
Operation Manual 160001

Inlabtec Serial Diluter UC



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1 About this manual

This manual contains a detailed instruction of the Inlabtec Serial Diluter UC and contains all information required for its safe operation and to maintain it in good working order

It is addressed to laboratory personnel and operators in particular.

Read this manual carefully before installing and running your system and note the safety precautions in chapter 3 in particular. Store the manual in the immediate vicinity of the instrument, so that it can be consulted at any time.

More information regarding the application of the Inlabtec Serial Dilution Systems (Instruction movies, background information) can be found on www.inlabtec.com.

No technical modifications may be made to the instrument without the prior written agreement of iNLABTEC AG. Unauthorized modifications may affect the system safety or result in accidents. Technical data are subject to change without notice.

This manual is copyright. Information from it may not be reproduced, distributed or used for competitive purposes.

This is a translation of the original operation manual written in German.
The manual in the other languages can be downloaded from www.inlabtec.com.

2 Quick guide

This guide provides basic information and procedures. Please be sure to observe the safety aspects outlined in Section 3.

Note: If you wish to use the Bagholder UC as an upgrade for an existing Serial Diluter UA, please follow these steps:

1. Replace the Power Adapter: Replace the power adapter of the Serial Diluter UA with the more powerful 24V/36W power adapter included with the Bagholder UC.

2. Software Update: Use the USB stick included with the Bagholder UC to perform a software update as described in Chapter 11.

Standard operation

1. Establish the electrical connections (chapter 6.3) and power on the device. The dosing arm moves to position 6 and then returns to position 1. Complete the installation of the pipette and diluent as described in chapters 6.4 and 7.1

Note: When initializing the Bagholder UC for its initial startup, the dosing arm exhibits a slow transition from the transport position to the parking position. If the dosing arm is stopped on the way to Position 6 or when returning to Position 1, remove obstacles and switch off and on the device.

2. The blue indicator blinks, indicating that new bags need to be inserted.

3. The blue indicator stays lit, indicating that fresh bags are present.

4. Swing the dosing arm forward. The first bag will be filled.

Note: The dosing arm returns to the parking position if the Serial Diluter STATUS is red or if no Serial Dilution Bags are present.

5. After filling, the blinking green LED indicates the position for sample addition.

6. Once the sample addition is detected, the green LED remains lit.

Note: Insert the pipette into the bag as straight as possible.

7. After sample addition is complete (when the pipette is no longer in the bag), mixing occurs, and the next bag is filled.

8. After mixing and filling are complete, a red LED indicates the position for sample withdrawal, and the blinking green LED indicates the position for sample addition.

9. Once the series of dilutions is complete, the dosing arm returns to the park position, and the blue LED starts blinking. Remove the bags, and the dosing arm moves to position 1, ready for the next series of dilutions.

Note: To ensure the automatic function operates reliably, it is crucial to align the bag's perforation as closely as possible with the center mark of the Bagholder (approximately +/- 3 mm).

Additional Mixing

Briefly press the + or - button under TIME [s] for additional mixing.

To change the mixing duration, hold down the + or - button under TIME [s]. Once bL is displayed, the setting is completed.

Interrupting a Dilution Series

Press ASPIRATE until the STATUS lights up green: The dosing lever returns to the park position and the blue LED starts blinking (insert new bags).

Operational Malfunctions

Check if the green LED above the power connector is lit (Section 6.3.1) and/ or consult Section 12. Turn off the device, remove the bags, and turn on the device again. Avoid wearing wristwatches or other reflective objects during work, as they can cause operational malfunctions

3 Safety

This chapter highlights out the safety concept of the instrument and contains general rules of behaviour and warnings from direct and indirect hazards concerning the use of the product. For the user's safety, all safety instructions and safety messages in the individual chapters shall be strictly observed and followed. Therefore, the manual must always be available to all persons performing the tasks described herein.

3.1 User qualification

The instrument may only be used by laboratory personnel and other persons who know by training and professional experience of the potential dangers that can develop when operating the instrument.

Untrained personnel, or persons who are currently being trained, require careful supervision by a qualified person. The present Operation Manual serves as a basis for training.

3.2 Proper use

The Inlabtec Serial Dilution Systems has been developed for the use in laboratories for microbiological analysis. It is designed for preparing dilutions with aqueous diluents.

Every other application as well as applications, which do not comply with the technical data (see section three of this manual) are considered to be improper.




The operator bears the sole risk for any damages or hazards caused by improper use.

3.3 Safety warnings and safety signals used in this manual

DANGER, WARNING, CAUTION and NOTICE are standardized signal words for identifying risk levels of hazard related to personal injury and property damage. All signal words, which are related to personal injury, are accompanied by the general safety sign.








Additional safety information symbols can be placed adjacent to a signal word and accompanying text.

For your safety it is important to read and fully understand the below table with the different signal words and their definitions!

Symbol	Signal word	Definition
	DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
	NOTICE	Indicates possible malfunctions, but no practices related to personal injury.

3.3.1 Table of supplementary safety information symbols







The below reference list incorporates all safety information symbols used in this manual and their meaning.

Symbol	Meaning
	General warning
	Electrical hazard
	Explosive gases, explosive environment
	Instrument damage
	Wear laboratory coat
	Wear protective glasses
	Wear protective gloves

3.4 Product safety

3.4.1 Product related hazards

Pay attention to the following safety notices:

	Warning
	Death or serious injuries by use in explosive environments. <ul style="list-style-type: none"> Do not operate the instrument in explosive environments Do not operate the instrument with liquids that might generate explosive fumes
	
	Electrical hazard
	Risk of instrument short-circuits and damage by liquids. <ul style="list-style-type: none"> Do not spill liquids over the instrument or its component parts Wipe off any liquids instantly Ensure a safe positioning of the flask containing the diluent Do not move the instrument when it is loaded with liquid
	
	Wear protective glasses and laboratory coat
	Danger of liquid splashes due to damaged or loose tubes. <ul style="list-style-type: none"> Always wear protective glasses (see general hazards)
	

3.4.2 General hazards



Warning

While handling liquid filled flasks there is always the danger of spilling of liquids or breaking of flasks.

- Always wear personal protective equipment appropriate to the liquids handled.



3.5 General safety measures

3.5.1 Responsibility of the operator

The head of laboratory is responsible for training his personnel. The operator shall inform the manufacturer without delay of any safety-related incidents which might occur during operation of the instrument.

Legal regulations, such as local, state and federal laws applying to the instrument must be strictly followed.

3.5.2 Maintenance and care

The operator is responsible for ensuring that the instrument is operated in proper condition only, and that maintenance, service, and repair jobs are performed with care and on schedule, and by authorized personnel only.

3.5.3 Spare parts

To assure good system performance and reliability use only genuine consumables and genuine spare parts for maintenance. Exceptions are noted in the operations manual.

3.5.4 Modifications

Modifications to the instrument are only permitted after prior consultation and with the written approval of the manufacturer. The manufacturer will decline any claim resulting from unauthorized modifications.

4 Technical data

This chapter introduces the reader to the instrument specifications. It contains the scope of delivery, technical data, requirements and performance data.

