bNovate TECHNOLOGIES

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Instruction Manual

BactoSense

Rapid Bacterial Monitoring System

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1 Glossary

This glossary contains terms which might be unknown to the reader, but are widely used within the document. The terms used in this document can be found with in depth explanations in the Reference Handbook.

TERM	EXPLANATION
Autosampler	Automated sampling device, part of the BactoSense Multi instrument.
Cartridge	Cartridge with fluorescent dyes, bleach, rinse and waste compartments.
FL1/FL2	Fluorescence signal 1 (535 nm) and fluorescence signal 2 (715 nm).
Gate	Gates are tools for data analysis of a subset of data points in flow cytometry.
HNAC	High Nucleic Acid Count. The number of HNA bacteria inside the TCC or ICC gate, and above the HNA / LNA limit.
HNAP [%]	High Nucleic Acid Percentage. The percentage of HNA bacteria relative to the cell count.
ICC	Intact Cell Count. Total number of intact bacteria inside of the ICC gate.
LNAC	Low Nucleic Acid Count. The number of LNA bacteria inside the TCC or ICC gate below the HNA / LNA limit.
Online Sampling Device	Connection module to a water line, allowing online sampling with the BactoSense Online.
Manual Sampling Device	Connection module, allowing manual sampling with the BactoSense Online.
SSC	Side scatter signal. Scattered light increases with the internal complexity (granularity) of the detected object.
TCC	Total Cell Count. Total number of bacteria detected inside the TCC gate.

2 General User Information

2.1 About this instruction manual

This instruction manual provides the user with helpful information about the entire life cycle of the BactoSense and its peripheral devices. Before commissioning and using the instrument, you should be completely familiar with the instruction manual.

The instruction manual is intended for all persons who are responsible for the operation and maintenance of the instrument. This document is part of the product. It should be stored in a safe place and always be available to the user.

The most recent version of this document can be ordered from the bNovate representative in your country. A list with all bNovate representatives can be found on our website: www.bnovate.com/distribution-partners.

Additional associated product documentation can be found in the table below.

Table 2-1 Additional documentation

40101	Quick Guide	Basic information needed to quickly operate the BactoSense.
40103	Reference Handbook	Sophisticated menu functions, connectivity solutions and work steps for advanced users.
40108	Cleaning Kit User Manual	Usage of the reagent kit to decontaminate the BactoSense.
40107	Validation Kit User Manual	Usage of the reagent kit used to validate proper functioning of the BactoSense.
50112	CE declaration of conformity	Compliance with the underlying directives and standards.
50114	CB test report	UL/CSA/FCC compliance report, also under CH-11152 on https://certificates.iecee.org

2.2 Declaration of conformity, norms and classifications

Current technological principles were followed in designing and manufacturing the instrument. They comply with the applicable guidelines concerning safety and the duty to take due care.

CE

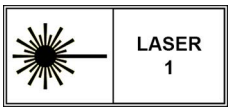
The measuring instrument meets all applicable requirements within the European Union (EU) for carrying the CE mark.

The unit is UL/CSA/FCC compliant.

Table 2-2 Compliance and Certifications.

COMPLIANCE AND CERTIFICATIONS	
Regulatory compliance	CE RoHS FCC compliant
Applied EMC standards	IEC 61326-1:2012 CFR 47 §15.107/109 ICES-003
Applied safety standards	IEC 61010-1:2010/Amd1:2016 IEC 61010-2-010:2019 IEC 60825-1:2014 CSA C22.2No. 61010-1-12 UL 61010-1:2012 EN ISO 12100:2010
National differences	EN 61326-1:2013 EN 61000-3-2:2019 EN 61000-3-3:2014+A1:2019

For more details on the CE mark, please refer to the separate declaration of conformity.
For UL/CSA/FCC compliance, please refer to the CB test report.
(https://certificates.iecee.org: CH-11152).



The BactoSense is classified as a Class 1 Laser product according to the standard IEC 60825-1:2014.

2.3 Safety symbols

The safety symbols used in this document are explained below:

DANGER!

Electric shock that may result in serious injury or death

Ignoring this notice may lead to electrical shocks and death.

EXPLOSION HAZARD!

Explosion that may result in serious injury or death

Ignoring this notice may cause explosions resulting in serious property damage and death.

WARNING!

Injury or hazards to health with long-term effects

Ignoring this warning may lead to injuries with possible long-term effects.

CAUTION!

Material damage

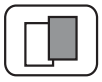
Ignoring this notice may cause material damage to the instrument and its peripherals.

2.4 Pictograms

All pictograms used in this document are explained below:

Additional information about the current topic.

Practical procedures when working with the BactoSense.



The screenshot is an example of the graphical user interface and may be different on your instrument.

2.5 Intended use of the BactoSense

The intended use of the BactoSense and peripheral equipment is the measurement of the concentration of microbial cells in drinking water.
The instrument must be operated by trained technical personnel who have read and understood the content of the instruction manual.

2.6 Usage restrictions

EXPLOSION HAZARD!

Operation in explosive areas can cause explosions, which can lead to the injury or death of persons in the vicinity.

- It is not permitted to operate the instrument in explosion hazardous areas or rooms.
- It is not permitted to use the instrument with explosive sample substances.

2.7 Improper use

DANGER!

Improper use of the instrument can cause injuries to persons, process-related consequential damage and damage to the instrument and its peripherals.

In the following cases the manufacturer cannot guarantee the protection of persons and the instrument and therefore assumes no legal responsibility:

- The instrument is not used in the described area of application.
- The instrument is not properly mounted, set up or transported.
- The instrument is not installed and operated in accordance with the instruction manual.
- The instrument is operated with accessory parts and consumables which bNovate Technologies SA has not recommended.
- Improper changes to the instrument
- The instrument is operated outside of specifications, in particular pressure and temperature limits.
- The instrument is exposed to vibrations, shocks, or other mechanical forces.

3 Instrument Overview

3.1 BactoSense overview

Below an overview of the BactoSense is shown. An overview of the cartridge can be found in section 6.5.2.

Figure 3-1 BactoSense overview

1	Handle	**2**	Wall mount
3	Desiccant bag compartment cap	**4**	Online sampling device
5	Manual sampling device	**6**	Touchscreen graphical user interface
7	Cartridge compartment door	**8**	USB interface
9	Power button	**10**	Input connector
11	Output connector	**12**	Ethernet/Modbus TCP interface
13	Power connector		

3.1.1 Type plate of the BactoSense

The type plate of the BactoSense can be found on the right hand-side of the instrument.

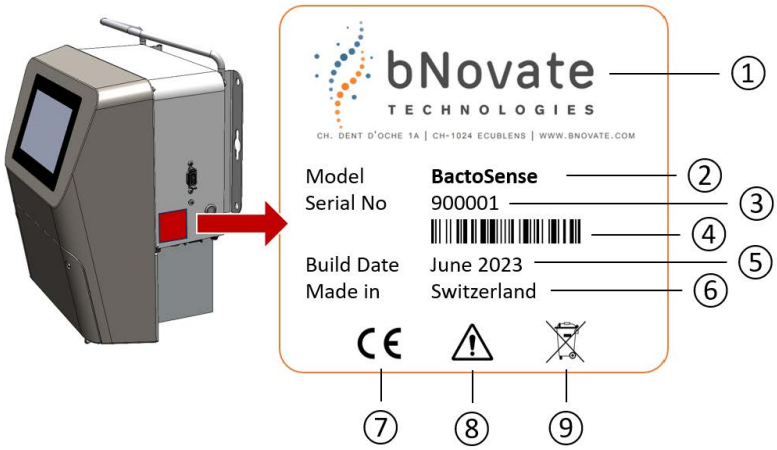


Figure 3-2 Type plate of the BactoSense.

1	Manufacturer	**2**	Product name
3	Serial number	**4**	Barcode
5	Manufacturing date	**6**	Country of origin
7	CE symbol	**8**	Read the instructions and operate with caution.
9	Disposal information		

3.1.2 Type plate of the BactoSense power supply

The type plate of the BactoSense power supply can be found on the power supply and has the following elements:

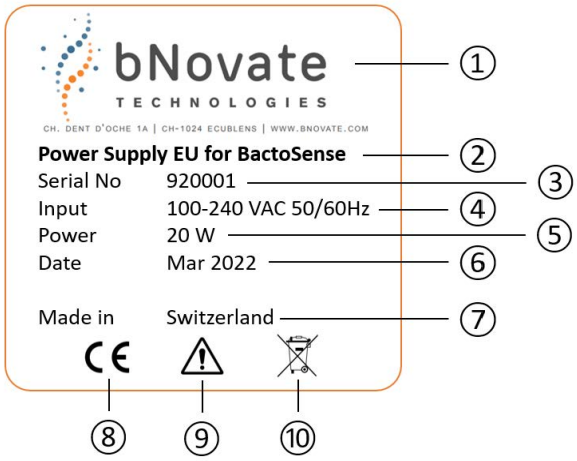


Figure 3-3 Type plate of the BactoSense power supply.

1	Manufacturer	**2**	Product name
3	Serial number	**4**	Service voltage and frequency
5	Power consumption	**6**	Manufacturing date
7	Country of origin	**8**	CE symbol
9	Read the instructions and operate with caution.	**10**	Disposal information

3.2 Technical data

Table 3-1 Technical data of the BactoSense

GENERAL	
Operating environment	Indoor use
Operating altitude	Max. 2000 m (6600 feet) above sea level
Operating temperature	5 °C – 30 °C
Operating humidity	10 % – 90 % RH
Storage temperature	10 °C – 30 °C
Storage humidity	10 % – 70 % RH
Ventilation requirements	None
Sound pressure level	< 64 dBA
Protection class	BactoSense enclosure: IP65 Power supply: IP67

PHYSICAL	
Enclosure dimension (W x D x H)	350 x 240 x 373 mm
Enclosure weight	14.5 kg with cartridge 11.3 kg without cartridge
Power supply dimension (W x D x H)	230 x 80 x 65 mm
Power supply weight	0.9 kg

ELECTRICAL	
Installation category	II
Pollution degree	2
Supply voltage	100 – 240 VAC +/-10 %, 50/60 Hz, 1.4 A
Power consumption	20 W

INTERFACES	
USB	1 x USB 2.0
Ethernet	1 x RJ45
Digital inputs	4 x digital inputs, optocoupler input: forward voltage 1.2 VDC with 4.7 kOhm in serial, cathode connected to COMMON, max. 30 mA, max. 50 mW.

Analogue and digital outputs	2 x analogue outputs 0/4 – 20 mA, galvanically isolated, recommended 250 Ohm load. 4 x digital outputs, freely configurable, SSR output: Max. 60 VDC or 30 VAC, max. 550 mW, ON-resistance 25 Ohm.
Display	WVGA, 7.0"capacitive touchscreen
Storage capacity	32 GB

SPECIFICATIONS	
Measuring principle	Flow cytometry
Detection range	0 – 5´000´000 cells/mL
Quantification range	TCC: 1000 – 2'000'000 cells/mL ICC: 100 – 2'000'000 cells/mL
Laser type and wavelength	Laser diode 488 nm
Fluorescence	535/43 nm FL1 715 LP nm FL2
Side scatter	488 nm SSC
Microbial parameters	TCC/mL, ICC/mL, LNAC/mL, HNAC/mL, HNAP (%), depending on cartridge used.
Cartridge capacity	Maximum 1000 measurements 9 months validity
Automatic measuring interval	Max. every 30 min, min. every 6 hours

SAMPLING	
Sampling type	Online or manual

Online sampling device	Flow through device: 200 – 400 mL/min Pressure in device: Max. 0.5 bar Aspirated volume: 260 µL Measured volume: 90 µL Inlet tubing • Material: PFA (transparent) • Outer diameter: 6.35 mm (1/4") • Inner diameter: 4.35 mm • Max. length: 2 m Outlet tubing • Material: FEP (blue) • Outer diameter: 6.35 mm (1/4") • Inner diameter: 4.83 mm • Max. length: 2 m
Manual sampling device	Sample container: 5 mL screw-cap tube Sample volume: 2 – 5 mL Aspirated volume: 260 µL Measured volume: 90 µL
Sample conditions	Chlorine: max. 3 mg/L pH-value: 5 – 12 Temperature: 5 °C – 40 °C Conductivity: 0 – 100'000 µS/cm at 20 °C Turbidity: 1 – 10 FTU

CARTRIDGE	
Storage temperature	15 °C – 25 °C, ideally at 15 °C
Storage humidity	20 % – 60 % RH

COMPLIANCE AND CERTIFICATION	Please refer to section 2.2.

4 Safety

4.1 Dangers

DANGER!

Damaged instrument or cabling

Touching damaged cables may lead to electrical shocks or death.

- The instrument may be operated only when the cables are intact.
- The instrument may be operated only if it has been properly installed or repaired.

DANGER!

Dangerous voltage inside the supplied mains device

Touching a wet or damaged mains device may lead to electrical shocks or death.

- Do not position the mains device in moist locations.
- Do not operate the mains device if its housing is damaged.

DANGER!

Damage due to incorrect service voltage

If the instrument is connected to an incorrect service voltage, the instrument can be damaged.

- The instrument must only be connected to voltage sources as specified on the type plate.

WARNING!

Missing instruction manual

Operating the instrument without following the procedures indicated in the Instruction Manual may lead to injuries to persons and damage to the instrument.

- If the instrument changes hands, always include the Instruction Manual.
- If the Instruction Manual is lost, you can contact bNovate to request a replacement www.bnovate.com/contact.

CAUTION!

Moisture or condensation on the electrical components

If moisture enters the instrument, the BactoSense can be damaged.

- The covers and lids must always be attached during operation.
- Service inside the instrument must only be performed by trained personnel in a dry room and at room temperature. The instrument should be at operating or room temperature (avoid condensation on optical and electrical surfaces).

Use of aggressive chemicals

Use of aggressive chemicals can cause damage to instrument components.

- Do not use aggressive chemicals or cleaning agents.
- Should the instrument come in contact with aggressive chemicals, clean it thoroughly with a neutral cleaning agent.
- Use a damp cloth (water only) to clean the exterior of the device.

4.2 Safe handling of chemicals

Improper handling of chemicals

Please observe the following instructions for safe handling of chemicals:

- Wear the recommended personal protection (safety goggles, protective gloves, protective clothing).
- Wash your hands thoroughly after working with chemicals.
- Study the MSDS (Material Safety Data Sheet) before working with chemicals. If an accidental release happens, please follow the instructions of the MSDS.
- Never smoke or store food or beverages in the working environment.

