvements and further developments in all the different parts of the equipment.

AMPTS III was designed to cover a broad range of applications, including:

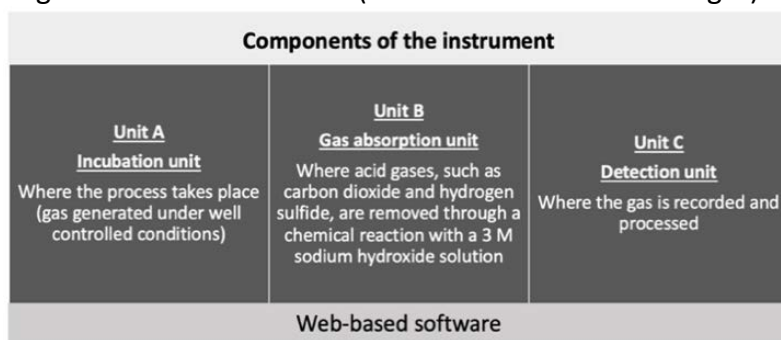
- Biochemical Methane Potential (BMP) tests
- Biogas production (Gas composition based on methane and carbon dioxide)
- Specific Methanogenic Activity (SMA) assays
- Residual Gas Potential (RGP) assays
- Biological Hydrogen Potential (BHP) tests

In addition, this instrument is suitable to optimise relevant parameters involved in the Anaerobic Digestion (AD) process, providing key information regarding the optimum mix of substrates for co-digesting processes, proper pre-treatment methods, the need for additives, etc. During the degradation of the organic material under anaerobic condition, the produced gas is continuously collected and measured when working with AMPTS III, which makes it possible to determine the dynamic degradation profile of any biomass substrate.

Regarding the application, the main difference between AMPTS III and AMPTS II (previous version) is the possibility to perform single (e.g., methane) and total gas (e.g., biogas) measurements. In this case, users have the possibility to measure both biogas and methane in the same batch test for estimation of gas composition. The gas measured can be easily collected for further composition analysis.

AMPTS III retains the features of the previous version (AMPTS II), which include the following:

- Same configuration in two versions (AMPTS III and AMPTS III Light).







- Automated sampling, recording, data analysis and report generation.

- Standalone instrument with embedded data acquisition and web server for remote access (no need for software installation).
- The measuring cell is pre-calibrated by the factory.
- The software can be accessed locally or remotely from any device with a web browser (preferably Google Chrome).
- Option for real-time automatic compensation for atmospheric pressure, environmental temperature and moisture content changes to normalise the data to standard conditions.
- Function to remove gas overestimation and automatic calculation of the amount of substrate and inoculum needed per reactor in order to perform BMP tests.
- Reliable operation and easy maintenance where most of the components can be easily exchanged without special requirements.
- System log for operational diagnosis.

**Table 1** summarizes the new features of AMPTS III and AMPTS III Light:

**Table 1.** Overview of the new features of AMPTS III and AMPTS III Light.

<b>AMPTS III and AMPTS III Light</b>	
<b>INCUBATION UNIT</b> 	<ul style="list-style-type: none"> <li>- 18 channels (AMPTS III) and 9 channels (AMPTS III Light)</li> <li>- AMPTS III standard configuration with 1 L reactors (0.5 L reactors as an option).</li> <li>- AMPTS III Light comes with 2 L reactors</li> <li>- New thermostatic water bath with capacity to place 18 (0.5 / 1 L) or 9 (2 L) reactors</li> </ul>
<b>CO<sub>2</sub>-ABSORPTION UNIT</b> 	<ul style="list-style-type: none"> <li>- Improved bottle holder design for CO<sub>2</sub> removal bottles</li> <li>- AMPTS III comes with two bottle holder units, each for nine bottles, allowing more flexibility to arrange the instrument</li> <li>- Higher capacity for CO<sub>2</sub> removal with 250 mL sized bottles (AMPTS II offered 100 mL bottles).</li> </ul>
<b>BPC CORE AMPTS UNIT AND SOFTWARE</b>  	<ul style="list-style-type: none"> <li>- New design where each flow cell is enclosed in a chamber</li> <li>- The flow cell chambers can be easily replaced without tools</li> <li>- Two possible measurement resolutions (2 and 9 mL)</li> <li>- New electronics for faster and more stable operation compared to the previous version</li> <li>- 150 times higher storage capacity compared to AMPTS II</li> <li>- USB port for software upgrade</li> <li>- Addition of a power button</li> <li>- Factory reset function</li> <li>- OLED screen to easy access the status and IP address of the instrument.</li> <li>- Built-in accelerometer for leveling of the unit C</li> <li>- New software platform Aurora™</li> <li>- It is possible to start and stop all channels with one click</li> <li>- Three types of normalisation</li> <li>- New set of settings to visualise data and generate reports</li> </ul>

Accessories	<ul style="list-style-type: none"> <li>- More robust and less gas permeable tubing</li> <li>- Tubing connectors to simplify and ensure a good and tight connection between the tubing and the inlet of the flow cell chamber and the outlet of the reactor</li> <li>- Push-in valves to simplify the flushing step of the headspace of the reactor in order to create an anaerobic environment</li> <li>- New tubing markers for easy identification of the different channels</li> <li>- New tool for removing lids and tubing</li> </ul>
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## Chapter 02: Delivery Checks

AMPTS III (**Figure 1**) and AMPTS III Light (**Figure 2**) are delivered with the components listed below:



**Figure 1.** AMPTS III Complete System.

### Unit A – Incubation Unit

20 glass reactors (0.5 or 1 L)	1 motor controller signal cable	1 MCU power adapter
18 brushless DC motors 1 motor power splitter	18 axis couplings for brushless DC motors	1 thermostatic water bath 1 base tray
19 brushless DC motor cables 250 mm (15 units) 500 mm (3 units) 1500 mm (1 unit)	20 stirrers GL 45 (0.5 or 1 L) standard 1 motor controller unit (MCU)	1 thermostatic water bath lid for 18 reactors (0.5 or 1 L) 20 push-in valves 6 mm

### Unit B – CO<sub>2</sub>-absorption Unit

2 bottle holders 9 x 250 mL	20 bottle nuts GL 45
20 glass bottles (250 mL)	20 lids GL 45

### Unit C – BPC Core AMPTS Unit

1 BPC Core AMPTS	40 check valves	1 main unit power adapter
20 flow cell units (FCUs)	1 plastic syringe	1 ethernet cable

### Additional Components

1 Festo tubing 50 m	40 push-in connectors 6 mm	1 bottle/tube opening tool
1 funnel	12 soft binders 7/180 mm	FCU volume sheet (2 or 9 mL)
20 tubing stoppers	40 multi-coloured marker clamps	





Figure 2. AMPTS III Light Complete System.