4.1 Scope of delivery

Number/ Description	Article number	Illustration
1x Serial Diluter UA incl. external power supply	160000	
1x Serial Dilution Bags	100101	
1x Tubing Set, silicone, incl. 2x caps, autoclavable	100010	
1x Dispensing Nozzle UA/UC, PEEK and stainless steel, autoclavable	140011	
1x Connector Cap GL 45 cpl, with PTFE sterile filter 0.2 µm, Ø 25 mm, 2 tube connections for 3 mm ID (inner diameter) in PVDF, 300 mm intake silicone tube, silicone cap, fully autoclavable	100020	

1x Bag Shell	100030
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1x Serological pipette, 10 ml	
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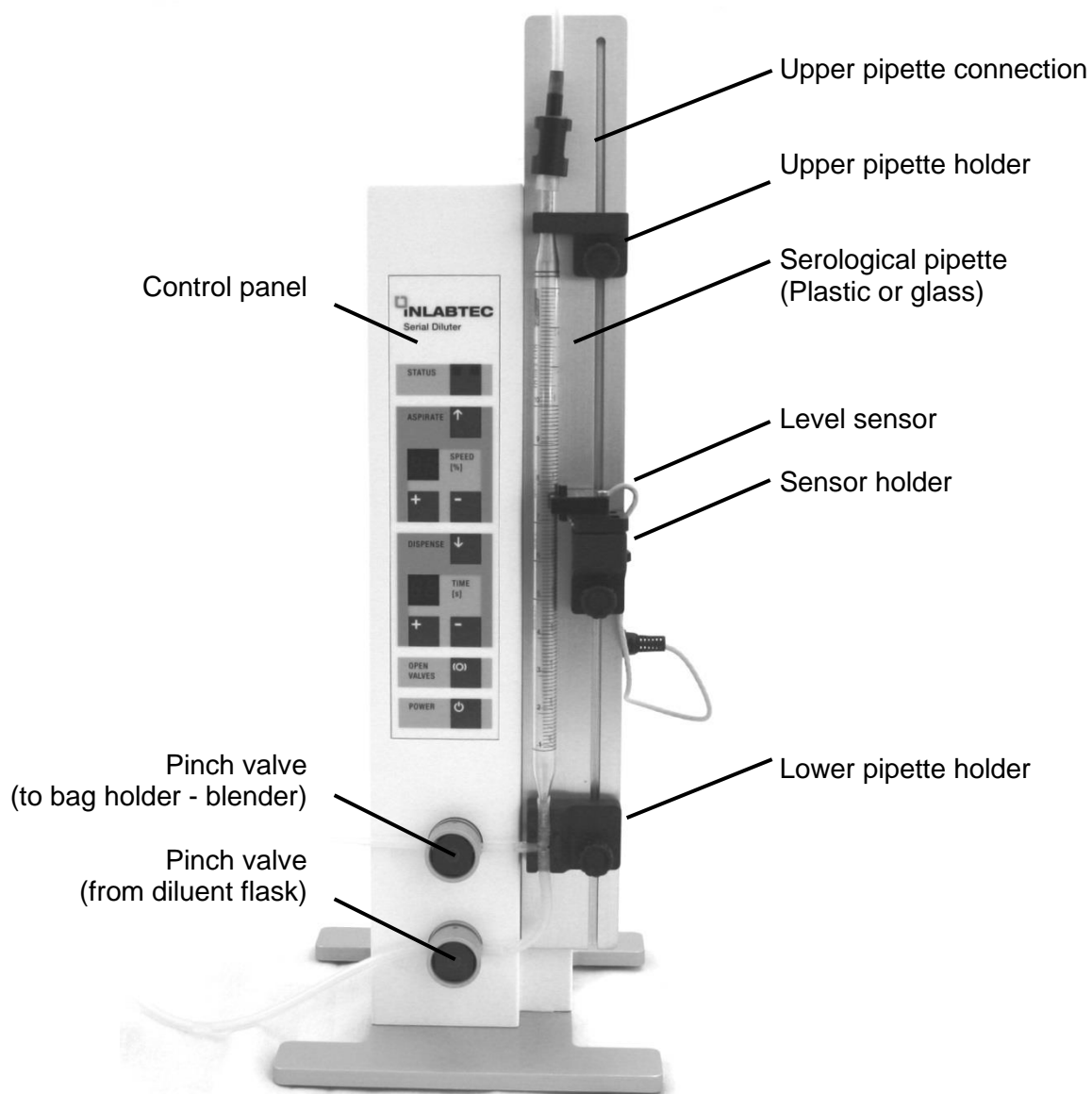


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For detailed information on the listed products see www.inlabtec.com.

4.2 Overview Operation

4.2.1 Front



4.2.2 Functions control panel

STATUS

green: instrument ready
green flashing: instrument in operation.
red: instrument not ready or malfunction

ASPIRATE

Press and hold: Fills the pipette until the set level is reached, at which point the STATUS indicator turns green, and the dilution series will be interrupted. The dispensing arm pivots to the parking position and the blue LED on the bag holder flashes.

Release the key before STATUS is green: Filling stops and the STATUS lights up red.

SPEED [%]

Aspiration speed.
Adjustable with key + and key – from 25 to 99 %.

DISPENSE

Key inactive with Serial Diluter UC, as dispensing is performed automatically in the process.

TIME [s]

Alternating display of bL for mixer (blender) and the mixer operating time in seconds.
During mixing, the time is displayed as a countdown.

Briefly pressing the + or - key: Mixer is started.

Pressing the + or - key for 1 second: Mixing time can be set between 0.5 - 99 s with + / -.

A mixing time of 3 s is sufficient for 1:10 diluted samples (Stomacher) and corresponds to the factory setting.

OPEN VALVES

Opening and closing of the pinch valves for inserting and removing the silicone tubes as well as draining the aspiration tube (purge).

1st Press: pinch valves open for inserting and removing the silicone tubes and the display SPEED [%] shows PU for purge. To purge tubing, press ASPIRATE to deliver liquid in aspiration tube back into bottle. Afterwards tubing set can be removed without dripping.

2st Press: pinch valves close.

POWER

Switching on and off.



4.2.3 Functions Bag Holder UC

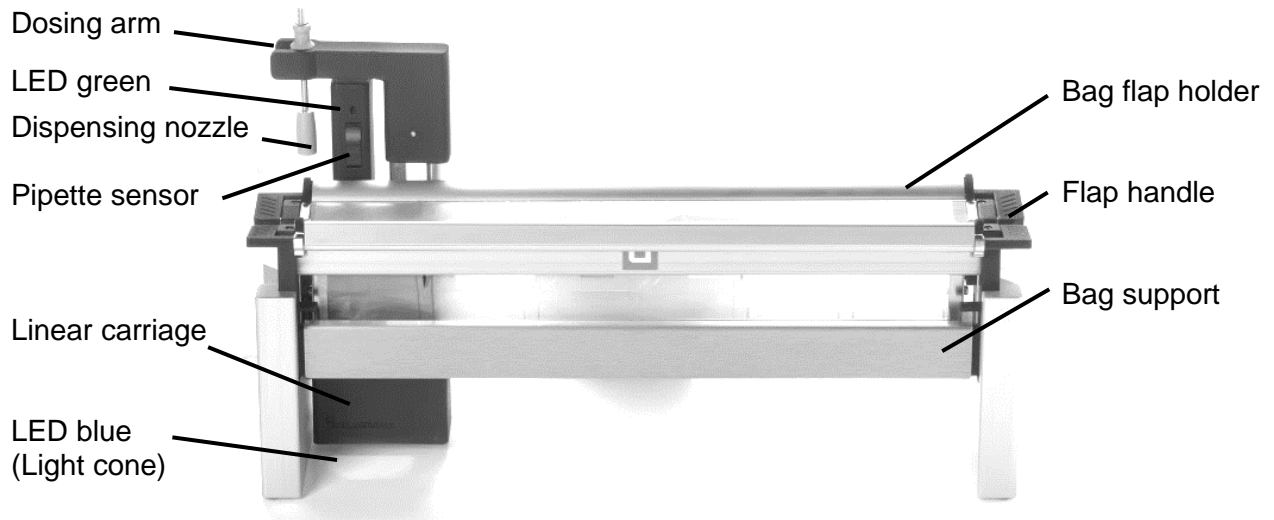


Figure: Bag Holder UC with dosing arm in the parking position.

In the Bag Holder UC, the Serial Dilution Bags are opened with the flap handles and fixed in place by the two bag tab holders. When fresh Serial Dilution Bags are present in the Bag Holder, the LED remains constantly blue. By pivoting the dosing arm from the parking position (dosing arm parallel to bag flap holders) forward, the first bag is filled, and the LED blinks green. Once the sample addition is detected by the pipette sensor, the LED remains green constant. Upon completion of the sample addition, the sample is automatically mixed, while simultaneously the next bag is precisely filled.

The bag containing the diluted sample is then illuminated in red, while the blinking green LED indicates the opening for the next sample addition.