4.3 Residual risk

Residual risk

According to the risk assessment of the applied safety directive DIN EN 61010-1, there remains the risk of the displayed measurement values being incorrect. This risk can be reduced with the following measures:

- Use an access code to prevent unauthorized persons from changing parameters.
- Perform the specified servicing duties.

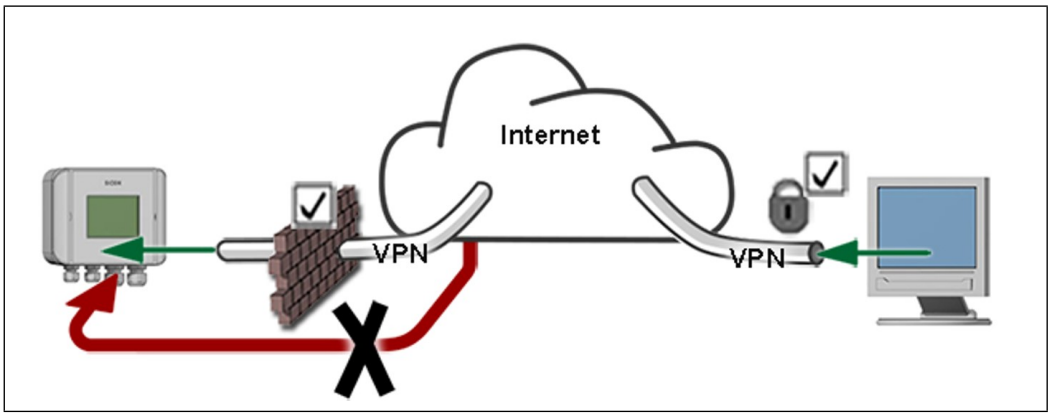
4.4 Warning and danger symbols on the instrument

No warning or danger symbols on the instrument

Users must ensure that they observe the safety measures as specified in the Instruction Manual at all times when working with the instrument and its peripheral equipment, even if no warning or danger symbols are attached to the instrument.

- Observe safety points when performing the described procedures.
- Observe local safety regulations.

4.5 Preventing unauthorized online access



CAUTION!

bNovate instruments are equipped with an integrated web user interface. Any malintending internet user can access your instrument when you expose the instrument directly to the internet.

Please note the following points to prevent this:

- Never expose the instrument's network ports to the open internet.
- Operate it behind a firewall and block access to the instrument.
- Only connect to branch offices via VPN.
- Change the standard password on commissioning.
- Always keep up-to-date with the latest changes regarding internet security so that you can react promptly in the event of alterations.
- Install the latest updates immediately (also for the router and firewall).

5 Installation

DANGER!

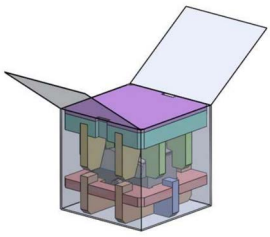
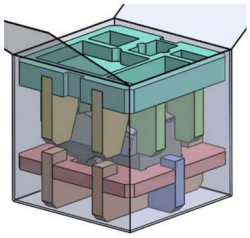
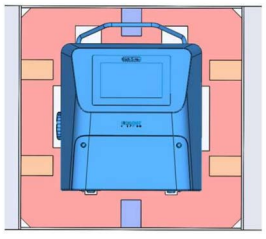
Attention

Before working on the instrument, carefully read the safety points.

- It is forbidden to modify or repair the BactoSense.
- Perform the work steps in the exact order instructed.
- When replacing parts, use only genuine original parts supplied or recommended by bNovate.
- Use the original packaging of the BactoSense when returning components.

5.1 Unpacking the BactoSense

Carefully follow the procedure below to unpack the BactoSense instrument from its packaging.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Open the box and remove the first lid.	
2.	Remove the compartments with accessories.	
3.	Carefully remove the BactoSense from the box.	
4.	Keep the packaging and foams for future use.	

5.2 Placement of the BactoSense

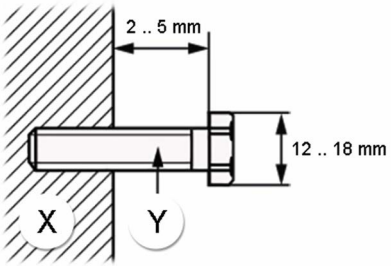
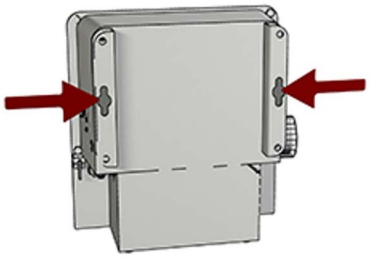
The BactoSense can be operated as a bench top instrument on a flat surface, or mounted to a wall or panel.

Note the following points for selecting an appropriate operating location:

- The BactoSense shall be installed in a vibration-free environment.
- The power supply must be stable, without spikes or interruptions.
- The BactoSense should not be exposed to direct sunlight during operation.

5.2.1 Mounting the BactoSense on a wall

The following procedure describes the mounting of the BactoSense to a vertical wall or panel:

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Install two M8 screws at the same height, separated horizontally by 265 mm on a wall. The screw head diameter needs to be between 12 mm and 18 mm.	CAUTION! The fixation must carry at least 60 kg.
2.	Adjust the distance of the screws head and the wall according to the picture on the right. X: Wall Y: Screw	
3.	Mount the BactoSense on the wall using its wall mounting system (red arrows). Tighten the two screws such that the BactoSense is firmly attached to the wall.	

5.3 Connecting the BactoSense to power

The power supply comes in an IP67 enclosure and a cable with either a plug type J, type E or type G. For connecting the BactoSense to power using one of these plugs supplied by bNovate, follow the instructions in section 5.3.1.
For the connection using a different plug or power connectors, use the procedure described in section 5.3.2.

- The electrical plug or an additional circuit breaker should always be accessible to disconnect the main supply.
- The circuit breaker should respect the standards IEC60947-1 and IEC60947-3 and should protect a current of 10 A to 16 A.

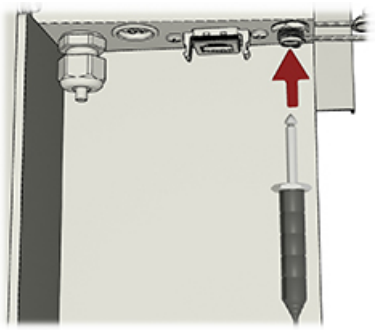
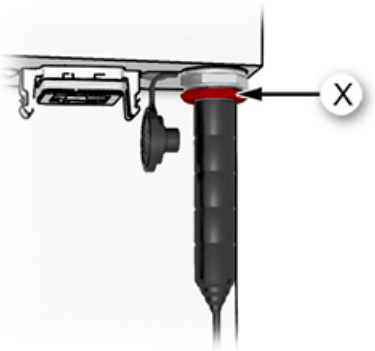
CAUTION!

An uninterrupted and stable power supply as specified in the technical information in section 3.2 must be guaranteed.

5.3.1 Connecting using the standard plug of the power supply unit

The following procedure describes how to connect the BactoSense to power using the standard power supply unit and power plug of type J, E or G.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure the power supply unit is dry and does not show any signs of damage.	
2.	Plug the J, E or G-type plug of the power supply unit to a power source supplying the indicated voltage.	

	WORK STEP	ADDITIONAL INFO / IMAGES
3.	Remove the cover of the power socket on the BactoSense.	
4.	Insert the power connector plug into the power socket.	
5.	Fasten the power connector lock ring (X).	

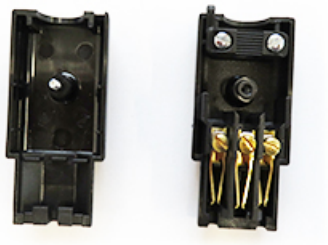
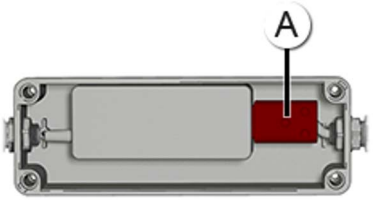
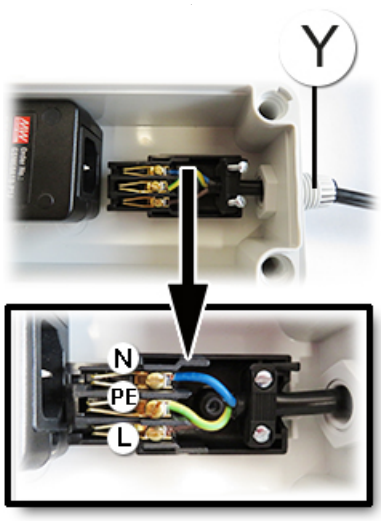
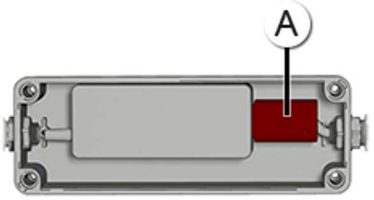
5.3.2 Modifying the standard power supply unit with a different connector

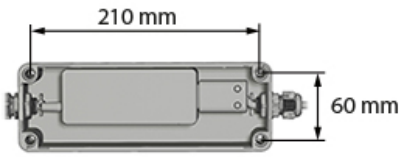
The following procedure only applies, if the BactoSense shall be connected to a power source with a different plug than what has been delivered together with the standard power supply unit (J, E or G). In that case, the power supply unit is opened and the new connector installed manually.

DANGER!

- Only professional electricians are authorized to modify the power supply unit.
- It is forbidden to modify or repair the BactoSense instrument.
- Perform the work steps in the exact order instructed.
- Always use a plug with Protective Earth (PE).

- If the power supply cable is longer than 2 m, label it near the plug with the name of the device.
- If the power supply cable is longer than 20 m, the impedance of PE needs to be smaller than 0.2 Ω.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	DANGER! Ensure that the power supply is not connected to power. Remove the cover of the enclosure by unscrewing the four screws (circles).	
2.	Remove the C13 connector (A) and unscrew it to open. 	
3.	Open the cable connector (Y) and insert the new cable. Wires cross sections and cable length: • 0 – 9 m, 1 mm^2 • 9 – 21 m, 1.5 mm^2 (maximal) The cable connector is dimensioned for a cable diameter of 3 – 10 mm.	
4.	Tighten the 3 wires (N, PE, L) in the electrical terminal and block the cable isolation. DANGER! Ensure, that a plug with Protective Earth (PE) is used and the device is correctly connected to it.	
5.	Close the C13 connector (A) using the screw and plug it in the power supply. Tighten the cable connector. Try to pull the cable to assess whether the cable connector is tight enough.	

	WORK STEP	ADDITIONAL INFO / IMAGES
6.	Optional: the power supply can be mounted on a wall. M4 screws should be used with a minimum length of 20 mm. With the cover still removed, place the 4 screws and fix the enclosure to the wall.	
7.	Put the cover of the enclosure back and tighten the four screws to seal it.	
8.	Connect the power supply unit to power and the instrument as described in section 5.3.1.	

5.4 Connecting the IO-box

The IO-box is an accessory to the BactoSense. It can be used to connect the in- and outputs of the BactoSense to a Programmable Logic Controller (PLC) / SCADA system.

The following in- and outputs can be connected to the box:

Digital

- 4 digital inputs referenced to Common allow to control the instrument from a PLC.
- 4 digital outputs allow the transmission of 4 digital signals, e.g. errors, alarms, thresholds. They use Solid-State relays (SSR) and therefore the polarity is equal

Analog

- 2 analog outputs (4 – 20 mA) allow the transmission of two measurement results, e.g. Total Cell Count and HNAP.

5.4.1 IO-box overview

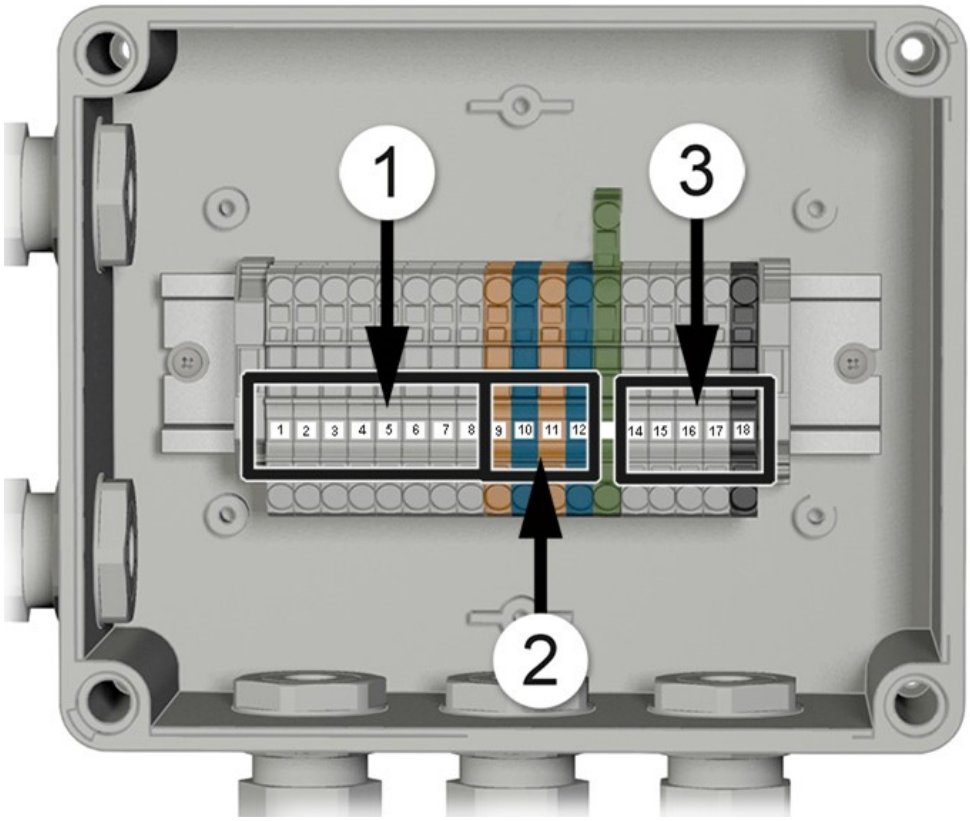


Figure 5-1 Overview of the BactoSense IO-box

①	Position of the *digital outputs* Terminals 1 – 8 Cable requirements: • AWG 12 – 22 • Cross section: 0.25 – 2.5 mm2	②	Position of the *analog outputs* Terminals 9 – 12 Cable requirements: • AWG 12 – 22 • Cross section: 0.25 – 2.5 mm2
③	Position of the *digital inputs* Terminals 14 – 18 Cable requirements: • AWG 12 – 22 • Cross section: 0.25 – 2.5 mm2		