#### Unit A – Incubation Unit

10 glass reactors (2 L)	1 motor controller signal cable	1 MCU power adapter
9 brushless DC motors	9 axis couplings for brushless DC motors	1 thermostatic water bath
1 motor power splitter		
10 brushless DC motor cables	10 stirrers GL 45 (2 L) standard	1 thermostatic water bath lid for 9 reactors (2 L)
250 mm (6 units)		
500 mm (3 units)	1 motor controller unit (MCU)	10 push-in valves 6 mm
1500 mm (1 unit)		

#### Unit B – CO<sub>2</sub>-absorption Unit

1 bottle holders 9 x 250 mL	10 bottle nuts GL 45
10 glass bottles (250 mL)	10 lids GL 45

#### Unit C – BPC Core AMPTS Light Unit

1 BPC Core AMPTS	20 check valves	1 main unit power adapter
10 flow cell units (FCUs)	1 plastic syringe	1 ethernet cable

#### Additional components

1 Festo tubing 50 m	20 push-in connectors 6 mm	1 bottle/tube opening tool
1 funnel	6 soft binders 7/180 mm	FCU volume sheet (2 or 9 mL)
20 tubing stoppers	20 multi-coloured marker clamps	

The following items are **NOT** provided in the package of both instruments:

- Flushing gas to obtain anaerobic conditions inside the reactors during the sample preparation phase.
- 3 mol/L sodium hydroxide (NaOH) solution.
- pH indicator (Thymolphthalein) and ethanol.
- Additional wall socket adapters (plugs/contacts). The ones supplied are according to European, US or UK standards, depending on the country where the instrument will be operated.
- Gas sampling units and gas bags for off-line gas composition analysis.

## Chapter 03: Equipment Description

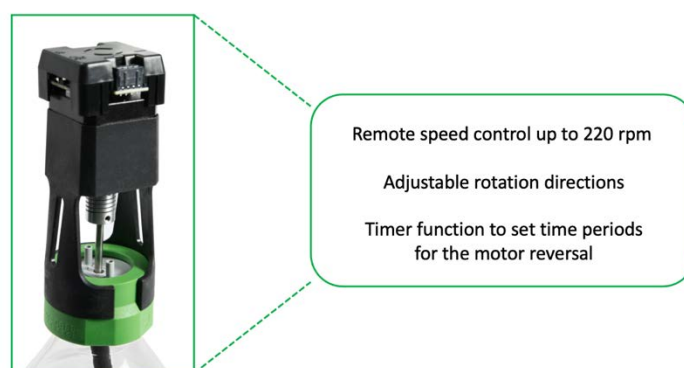
AMPTS III and AMPTS III Light consist mainly of three parts: Incubation unit, CO<sub>2</sub>-absorption unit and detection unit (also called gas volume measuring device).

- 1) **Incubation Unit (Unit A):** Here is where the fermentation process takes place (**Figure 3**). 18 (0.5 or 1 L) or 9 (2 L) reactors are placed inside a thermostatic water bath (68 x 56 x 33 cm), which is used for temperature control (up to 60° C, precision of 0.2° C). The thermostatic water bath is provided with a lid for 18 or 9 reactors to minimize water loss and ensure that the temperature set point is rapidly reached. The incubation system provides a well-controlled environment in regard to temperature, pH, and relative humidity for biogas/biohydrogen production.



**Figure 3.** (A) Incubation unit for AMPTS III and (B) AMPTS III Light.

Each reactor is connected to a brushless DC motor that ensures a well-mixed content through a strong, reliable, and multifunctional agitation system (**Figure 4**). A motor controller provides the power via motor cables, where all the motors receive the same information. **The MCU needs to be turned off and unplugged from the power source when any cables are connected or disconnected from the motors.**



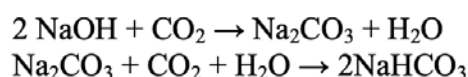
**Figure 4.** Main features of the agitation system in AMPTS III and AMPTS III Light.

- 2) **CO<sub>2</sub>-absorption Unit (Unit B):** Different amounts of biogas is generated during the AD process based on the content of the reactors (blank, positive control, negative control, and samples). Biogas is mainly made of methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>). The unit B is where the CO<sub>2</sub> and traces of hydrogen sulphide are removed through a chemical reaction with a 3 mol/L NaOH solution (**Figure 5**). *The absorption efficiency is higher than 98% even at high flow rates.*



**Figure 5.** Bottler holder designed for 9 glass bottles (250 mL). AMPTS III is equipped with two bottle holders.

Carbon dioxide reacts with sodium hydroxide in an acid-base reaction to generate sodium carbonate and sodium bicarbonate:

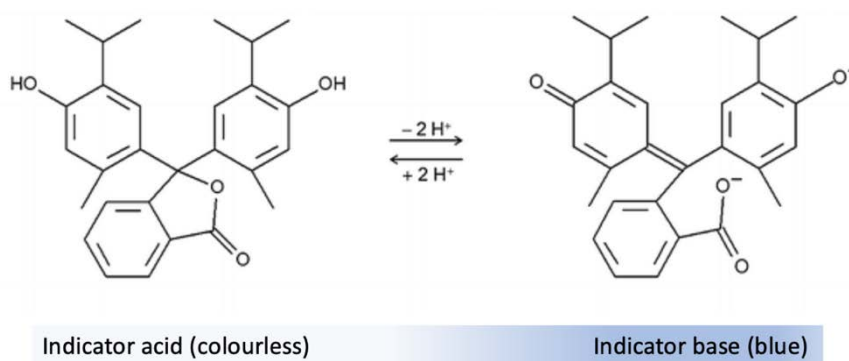


In this case, only methane will reach the detection unit (single gas measurements). If the test aims to measure biogas, the Unit B is not needed, where the setup should present the following configuration (**Figure 6**).



**Figure 6.** Setup for total gas (e.g., biogas) measurements.

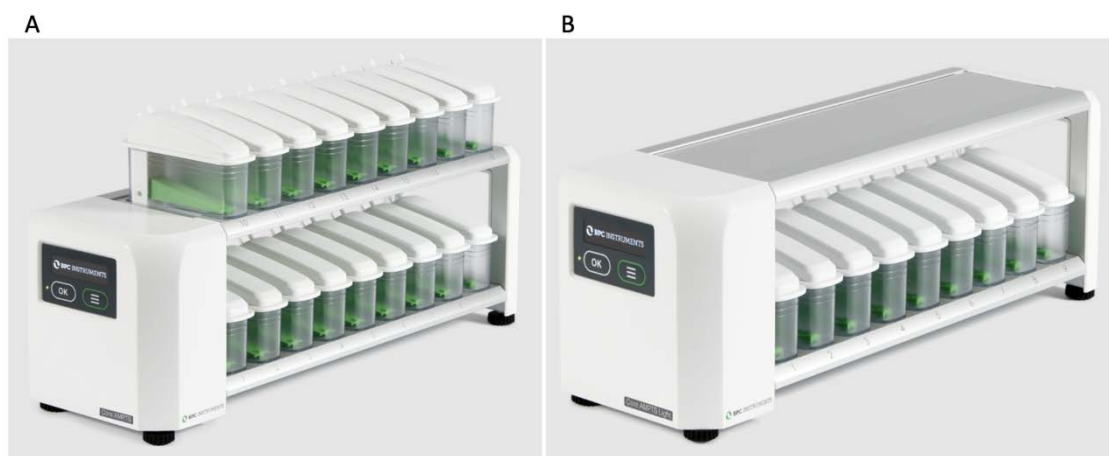
A pH indicator, Thymolphthalein, is used to keep track of the capacity of the alkaline solution to retain CO<sub>2</sub>. Since a high concentration of a strong base is used, the initial pH is 14. When CO<sub>2</sub> is added, NaOH is consumed and the pH decreases. This pH indicator changes from blue to colorless around pH 9 (**Figure 7**). In this pH, the capacity of NaOH to remove the CO<sub>2</sub> is reduced, indicating that the solution needs to be changed.