Demo video on www.inlabtec.com

4.3 Specifications

Size Diluter (WxDxH)	175 x 180 x 480	mm
Holder – Blender UC	433 x 146 x 241	mm
Minimal footprint UC	450 x 370	mm
Weight Dispenser	3.0	kg
Bag Holder UC	3.0	kg
Voltage	24	VDC
Max. power consumption	36	Watt
Mains connection	via double insulated external power supply 2-pole (P,N) connectors US, GB, EU, AU and CN included	
Mains voltage/ frequency	100-240V ± 10 %/ 50 – 60 Hz	
Environmental conditions	for indoor use only	
Operation		
Temperature	10 – 40°C	
Altitude	up to maximum 2000 m.s.l.	
Humidity	Maximum relative humidity 80 % for temperatures up to 31°C, and then linearly decreasing to 50 % at 40°C.	
Pollution degree	2	
Installation category	II	
Degree of protection	IP 21	
Diluents	aqueous solutions, no highly acidic or basic solutions, no organic solvents	
Pipette diameter	8 – 15 mm	
Pipette length	150 – 350 mm	
Dispensing quantity	1 – 25 ml, depending on the pipette used	
Dispensing accuracy (without calibration i.e., accuracy determined by the pipette scale, see chap. 10)	with 10 ml graduated pipette, class A: ± 0.5 % with 10 ml graduated pipette, class B: ± 1 % with serological pipette, polystyrene (PS): ± 2 %	
Random error	≤ 0.5 %	
Bagmixer	Paddle type mixer with fix speed, stainless steel Mixing time: 0.5 s to 99 s (Default setting: 3.0 s)	

5 Description of function

The Inlabtec Serial Diluter UC has been developed for the use in microbiological laboratories. It is designed for preparing serial dilutions for viable cell counts and conforms to ISO Standard 6887-1.

The existing test tubes are replaced by sterile packaged polyethylene bags – the Inlabtec Serial Dilution Bags. These bags are provided as single-use consumables and can be taken out from the box depending on the required number of dilution steps. The addition of the dilution liquid as well as the mixing with the sample are performed automatically in the Inlabtec Serial Diluter UC.

To automatically provide the required volume of diluent, the Serial Diluter uses a standard 10 ml pipette. The needed volume is adjusted using an optical IR-sensor which sits adjacent to the pipette and is positioned at the level required (typically 9ml). The volume accuracy is thus determined by the accuracy of the pipette used.

Once the green status light indicates that the Serial Diluter is ready for operation, and the blue LED on the Bag Holder remains steadily lit, the first bag is filled as soon as the dosing arm is moved forward from the parking position. Subsequently, the green LED starts blinking to indicate the opening for sample addition. The green LED remains lit steadily once the sample addition is carried out.

Upon completion of the sample addition, automatic mixing of the sample takes place, while simultaneously the next bag is precisely filled. The diluted sample is indicated by red light, while the blinking green LED indicates the opening for the next sample addition. For storage and disposal, the bags are placed into the Inlabtec Bagshell.

For aspirating and dispensing of probes, any kind of pipette can be used.

A more detailed description of the process can be found in chapter 7.2.

Demo videos on www.inlabtec.com

6 Installation

6.1 Preparation

To prepare serial dilutions for viable cell counts a sterile diluent must be used. All components in contact with the diluent must be sterilised also.

6.1.1 Sterilising the diluent

Put the connector cap GL 45 (included) on a flask with a GL45 thread (e.g., Duran), filled with the diluent and tighten the cap only lightly, so that a gap remains between flask and cap to allow pressure equalisation. This prevents liquid pressed out during autoclaving via the connecting tubes.



Notice

If there is no gap between flask and cap liquid pressed out can get into the autoclave. This can cause damage to the autoclave.



Pack the loosely mounted connector cap in aluminium foil and autoclave the flask.

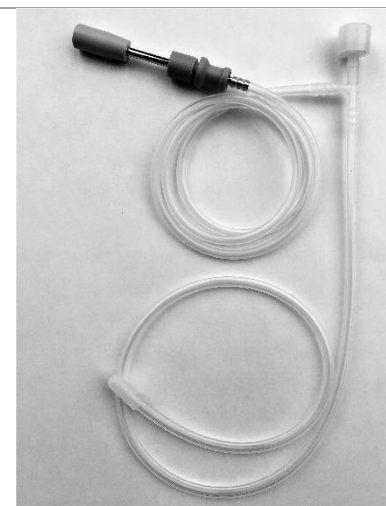


After autoclaving tighten the connector cap so the gas exchange is possible via the 0.2 µm PTFE sterile filter only.



6.1.2 Sterilising tubing set and dispensing nozzle

Connect the dispensing nozzle with the tube connected right-angled to the pipette connection. The end of the intake tube and the short pipette connection are sealed with the enclosed silicone caps.



The tubing set and connected dispensing nozzle are autoclaved in a suitable bag. Tip: Dispensing nozzle can be packed in aluminium foil to reduce the contamination during unpacking.

Notice

Tubing set and dispensing nozzle must be free from diluent residues. Sodium chloride and other components may cause corrosion of the dispensing nozzle over time by steam sterilization, despite the use of a stainless steel. Rinse tubing set and dispensing nozzle with water before autoclavation.



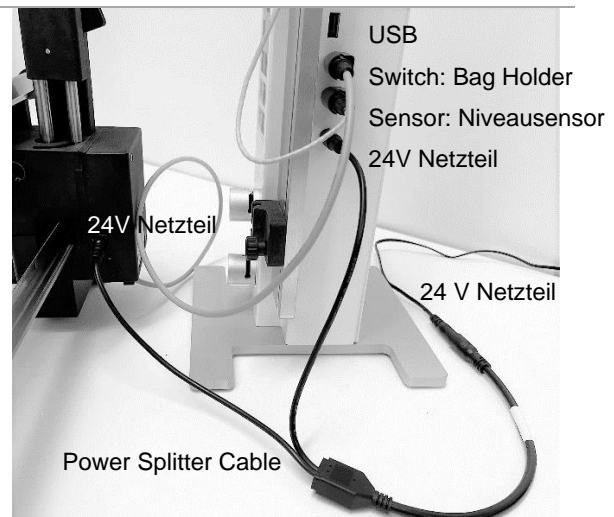
6.2 Installation site

Place the instrument on a stable, horizontal work surface readily accessible for handling and with a good view of the display. Remove the two rubber bands on the bag holder that secure the bag holder during transport.

6.3 Electrical connections

In addition to the power supply the level sensor and bag holder must be connected prior to working.

1. USB socket: For software update (see Chapter 10).
2. Switch socket: Bag Holder
3. Sensor socket: Level sensor Serial Diluter.
4. 24V DC socket: 24V plug from 24V/ 36W power supply.
5. DC 24V Bagholder: via Power Splitter Cable from 24V/ 36W power supply.



The mains circuit must provide the voltage that is given on the type plate of the plug in power supply (100 – 240 VAC, 50 – 60 Hz) and be equipped with adequate fusage and electrical safety measures.



Notice

Risk of instrument damage by wrong mains supply.

- External mains supply must meet the voltage given on the type plate
- Additional electrical safety measures such as residual current breakers may be necessary to meet local laws and regulations!

6.3.1 Checking electrical connections

Check the electrical installation before proceeding with the commissioning of the Serial Diluter.

1. Press the POWER button. If the device is being powered on for the first time, the dosing arm will move slowly to the park position.

After each power-up, the linear carriage moves to Position 6 (far right) and then returns to Position 1 to check the travel path.

Blue LED light on the Bag Holder blinks (blue light cone on the lab bench).

If the linear carriage doesn't move, check if the Bag Holder is correctly plugged into the Serial Diluter

Check if the green LED on the Bag Holder UC is lit (arrow): Power supply is present.

2. Use your finger to cover the detection zone of the level sensor, and a red LED on the sensor will illuminate (arrow). If this test cannot be successfully performed, check if the level sensor is correctly plugged into the Serial Diluter.