For digital inputs:

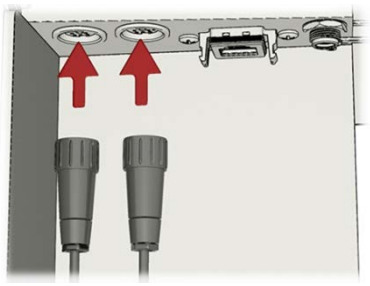
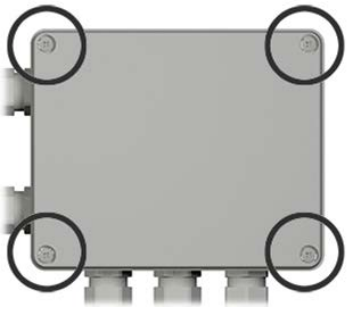
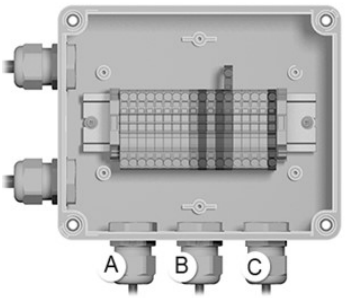
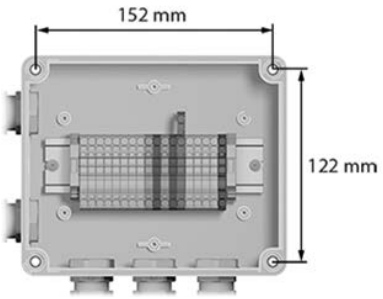
- The Common (port 18) must be connected to the PLC zero (minus)
- The digital inputs (ports 14 – 17) must be connected with a voltage of 5 – 25 V to produce an input signal of 1. Otherwise the signal is 0.
- If any of the digital inputs is 1 (e.g. 1-0-0-0), the BactoSense enters "PLC-mode". For more information refer to the Reference Handbook, section 2.2.

5.4.2 IO-box reference table

Table 5-1 IO-box reference table

Terminal	Function	Terminal Color	Cable Color
1	Digital output 1 - c	Grey	Red
2	Digital output 1 - no	Grey	Blue
3	Digital output 2 - c	Grey	Pink
4	Digital output 2 - no	Grey	Grey
5	Digital output 3 - c	Grey	Yellow
6	Digital output 3 - no	Grey	Green
7	Digital output 4 - c	Grey	Brown
8	Digital output 4 - no	Grey	White
9	Analogue 1+ mA	Orange	Black
10	Analogue 1- mA	Blue	Purple
11	Analogue 2+ mA	Orange	Pink-Grey
12	Analogue 2- mA	Blue	Red-Blue
13	Shield	Green/Yellow	
14	Digital input 1	Grey	White
15	Digital input 2	Grey	Brown
16	Digital input 3	Grey	Blue
17	Digital input 4	Grey	Black
18	Common	Black	Grey

5.4.3 Connecting the IO-box

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Insert the two M16 plugs of the IO-box on the right-hand side of the instrument.	
2.	Remove the cover of the enclosure by unscrewing the four screws (circles).	
3.	Insert cable through the cable gland (A, B or C) and connect the wires to the corresponding terminal according to the IO-Box reference table in section 5.4.2.	
4.	Tighten the cable gland. Try to pull the cable to see if the cable gland is tight enough.	
5.	Optional: the IO-box can be mounted on a wall. M4 screws should be used with a minimum length of 20 mm. With the cover still removed, place the 4 screws and fix the enclosure to the wall.	
6.	Put the cover of the enclosure back and tighten the four screws to seal it.	

5.5 Connecting the outputs without IO-box

The BactoSense exposes the outputs on a 12 pin M16 female connector. The use of an IO-box is recommended however. The pinout of the connector is given below.

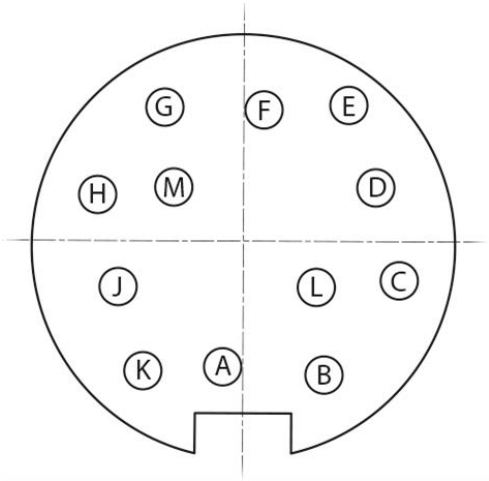


Figure 5-2 Overview of the output connector pinout

A	Digital output 4 - no	G	Digital output 1 - no
B	Digital output 4 - c	H	Digital output 1 - c
C	Digital output 3 - no	J	Analog 1+
D	Digital output 3 - c	K	Analog 1-
E	Digital output 2 - no	L	Analog 2+
F	Digital output 2 - c	M	Analog 2-

5.6 Connecting the inputs without IO-box

The BactoSense exposes the inputs on a 5 pin M16 female connector. The use of an IO-box is recommended. The pinout of the connector is given below.

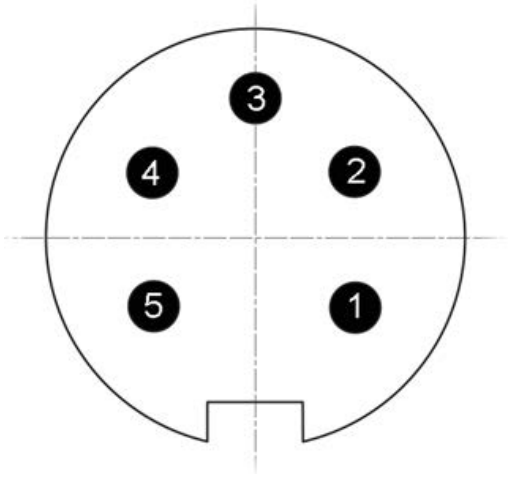


Figure 5-3 Overview of the input connector pinouts

1	Digital input 1	2	Digital input 2
3	Digital input 3	4	Digital input 4
5	Common		

5.7 Installation of the manual sampling device

The manual sampling device is intended for measuring individual grab samples, collected in 5 mL screw-cap tubes. The following procedure describes how to install the manual sampling device.

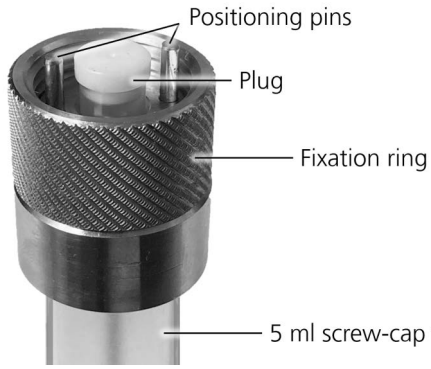


Figure 5-4 Manual sampling device with attached 5 mL screw-cap tube

Avoid contamination of the equipment. Wear nitrile gloves when handling samples, sampling devices and any components which come in contact with them.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Inspect the manual sampling device • Make sure it is free of dust and fibers. If not, clean it with a lint-free tissue wetted with sterile water or ethanol • Make sure the white sealing plug is sitting tightly in the connector	
2.	Attach an empty 5 mL screw-cap tube or the Washstation at the sampling device.	
3.	Carefully insert the connector of the sampling device into the sampling device port on the left hand-side of the BactoSense by inserting the metallic positioning pins located inside of the sampling device connector into the openings on the BactoSense sampling device port.	

	WORK STEP	ADDITIONAL INFO / IMAGES
4.	Then tighten the knurled fixation ring until the sampling device is installed tightly. CAUTION! Finger-tightening only. Do not use any tools.	
5.	It is recommended to clean the sampling device after installation. If a Washstation is available, follow the procedure in section 8.2.2, otherwise the procedure in section 8.2.3.	
6.	After the cleaning, it is recommended to perform a Prime prior to measuring the first sample. Follow the procedure in section 7.7.3.	

5.8 Installation of the online sampling device

The online sampling device is intended to measure samples continuously in predefined measurement intervals, and it is therefore directly connected to a water source and drain using an inlet and outlet tubing. The following procedure describes how to install the online sampling device.

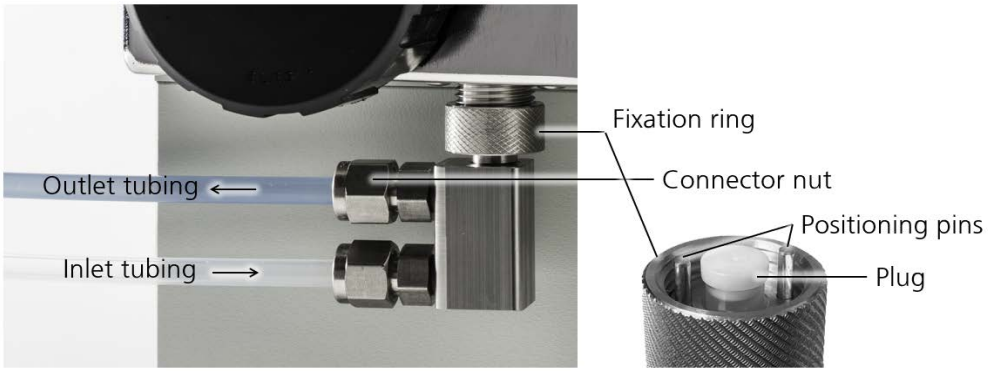


Figure 5-5 Left: Installed online sampling device with inlet connector at the bottom and outlet connector at the top. The inlet tubing is connected to a water source, and the outlet tubing to a drain. Right: Connector piece with positioning pins and sealing plug.

Avoid contamination of the equipment. Wear nitrile gloves when handling samples, sampling devices and any components which come in contact with them.

CAUTION!

Firmly attach tubings and sampling device

If the plumbing, tubings or sampling device are not tightly assembled or mounted, liquid can flood surrounding areas and cause material damage to nearby objects or infrastructure. All tube junctions must be carefully secured and tightened. The connections should be checked periodically after installation.

WARNING!

Connect outlet tubing to a drain

In drinking water installations, connect the outlet tubing to a drain to make sure that water which has been diverted from the drinking water pipe system is not returned after flowing through the additional fittings, tubings and BactoSense sampling device.

5.8.1 Attaching the tubings to the online sampling device

The following instructions describe how to attach the inlet and outlet tubings to the body of the online sampling device.
Specifications of the tubings can be found in the technical data in section 3.2.
The exchange of tubings in case they are contaminated or damaged is described in section 8.2.4.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure the sampling device is not installed at the BactoSense.	
2.	Unscrew the nuts of the two connectors on the sampling device. If necessary use a spanner. Be careful not to lose the ferrules located inside the nut.	
3.	Inspect the two tubings for contamination and damage. Only use clean and intact tubings with straight cuts.	
4.	For both tubings, insert one end through a nut and a ferrule as illustrated.	
5.	Attach the blue tubing (outlet) to the connector closer to the attachment port of the sampling device. Attach the transparent tubing (inlet) to the more distant connector to the attachment port of the sampling device. Use a clamp to fasten the nuts.	
6.	If you want to attach the sampling device, proceed with section 5.8.2.	

5.8.2 Installing the online sampling device at the BactoSense

In this section, the installation of the online sampling device with attached inlet and outlet tubings is described.

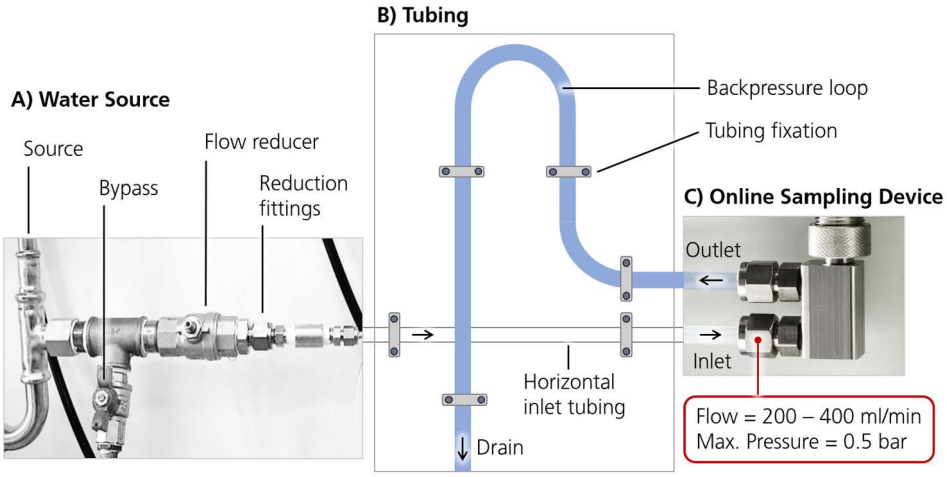
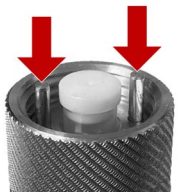
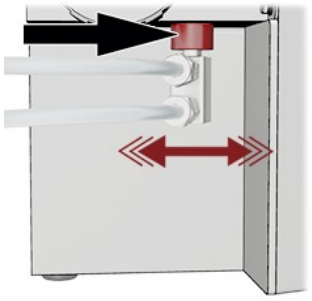


Figure 5-6 Typical installation for the online mode using the online sampling device.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure the inlet and outlet tubings are firmly attached to the online sampling device.	
2.	Carefully insert the connector of the sampling device into the sampling device port on the left hand-side of the BactoSense by inserting the metallic positioning pins located inside of the sampling device connector into the openings on the BactoSense sampling device port.	
3.	Then tighten the knurled fixation ring (red) until the sampling device is installed tightly. CAUTION! Finger-tightening only. Do not use any tools.	