**Figure 7.** Structure of Thymolphthalein depending on the pH.

**NOTE:** For most applications it is not necessary to submerge the tubing inside the alkaline solution to remove CO<sub>2</sub>.

- 3) **BPC Core AMPTS Unit (Unit C):** Here the gas is recorded and processed. The BPC Core AMPTS Unit consists of 18 or 9 flow cell units for simultaneous gas volume detection from 18 or 9 independently operating reactors (**Figure 8**). Unit C comes with an OLED screen which will display various information, including IP address of the instrument, version of the software, current environmental parameters (temperature and pressure), and alignment indicator. The information can be accessed through two physical buttons located below the screen. The detection unit is equipped with a USB port for software upgrades and possible new applications and a power button.



**Figure 8.** (A) Gas volume measuring device for AMPTS III and (B) AMPTS III Light.

The FCU has 2 possible resolutions, 9 mL and 2 mL for low and ultra-low gas measurements. **The operational principle is based on liquid displacement and buoyancy.** When a certain gas volume enters the flow cell unit, the force of buoyancy leads the flow cell to open and releases the entrapped gas (Figure 9). The system counts each flow cell opening and registers the temperature and pressure for automatic compensation to normalise the flow rate and volume to standard conditions.

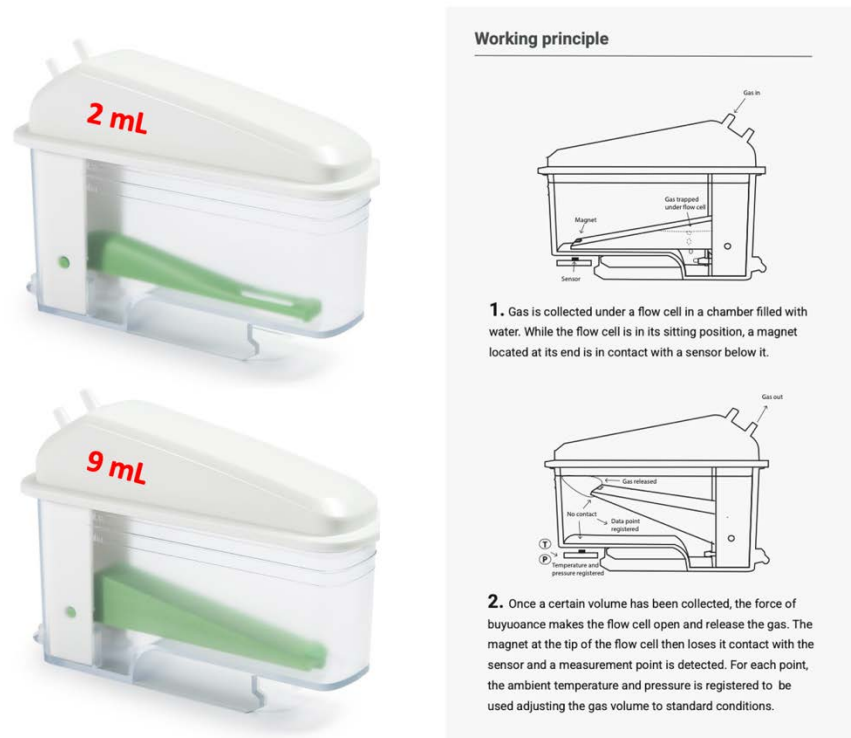


Figure 9. 2 and 9 mL FCUs and working principle.

The entire process involving the different components of the system is summarized in the illustration below (Figure 10):

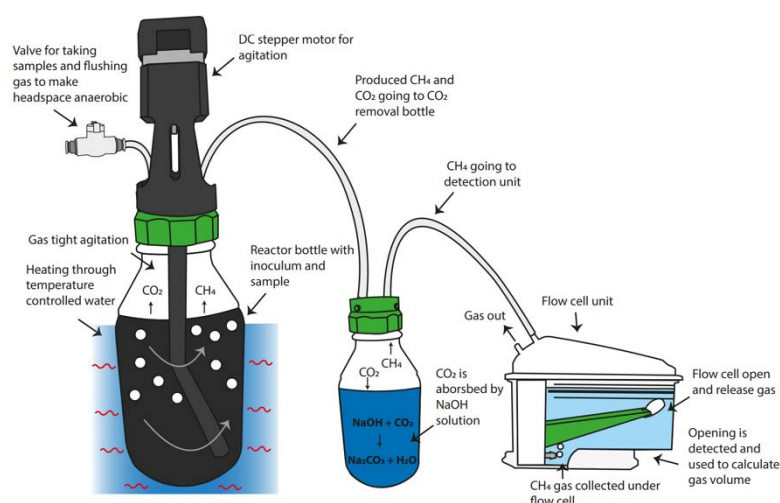


Figure 10. Illustration of the process from biogas production to methane measurement.

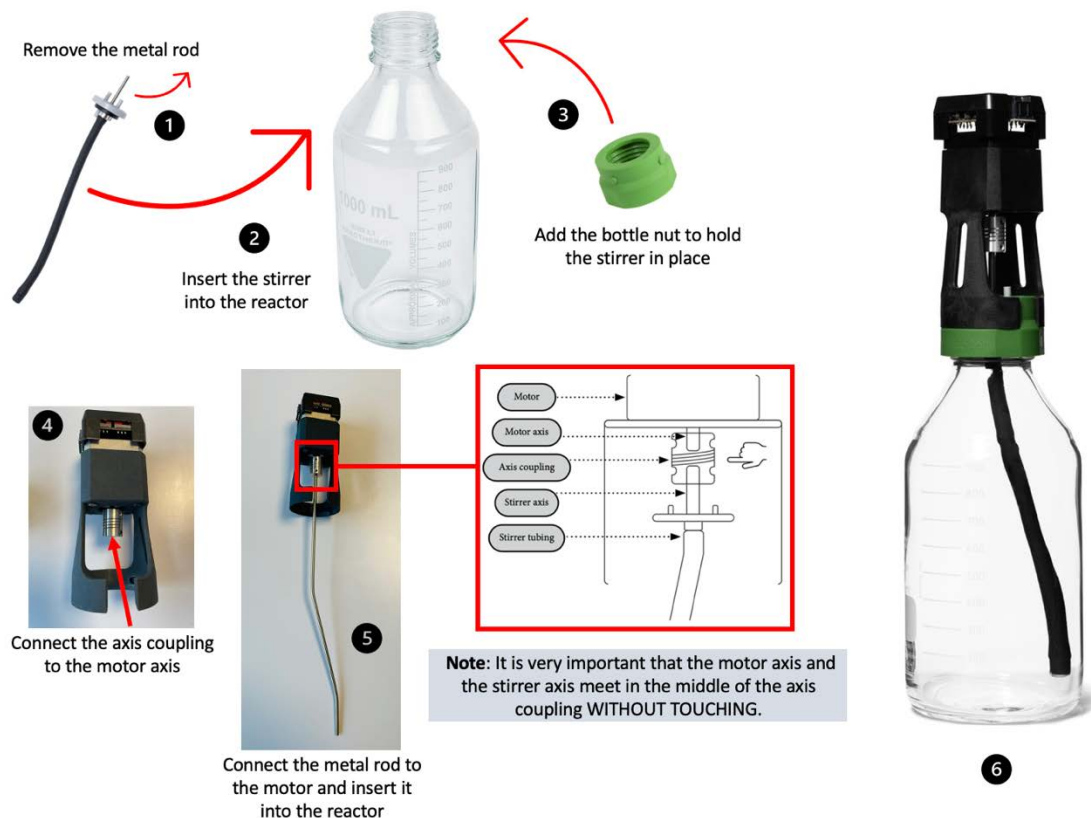
## Chapter 04: Setting up the Instrument