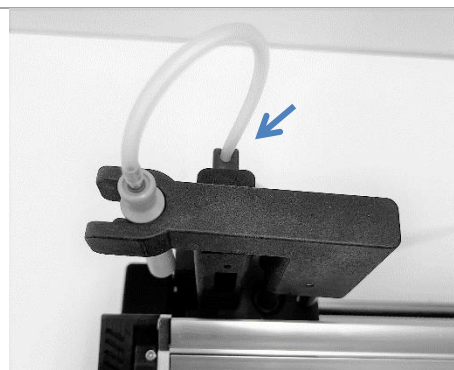


Notice

When initializing the Bagholder UC for its initial startup, the dosing arm exhibits a slow transition from the transport position to the parking position. If the dosing arm is stopped on the way to Position 6 or when returning to Position 1, remove obstacles and switch off and on the device.

6.4 Assembly tubing set and graduated pipette

Insert the dispensing nozzle. Fix the tube in the holder on the back side (arrow).



Insert T-piece tubing connector of tubing set in the lower pipette holder.

Do not remove the cap yet (arrow)!



Switch Serial Diluter on by pressing the POWER key and press the OPEN VALVES key. Two horizontal lines appear on the lower display - - and the pinch valves open. Insert the silicone tubes into the valves (Stretch tubes by pulling them apart and press them into the opening on top of the valves) and after, press OPEN VALVES again to close the pinch valves.



Connect the tube running through the lower valve to the diluter flask.

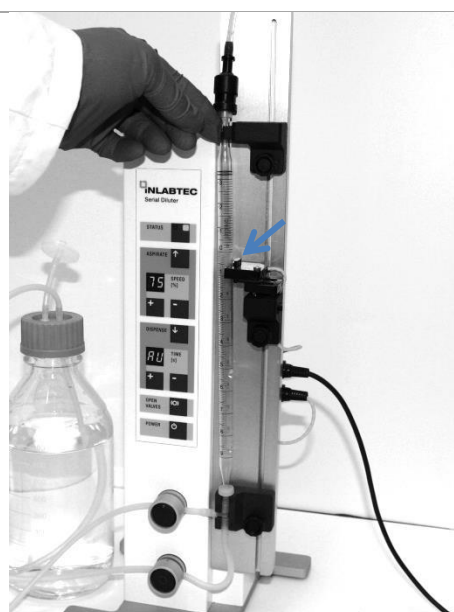


Remove the cap from the T-piece and insert a sterile graduated pipette.





Connect the upper pipette connection with the pipette.



Bring the upper pipette holder by releasing the locking screw to the height of the connecting piece of the pipette (lowest diameter of the pipette). Snap the pipette laterally into place and check whether the optical sensor touches the pipette (arrow).

7 Operation

7.1 Adjusting dosing volume

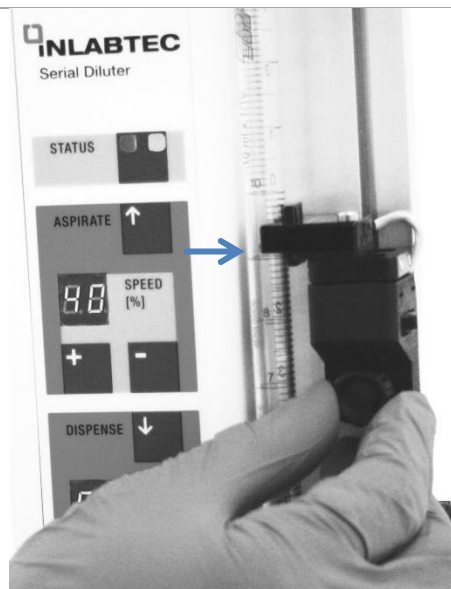
Adjust the desired amount to be dispensed by setting the level sensor along the graduated pipette. The lower edge of the sensor shows the approximate level inside the pipette (arrow). Tighten the clamping screw to fix the sensor and press **ASPIRATE** until the **STATUS** lights up green and the set volume is reached. The device is ready for dispensing and mixing.



Notice

In order for the optical sensor to function reliably, it must be in contact with the pipette, i.e., touch the pipette.

To ensure that the set volume is completely dispensed, all tubes must be wetted. To do this, dispense into a bag without using it for dilution.



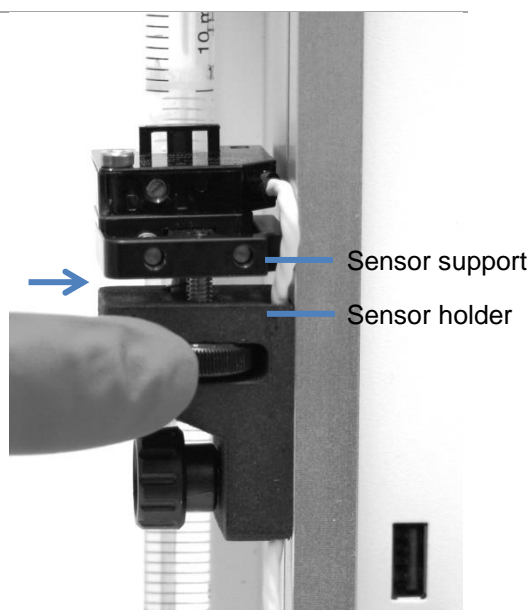
If the level inside the graduated pipette differs from the level required it can be fine tuned by turning the knurled nut at the side of the sensor holder.

After fine tuning the sensor position refill the pipette by pressing **ASPIRATE** until the **STATUS** lights up green and the set volume is reached.



Notice

The adjusting range for fine tuning the level is limited. Make sure that the distance between sensor support and sensor holder (Arrow) is approx. 3 mm before setting the sensor along the graduated pipette.



To check the adjusted dosing volume, see chap. 10 Verification of dispensed volume.



Notice

To form a meniscus in the pipette for an exact volume adjustment, the diluent aspirated into the pipette must be able to flow back into the reservoir bottle. Because of that, make sure that the level of the liquid in the reservoir bottle is not higher than the adjusted liquid level in the graduated pipette.

7.2 Serial Dilution Process

Before you can conduct a dilution series, the STATUS on the Serial Diluter must remain consistently green. This indicates that the diluent is correctly connected to the device and the desired volume is set in the pipette. The bag holder flashes blue to indicate that fresh Serial Dilution Bags can be inserted.

Pull the required number of Dilution Bags (1 to 6) corresponding to the number of dilution steps from the box. The perforation of the last bag should be in line with the edge of the box.



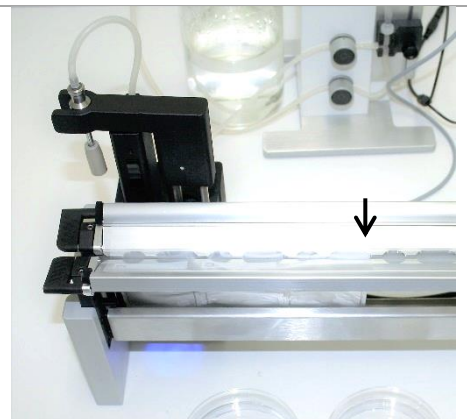
Press down the cover of the box on both sides of the recess and tear off the Dilution Bags along the perforation.

This works best if you push downwards in the perforated middle of the bag near the recess in the box.

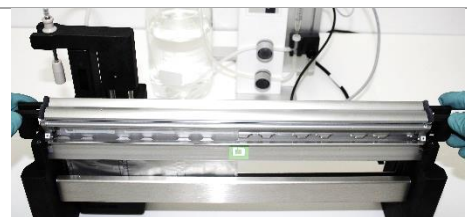


The bags taken from the box are inserted sideways into the Bag Holder. For 3 bags, align the right end of the bags with the engraved marker (center of the pipette table) (arrow). For more than 3 bags, align the right perforation seam of the 3rd bag with the engraved marker. Once the bags have been inserted, the LED light will shine steadily in blue.

Note: To ensure the automatic function operates reliably, it is crucial to align the bag's perforation as closely as possible with the center mark of the Bagholder (approximately +/- 3 mm).