	WORK STEP	ADDITIONAL INFO / IMAGES
4.	Carefully connect the free ends of the tubings to the inlet water source and outlet drain. • Level the inlet tubing with the water source to prevent trapping of air bubbles • Shorten the length of the tubings as much as possible • Install the outlet tube with a loop in high position • Minimize the amount of connectors to reduce potential sources of contamination • To prevent any damage to the sampling device and BactoSense, make sure no force is exerted via the tubings. Fixate the tubings to a solid structure in the proximity of the sampling device (30 – 50 cm) if possible. CAUTION! In drinking water installations, connect the outlet tubing to a drain to make sure that water which has been diverted from the drinking water pipe system is not returned after flowing through the additional fittings, tubings and BactoSense sampling device.	See figure 5-6.
5.	Open the water supply carefully and check the appliance for leaks.	
6.	Adjust the flow rate coming from the water supply. Flow rate range: 200 to 400 mL/min. CAUTION! If the flow rate is not within the specified limits, results may be inaccurate or the BactoSense may be damaged. CAUTION! Make sure the pressure in the sampling device does not exceed 0.5 bar. Install a pressure reducer if needed.	See figure 5-6.

5.9 Connectivity options

The BactoSense offers several options for integration and online data access.

Table 5-2 BactoSense connectivity options

Connectivity Option	Documentation
Web user interface	Reference Handbook, chapter 5
HTTP and HTTPS	Reference Handbook, section 6.3
Modbus TCP	Reference Handbook, section 3.1
Virtual network computing (VNC) user interface relay (remote control)	Reference Handbook, section 6.4
FTP	Reference Handbook, section 6.2

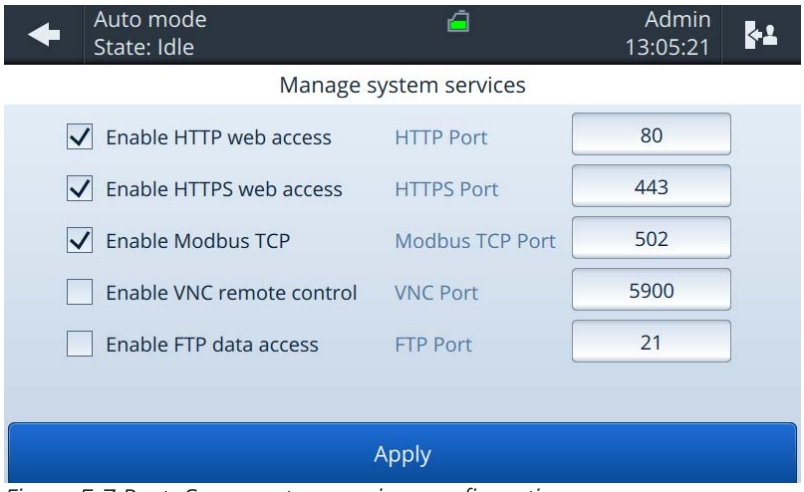


Figure 5-7 BactoSense system services configuration menu.

6 General Operations and Configurations

6.1 Switching on and off

The power button of the BactoSense is located on the right hand-side of the instrument.

Figure 6-1 Power button of the BactoSense

CAUTION!

Before switching the BactoSense on, make sure that the instrument is connected to a stable power supply meeting the requirements described in section 5.3.

Switching on
To switch the BactoSense on, shortly press on the power button. The power button LED starts lighting up and after a few seconds, the welcome screen is displayed on the user interface.

Switching off
If you are logged in and want to switch the BactoSense off, tap on the logout button on the top right corner of the user interface and select *Power off*. If you want to switch off from the login page itself, press the power button for 10 seconds.

6.2 Login, user roles and permissions

BactoSense operation requires users to log in. Different user roles with different permissions are available. The user role permissions are listed in section 6.2.6. All logins are password protected.

Login and logout can be performed using the login button displayed in the top right corner of the user interface. The currently active user role is displayed next to that button.

6.2.1 Login

	WORK STEP
1.	Press the login button on the top right corner of the user interface, or the login bar at the bottom in case you switched on the instrument.
2.	Select one of the user profiles *Basic*, *Advanced* or *Admin*.
3.	Enter the password and press *OK*. If you don't know the password, ask your Admin user. In a new instrument no passwords are set. In that case, follow the procedure described in section 6.2.4.
4.	After logging in, you see the BactoSense user interface.
5.	To log out, follow the procedure described in section 6.2.2.

6.2.2 Manual logout

	WORK STEP
1.	Make sure all processes (e.g. measurements or cleanings) have completed. The idle state of the instrument is indicated on the left hand-side of the top bar of the BactoSense user interface.
2.	Press the logout button in the top right corner of the user interface.
3.	Select *Log out Lock screen*.
4.	To log in again, follow the procedure described in section 6.2.1.

6.2.3 Auto logout

The BactoSense auto logout is a functionality to automatically log out from the user interface after a configurable time period of user interface inactivity. The auto logout can be configured by Admin users.

	WORK STEP
1.	Navigate to the BactoSense *Home menu* and press on *System settings*.
2.	Press the *Users* button.
3.	Press the *Settings* button.
4.	Change the auto logout time period in minutes in the respective field. ⓘ Setting the time period to 0 minutes disables the auto logout.
5.	Press the *Save* button.

6.2.4 Setting and changing user role passwords

Each user role is password protected.

Setting a password at first login
Upon initial login with any user role, click *OK* when being prompted for a password. This action will initiate the guided process for configuring your password. The only exception is the service password, where a preset password is provided.

Setting and changing a passwords
Each user profile can change its own password. Admin users are allowed to change passwords from other user profiles. The following procedure describes how to change passwords.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Navigate to the BactoSense *Home menu* and press on *System settings*.	
2.	Press on *Users* and then select the user profile you want to edit. Press *Edit* after selecting one check box.	Admin users are allowed to change passwords from other user profiles.
3.	Press on *Change PIN*, enter the new pin twice and press *Save*.	

6.2.5 Changing password requirements

Admin users can change the requirements for user role passwords.

	WORK STEP
1.	Navigate to the BactoSense *Home menu* and press on *System settings*.
2.	Press the *Users* button.
3.	Press the *Settings* button.
4.	Change the password requirements: • *Password expiration* is the number of days until a password expires. After expiration, the user is prompted to set a new password. Setting the expiration to 0 days means that the password does not expire. • *Minimum password length* is the minimum required number of characters for a valid password. • *Maximum failed login attempts* is the maximum number of failed attempts before the login is disabled for a certain time period (see below). • *Disable duration after max attempts* is the duration for which the login is disabled after too many failed login attempts (see above).
5.	Press the *Save* button.

6.2.6 User roles and permissions

Table 6-1 User roles and permissions

RIGHT	BASIC	ADVANCED	ADMIN
View last result	✓	✓	✓
View all results and export	✓	✓	✓
Start, stop, and schedule measurement	✓	✓	✓
Switch between Auto and Manual mode	✓	✓	✓
View error and warning log	✓	✓	✓
Rename results	✓	✓	✓
Validate device	✓	✓	✓
Change their own password	✓	✓	✓
View system info	✓	✓	✓
See network settings	✓	✓	✓
View last self-check	✓	✓	✓
Change cartridge	✓	✓	✓
Clear errors	✓	✓	✓
See intervention log	✓	✓	✓
See validation results	✓	✓	✓
Delete results		✓	✓
Re-gate results		✓	✓
Adjust alarms		✓	✓
Adjust gates		✓	✓
Reboot		✓	✓
Run a self check		✓	✓
Delete old measurements		✓	✓
Export all		✓	✓
See intervention info		✓	✓
Export diagnostics		✓	✓
Change auto logout settings			✓
Change password requirements			✓
Change analog and digital outputs			✓
Test analog and digital outputs			✓
Change other users' password			✓

RIGHT	BASIC	ADVANCED	ADMIN
Create other users			✓
Change authentication settings			✓
Set device name			✓
Set date and time			✓
Change network settings			✓
Change services settings			✓
Activate Modbus with key or deactivate			✓
Change language			✓
Switch to demo mode			✓
Reset settings			✓
Full factory reset (except intervention log)			✓
Import settings			✓

6.3 Basic configurations

6.3.1 Changing the language of the user interface

The language can only be changed by admin users.

	WORK STEP
1.	Navigate to the *Home menu* of the user interface.
2.	Press on *System settings*, then press *Language*.
3.	Choose the language and press the *OK* button.
4.	A message appears requesting a reload of the user interface. Confirm the message.

6.3.2 Changing date and time

Date and time can only be changed by admin users.

If time synchronization is enabled, either with NTP servers or through Modbus TCP, your manual date and time settings will be overridden during the next synchronization. Settings can be found under *System settings* > *Date & Time* > *Time synchronization settings*. For setting up NTP sever, please refer to the Reference Handbook, section 2.9.

	WORK STEP
1.	Navigate to the *Home menu* of the user interface.
2.	Press the *System settings* button.
3.	Press the *Date & Time* button.
4.	Enter the date and time.
5.	Select the *Time zone.*
6.	Press the *Set* button.

6.3.3 Changing the device name

The device name can only be changed by admin users.

	WORK STEP
1.	Navigate to the *Home menu* of the user interface.
2.	Press the *System settings* button.
3.	Press the *Device name* button.
4.	Enter your individual device name in the input field.
5.	Press the *Save* button.

6.4 The BactoSense user interface

6.4.1 General structure and home menu

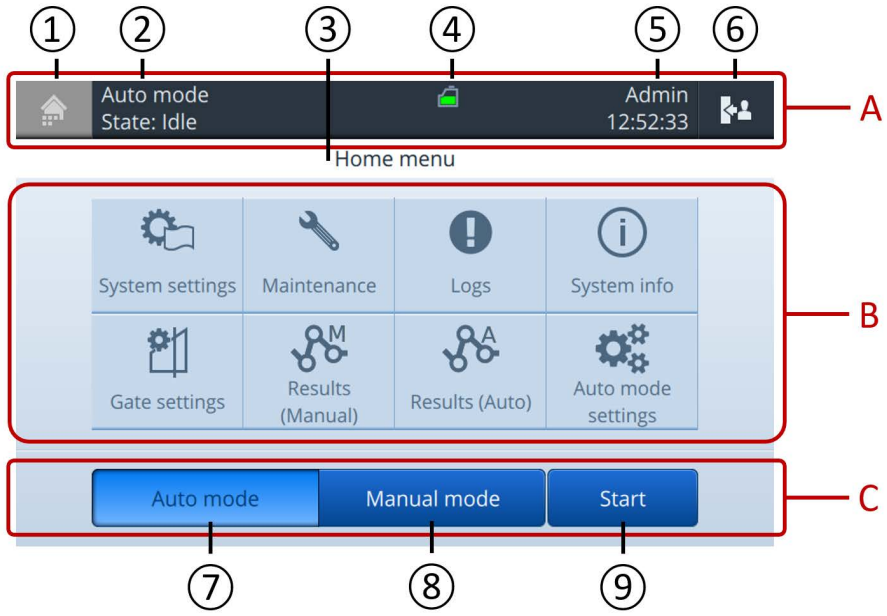


Figure 6-2 The Home menu of the BactoSense user interface.

The BactoSense user interface is divided into 3 main sections:

A	Top bar
B	Content view
C	Action bar

The main elements of the user interface are:

①	Home or return button. To navigate through the menu.	②	Operation mode (manual or auto) Instrument status (currently active process)
③	Current view	④	Top bar status icons, see 6.4.2.
⑤	User Role Current time	⑥	Logout or power off
⑦	Auto mode (continuous measurements using the online sampling device)	⑧	Manual mode (measuring grab samples using the manual sampling device)
⑨	Go to the list of analysis protocols.		

Depending on the user role, some options may not be visible or disabled.

6.4.2 Top bar status icons

Top bar icons are displayed in the bar in the top of the display. They indicate the status of the instrument.

Table 6-2 Top bar icons

ICON	DESCRIPTION	ICON	DESCRIPTION
	Process running		Demo mode activated
	Rapid or stand-by heating in progress (see Reference Handbook section 7.4)		Service required (see chapter 8)
	Cartridge almost empty		Cartridge level indication
	Cartridge almost expired		Cartridge empty
	Cartridge not correctly initialized or no cartridge		Cartridge expired
	Critical error (section 9.3)		Non-critical error (section 9.2)
	Alarm on last measurement (Auto mode only, see Reference Handbook, section 2.1)		

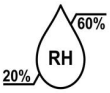
6.5 Cartridge management

The BactoSense cartridges contain the reagents required for measuring and maintaining the instrument clean. The BactoSense can be operated with different cartridge types. In the following sections, the handling of the cartridge is explained. Cartridge storage, transportation and refill are described in chapter 11.

6.5.1 General instructions for cartridge handling

When handling the cartridge, the following instructions must be followed:

Table 6-3 Cartridge handling instructions

	Follow the procedures described in this manual.		Store and ship between 15 °C and 25 °C. The optimal temperature is 15 °C.
	Wear nitrile gloves when handling the cartridge.		Store and ship between 20 % and 60 % relative humidity.
	Wear safety glasses when handling the cartridge.		The cartridge is intended for refill.
	Ship, install and store in the indicated orientation		Do not throw the cartridge into the trash.

6.5.2 Cartridge overview

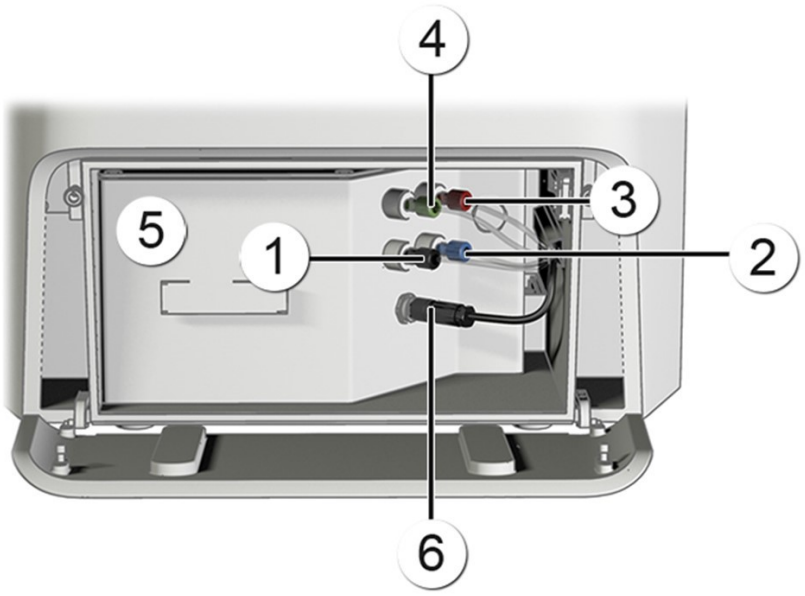


Figure 6-3 Overview of the cartridge installed in the BactoSense

①	Waste connector (black or beige)	②	Rinse connector (blue)
③	Clean connector (red)	④	Dye connector (green)
⑤	Cartridge	⑥	Electrical connection

6.5.3 Checking the filling level and expiration date of a cartridge

The cartridge filling levels and expiration date can be retrieved from several sources.