In order to install the system properly, the steps described below need to be followed:

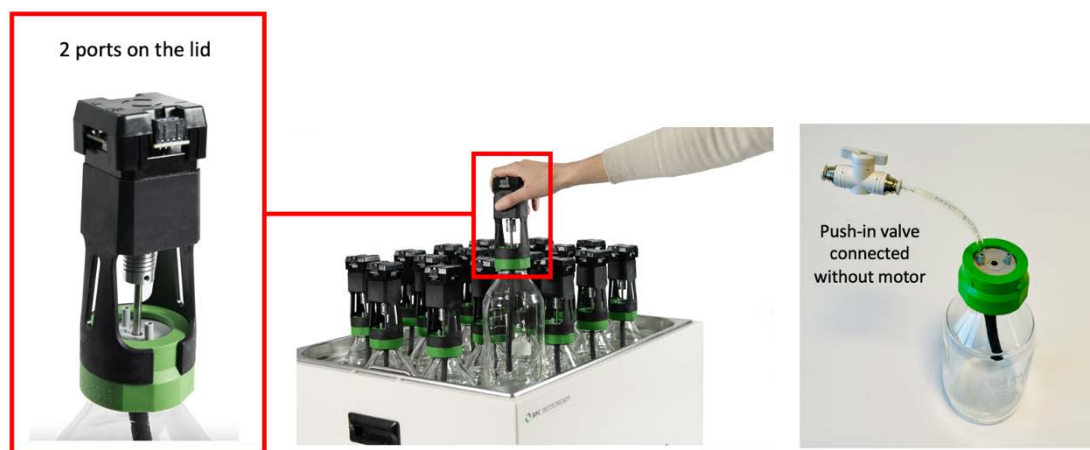
**Step 1:** Unpack the instrument and place the thermostatic water bath on a flat and stable surface.

**Step 2:** Remove the blue plastic protection on the thermostatic water bath lid, mount the legs and handles and place the lid on top of the thermostatic water bath.

**Step 3:** Fix the reactors after adding the samples by following the instructions below:



**Step 4:** Place the reactors inside the thermostatic water bath. Add a piece of tubing to the push-in valve and attach it to one of the 2 ports on the lid (the other one is the gas outlet).





A funnel is provided with the instrument to facilitate the introduction of solid samples inside the reactor. Once all reactors are in place, distilled/deionised water needs to be added into the thermostatic water bath until the recommended level by using the designated hole on the thermostatic water bath lid.

In the thermostatic water bath, the temperature is controlled by a simple and intuitive digital interface. The instrument contains 2 LED screens: the first one displaying the current temperature (PV) and the second one showing the desired temperature (SV). Press the button **SET** to determine SV. The desired temperature can be easily selected by using the shift digit, increase and decrease buttons. When the button **SET** is pressed, the last digit of the value displayed in SV blinks, indicating that the respective digit can be changed by pressing the buttons increase ( $\wedge$ ) and decrease ( $\vee$ ). If there is a considerable difference between the current and desired temperature in SV, the user can use the shift digit button (R/S) to select the first digit and quickly go from 30 to 60°C, for example. Once the desired temperature is selected, press the button **SET** again to save the value. Once the desired temperature is established, the instrument will heat the water until PV and SV reach the same values. When the light **HEAT** is on, it is an indication that the instrument is on heating mode. When the temperature in PV is close to reach the SV, 2° C from SV, the light **HEAT** will start blinking until the desired temperature is achieved.



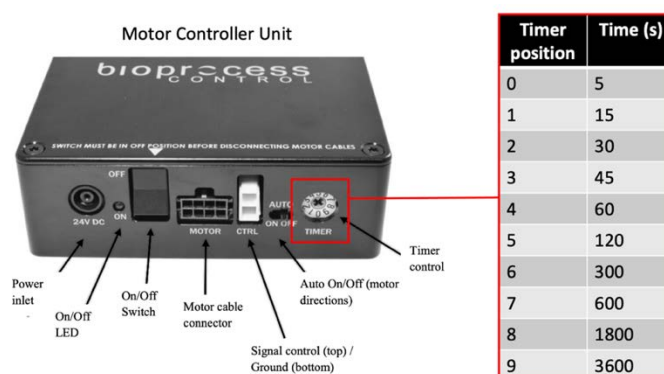
**NOTE:** Check periodically the water level inside the thermostic water bath.

**Step 5:** Fixing the agitation system for AMPTS III. Connect the short motor cables (250 mm) in series by attaching one short motor cable to each motor (excluding the last motor in the chain), and then connecting the free end of the cable from motor 1 to the free port on motor 2 and so on until motor 9. Repeat the same operation for the remaining nine motors, creating two groups of motors connected to each other through short cables. After that, connect the 500 mm motor cable from the last motor in the chain of each group to the motor power splitter. Finally, use the 1500 mm motor cable to connect the power splitter to the MCU. The last step is to connect the signal cable from the motor controller to the detection unit.

The same procedure described above can be used for AMPTS III Light.

**NOTE:** Make sure that the power adapter for the motor controller is disconnected from the power supply when inserting or removing the motor cables.

From the motor it is only possible to control the direction of the mixing, clockwise (CW), AUTO and counterclockwise (CCW). If users select AUTO, the motor controller will dictate the change of direction at certain intervals using the timer, if the motor controller's AUTO is ON. Since the signal cable connects the motor controller to the unit C, the phase (single or double) and speed can be controlled using the software (see page 24).



**Step 6:** Prepare 3 mol/L NaOH solution. The 250 mL bottles should be filled with 200 mL of the alkaline solution which makes it necessary to add 3.6 L and 1.8 L of 3 mol/L NaOH for 18 and 9 glass bottles, respectively. After weighing 432 g (for 18 bottles) or 216 g (for 9 bottles) of NaOH pellets, mix it with approximately 3/4 of the required total volume of distilled water. The heat generation following dissolution of NaOH in water is high, it is therefore recommended to add small amounts of supplementary water followed by mixing. When the NaOH is completely dissolved, add the remaining amount of water until the total volume (3.6 or 1.8 L) is reached. Prepare 0.4% Thymolphthalein by dissolving 40 mg in 9 mL ethanol followed by 1 mL of water. Mix it with 3 mol/L NaOH solution. After adding 200 mL of 3 mol/L NaOH solution with pH indicator in each bottle, place them on the bottle holder.