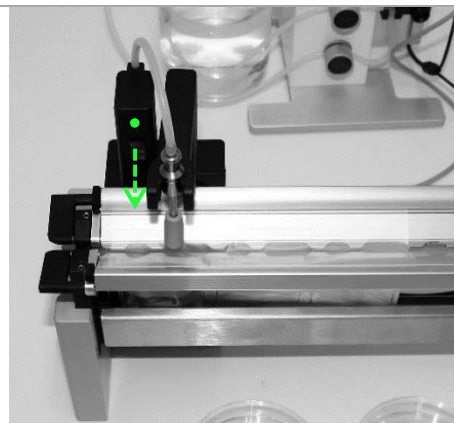
By folding and unfolding the bag flap holders using the side black handles, the bags are opened and held in the Bag Holder.



Swing the dosing arm forward for filling the first bag with the dilution solution.

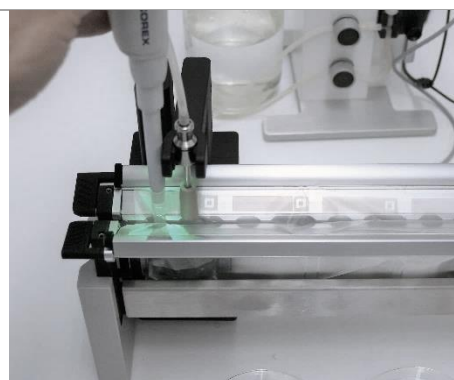
A blinking green LED light indicates the opening for adding the sample.

Note: If the STATUS on the Serial Diluter is red (device not ready), the bag cannot be filled as the dosing arm will swing back to the parking position.



Add the sample into the bag. Once the pipette is detected, the LED light shines steadily in green. Once the pipette is removed from the bag, the dosing arm automatically moves to the next bag to fill it. Meanwhile, the sample in the current bag is mixed.

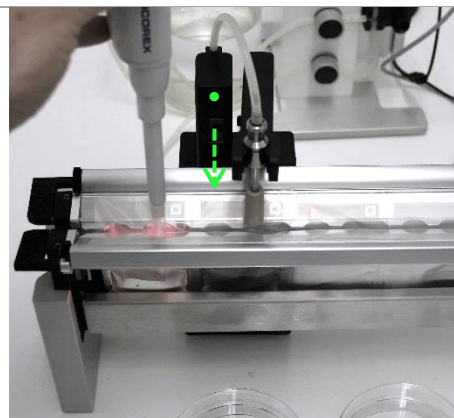
Note:
Insert the pipette with the sample as vertically as possible in front of the pipette sensor for reliable detection.



After the mixing process is complete, the bag containing the diluted sample illuminates in a reddish light. Now, extract the diluted sample – either for continuing the dilution series or for inoculating culture media.

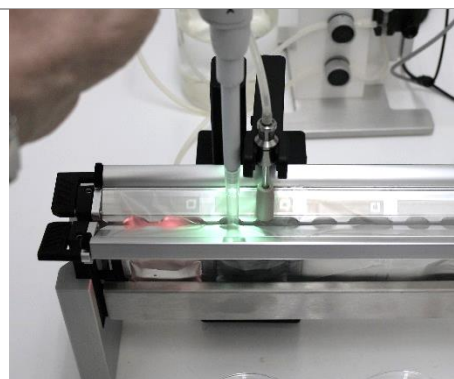
Simultaneously, a blinking green LED light indicates the opening through which the sample can be added to the next bag.

A mixing time of 3 seconds is sufficient for 1:10 Stomacher diluted samples.



Transfer the diluted sample into the next bag. Once the pipette is detected, the LED light shines steadily in green. When the pipette is removed from the bag, the dosing arm automatically moves to the next bag to fill it. Meanwhile, the sample in the current bag is mixed.

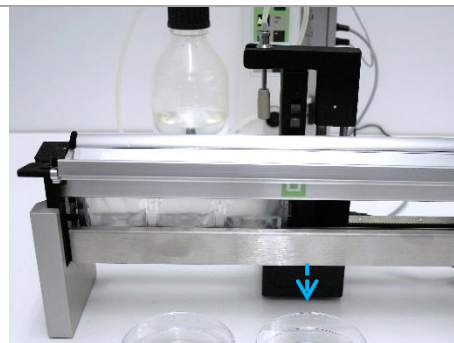
Note:
Avoid wearing wristwatches or other reflective objects during work, as they can cause operational disruptions due to sensor interference.



After the sample has been added to the final bag in the dilution series, the dosing arm pivots back to its parking position while the sample is mixed. Subsequently, a blinking blue LED light signals the end of the dilution series.

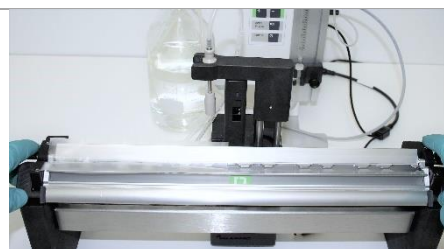
Note:

To interrupt a dilution series, for instance, if you've inserted too many bags, press the ASPIRATE button until the STATUS indicator turns green again. This action will cause the dispensing arm to return to the park position, and the blue LED will commence flashing.



To remove the bags, press down fully on the bag flap holders on both sides and carefully take out the bags.

The linear carriage returns to position 1. The Serial Diluter is ready for the next dilution series.



The bags can be transferred to the bag shell for storage and/or disposal.



See a video of the preparation of a serial dilution on www.inlabtec.com.

7.3 MixWhilePipet Mode

The Serial Diluter UC is delivered from the factory in the default Standard Mode. Conducting dilution series is carried out according to Section 7.2. To further maximize efficiency in creating dilution series, we offer the option to switch the Bag Holder UC to MixWhilePipet Mode.

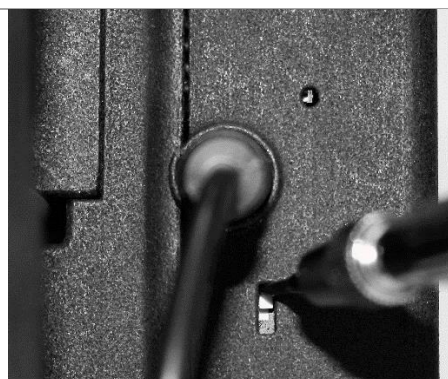
In MixWhilePipet Mode, the mixing of the sample inside the bag begins during the sample addition, eventually leading to additional time savings depending on the workflow.

To switch the operating mode, use a small screwdriver, toothpick, pipette tip, or similar tool to activate the slide switch located at the back and side of the linear carriage.

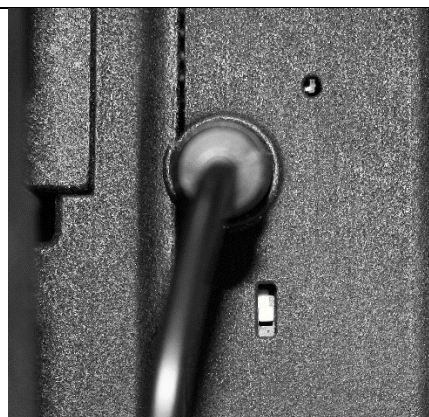
Serial Diluter UC in standard mode. Slide switch up.



Slide switch is pressed down with a suitable screwdriver.



Serial Diluter UC in MixWhilePipet mode. Slide switch down.

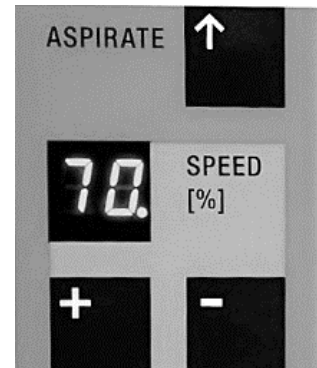


7.4 Locking control panel

It is possible to lock the settings for suction speed and mixing time to prevent unintentional changes.

To lock the control panel, press the ASPIRATE button and simultaneously press the + - button. Activation is indicated by the appearance of a decimal point in the SPEED [%] display.