- The cartridge icon shown in the top bar of the user interface constantly indicates the approximate cartridge filling level. In case the cartridge is about to expire, the cartridge icon displays this too. Explanations of the different icons can be found in section 6.4.2.
- If you need more information, navigate to the *Home menu*, and then press *System info*. Under *Cartridge capacity remaining* you see how full the cartridge still is (in percent), and under *Cartridge expiration date* you see when the cartridge expires. The same information can also be retrieved from the web interface (see Reference Handbook, chapter 5)

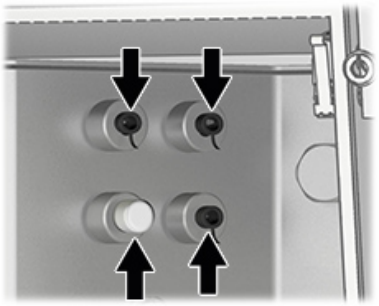
6.5.4 Change cartridges

The following procedure describes the exchange of cartridges. Use this procedure if you want to remove and directly install another cartridge. If you only want to remove a cartridge and not install another one, follow the instruction in section 6.5.5.

The duration of the cartridge exchange is approximately 30 min.

CAUTION!

Strictly follow the procedure of the on-screen wizard for removing or installing a cartridge. This procedure includes an automatic initialization and priming of the cartridge, which is important for proper functioning. **Do not remove or install cartridges without this procedure.**

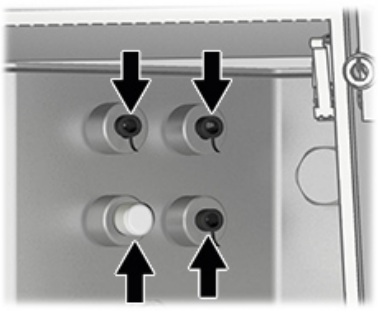
	WORK STEP	ADDITIONAL INFO / IMAGE
1.	Have the replacement cartridge ready and adjusted to ambient temperature.	
2.	Navigate to the *Home menu* of the user interface.	
3.	Press the *Maintenance* button.	If you are in Basic mode, skip this step.
4.	Press the *Cartridge change* button.	
5.	Follow the instructions of the on-screen wizard. WARNING! Adhere to the general cartridge handling instruction in section 6.5.1. Wear nitrile gloves and safety glasses. WARNING! Only open the cartridge compartment door when instructed. WARNING! Open and close the cartridge compartment door only with the dedicated 7 mm hex nut screwdriver. WARNING! Tightly seal the fluidic connectors of the old cartridge with the attached plugs before removing it.	Carefully open the cartridge compartment door.  Tightly seal the fluidic connectors. 
6.	Handling the removed cartridge • If you wish to store the removed cartridge, refer to the storage instructions in section 11.1.3. • If you wish to refill the removed cartridge, refer to the refill instructions in section 11.3.2.	

6.5.5 Removing a cartridge

This procedure is intended for the removal of a cartridge, without immediate installation of another cartridge. If you want to exchange cartridges, follow the procedure described in section 6.5.4.
The duration of the cartridge removal is approximately 5 min.

CAUTION!

Strictly follow the procedure of the on-screen wizard for removing or installing a cartridge. This procedure includes an automatic initialization and priming of the cartridge, which is important for proper functioning. **Do not remove or install cartridges without this procedure.**

	WORK STEP	ADDITIONAL INFO / IMAGE
1.	Navigate to the *Home menu* of the user interface.	
2.	Press the *Maintenance* button.	If you are in Basic mode, skip this step.
3.	Press the *Cartridge change* button.	
4.	**Follow the instructions of the on-screen wizard to the point where the old cartridge has been removed, i.e. complete the step "1. Remove cartridge".** WARNING! Adhere to the general cartridge handling instruction in section 6.5.1. Wear nitrile gloves and safety glasses. WARNING! Only open the cartridge compartment door when instructed. WARNING! Open the cartridge compartment door only with the dedicated 7 mm hex nut screwdriver. WARNING! Tightly seal the fluidic connectors of the old cartridge with the attached plugs before removing it.	Carefully open the cartridge compartment door.  Tightly seal the fluidic connectors. 
5.	Exit the cartridge change on-screen wizard by pressing the return button on the top left of the user interface to return to the *Home menu*.	The top bar of the user interface indicates that no cartridge is connected. The maintenance button in the *Home menu* is now displayed in orange.

	WORK STEP	ADDITIONAL INFO / IMAGE
6.	Inside of the open cartridge compartment of the BactoSense, place the loose tubing connectors in a clean plastic bag and tightly seal the bag. Prevent the tubings and electrical connector from loosely moving around in the compartment.	
7.	Close the cartridge compartment door and secure it by fastening the two screws using the dedicated 7 mm hex nut screwdriver.	
8.	Handling of the removed cartridge • If you wish to store the removed cartridge, refer to the storage instructions in section 11.1.3. • If you wish to refill the removed cartridge, refer to the refill instructions in section 11.3.2.	

6.5.6 Installing a cartridge

This procedure is intended for the installation of a cartridge, when no other cartridge is installed in the BactoSense. If there is already a cartridge and you want to exchange cartridges, follow the procedure described in section 6.5.4.
The duration of the cartridge installation is approximately 30 min.

CAUTION!

Strictly follow the procedure of the on-screen wizard for removing or installing a cartridge. This procedure includes an automatic initialization and priming of the cartridge, which is important for proper functioning. **Do not remove or install cartridges without this procedure.**

	WORK STEP	ADDITIONAL INFO / IMAGE
1.	Have the new cartridge ready and adjusted to ambient temperature.	
2.	Navigate to the *Home menu* of the user interface.	
3.	Press the *Maintenance* button.	The *Maintenance* button is highlighted in orange in case no cartridge is installed. If you are in Basic mode, skip this step.

	WORK STEP	ADDITIONAL INFO / IMAGE
4.	Press the *Cartridge change* button.	
5.	**Follow the instructions of the on-screen wizard.** **Ignore the substeps 2 and 3 of the step "1. Remove cartridge", as they are meant for the removal of an old cartridge (see 6.5.4).** WARNING! Adhere to the general cartridge handling instruction in section 6.5.1. Wear nitrile gloves and safety glasses. WARNING! Only open the cartridge compartment door when instructed. WARNING! Open the cartridge compartment door only with the dedicated 7 mm hex nut screwdriver.	Carefully open the cartridge compartment door. 
6.	After following through all 3 steps of the on-screen wizard, the new cartridge is properly initialized.	The cartridge status is indicated with a cartridge symbol in the top bar of the user interface, see 6.4.2.

6.6 Switching between sampling devices

The BactoSense can be operated with either the manual or the online sampling device. The following procedure describes the exchange of sampling devices. Sampling device storage information can be found in section 11.1.2.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Remove the mounted sampling device according to the instructions in section 6.6.1 (online sampling device) or 6.6.2 (manual sampling device)	
2.	Install the new sampling device according to the instructions in section 5.8 (online sampling device) or 5.7 (manual sampling device).	

6.6.1 Removal of the online sampling device

When switching to the manual sampling device, the online sampling device has to be removed. Follow the procedure below to safely remove the device and prepare it for storage.

Avoid contamination of the equipment. Wear nitrile gloves when handling samples, sampling devices and any components which come in contact with them.

	WORK STEP
1.	Terminate any ongoing measurement series, as described in section 7.2.2.
2.	Stop the water flow through the sampling device tubings and sampling device.
3.	Carefully unscrew the knurled sampling device fixation ring until the sampling device can be removed.
4.	Remove the online sampling device. Make sure the white sealing plug still sits tightly in the connector of the sampling device. If not, it may have remained in the BactoSense sampling device connector. In this case carefully remove it with tweezers and place it back in the sampling device.
5.	Disconnect and drain the inlet and outlet tubings from the water source and the sampling device body.
6.	Inspect the inlet and outlet tubings for contamination and damage. Only reuse clean and intact tubings.
7.	If you want to store the sampling device, place the device and the tubings separately in a clean and dry plastic bags and follow the storage instructions in section 11.1.2.
8.	To mount now the manual sampling device, see section 5.7.

6.6.2 Removal of the manual sampling device

When switching to the online sampling device, the manual sampling device has to be removed. Follow the procedure below to safely remove the device and prepare it for storage.

Avoid contamination of the equipment. Wear nitrile gloves when handling samples, sampling devices and any components which come in contact with them.

	WORK STEP
1.	Perform a cleaning of the manual sampling device: If a Washstation is available, follow the procedure in section 8.2.2, otherwise the procedure in section 8.2.3.
2.	After finishing, attach a clean and empty 5 mL screw-cap tube or the Washstation to the sampling device.
3.	Carefully unscrew the knurled sampling device fixation ring on top of the device until the sampling device can be removed.

	WORK STEP
4.	Remove the manual sampling device. Make sure the white sealing plug still sits tightly in the connector of the sampling device. If not, it may have remained in the BactoSense sampling device connector. In this case, carefully remove it with tweezers and place it back in the sampling device.
5.	If you want to store the sampling device, place it in a clean and dry plastic bag and follow the storage instructions in section 11.1.2.
6.	To mount now the online sampling device, follow the procedure in section 5.8.

6.7 Operational qualification

Operational qualification is a process to ensure the BactoSense operates as intended. Different options are available:

- To do a fully automated quick check of the instrument status, perform the self-check procedure described in section 9.6. This test does not require any reagents or user interaction, is very quick and checks the integrity and communication between the different modules of the BactoSense.
- To assess the cleanliness of the BactoSense and rule out a contamination, perform the cleanliness verification procedure in section 6.7.1.
- To do a full instrument validation procedure, use the Validation Kit (see section 12.3). This procedure validates cleanliness and proper functioning of the BactoSense.

6.7.1 Cleanliness verification

	WORK STEP
1.	Make sure the manual sampling device is tightly installed as described in section 5.7.
2.	Perform a cleaning of the sampling device with two replications: If a Washstation is available, follow the procedure in section 8.2.2, otherwise the procedure in section 8.2.3.
3.	Prepare the blank sample in a 5 mL screw-cap tube. There are two options: A) Use cell-free water, e.g. a sterile solution aliquot from the Validation Kit. If you use the sterile solution aliquot from the Validation Kit, remove the cap of the aliquot and place the aliquot in an empty 5 mL screw-cap tube, as described in the instruction manual of the Validation Kit. B) Take a still mineral water and filter twice using a membrane filter with a pore size of 0.22 µm or smaller.
4.	In the BactoSense user interface, navigate to the *Home menu*.
5.	On the action bar at the bottom, select *Manual mode* and press *Start*.
6.	Choose the *Prime* protocol from the list of available protocols.
7.	Press the *Next* button.
8.	Remove the tube or Washstation from the manual sampling device and attach the blank sample.
9.	Press the *Start* button to run the Prime protocol.
10.	After completion of the Prime, press the *New* button to navigate back to the list of protocols.
11.	Select the *Water Analysis* protocol from the list of available protocols.
12.	Configure two replications.

	WORK STEP
13.	Enter a sample name by tapping into the *Sample name* text field, entering the name and pressing *OK*.
14.	Verify that the ICC or TCC default gate is configured and change it otherwise by pressing into the *Gates* field.
15.	Press the *Next* button.
16.	Press the *Start* button and wait for the two measurements to complete.
17.	After finishing, press the *Next* button to review the results.
18.	Look at the results and compare them to the reference values indicated below. The BactoSense is clean if the following criteria are fulfilled: • For TCC cartridges: **TCC [/mL] < 300** • For ICC and ICC+ cartridges: **ICC [/mL] < 100**
19.	If the cell concentrations are higher than the specified limits, apply the following procedure: • Repeat the procedure with a freshly prepared blank sample. • Repeat the procedure after a decontamination using the Cleaning Kit (see section 12.3). • If the test keeps failing, contact bNovate support or your local service representative.
20.	After finishing, attach a clean and empty 5 mL screw-cap tube or the Washstation to the manual sampling device.

7 Measurements

7.1 Samples

The BactoSense can measure manually collected grab samples using the manual sampling device, and also sample automatically from a connected water source using the online sampling device.

Sample types and pretreatments:

- Raw waters and especially surface waters must be filtered with a 20 µm filter. Particles can block the internal filters and damage the instrument. Clear water expected to be potable usually does not need filtering.
- Sparkling water and soft drinks cannot be measured by the instrument.
- Water with a high concentration of chlorine can affect the results of the measurement.
- The sample and operating conditions listed in the technical data in section 3.2 must be fulfilled.

7.2 Measuring automatically in online mode

Measuring in online (also called *automatic* or *auto*) mode describes a configuration, in which the BactoSense is connected to a water source using the online sampling device, and automatically draws and measures a sample at predefined intervals.

If you want to measure manually collected grab samples instead, refer to section 7.3.

7.2.1 Configuring and starting automatic online measurements

The following instructions show how to configure and start automatic online measurements using the online sampling device.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure the online sampling device is tightly installed as described in section 5.8.	If you have the manual sampling device installed and want to change to the online sampling device, refer to section 6.6.2 to remove the manual sampling device and section 5.8 to install the online sampling device.
2.	In the BactoSense user interface, navigate to the *Home menu*.	
3.	On the action bar at the bottom, select *Auto mode* and press *Start*.	
4.	Press the *Start* button.	
5.	Under Protocol, make sure the check box for *"Online Sampling Device (with Backflush)"* is checked.	
6.	Enter a sample name by tapping into the *Sample name* text field.	

	WORK STEP	ADDITIONAL INFO / IMAGES
7.	Select the desired gate to be applied to the measurements by tapping into the *Gates* text field.	Generally, default TCC and ICC gates are used. Use user-defined gates if your application requires it. Creating and adjusting gates is described in the Reference Handbook in chapter 4.
8.	Press the *Next* button.	
9.	Select the measurement interval using the wheel on the right hand side.	The measurement interval describes the time between different measurements and can be as short as 30 min and as long as 6 hours.
10.	If needed, you can delay the starting time by unchecking the *Start immediately* box and chose a specific time to start.	The time setting of the BactoSense is described in section 6.3.2.
11.	Press the *Start* button.	During the measurement, the current estimate of the cell concentration is displayed in the action bar under “Last”.
12.	After each measurement, the time series graph is updated.	For more details press the *View results* button.
13.	If you want to stop an online measurement series, refer to section 7.2.2.	