**Step 7:** Add distilled water inside the FCU and place them on the detection unit.

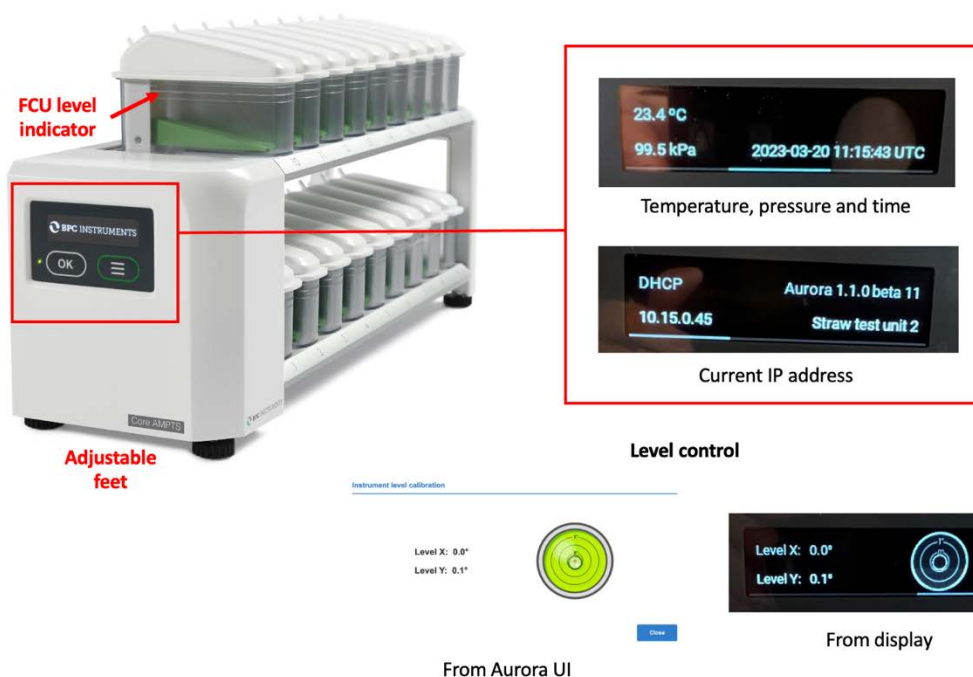


Each FCU has an inlet and outlet for the gas. Use the syringe to introduce water through the inlet of the FCU



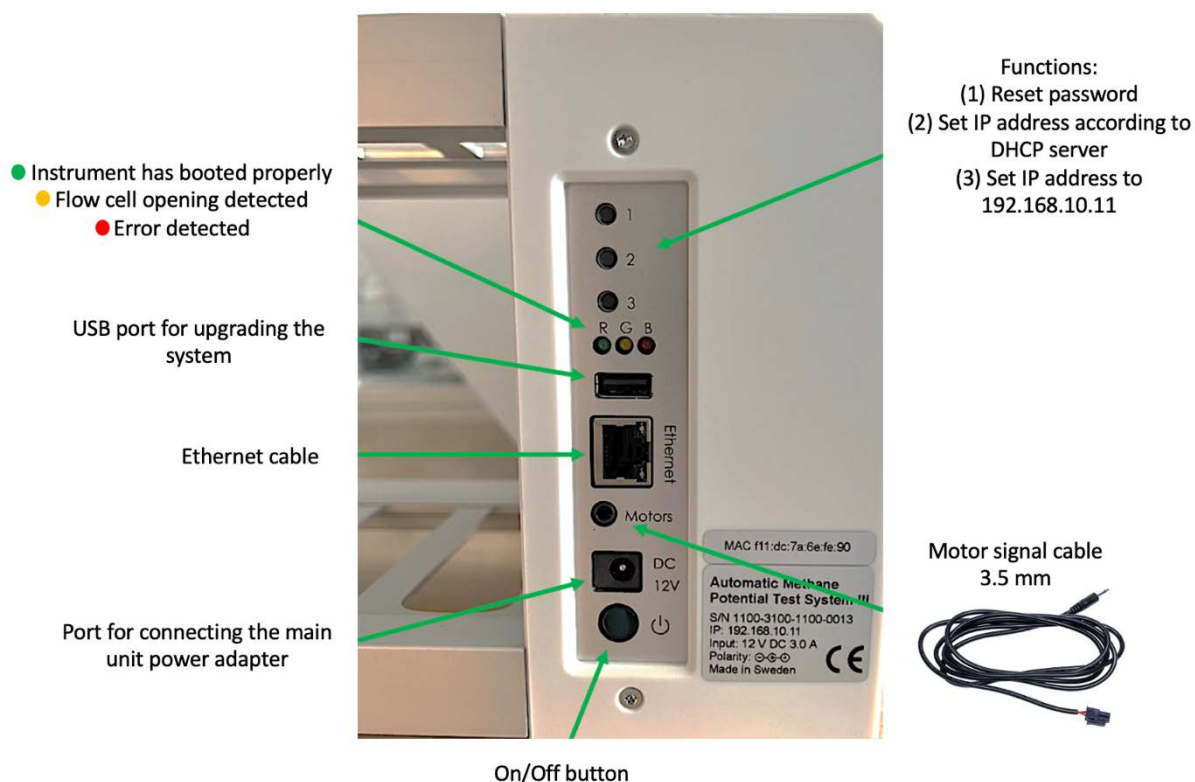
The water should be added until the recommended level

Make sure that each FCU is perfectly seated (horizontally levelled) on the BPC Core AMPTS Unit. It can be easily observed by checking the **FCU level indicator** and the level control from the software or the OLED screen as shown below. **Adjustable feet** are used to level the instrument.



The BPC Core AMPTS Unit is equipped with an OLED screen that provides information regarding the status of the instrument (environmental conditions, time, current IP address used by the instrument and alignment indicator). This can be accessed through two physical buttons located below the screen.

## Backside of the BPC Core AMPTS Unit:



**Step 8:** Cut 36 (AMPTS III) or 18 (AMPTS III Light) pieces of festo tubing sufficient in length to connect the gas outlet of each reactor to the corresponding alkaline solution bottle (Unit B) and then a second piece to couple the glass bottle with NaOH solution to the FCU. In order to simplify this procedure, use push-in connectors (two per channel) provided with the instrument. To avoid water flowing back from Unit C to Unit B, check valves can be inserted close to the inlet of each FCU in order to the target substance flow in one direction only.



**NOTE:** If the user wants to flush the reactors to create the anaerobic environment, disconnect the tubing from the CO<sub>2</sub>-absorption unit before to eliminate the risk of damaging the external check valves (if used) by the high-pressure gas flow.

**Step 9:** Use the softer binder to group tubing of channels that are related to each other. If the test is conducted in triplicate, it is possible to put together six groups with three channels (tubing) each based on the content of the reactors. In order to easily identify each channel, add the multi-coloured marker clamps (two per channel) provided in different colors. Mark each channel by writing the proper description using a ballpoint pen, water-based pen, marker, etc. After the experiment, users can wipe the label off with a wet tissue and reuse them.



Soft binder 7/180 mm



Multi-coloured marker clamps

**Step 10:** In order to start the test, access the software following the instructions in Chapter 6 of this manual. Add the parameters required for the test and make sure that the status of each channel is classified as ready before starting the gas measurements. When using the instrument for the first time, the cell volume of each channel needs to be entered in the control page. A calibration sheet is delivered with the equipment, where the serial number of the flow cell unit is listed together with its calibrated volume. It is important to know where each flow cell unit will be placed on the system, so that the calibrated values can be entered in the right position.