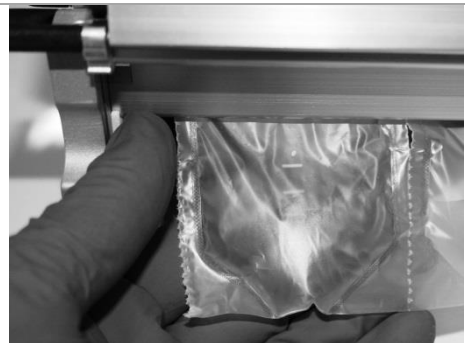
To release the lock, press the ASPIRATE button and simultaneously press the - - button.



7.5 Checking set mixing time bL

Viscous or fatty samples, e.g., cosmetic products require a longer mixing time for homogeneous dilutions than standard aqueous samples from a stomacher bag for which a mixing time of 3 seconds is usually sufficient.

To check the mixing efficiency after mixing, lift the bag support and remove it to the front (see chapter 8.4). Visually inspect bag containing homogenized sample. Insert the bag support again and correct the set mixing time bL if necessary. For viscous samples, consider testing the MixWhilePipet Mode if necessary (see Chapter 7.3).



7.6 Disposal of used Serial Dilution Bags

If the unused rest of the diluted samples don't have to be autoclaved, the bags can be emptied into the laboratory sink and the empty bags disposed into the waste bin or recycled. If the probes have to be sterilised put the filled bags into an autoclavation bag or bin and sterilize them before disposal or recycling.

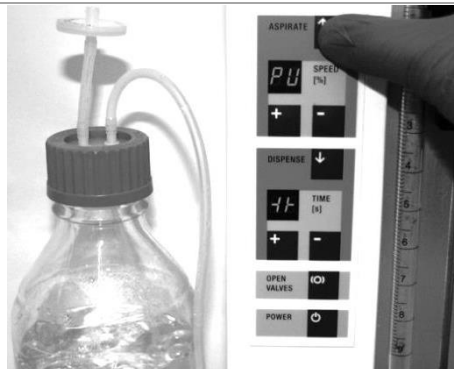
7.7 Disassembly of tubing set and pipette

Press OPEN VALVES. PU (purge) appears now in the top display SPEED [%]. Now press ASPIRATE, the liquid in the pipette and in the suction tube flows back into the bottle until only sterile air emerges (air bubbles). Then you can remove the tubing set and the pipette cleanly.



Notice

Before disassembly, first rinse the tubes and dispensing nozzle by replacing the diluent with water followed by aspirating and dispensing it 2 to 3 times. Immerse the dispensing nozzle in water so that no salt residues lead to surface corrosion during steam sterilization.



7.8 Using the diluent over several days

To reduce the effort needed to prepare the diluent you can install a larger flask containing the amount needed over a period of several days. The system remains reliably sterile since only sterile liquid is dispensed and the Serial Diluter is never in direct contact with the sample to be diluted.

As an additional precaution during longer breaks for example over weekend the dispensing nozzle can be stored in 70% ethanol.

Remove the dosing tip from the dosing arm and immerse it in a test tube, measuring cylinder, etc., containing 70% ethanol.

Allow the dispensing nozzle to dry briefly before reuse and / or wipe it outside with a sterile paper towel.

Note: It is recommended that the first dispensing after an interruption is made into an empty bag and a sample of it is used for a sterility control.



8 Cleaning

All parts can be cleaned using 70% ethanol. Electrical contacts (plugs, receptacles) must not be exposed to solvents.

8.1 Surfaces

Clean the housing with a damp cloth. Soapy water or 70% ethanol can be used as cleaning agent.

Spray the Bag Holder with 70% ethanol and let it dry. Pay attention to the linear guiding and spray these as little as possible (see Chapter 9.1.4)

8.2 Tubing

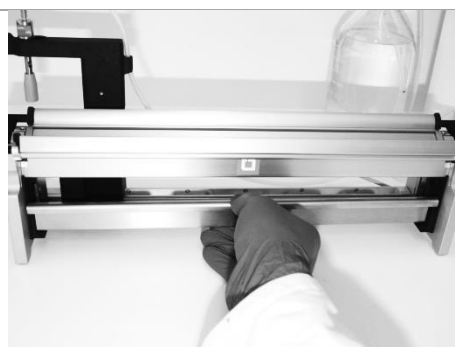
The cleaning and sterilising of tubing and pipettes is part of the preparation process and are described in chapter 6.

8.3 Adhesion gripper

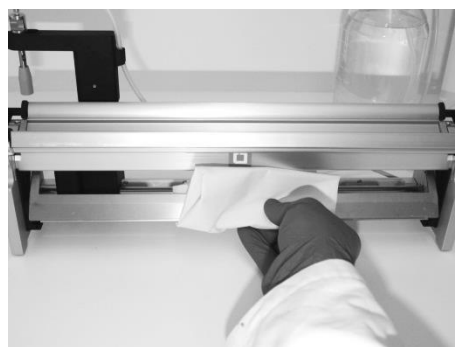
If the adhesion gripper loses its adhesion clean it cautiously using water and/or 70% ethanol to remove any dust or particles.

8.4 Bag support and mixer rocker

Lift the bag support and remove it to the front for cleaning.



For cleaning the mixer rocker can be swiveled a bit forward.



After reinstallation of the bag support, check if the mixer rocker moves freely by pressing the mixer rocker with the finger against the bag support.



Notice

The bag support must be fully inserted for proper mixing and opening of the bags.



9 Maintenance and repairs

This chapter describes the maintenance required to ensure proper function of the instrument. All tasks that require opening the housing must be performed by trained service personnel only using tools and documentation provided by Inlabtec.



Notice

In order to assure warranty and continued system performance use only genuine consumables and spare parts for any maintenance and repair work. Without written permission of the manufacturer no modifications of the Inlabtec Serial Diluter System are permitted.

9.1 Maintenance

To maintain the system in good working order the checks described in this section should be performed annually. Defective or worn-out parts must be exchanged directly to ensure safe use and optimal efficiency.

9.1.1 Cables and Tubing

Check the cables and tubing for visible defects (cracks, kinks etc.) and replace them if necessary.

9.1.2 Check sterile filter

The hydrophobic sterile filter (PTFE syringe filter) on the Serial Diluter must be replaced annually as a preventive measure or if the pipette is not filled in the usual time.



Notice

Liquid in the device can cause damage. Therefore, a hydrophobic filter must be used to prevent liquid from entering the device in case of mishandling or sensor malfunction.

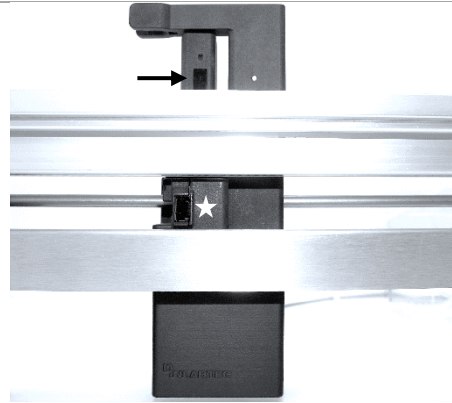


9.1.3 Optical Sensors

The addition of samples and the presence of bags in the Bag Holder are detected by optical sensors. To ensure reliable operation, it is recommended to check these sensors for any dirt or contaminants and clean the detection windows if necessary.

The optical sensor for detecting sample addition (arrow) and bag presence (star) is integrated into the linear carriage.

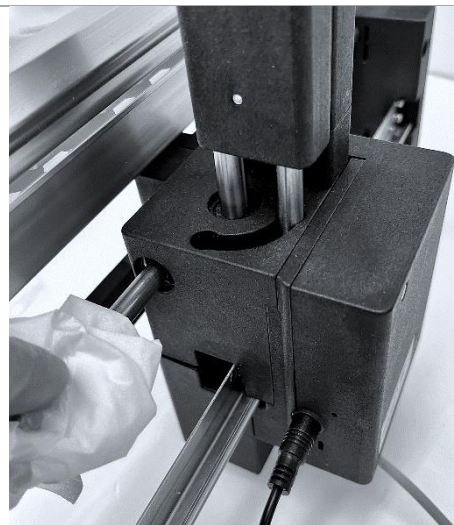
If the detection windows of both sensors become dirty, it is advised to clean them using an aqueous cleaning agent (such as 70% ethanol or window cleaner) to avoid potential operational disruptions.