7.2.2 Terminating automatic online measurements

Follow the steps below to terminate a measurement series in auto mode.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Press the *Stop* button on the user interface.	
2.	Confirm the message to stop the auto mode measurement series.	

	WORK STEP	ADDITIONAL INFO / IMAGES
3.	If a measurement is running, you can select whether you want to abort it immediately, or wait for completion.	
4.	If you don't continue with another measurement series within the next hours, proceed with removing the online sampling device as described in section 6.6.1 and installing the manual sampling device as described in section 5.7.	
5.	If you want to view your data, refer to section 7.2.3. If you want to retrieve your data, refer to section 7.6.	

7.2.3 Reviewing automatic online measurements

The home screen in Auto mode shows a line plot of the measurement results over time.

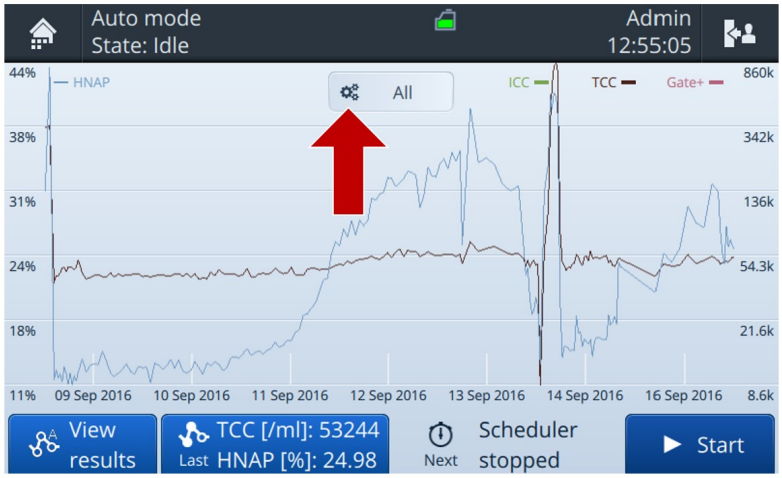


Figure 7-1 Auto mode results overview plot

By tapping the button with a gear icon (arrow in figure 7-1), users can change the scales and which metrics are displayed (see figure 7-2). To display alarms on the plot, create an alarm and enable its "Display alarm" setting (Reference Handbook, section 2.1).

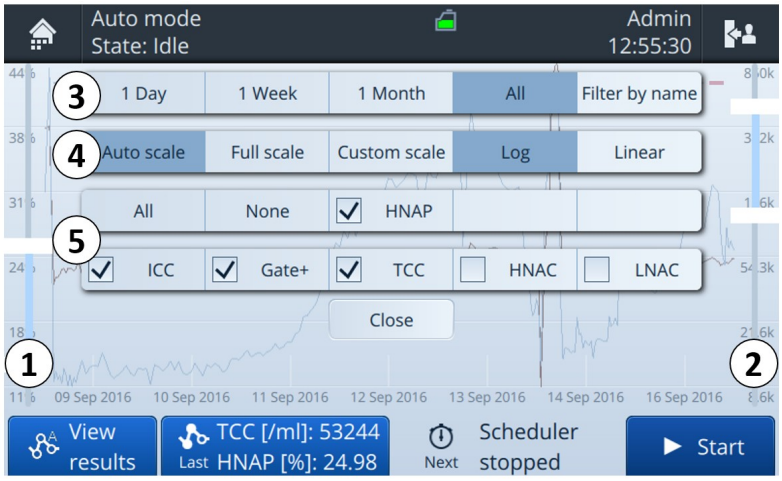


Figure 7-2 Auto mode plot settings

①	Adjust the percentage scale. Touch the upper half of the scale bar to move the upper limit. Touch the lower half to move the lower limit.
②	Adjust the counts scale. Touch the upper half of the scale bar to move the upper limit. Touch the lower half to move the lower limit.
③	Choose the display interval or filter by name (see section 7.5).
④	Choose the vertical scale: • Auto scale adapts to the current data • Full scale shows the full range of the instrument • Custom scale is adjusted with sliders 1 and 2. Log and Linear control the counts scale (right-hand-side scale).
⑤	Choose which metrics to display on the graph.

7.3 Measuring in manual mode

Measuring in manual mode describes a configuration, in which the manual sampling device is connected to the BactoSense, and the operator attaches individual grab samples collected in 5 mL screw cap tubes to the instrument.

7.3.1 Performing a measurement in manual mode

The following instructions show how to configure and start a measurement in manual mode.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure the manual sampling device is tightly installed as described in section 5.7.	
2.	If the manual sampling device has been newly installed or the instrument has been switched off or idle for more than 3 days, it is recommended to clean the sampling device. If a Washstation is available, follow the procedure in section 8.2.2, otherwise the procedure in section 8.2.3.	
3.	If a cleaning of the manual sampling device has been conducted (see previous step), it is recommended to perform a prime prior to measuring the sample. Follow the procedure in section 7.7.3.	
4.	In the BactoSense user interface, navigate to the *Home menu*.	
5.	On the action bar at the bottom, select *Manual mode* and press *Start*.	
6.	Choose the *Water Analysis* protocol from the list of available protocols.	If you want technical replicates, select the number of replicates in *Replications* column. By default, one sample is measured. If more replicates are configured, multiple samples are drawn from the same sample tube.
7.	Enter a sample name by tapping into the *Sample name* text field, entering the name and pressing *OK*.	
8.	Check whether your desired gate is configured in the *Gates* field. If you wish to use another gate, tap into the *Gates* field and select the desired gate from the available options (depending on the cartridge installed).	Generally, default TCC and ICC gates are used. Use user-defined gates if your application requires it. Creating and adjusting gates is described in the Reference Handbook, chapter 4.
9.	Press the *Next* button.	

	WORK STEP	ADDITIONAL INFO / IMAGES
10.	Attach a 5 mL screw-cap tube containing 2 – 5 mL of sample to the manual sampling device.	
11.	Press the *Start* button.	The estimated protocol duration and expected termination timepoint are displayed. The current state of the measurement is indicated in the top bar (e.g. Initializing, Mixing...)
12.	After finishing the measurement, press the *Next* button to view the results. Results are explained in section 7.3.2.	
13.	If you want to proceed with the next measurement, press the *New* button.	
14.	If you want to see previous measurement results, press the *View results* button.	
15.	If you want to rename, regate or export the measurement, refer to the instructions in following sections.	
16.	If you don't want to measure more samples and the instrument will be idle or switched off, perform a cleaning of the manual sampling device. If a Washstation is available, follow the procedure in section 8.2.2, otherwise the procedure in section 8.2.3.	

7.3.2 Reviewing manual measurement results

This page shows a measurement result. From here, the user can delete a measurement, look up older results or export results. Expert users can re-gate the measurements. Some actions are bound to specific roles (Basic, Advanced or Admin).

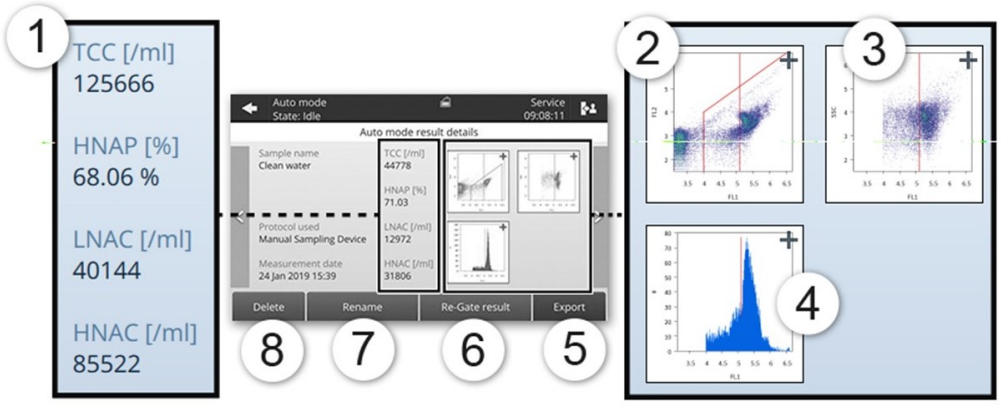


Figure 7-3 Display of a single measurement result, using a TCC cartridge.

①	Measured parameters are displayed. For details refer to the Reference Handbook, chapter 4.3.
②	The FL2 vs FL1 dotplot shows all detected events according to the amplitude of their fluorescence signals FL1 (535 nm, X-axis) and FL2 (715 nm, Y-axis). The red polygon defines the gate. For details refer to the Reference Handbook, chapter 4.3.
③	The SSC vs FL1 dotplot shows only cells inside the gates, according to their fluorescence signal FL1 (535 nm) and scattered light signal SSC (488 nm).
④	The FL1 histogram shows all cells inside the gates, binned according to their fluorescence in FL1.
⑤	*Export* saves this result to a USB stick (section 7.6.1). To export all data or diagnostic data, refer to the Reference Handbook, section 6.1.1.
⑥	*Re-Gate result* allows you to move the gates and recalculate cell counts. You can optionally save the new gates for future measurements. For details refer to the Reference Handbook, section 4.4.1.
⑦	*Rename* allows to rename the measurement (section 7.3.3).
⑧	*Delete* allows to delete the measurement permanently.

7.3.3 Renaming measurements

Measurements can be renamed from their result details view.

	WORK STEP
1.	Navigate to the *Home menu* and press *Results (Manual)* or *Results (Auto)*.
2.	In the results list, select the measurement you want to rename. Exception: If you want to rename a group of replicates (see section 7.3.4), long-press on the group of replicates and then press the rename button.
3.	In the result details view, press the *Rename* button (see section 7.3.2).
4.	A keyboard and text field with the current sample name will appear. Use the keyboard to change the sample name and press *OK*.

7.3.4 Working with measurement replicates

When working in manual mode, analysis protocols can be repeated. This is particularly useful for generating technical replicates of a single sample.

- The number of replicates can be selected when configuring a manual measurement, as described in section 7.3.1.
- In the manual mode results list, replicates are grouped into one entry, and the number in brackets next to the sample name indicates the number of replicates. In this view, the results shown for the replicate group consist of average and standard deviation. Individual replicate measurements can be accessed by pressing on the replicate group.
- Replicate groups can easily be renamed, deleted, exported or regated after a long-press on the replicate group in the manual mode results list.

7.4 Regating measurements

Adjusting the gates of individual measurements or a set of measurements is described in the Reference Handbook in section 7.4.

7.5 Filtering measurements

Filtering can be applied to display a subset of the measurement results. Filtering by text and date range is possible.

	WORK STEP
1.	Navigate to the *Home menu* and press *Results (Manual)* or *Results (Auto).*
2.	In the results list, press the *Filter* button.
3.	Specify your filter by applying one or both of the following options: • Define a date range by specifying start and end date • Define a text string to filter by measurement name
4.	Press *OK*. The result list will be refreshed showing filtered results.

7.6 Exporting measurements

There are multiple ways to retrieve measurement data. Retrieval via HTTP, HTTPS, FTP and the web interface are described in the Reference Handbook in chapter 5 and chapter 6. In this section, data export to a USB drive is described.

7.6.1 Export to a USB drive

It is possible to export selected or all measurements to a USB flash drive.
Make sure your USB flash drive is formatted in FAT32 format.

	WORK STEP
1.	Navigate to the *Home menu* and press *Results (Manual)* or *Results (Auto)*.
2.	In the results list, • press the *Export series* button to export a set of measurements or all measurements. • select a group of replicates and press the *Export series* button to export this group of replicates. • select a single measurement and then press *Export* to export only a single measurement.
3.	In the *folder name* field, the name of the target folder which will be created on the USB drive is shown. Change the name if desired.
4.	Insert a USB stick with enough available memory. Press *Refresh list* to display the connected USB stick.
5.	Export options • press *Export results* to export only the basic results (see details in the user interface) • press *Export all* to export results, raw data and diagnostic information (see details in the user interface)
6.	Wait for the export to complete and then press *OK*.

7.7 Available analysis and maintenance protocols

7.7.1 Overview of protocols in manual mode

Operators can choose between two analysis protocols in manual mode.

Table 7-1 Analysis protocols for manual mode

PROTOCOL NAME	PROTOCOL DESCRIPTION
Water Analysis	Analyze a water sample and finish with a cleaning cycle. If several replications are executed, the cleaning step is executed only once, at the end. A prime is executed automatically between replicates.
Beads Analysis	This protocol is intended for the analysis of calibration beads and is used with the Validation Kit. The protocol automatically finishes with a cleaning cycle. If several replications are executed, the cleaning step is executed only once, at the end.

Maintenance protocols can be executed before or between analysis protocols, to prepare, flush, or clean the system. In manual mode, the following maintenance protocols are available:

Table 7-2 Maintenance protocols for manual mode

PROTOCOL NAME	PROTOCOL DESCRIPTION
Clean Optics	Launches a cleaning step that washes all components in contact with the sample inside the BactoSense, except the sampling device.
Clean Sampling Device with Washstation	Cleans the manual sampling device such that the outside filter, the needle's interior and exterior can be fully washed between measurements, after a dirty sample or in case of filter blockage. The Washstation device must be mounted on the manual sampling device and a cartridge must be installed for this protocol to appear. This protocol has a higher disinfection power than the *Clean Sampling Device* protocol and should therefore be preferred. Using the Washstation is the best way to keep the manual sampling device clean and to avoid cross-contaminations. Instructions for this protocol can be found in section 8.2.2.
Clean Sampling Device	Cleans the sampling device so that the external filter and the needle’s interior can be washed after an extremely loaded sample or in case of filter blockage. Instructions for this protocol can be found in section 8.2.3.

PROTOCOL NAME	PROTOCOL DESCRIPTION
Fill Tubing	Fills all tubing carrying reagents from the cartridge, to remove bubbles in the tubing. Cleans optics at the end of the process.
Prime and Clean Optics	Fills the tubing with liquid from the sample. Helps to dilute any residues after a clean sampling device for instance. Is finished by the cleaning step.
Prime	Loads sample into the instrument. Instructions can be found in section 7.7.3.