**NOTE:** Testing the detection unit and software. Before starting the experiment, simulate a flow cell opening by manually removing each FCU and put it back in numerical order from 1 to 18 (repeat this procedure three times). Follow the corresponding result of each opening on the plots in the graph page of the software to make sure that both the detection system and data acquisition system function properly.

**Step 11:** Once the experiment is finished, generate and download a report in the report menu of the software. Turn off the thermostatic water bath and the motors, including the motor controller. Next, unplug the power adapters (for the Motor Controller and the Gas Volume Measuring Device) from the power source. Disconnect the tubing and remove the lids from the reactors and CO<sub>2</sub> removal bottles after the tests. These components are often difficult to remove after the experiments, since they sit very tightly after usage, specially the tubing to the different connectors. AMPTS III is equipped with a bottle/tube opening tool to easily remove lids and tubing without the risk of damaging them and the connectors.



Bottle/tube opening tool

## Chapter 05: AMPTS III and AMPTS III Light DUO

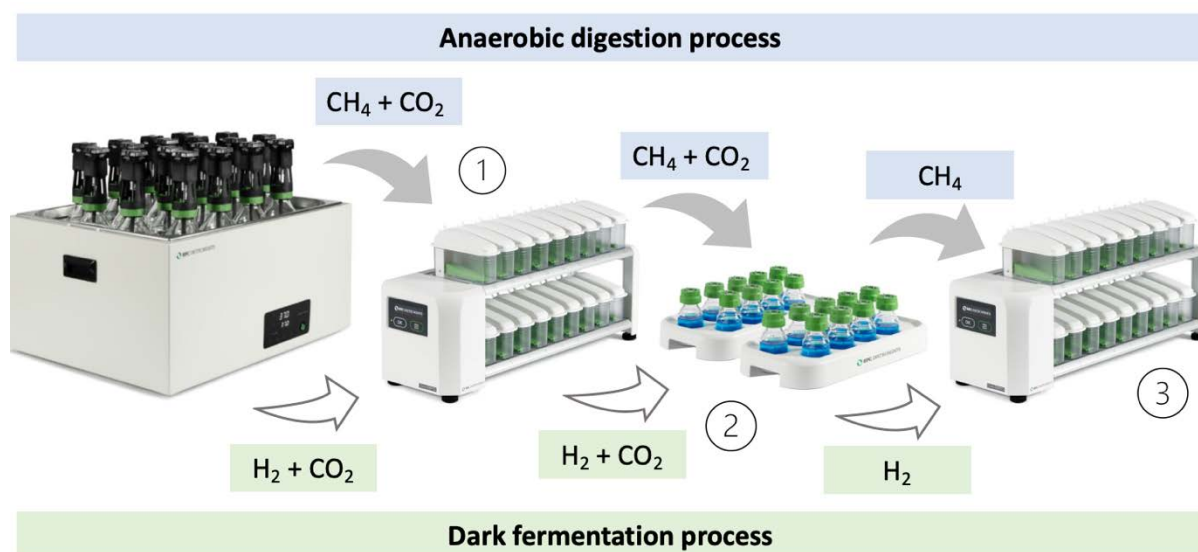
The AMPTS III and AMPTS III Light DUO was designed to increase the testing capacity for double gas measurements. This configuration consists of two BPC Core AMPTS Units, where users can measure the total gas (e.g., CH<sub>4</sub> + CO<sub>2</sub>) and a gas component (e.g., CH<sub>4</sub>) from 18 samples simultaneously (**Figure 11**).

The system operates based on three different stages:

- **Stage ①**: The accumulated gas volume and flow rate generated by the anaerobic digestion process (CH<sub>4</sub> + CO<sub>2</sub>) or dark fermentation process (H<sub>2</sub> + CO<sub>2</sub>) is continuously measured by the first BPC Core AMPTS Unit.
- **Stage ②**: Carbon dioxide is removed using a 3 mol/L NaOH solution (selective absorption). In this case, only a single gas component will be measured by the second detection unit.
- **Stage ③**: CH<sub>4</sub> or H<sub>2</sub> is collected and measured.

The average gas composition can be backcalculated and plotted at any time during the test.

Additionally, different measurement resolutions (2 and 9 mL) can be combined in this configuration depending on the application and requirements of the test. For instance, the first detection unit can have 9 mL FCUs and the second one 2 mL FCUs.



**Figure 11.** Illustration of how AMPTS III DUO works in three stages.

For AMPTS III Light DUO, the same process can be done with nine samples in 2 L reactors simultaneously. The default package comes with one BPC Core AMPTS Unit with 18 active channels for both total and single gas measurements (**Figure 12**). This configuration can be provided with two BPC Core AMPTS Light units with nine active channels each upon request.

As for AMPTS III and AMPTS III Light, the instrument (DUO configuration) runs completely independent with all data kept locally in the detection unit (no need to have an external computer or data acquisition device connected to the instrument during the experiments). Furthermore, AMPTS III presents 150 times higher capacity to record data compared to AMPTS II (130 000 L of gas can be recorded compared to 900 L for 9 mL FCU).



**Figure 12.** AMPTS III Light DUO configuration.

### 6.1 Computer Network Configuration

In order to have access to the web-based software Aurora™, the following steps need to be followed (this procedure is described considering the most common operating system setups – **Windows 11** and **Mac Os 12.x**):

1

Connect the shielded Ethernet cable to the detection unit (Unit C)  
Connect the shielded Ethernet cable to a computer.

2

Start → Settings → Network & Internet  
Ethernet (select the Ethernet network you are connected to) →  
Edit network IP settings → Manual →  
IPv4 → Insert IP address and Subnet mask

IP address: 192.168.10.10  
Subnet mask: 255.255.255.0  
Default gateway:



Windows 11

Press [Command] (in the top left corner) → System preferences → Network settings →  
Ethernet (select the Ethernet network you are connected to) →  
Configure IPv4: manually → Insert IP address and Subnet mask

Configure IPv4: Manually  
IP address: 192.168.10.10  
Subnet mask: 255.255.255.0  
Router:



Mac OS 12.x

3

Open a web browser (preferably Google Chrome) and insert **192.168.10.11**

### 6.2 Network Quick Guide

	Instrument	Computer
IP address	192.168.10.11	192.168.10.10
Subnet mask	255.255.255.0	255.255.255.0
Default gateway / Router	Leave empty	Leave empty

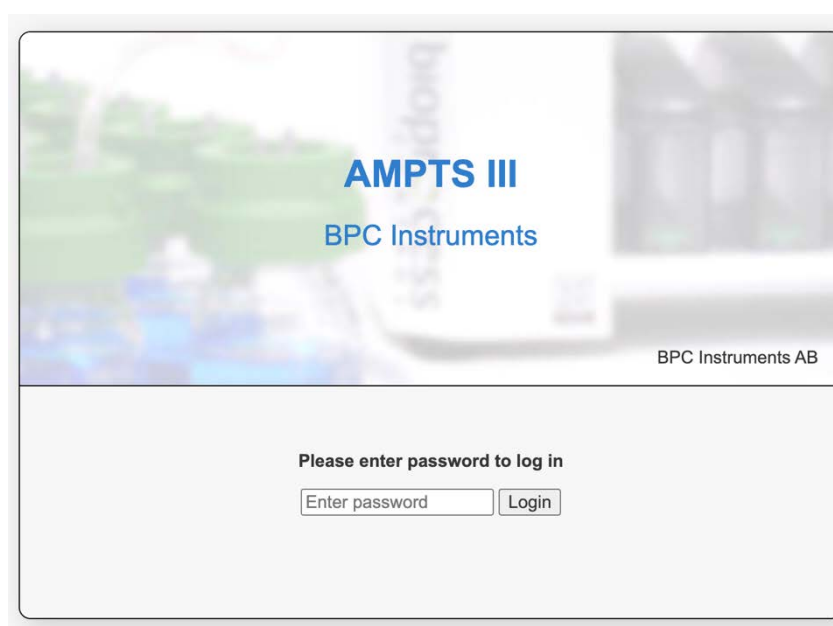
**NOTE:** IP address for the computer and the IP address for the AMPTS III are different. This is a design requirement of the IP protocol. Care needs to be taken so that the same address is not used in both locations, as it will render the system inaccessible from the designated computer. When using multiple BPC Core AMPTS units, make sure that each unit has its own IP address. This can be achieved by changing the last digit of the IP address.