9.1.4 Linear guiding

At least once a year, the linear guiding must be cleaned and greased with normal ballbearing grease/oil.

Put a little bit of grease/oil on a paper and lightly grease the guidings. A thin film of grease is enough for the lubrication and protection of the steel surface.



9.1.5 Adhesion grippers

If the adhesion grippers still don't grip the bag flaps reliably after cleaning, they must be replaced. Peel off the worn parts from the bag holder.

Note: Carefully and completely remove the gripper so that the silicone layer does not separate from the adhesive layer.

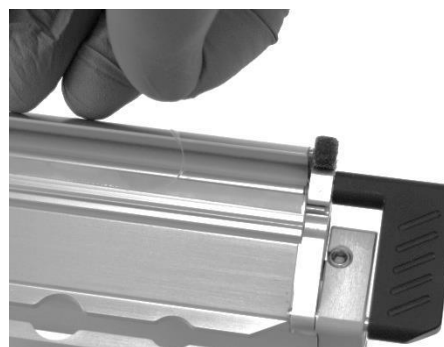
Pull the protective foil on the adhesive layer from the replacement gripper (Art.-Nr. 100015) over approx. 30 mm and attach the gripper to the Alu-holder.



Peel the protective foil off and continually press the adhesion gripper onto the bag holder.



After completely taping on the adhesion gripper peel off the protective foil from the upper surface of the gripper.



www.inlabtec.com offers a demo video on the maintenance of the adhesion grippers.

10 Verification of dispensed volume

The volume dispensed by the Serial Diluter can be easily checked with a balance. The weight difference of filled and empty Serial Dilution Bags divided by the density of the liquid corresponds to the dispensed volume.

EN ISO 7218: Microbiology of food and animal feeding stuffs – General requirements and guidance for microbiological examinations dictates a regular verification of dispensers. For decadal dilutions, check that the dispensed volume is dispensed with a maximum error of 2.2% (9 ml \pm 0.2 ml) according to DIN EN ISO 6887-1: 2017-07: Microbiology of the food chain - Preparation of test samples and production of test samples Initial dilutions and decimal dilutions for microbiological examinations - Part 1: General rules for the preparation of first dilutions and decimal dilutions.

10.1 Testing interval

Check the volume dispensed:

- before initial use
- after switching to a different production lot of 10 ml pipettes.
- after switching to a different type of 10 ml pipettes
- After adjusting the length of the tubing
- Regularly in accordance with a documented schedule

10.2 Testing conditions according to ISO

General conditions

The temperature of the laboratory must be between 15 °C and 30 °C with a relative humidity of > 50 %.

Avoid direct sunlight.

The liquid used for testing must be stored in the laboratory for at least 2 hours to guarantee a constant temperature.

Balance

Use a balance with a resolution of 0.001 g or better.

Test liquid

Distilled water (Z-factor (20°C) = 1.003) or peptone saline diluent (Z-factor (20°C) = 0.993). The test liquids must have ambient temperature.

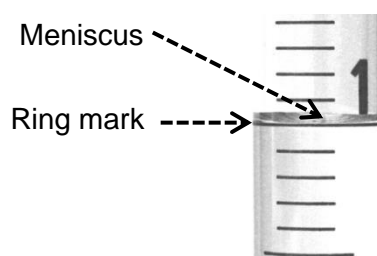
Operation manual

Follow the operation manual. Install the graduated pipette and the tubing set (see chapter 6.4) and connect the Serial Diluter with the test liquid.

10.3 Preparation of test

10.3.1 Adjust the Serial Diluter to 9 ml

9 ml are correctly adjusted when the meniscus touches the 9 ml ring mark. The operator's eye must be level with the mark. Depending on the wetting behaviour of the pipette the meniscus will more or less prominent.



Dispense at least once 9 ml into a Serial Dilution Bag, cup etc. so all surfaces in contact with the liquid are properly wetted.

10.3.2 Gravimetry of Serial Dilution Bags

Take 6 Serial Dilution Bags from the box and weigh them = total weight.

Average weight of Serial Dilution Bags = total weight / 6

10.4 Test procedure

Step	Action
1	Put 6 Serial Dilution Bags into the Bag Holder.
2	Dispense 9 ml test liquid in every one of the 6 Serial Dilution Bags. To do this, activate the pipette sensor with a pipette/finger/etc.
3	Take the filled bags from the Bag Holder and put them into a Bag Shell.
4	Carefully separate the bags from each other along the perforation.
5	Weigh every filled bag.

10.5 Evaluation of test results

Step	Action
1	Weight of test fluid [g] = Total weight [g] – average weight of Serial Dilution Bags [g]
2	Volume of test fluid [ml] = Weight of test fluid [g] * Z-Factor (reciprocal density). Z-factor water= 1.003, Z-factor peptone saline diluent = 0.993
3	Calculate average volume of testing fluid [ml]
4	Calculate inaccuracy [%]
5	Calculate standard deviation [ml]
6	Calculate imprecision P [%]
7	Calculate maximum error [%]
8	Calculate test result (see 8.2.7 assessment of test results)

Step 4:

Inaccuracy = systematic error for 9 ml

Inaccuracy [ml] = Average volume of testing fluid [ml] – 9 ml

Inaccuracy R [%] = (Inaccuracy [ml] / 9 ml) * 100%

Step 6:

Imprecision (Random measurement error) = standard deviation from mean value

Imprecision P [%] = (random measurement error [ml] / average volume of test liquid [ml]) * 100%

Step 7:

Maximum error

Calculated maximum error [%] = Inaccuracy R + (2 * imprecision P)

Step 8:

Calculate test result

Test passed according to ISO 6887-1 if maximum error ≤ 2.2 % (smaller or equal 2.2 %).

Test failed according to ISO 6887-1 if maximum error > 2.2 % (bigger than 2.2 %).

10.6 Template: Test Inlabtec Serial Diluter

Company/ Lab	INLABTEC AG/ R&D
Date	2018-08-07
Inlabtec Serial Diluter Serial No.	1402001
Examiner	EFr
Test reason	System check

Serological Pipette	
Type/ Manufacturer	94010/ TPP
LOT Nr.	20110091

Inlabtec Serial Dilution Bags	
LOT Nr.	PE131001

1 ml Pipette Tips (not relevant for Serial Diluter UA)	
Type/ Manufacturer	1000WS/ UNX
LOT Nr.	299.262.206.352

Test Liquid	
z-factor (reciprocal density) [ml/g]	1.003
Water, z-factor = 1.003	
Peptone saline diluent, z-factor = 0.993	

Weight Serial Dilution Bags	
Total weight of 6 Serial Dilution Bags [g]	1.506
Average weight per bag [g]	0.251

Measurement Serial Dilution Bag	Total Weight [g]	Weight Liquid [g]	Liquid Volume [ml]
1	9.345	9.094	9.121
2	9.286	9.035	9.062
3	9.250	8.999	9.026
4	9.329	9.078	9.105
5	9.263	9.012	9.039
6	9.261	9.010	9.037
Arithmetic average [ml]			9.065
Set value [ml]			9.000
Deviation from the set value [ml]			0.065
Relative deviation from the set value R (Inaccuracy)			0.7%
Standard deviation [ml]			0.039
Relative standard deviation P (Precision)			0.4%
Permissible error according to ISO 6887-1:2017			2.2%
Determined maximum error			1.6%
Test result			Passed

You can download the test sheet (Excel) from <http://www.inlabtec.com/ressourcen>, enter the measured values and the calculation of the results will be done automatically.

10.7 Assessment of test result

If the calculated maximum error is 2.2 % or lower for a dispensed volume of 9 ml the Serial Diluter complies with ISO 6887-1.

If the calculated maximum error is above 2.2 % for a dispensed volume of 9 ml the test has to be repeated.