7.7.2 Overview of protocols in auto mode

Operators can choose between two analysis protocols in *Auto mode*.

Table 7-3 Analysis protocols for Auto mode

PROTOCOL NAME	PROTOCOL DESCRIPTION
Online Sampling Device (with Backflush)	This is the standard protocol to be used with the online sampling device. This protocol includes automated cleaning procedures between measurements.
Manual Sampling Device	This protocol is used with the manual sampling device installed.

7.7.3 Performing a Prime

Priming preconditions the BactoSense with the sample. Priming can be used to reduce the carryover of cells or unwanted substances, and takes approximately 5 minutes.

Use a Prime under the following circumstances:

- After a *Clean Sampling Device* protocol (with and without Washstation)
- After measuring a sample with a high chlorine concentration or any other unwanted substance which may affect subsequent measurements

	WORK STEP
1.	Make sure the manual sampling device is tightly installed as described in section 5.7.
2.	In the BactoSense user interface, navigate to the *Home menu*.
3.	On the action bar at the bottom, select *Manual mode* and press *Start*.
4.	Choose the *Prime* protocol from the list of available protocols.
5.	Press the *Next* button.
6.	Attach the sample you want to measure next to the manual sampling device.
7.	Press the *Start* button.

8 Maintenance

BactoSense maintenance refers to the activities and procedures performed to ensure the proper functioning, accuracy, and reliability of the instrument over its life cycle.

CAUTION!

BactoSense service duty

Adhering to the maintenance schedule is important to ensure a long instrument lifetime, safe operation and correct measurement results.

Service duties have to be carried out according to the maintenance schedule and original bNovate spare parts have to be used, otherwise this can lead to damage to the instrument or measurement errors. In case of neglected maintenance, bNovate Technologies accepts no warranty claims made by the customer and is not responsible for any resulting costs.

Importantly,

- Only service-trained and authorized personnel are allowed to carry out BactoSense service operation
- Carry out servicing duties according to the servicing schedule in section 8.1 and 8.2.1.
- When carrying out servicing duties, use original bNovate spare parts. The use of third-party spare parts requires the written approval of bNovate Technologies.
- If the instruments are subjected to heavy use or exposed to adverse environmental conditions, service duties must be carried out more frequently.

DANGER!

Observe the safety points

Before working on the instrument, ensure that you have carefully read the safety points in the instruction manual.

You should also follow these regulations:

- Only professional electricians are authorized to do the electrical installation of the power plug.
- It is forbidden to modify or repair the BactoSense instrument.
- Perform the work steps in the instructed order.
- When replacing parts, use only genuine original parts listed in the consumables and spare parts list.
- When returning components use the original packaging of the BactoSense
- Be sure to use a plug with Protective Earth (PE) and that the device is correctly connected to it.

8.1 Periodic preventive maintenance by service professional

Preventive maintenance of the BactoSense is a scheduled intervention to replace wear parts, update the software and inspect and validate the instrument. Preventive maintenance is important to prevent failures and optimize the performance and reliability. It can only be conducted by service professionals specifically trained by bNovate.

A preventive maintenance is due after the consumption of either 3 cartridges or 1 year, whichever comes first.

Contact bNovate support or your local service partner to see available options. Contact details can be found in section 13.1.

8.2 Maintenance by the user

Maintenance by user refers to simple and occasional maintenance activities performed by the user. They are important to maximize the instrument's performance, minimize downtime, and extend its operational life.

8.2.1 Overview of maintenance by user

Table 8-1 Overview of the maintenance activities performed by the user

WHEN	WHAT	PROCEDURE
Manual sampling device is newly installed. Instrument has been or will be idle or switched off for more than 3 days.	Cleaning with Washstation or Basic Cleaning	If Washstation is available, see section 8.2.2. Otherwise see section 8.2.3.
Instrument shows signs of contamination	Decontamination	Requires a Cleaning Kit, see consumables list in section 12.3. See Cleaning Kit user manual.
Online sampling device tubing is damaged or dirty	Replace tubing	See replacement process in section 8.2.4.
Cartridge expired or empty	Replace cartridge	See cartridge exchange procedure in section 6.5.4. See cartridge shipping instructions in section 11.3.2.

WHEN	WHAT	PROCEDURE
Error E08 appears (internal humidity)	Internal humidity is not within specified limits. Replace the desiccant bag	Replace the desiccant bag. See instructions in section 8.2.5. See consumables list in section 12.3.
Cell concentrations lower than expected or no cells measured	Sampling device inlet filter clogged. Replace the filter.	See section 8.2.6. See consumables list in section 12.3.
Error E07 appears (disk full)	Disk space is full. Clear disk space	See instructions in section 8.2.7.

8.2.2 Clean manual sampling device with Washstation

This protocol describes how to clean the manual sampling device using the Washstation. If no Washstation is available, follow the procedure in section 8.2.3.

- This protocol automatically cleans the inner and outer surfaces of the aspiration needle.
- All reagents required come directly from the installed cartridge.
- The protocol takes approximately 15 min.

Figure 8-1 Washstation for cleaning the manual sampling device

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure the manual sampling device is tightly installed as described in section 5.7.	
2.	Navigate to the *Home menu* of the BactoSense user interface.	
3.	On the action bar at the bottom, select *Manual mode* and press *Start*.	
4.	In the list of available protocols, select *Clean Sampling Device with Washstation*.	
5.	Make sure 1 replication is configured in the *Replications* column.	More replications can be conducted for stronger cleanings.

	WORK STEP	ADDITIONAL INFO / IMAGES
6.	Press the *Next* button.	
7.	Mount the Washstation by screwing it on the manual sampling device, similar to a sample tube. Make sure you install it to the end of the thread.	
8.	Press the *Start* button and wait for 15 min for the protocol to complete.	
9.	If the instrument will be idle or decommissioned, leave the Washstation attached to the manual sampling device. If you want to keep on measuring, remove the Washstation and close it with a cap from a 5 mL screw-cap tube.	
10.	If the contamination persists, repeat the procedure with more replications. If it still persists, use the Cleaning Kit to decontaminate the instrument (see section 12.3).	

8.2.3 Clean manual sampling device with basic cleaning

This protocol describes how to clean the manual sampling device without the Washstation. If a Washstation is available, follow the procedure in section 8.2.2 instead.
This protocol requires sterile water.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure the manual sampling device is tightly installed as described in section 5.8.	
2.	Attach a fresh 5 mL screw-cap tube containing 2 – 5 mL sterile water to the manual sampling device.	
3.	Navigate to the *Home menu* of the BactoSense user interface.	
4.	On the action bar at the bottom, select *Manual mode* and press *Start*.	
5.	In the list of available protocols, select *Clean Optics*.	
6.	Make sure 1 replication is configured in the *Replications* column.	Configure more replications for a stronger cleaning.
7.	Press the *Next* button.	
8.	Press the *Start* button and wait for 5 min for the protocol to complete.	

	WORK STEP	ADDITIONAL INFO / IMAGES
9.	Then press the *New* button to navigate back to the protocol list. In the list of available protocols, select *Clean Sampling Device*.	
10.	Make sure 1 replication is configured in the *Replications* column.	Configure more replications for a stronger cleaning.
11.	Press the *Next* button.	
12.	Press the *Start* button and wait for 5 min for the protocol to complete.	
13.	Once the protocol is finished, remove the 5 mL screw-cap tube and discard it.	
14.	Press the *Home* button on the top left of the user interface to return to the *Home menu*.	
15.	If you want to continue with measurements, perform a Prime prior to the first measurement. The instructions can be found in section 7.7.3. If the instrument will be idle or shut off, attach a fresh sample tube to the manual sampling device.	
16.	If you face a persisting contamination, first repeat the procedure with more replications. If it still persists, use the Cleaning Kit to decontaminate the instrument (see consumables in section 12.3).	

8.2.4 Replacing online sampling device tubings

The inlet- and outlet tubings of the online sampling device must be exchanged if they show signs of damage or contamination. The required materials are the inlet and outlet tubing and two ferrules. For specifications refer to the technical information in section 3.2, and for the part numbers to section 12.3.

CAUTION!

Never use a spanner on the sampling device when attached to the BactoSense

Wear nitrile gloves when manipulating the sampling device or any other components which come in contact with the sample.

	WORK STEP	ADDITIONAL INFO / IMAGES
1.	Make sure all protocols (e.g. measurements) have terminated, or terminate them if needed.	
2.	Stop the water flow through the sampling device.	
3.	Disconnect the tubings to the water supply and drain them.	
4.	Carefully unscrew the knurled sampling device fixation ring until the sampling device can be removed.	
5.	Make sure the white sealing plug still sits tightly in the connector of the sampling device. If not, it may have remained in the BactoSense sampling device connector. In this case carefully remove it with tweezers and place it back in the sampling device.	
6.	Unscrew the nuts of the two connectors on the sampling device using a spanner.	
7.	Pull the nuts off the old tubings.	

	WORK STEP	ADDITIONAL INFO / IMAGES
8.	Discard the old tubings with ferrules.	
9.	Take the new tubings and install the nut and ferrule as illustrated. Screw the nut on the online sampling device using a clamp. Make sure the blue FEP tubing is connected to the top fluidic connector (see figure 5-5 in section 5.8).	
10.	Continue with the procedure for installing the online sampling device described in section 5.8.2.	

8.2.5 Replacement of the desiccant bag

The following procedure describes how to replace the desiccant bag. The desiccant bag is a consumable listed in section 12.3.

	WORK STEP	ADDITIONAL INFO / IMAGE
1.	Open the desiccant bag container by unscrewing the large cap on the left-hand side of the instrument.	
2.	Replace the used desiccant bag by a new one.	
3.	Close the desiccant bag container by screwing back the large cap.	

8.2.6 Replacement of the sampling device filter

The sampling device of the BactoSense contains a 25 µm filter which can be replaced by the user. The filter is a consumable listed in section 12.3.

Wear fresh, non-powdered nitrile gloves when handling the samples, sampling device, or any components which come in contact with them.

	WORK STEP	ADDITIONAL INFO / IMAGE
1.	Unscrew the sampling device from the BactoSense, as described in section 6.6.1 for the online sampling device, and 6.6.2 for the manual sampling device.	
2.	Place flat tweezers under the white plug.	
3.	Remove the white plug and mind the transparent filter disc. The filter sometimes stays inside the cavity and sometimes remains attached to the white plug.	
4.	Remove the filter and place a new one. Do not use force, let the filter sink with gravity. Do not push the filter inside with tweezers.	
5.	Re-insert the white plug. Be sure to press it until it reaches the bottom. The force of the white plug will press the filter in the right position.	
6.	Re-install the sampling device as described in section 5.7 for the manual sampling device and 5.8 for the online sampling device.	

8.2.7 Clearing of disk space

When running out of disk space, old data can be deleted.

CAUTION!

Make sure you retrieve all data from other users and your data before deleting it from the BactoSense.

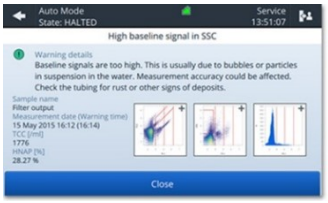
	WORK STEP
1.	Navigate to the *Home menu* in the BactoSense user interface.
2.	Press the *Maintenance* button.
3.	Press the *Delete old measurements* button. This function is only available for the *Admin* role.
4.	If available, choose one of the following measuring modes: *Auto* / *Manual*
5.	Choose the time interval for the measurements to keep. Measurements older than this will be deleted.
6.	Press *Delete measurements* to permanently delete the data.

9 Error and Warning Messages

If the instrument encounters a problem, it enters a different state, depending on the severity of the issue. There are warnings, noncritical errors and critical errors, each having different implications and requiring different actions.

9.1 Warnings

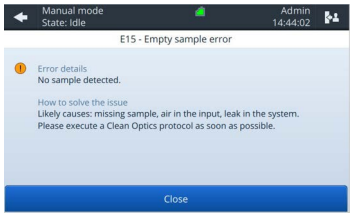
Warnings appear when unusual behavior is detected during an otherwise successful measurement. They can indicate reduced accuracy of the measurement results or indicate impending errors. Unlike errors, warnings do not prevent the instrument from functioning, but users should pay attention to them as they can indicate sources of inaccuracies.

WARNING	IMAGE
When unusual behavior is detected, a warning is shown next to the measurement results.	

The warning messages are described in detail in the Reference Handbook.

9.2 Non-critical errors

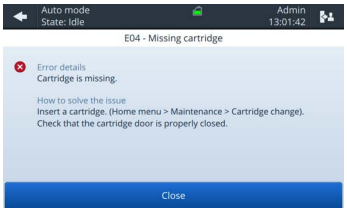
Non-critical errors prevent a measurement from terminating successfully, but do not prevent the instrument from running another measurement afterwards. These errors do not require human intervention. Some non-critical errors are promoted to critical errors if they repeat multiple times.

NON-CRITICAL ERRORS	IMAGE
The protocol stops. The cause of the error is usually fixed by repeating the analysis or waiting. • Another measurement can immediately be started. If it completes successfully, the error state is cleared. • More information on the error can be found in the error log, see section 9.4.	

Non-critical error messages are described in detail in the Reference Handbook.

9.3 Critical errors

Critical errors interrupt the workflows of the instrument and require human intervention. The error source needs to be eliminated and the instrument set into running conditions again. Critical errors need to be cleared.

CRITICAL ERRORS	IMAGE
If a critical error occurs during operation, it has the following effects: • The measurement is canceled. • The instrument goes into critical error state, and manual intervention is needed before any new protocol can be launched. • The cause of the error must be solved by an operator, then the errors can be manually cleared from the Error log, as described in section 9.4 and 9.5.	

Critical error messages are described in detail in the Reference Handbook.

9.4 Error and warning logs

The error and warning log views can be accessed separately through the user interface **Home menu** when pressing the **Logs** button.