The OLED screen in the detection unit will display whether the instrument uses a manually assigned IP or an automatic IP assigned by a DHCP server as well as what IP address is currently in use and the version of the instrument's Aurora software. In this way, it is simple and easy to connect the instrument to a computer or network.

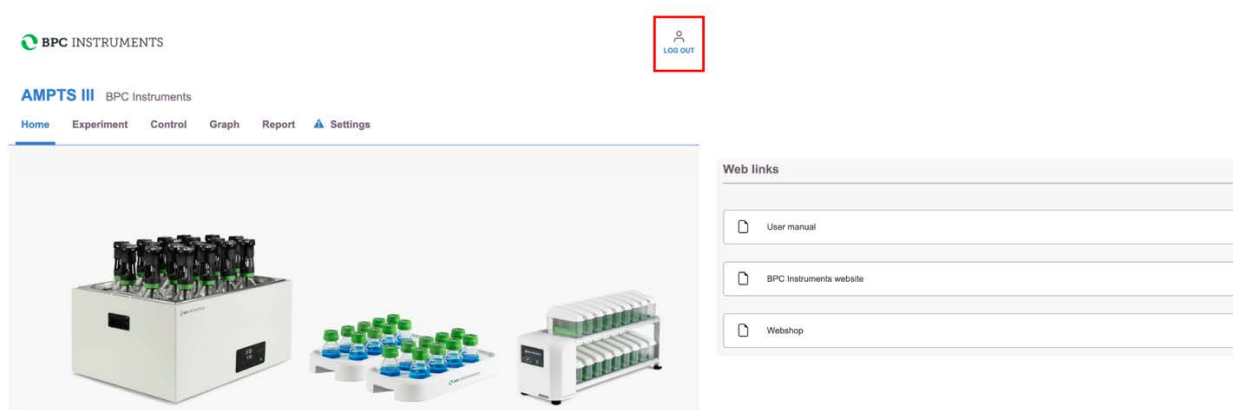
### 6.3 Web-based Software Aurora™

After inserting the default IP address of the instrument, users will have access to the **Log in** page (**Figure 13**). In the Log in page, the default password **bpc** needs to be added.



**Figure 13.** Log in page for AMPTS III and AMPTS III Light.

In the **Home** page, users get an overview of the features of the software, where the topics are ordered according to experimental setup, execution, monitoring and finally documented. In addition, three useful links are provided together with the Log out function (**Figure 14**).



**Figure 14.** Home page for AMPTS III and AMPTS III Light.

The loading time of this new software is significantly shorter than the previous version. Additionally, several new features were implemented to offer a better user experience.

In the **Experiment** page for AMPTS III (the same description is valid for AMPTS III Light – 9 lines), 18 lines are related to the 18 reactors where each one of them should be properly labelled based on its content. In this page, using the function *Print Experiment Guidelines*, it is possible to directly print or save the page in pdf format which contains information regarding the parameters established for the test. The experiment setup can be arranged in two ways: *calculated* or *manual* (**Figure 15**).

**A**

AMPTS III BPC Instruments (Batch mode)

Home Experiment Control Graph Report Settings

Experiment setup ☒ Calculated ☐ Manual

Line	Name	Total amount [g]	Inoculum conc. [%]	Substrate conc. [%]	Unit of conc. [%] TS VS COD	ISR	Inoculum [g]	Substrate [g]	Organic inoculum [g]	Organic substrate [g]
1	Line 1	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
2	Line 2	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
3	Line 3	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
4	Line 4	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
5	Line 5	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
6	Line 6	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
7	Line 7	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
8	Line 8	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
9	Line 9	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
10	Line 10	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
11	Line 11	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
12	Line 12	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
13	Line 13	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
14	Line 14	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
15	Line 15	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
16	Line 16	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
17	Line 17	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00
18	Line 18	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00

**B**

AMPTS III BPC Instruments (Batch mode)

Home Experiment Control Graph Report Settings

Experiment setup ☐ Calculated ☒ Manual

Line	Name	Unit of conc. [%] TS VS COD	Organic inoculum [g]	Organic substrate [g]
1	Line 1	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
2	Line 2	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
3	Line 3	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
4	Line 4	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
5	Line 5	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
6	Line 6	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
7	Line 7	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
8	Line 8	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
9	Line 9	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
10	Line 10	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
11	Line 11	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
12	Line 12	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
13	Line 13	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
14	Line 14	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
15	Line 15	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
16	Line 16	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
17	Line 17	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00
18	Line 18	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	0,00	0,00

**Figure 15.** Experiment setup (A) Calculated and (B) Manual for AMPTS III.

If the *calculated* function is activated, the following parameters must be considered for each line:

Line	Name	Total amount [g]	Inoculum conc. [%]	Substrate conc. [%]	Unit of conc. [%] TS VS COD	ISR	Inoculum [g]	Substrate [g]	Organic inoculum [g]	Organic substrate [g]
1	Line 1	0,0	0,00	0,00	<input type="radio"/> TS <input checked="" type="radio"/> VS <input type="radio"/> COD	1,00	0,00	0,00	0,00	0,00

Annotations:

- Description of each channel (points to Line 1)
- Concentration of the inoculum and the investigated substrate (points to Inoculum conc. [%])
- The ratio based on organic matter (g COD, g TS or g VS) between the inoculum and the sample (points to Unit of conc. [%])
- The amount of organic matter in the inoculum and substrate added to the reactor (points to Organic inoculum [g] and Organic substrate [g])
- Indicates each channel of the instrument (points to Line 1)
- Total amount of added matter (points to Total amount [g])
- The unit used to characterise the organic matter in the sample and the inoculum TS and VS = % COD = g / L (points to Unit of conc. [%])
- The amount of inoculum and substrate added to the reactor (points to Inoculum [g] and Substrate [g])

The *manual* function allows more set-up flexibility - information regarding the amount of organic matter in the inoculum and substrate is directly entered.



The control tab is where direct interaction with the channels and motors are conducted (Figure 16). Using the Aurora™ software, it is possible to start and stop all or just selected channels.

AMPTS III BPC Instruments (Batch mode)

Home Experiment **Control** Graph Report Settings

Volume of head-space inside the reactor at the start of the test

The volume of gas corresponding to one opening of the flow cell. This value is provided with the calibration certificate provided with the flow cell unit (FCU)

Percentage of removable gas in the reactor headspace at the beginning of the experiment (i.e., flush gas or air)

Time elapsed since the experiment was started

Expected percentage of removable gas in the reactor headspace at the end of the experiment

The date and time the experiment was started

Mathematical compensation of the measured gas volume is necessary if the gas compounds are separated by selective absorption before measurement and the removable gas content in the reactor headspace is expected to be different at the start (i.e., flushing gas or air) and the end (i.e., generated gas) of the test

New function that allows users to start and stop all lines at the same time. With this function, specific lines can be selected





Line	Name	Cell volume (ml)	Correction	HS Volume (ml)	Initial HS (%)	Final HS (%)	Control	Status	Started (UTC)	Duration
1	Line 1	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
2	Line 2	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
3	Line 3	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
4	Line 4	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
5	Line 5	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
6	Line 6	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
7	Line 7	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
8	Line 8	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
9	Line 9	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
10	Line 10	9,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
11	Line 11	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
12	Line 12	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
13	Line 13	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
14	Line 14	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
15	Line 15	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
16	Line 16	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
17	Line 17	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		
18	Line 18	0,00	<input type="checkbox"/>	200	100,00	0,00	<input checked="" type="checkbox"/>	Detached		

Select/Deselect all lines ☒

Start Stop Pause Clear

Figure 16. Full description of each line of the Control page.

Located at the bottom right of the **lines section** is the control panel for the flow cell units. These work as follows:

-  Start data registration. In order to be able to press this button, the status needs to be **ready**
-  Pause data registration. In order to be able to press this button, the status needs to be **running**
-  Stop data registration. In order to be able to press this button, the status needs to be **paused**
-  Clear all data registrations. In order to be able to press this button, the status needs to be **stopped**

Regarding the agitation system, the motors can be controlled in *continuous (single)* or *two-phase (double)* modes. With the two-phase mode, the motors can run intermittently at two different speeds or as ON and OFF (Figure 17).

**Figure 17.** Controlling the agitation system through the software.

The software provides two graphs, ***accumulated gas volume as a function of time*** and ***flow rate as function of time***. The gas volume can be presented in three different ways: without normalization, with normalization without considering the moisture content (dry), and with normalization considering the moisture content (wet). There are three possible units for the gas flow: NmL / min, NmL / h, and NmL / day.

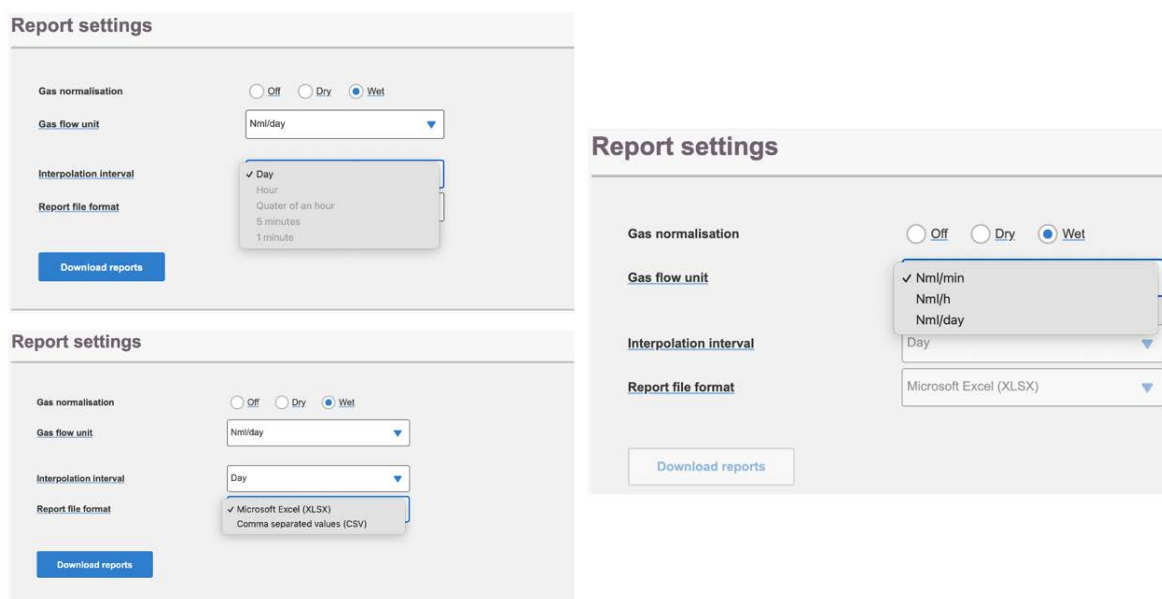
Once the gas registration starts, the box/line changes color from grayish to the corresponding color of a specific line, see line 10 in **Figure 18**. In this part, it is also possible to select all lines at once.

**Figure 18.** Gas flow segment in the Graph page.

In this new software, users have the option to zoom in both graphs in order to get a better visualisation of the real-time data.

**NOTE:** The graph requires at least two data points (i.e., flow cell openings) in order to display information. To simulate an opening during testing, briefly remove the FCU and place it right back; wait a few seconds and then repeat the action one more time. If everything is working properly, a line should appear in each graph.

Users can download and generate the report at any time from the **Report** tab. With Aurora Software, the raw data can be downloaded in a csv format either for each line separately or gathered in one file. Different settings can be applied to generate the report (**Figure 19**).



**Figure 19.** Report settings available in the report page.

The **Settings** page is home to a host of settings for the instrument. It also contains valuable information regarding versions, licenses, a logfile and so forth. Sometimes, a blue triangle with a white exclamation mark will appear next to the settings tab in the Aurora™ software. This symbol indicates that there is information in the logfile that needs to be reviewed or that one of the settings needs to be adjusted. If it is a setting that is in question, that particular setting will also display the same symbol; if it is the logfile, pressing the clear log button (after reviewing and potentially saving the information) will remove the warning.

Two settings are generally described below:

1. **Network settings:** Displays IP and Mac address for the instrument. Also allows for configuring the built-in network adapter using either DHCP or manual configuration.
2. **System warning log:** Contains a list of events registered by the instrument which might be useful when trying to resolve an issue. Please have this information ready when contacting support.

## Chapter 07: Maintenance and Spare Parts

In order to ensure that the instrument and its constituent parts will operate properly for a long period of time, it is crucial to follow the instructions described on this manual. The lifespan of the instrument and its components will depend heavily on how the equipment is used and well maintained. Always make sure to use the instrument according to the following guidelines:

- The instrument must be kept in a dry and clean environment.
- Avoid applying tap water as bath liquid in the thermostatic water bath, since the minerals included in this type of water might negatively impact the material of the bath chamber (calcification or corrosion of stainless steel).
- The flow cell units cannot be opened and are considered consumables.
- Reactors and stirrers are consumables that can be autoclaved.
- To clean the detection unit, wipe it with a damp piece of cloth and, if required, a gentle form of detergent. Water must not get into the machine, since it can harm electrical components.
- The used NaOH solution must **NOT** be poured into the sink. It should be saved in dedicated vessels and disposed as hazardous waste.

All consumables are easily replaceable in the instrument. The spare parts can be ordered from BPC Instruments. For further information, please visit our webshop (link below):

<https://webshop.bpcinstruments.com>

BPC Instruments also provides a *Maintenance Package* where users can get all consumables that are recommended to be changed at regular intervals.