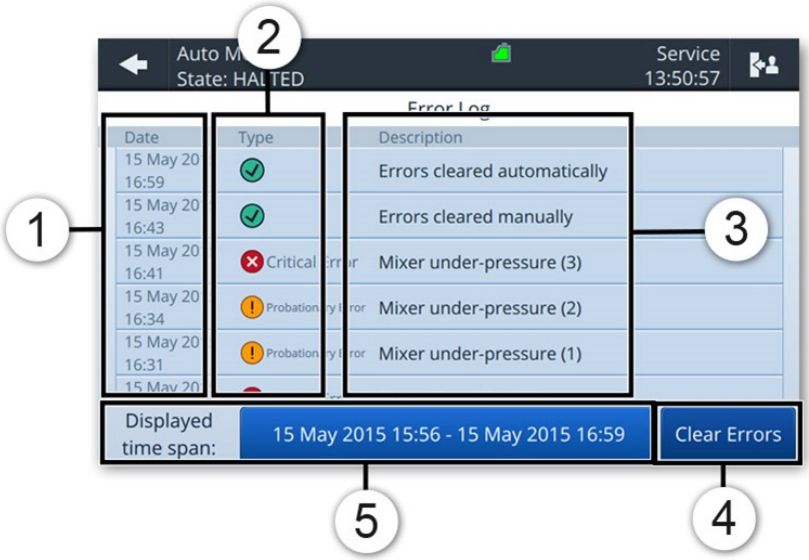


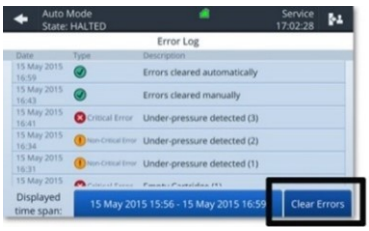
Figure 9-1 : Error logs

①	Date and time of the event	②	Type of the event
			Critical error
			Non-critical error
			Errors cleared
③	Short description of the error or event	④	Button to manually clear errors (only available for **Admin** and **Service** users)
⑤	Date range of displayed events. Click to change the range.		

Selecting any event on the list leads to a page with more information on the cause of the error and recommended resolution steps.

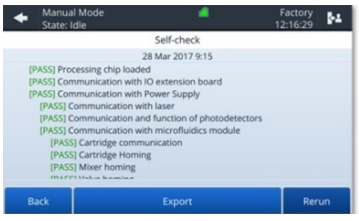
9.5 Clear errors

Critical errors must be cleared manually. Make sure to first solve the origin of the problem, then manually clear the error with the steps below. Please note that the procedure below does not automatically solve the root cause of the error.

	WORK STEP	ADDITIONAL INFO / IMAGE
1.	Navigate to the **Home menu** of the BactoSense user interface.	
2.	Press the **Logs** button, and then the **Error log** button	
3.	Make sure you have resolved the problem leading to the displayed error(s). Then press the **Clear Errors** button.	
4.	Cleared errors appear with grey error symbols and an “Errors cleared” event is added to the log. The instrument is ready to analyze again.	

9.6 Automatic self-check

The **automatic self-check** tool checks that each component of the BactoSense is functioning correctly and identifies those that are not. It can be used to identify problems with the instrument.

	WORK STEP	ADDITIONAL INFO / IMAGE
1.	Navigate to the **home menu** of the BactoSense user interface.	
2.	Press the **Maintenance** button.	
3.	Press the **Self-check** button.	
4.	Press the **Run** or **Rerun** button to start the self-check. ⓘ Once execution has terminated, the instrument shows a list of all tests, with a green PASS or red FAIL indicator. Some tests may be skipped: if the system cannot communicate with the cartridge, all the tests that require cartridge communication are skipped.	

10 Troubleshooting

The following table provides an overview of issues and resolutions. If the issue cannot be resolved, please contact your local service representative or bNovate customer service. Contact information for bNovate customer service can be found in section 13.1.

Table 10-1 Troubleshooting actions

OBSERVATION	RESOLUTION
Nothing on display	• Check whether the BactoSense is connected to power and switched on.
Error message on the display	• Respond to the error message as described in the chapter 9 about Error Messages in this manual. Additional information can be found in the Reference Handbook in chapter 7.
The measurements appear to be wrong	• Ensure that the sample and operating conditions described in section 3.2 are met. • Check whether the instrument is correctly mounted according to chapter 5. • Ensure that the servicing duties have been performed according to the servicing schedules described in sections 8.1 and 8.2. • Perform an instrument cleaning using the Cleaning Kit. • Perform an instrument validation using the Validation Kit.

11 Storage, Transport and Disposal

11.1 Storage

11.1.1 Storage of the BactoSense

Preparations

	WORK STEP
1.	Make sure the manual sampling device is installed
2.	Perform a *Clean sampling device with Washstation* process, as described in section 8.2.2. Alternatively, if no Washstation is available, follow the procedure in section 8.2.3.
3.	Leave an empty tube or empty Washstation attached to the manual sampling device.
4.	Follow the cartridge removal procedure in section 6.5.5 to safely remove the cartridge. Note: Cartridge removal is not required if the storage conditions of the cartridge can also be fulfilled.
5.	Make sure the USB-, Ethernet and power sockets are covered with the attached covers.
6.	Pack the BactoSense with attached manual sampling device in its standard cardboard box with foam inserts, or in the transport case.

Storage
Store the BactoSense according to the following storage conditions:

- Temperature between 10 °C and 30 °C
- Relative humidity between 10 % and 70 %
- Non-vibrating, non-corrosive, dark and clean environment

Re-installation
After storage, follow the general installation instructions described in chapter 5.

If the BactoSense has been stored for more than one month, perform an instrument validation using the Validation Kit before the first measurement to ensure proper functioning.

11.1.2 Storage of the sampling devices

Note: The BactoSense should always have a sampling device installed. This procedure refers to storage of additional sampling devices if available.

Preparations

	WORK STEP
1.	Remove and clean the sampling device according to the instructions in section 6.6.2 (manual sampling device) or section 6.6.1 (online sampling device). If the tubings of the online sampling device show any signs of contamination or damage, do not reuse and discard.
2.	Wear gloves and pack the clean sampling device into a clean and dry plastic bag.

Storage

Store the sampling device according to the following storage conditions:

- Temperature between 5 °C and 40 °C
- Relative humidity between 10 % and 70 %
- Non-vibrating, non-corrosive, dark and clean environment

Re-installation

After storage, follow the general installation instructions in section 5.7 (manual sampling device) or 5.8 (online sampling device).

11.1.3 Storage of the cartridge

WARNING!

Wear protective gloves and goggles. Leaking chemicals can cause skin irritation, eye damage and other health hazards.

Make sure the liquid connectors of the cartridge are all tightly sealed with the respective plugs.

Check the expiration date of the cartridge. The expiration date is printed on the handle of the cartridge in the format Day/Month/Year, or can be found on the *System info* page on the user interface, accessible from the *Home menu*.

Preparations

	WORK STEP
1.	Wear protective gloves and goggles.
2.	Follow the cartridge removal procedure in section 6.5.5 to safely remove the cartridge from the BactoSense.
3.	Make sure the liquid connectors of the cartridge are all tightly sealed with the respective plugs.
4.	Pack the cartridge in its original cardboard box with foam inserts.

Storage

Store the cartridge according to the following storage conditions:

- Temperature between 15 °C and 25 °C, ideally 15 °C
- Relative humidity between 20 % and 60 %
- Non-vibrating, non-corrosive, dark and clean environment

Re-installation

After storage, follow the general installation instructions in section 6.5.6.

11.2 Transport

11.2.1 Transport of the BactoSense

Refer to the following transportation instructions to safely transport the BactoSense. Note that the storage conditions for humidity and temperature listed in section 3.2 and 11.1.1 apply. Make sure the manual sampling device is installed for transportation.

Table 11-1 BactoSense transportation instructions

MODE	INSTRUCTIONS
Standard shipping	Follow the cartridge change procedure to safely remove the cartridge. Pack BactoSense and cartridge in their standard cardboard boxes with foam inserts. Ship on a pallet or skid. Perform instrument validation using the bNovate *Validation Kit* when re-installing.
Long distance by car or Uneven road by car	Follow the cartridge change procedure to safely remove the cartridge. Pack BactoSense and cartridge in their standard cardboard boxes with foam inserts, or alternatively use the transport case (see accessories in section 12.2). Perform instrument validation using the bNovate *Validation Kit* when re-installing.
Short distance by car, even road, instrument laying on its backside	Follow the cartridge change procedure to safely remove the cartridge. Transport the BactoSense in the transport case (see accessories in section 12.2).
Short distance by car, even road, instrument in upright position	Transport in the transport case (see accessories in section 12.2), without removing the cartridge. Perform a *Fill Tubing* process after switching on the instrument again, see section 7.7.1.
Short distance within facility, instrument in upright position	Transport in the transport case (see accessories in section 12.2) or by hand, without removing the cartridge. Perform a *Fill Tubing* process after switching on the instrument again, see section 7.7.1.

11.2.2 Transport of the cartridge

Preparations

	WORK STEP
1.	Wear protective gloves and goggles
2.	Follow the cartridge removal in section 6.5.5 procedure to safely remove the cartridge.
3.	Make sure the liquid connectors of the cartridge are all tightly sealed with the respective plugs.
4.	Pack the cartridge in its original cardboard box with foam inserts, or in the transport case if available.

Transportation

Transport the cartridge in normal horizontal position. The cartridge storage conditions listed in section 3.2 apply.

Re-installation

After transport, follow the general installation instructions in section 6.5.6.

11.3 Returning the BactoSense or accessories

In case you return the BactoSense or accessories to bNovate or a distribution partner, please follow the instructions in this section.

WARNING!

Do not return contaminated materials

Instruments that have come into contact with hazardous media must not be sent without prior decontamination and accompanied certificate of decontamination. Contact support@bnovate.com for more information.

CAUTION!

Adhere to shipping instructions

bNovate does not take responsibility for deliveries which do not comply with our shipping regulations and will charge for repairs. Please contact support@bnovate.com if the original packaging is no longer available or you need help with packaging.

11.3.1 Returning the BactoSense

Preparations

	WORK STEP
1.	If the instrument has been exposed to hazardous substances, fully decontaminate it and provide a certificate of decontamination.
2.	Make sure the manual sampling device is installed.
3.	Perform a *Clean sampling device with Washstation* process, as described in section 8.2.2. Alternatively, if no Washstation is available, follow the procedure in section 8.2.3.
4.	Leave an empty tube or empty Washstation attached to the manual sampling device
5.	Follow the cartridge removal procedure in section 6.5.5 to safely remove the cartridge.
6.	Pack the BactoSense with manual sampling device but without cartridge in its standard cardboard box and fixate the box on a pallet or skid.
7.	If you ship additional items, label them with the serial number of the BactoSense.
8.	Indicate with stickers that the contents of the parcels are fragile, shall be kept dry, and shall only be transported in the indicated orientation.

Return
Ship the BactoSense to bNovate or distribution partner, adhering to the general storage temperature and humidity requirements listed in section 3.2 and 11.1.1.

11.3.2 Returning a cartridge for refill

Preparations

	WORK STEP
1.	If the cartridge has been exposed to hazardous substances, fully decontaminate it and provide a certificate of decontamination.
2.	Follow the cartridge removal procedure in section 6.5.5 to safely remove the cartridge.
3.	Pack the cartridge in its standard cardboard box.
4.	Indicate with stickers that the contents of the parcels are fragile, shall be kept dry, and shall only be transported in the indicated orientation.

Return for Refill
Ship the cartridge to bNovate, adhering to the general storage temperature and humidity requirements listed in section 3.2 and 11.1.3.

11.4 Recycling and disposal

The disposal of the BactoSense, accessories and consumables has to be carried out in compliance with regional statutory regulations.
The BactoSense contains no environmentally damaging sources of radiation.

Table 11-2 Materials and their recycling or disposal

CATEGORY	MATERIALS	DISPOSAL POSSIBILITIES
Packaging	Cardboard, wood, paper	Reuse as packaging material or dispose for recycling
	Protective foils, polystyrene shells	Reuse as packaging material or dispose for recycling
Electronics	Printed circuit boards, electro-mechanical components	To be disposed as electronic waste. Follow the local legislation.
Optics	Glass, aluminum	Recycling via centers for recycling glass and waste metal
Housing	Styrene butadiene painted, stainless steel, polystyrene painted, Silica beads (Desiccant bag), filters	Local disposal center
Cartridge	CAUTION! Do not disassemble nor dispose the cartridge.	Prepare the cartridge according to section 6.5.5 and return the cartridge with a declaration to bNovate according to section 11.3.2.

12 Supply Scope, Accessories and Consumables

12.1 BactoSense

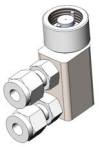
Table 12-1 BactoSense instrument

ART. NO.	NAME	IMAGE
200001	BactoSense Rapid Bacterial Monitoring System with packaging, certificates, screw-cap tubes, manual sampling device, power supply.	

12.2 Accessories

Accessories can be ordered upon need, for example if you need spare parts. bNovate Technologies recommends to order a second cartridge with your instrument in order to have a replacement cartridge when required.

Table 12-2 Accessories for the BactoSense

ART. NO.	NAME	IMAGE
200048 200049 200050	Power Supply Unit 200048 CH plug 200049 EU plug 200050 UK plug	
200017	Cartridge TCC	
200053	Cartridge ICC	
200135	Instruction Manual BactoSense English	
200006	Manual sampling device (included in 200001)	
200007	Online sampling device	
200008	Transport Box BactoSense	
200009	External IO-Box BactoSense	

ART. NO.	NAME	IMAGE
200071	Modbus TCP	
100173	Washstation	
200131	Hex nut screwdriver, 7mm, for cartridge compartment door	

12.3 Consumables

Available consumables are listed below. They can be ordered through your local sales team.

Table 12-3 Consumables of the BactoSense

ART. NO.	NAME
200003	Screw cap tubes 5 mL, 25 pcs set
200023	Desiccant bag
200025	Set of 5 filters 316L – 25 µm for sampling device
200004	Validation Kit
200005	Cleaning Kit
200019	Refill TCC cartridge
200054	Refill ICC cartridge
200030	Inlet tubing for online sampling device
200029	Outlet tubing for online sampling device
200065	Ferrules for online sampling device

13 Contact

13.1 Contacting customer service

Should you have any questions, please contact the responsible service center in your country or region. A current list of all bNovate country representatives is available online at www.bnovate.com/distribution-partners.

Please have the following information ready when you contact a bNovate service point or customer service:

- Serial number of the BactoSense.
- Description of instrument behavior and the work steps when the problem occurred.
- Description of what you did when trying to solve the problem yourself.
- Documentation of the third-party products you use in conjunction with the BactoSense.
- Description of operation conditions (place, power supply, measured medium, temperature etc.).
- Instruction Manual and Reference Handbook.
- Export of the last measurements when the error occurred, see section 7.6.

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