If the inaccuracy, which is the systematic deviation, is greater than 1.5% for 9 ml and at the same time the imprecision is less than 0.5%, a correction of the position of the sensor on the 10 ml pipette is necessary to compensate for the measured systematic error. Afterward, the dispensed volume will fall within the allowable error limits. Repeat the test with other pipettes of the same batch number to verify if the determined systematic error applies to all pipettes with the same batch number. This way, a batch-specific target value can be determined.

If the imprecision, e.g., the random error, is > 0.5 % check the meniscus during several aspirations and dispersions. The position of the meniscus should not vary more than 50 µl between two cycles (using a 10 ml pipette). If the position of the meniscus varies more than 50 µl replace the sterile filter on the diluent bottle and repeat the test.

If the imprecision, e.g., the random error, is > 0.5 % and the position of the meniscus does not vary between cycles, check the system for leaks, cracks etc. and replace defective parts. If no leaks can be found replace the graduated pipette.

If the imprecision is still > 0.5%, then the wettability of the pipette inside is too high for a reproducible discharge of the aspirated volume, which suggests a poor pipette quality. We recommend using 10 ml pipettes from another manufacturer.

11 Software Update

Using the USB-connection on the Serial Diluter a software update can be installed.
Download the latest software from www.inlabtec.com.

11.1 Check software version

Before updating the software check the version installed. Press the DISPENSE key and switch the Dispenser on by pressing the POWER key. Releases DISPENSE key after “bo” is displayed in SPEED. The following information is sequentially shown by the two displays SPEED and TIME (example):

bo 19	loaded bootloader software version
06 13	date of version
AP 23	Application software
06 27	date of version
HA 00	Hardware
00. 40	Version
bH 00	Bag Holder
00.40	Version

11.2 Performing a software update

Step 1	plug in USB-Stick with software (MHX-file) while Dispenser is shut off
Step 2	Keep OPEN VALVES key pressed and switch the Dispenser on by pressing the POWER key. Release OPEN VALVES key after STATUS light turns red.
Step 3	Wait for approx. 40 seconds until STATUS flashes green. During the software update Status red flashes and STATUS green lights up.
Step 4	Pull USB-Stick from socket. Software update is completed.

After the software update is completed at least one version date must have changed if the latest software was not already installed.

12 Resolving malfunctions

The Serial Diluter generates operating status messages. The messages are divided into thematic groups for a direct indication of the cause of the malfunction: A (aspiration diluent), b (bag mixer UA), C (connections sensor, bagholder and power), d (dispensing diluent), F (firmware), L (level control diluent).

Message	Description	Corrective measure
A1	Required amount of diluent is not aspirated within 15 seconds.	Check diluent flask, and tub connection to Serial Diluter. Increase aspiration speed. Replace sterile filter of Serial Diluter. Check aeration of diluent flask and change sterile filter if necessary. Check level sensor position, press ASPIRATE until the set volume is reached and the STATUS lights up green.
A2	Aspiration time too short compared to the last aspiration.	Check pipette regarding drops and air bubbles. Check position of the level sensor. Press ASPIRATE until the set volume is reached and STATUS green.
A3	Aspiration time too long compared to the last aspiration.	Check tubing from diluent flask. Check aeration of the diluent flask and change sterile filter if necessary. Check the pipette in the area of the sensor for adhering air bubbles (to do this, rotate the pipette around the longitudinal axis), press ASPIRATE until the set volume is reached. If the volume rises above the sensor, check whether the sensor is in contact with the pipette and then press OPEN VALVES to lower the level. Press ASPIRATE again until the set volume is reached. Change the pipette if the volume cannot be adjusted.
A4	Pressure changes in tubing during aspiration, e.g., due to air bubbles.	Check the level in the diluent flask, press ASPIRATE and check the flow of the liquid aspirated. If appropriate reduce aspiration speed.
b1	Blocked mixer rocker.	Check mixer rocker and bag support (see chap. 8.4).
b2	Mixer turns to slow.	Check mixer rocker and bag support (see chap. 8.4).
C1	Bag Holder not connected.	Connect Bag Holder.
C2	Level sensor not connected.	Connect level sensor.
C3	Supply voltage too low.	Check if the correct power supply is connected (see chap. 6.3),
C4	Supply voltage too high.	Check if the correct power supply is connected ((see chap. 6.3),
d1	Diluent is not dispensed within 15 seconds.	Check tubing and dispensing nozzle for clogging, pinched tube, etc.
d2	Dispense time too short.	Check the connection of the upper pipette connection with the pipette. Check position of level sensor (see chap. 6.4),
d3	Dispense time too high.	Check the hose to the bag holder for kinks and constrictions (see chap. 6.4),
F1	Firmware error.	Update firmware (see chapter 11). Call Inlabtec Service if error cannot be corrected.

L1	Time for adjusting volume exceeded.	Check if there is a drop attached in the pipette in front of the sensor (faulty signal). Check tubing from diluent flask to Serial Diluter. The level of the diluent inside the diluent flask must be lower than the level sensor as the diluent in the pipette must be able to flow back to the diluent flask during level adjustment. Use a suitable flask and position it below the Serial Diluter.
L2	Level sensor cannot adjust volume after third repetition.	Check whether there are drops or air bubbles in the pipette. Turn the pipette slightly around the longitudinal axis if you notice bubbles inside the pipette. Press ASPIRATE to adjust Volume. Sterile filter on the bottle may be blocked, causing a vacuum. Replace sterile filter. Note: Use hydrophobic sterile filters and replace after approx. 10 steam sterilizations.
L3	Level sensor defective.	Check the plug connection to Serial Diluter. Call Inlabtec Service if problem cannot be solved.

Messages can be acknowledged and resetted by pressing any key on the Inlabtec Diluter after the problem displayed has been corrected.

The table below lists possible malfunctions and errors which cannot be communicated via system messages. The corrective actions listed help the operator to solve the problem. Non-remediable malfunctions will be corrected by Inlabtec Service staff. Please contact the Inlabtec service if necessary.

Malfunction	Possible cause	Corrective measure
No display after pressing ON-key.	No mains voltage, No power supply or wrong power supply plugged in.	Check and/ or plug in.
	Power supply or internal board defective.	Contact Inlabtec Service.
Pumps are running but no liquid is aspirated into graduated pipette.	Tubing incorrect, no fluid connected. Suction tube with kink. Sterile filter on serial diluter loose or clogged.	Check tubing and diluent, check sterile filter on Serial Diluter.
Bags are not opened correctly.	Bag support not installed correctly	Install bag support correctly.
	Adhesion grippers must be cleaned or replaced.	Clean or replace adhesion gripper (see chap. 9.1.5).
Diluent not completely dispensed; pipette refilled before completely emptied.	Upper pipette connector not pushed tightly onto pipette. Sterile filter loose on Serial Diluter.	Check the connection of the upper pipette connector with the pipette. Press the connector firmly onto the pipette (see chap. 6.4). Check sterile filter on serial diluter.

After turning on the device, the linear carriage doesn't move all the way to the right and back to position 1.	Bag Holder not connected to the power supply. Linear carriage's path obstructed. Control cable not plugged in.	Check electrical connections (see section 6.3), turn the device off and on again.
After turning on the device, the linear carriage doesn't move to the right and the blue LED light blinks.	Bags are already in the Bag Holder before turning on. Bag sensor window is reflectively dirty.	Remove bags from the Bag Holder before turning on, clean the bag sensor window (see section 9.1.3).
Green LED remains lit after filling a bag.	Pipette sensor window is reflectively dirty.	Clean the pipette sensor window (see 9.1.3).
Sample addition is not detected. Green LED blinks during sample addition.	Pipette sensor window is absorbing dirty.	Clean the pipette sensor window (see 9.1.3).
The blue LED light blinks despite freshly inserted bags, meaning the bags are not detected in the Bag Holder.	Detection can be impeded by random folds, creases, or irregularities in the bags. Bag sensor window is absorbing dirty.	Clean the bag sensor window (see 9.1.3).

13 Shut down, storage, shipping and disposal

This chapter contains instructions regarding shut down, storage, shipping and disposal of the instrument.

13.1 Storage and transport

Switch off the instrument and remove the power cord. For disassembly of the Inlabtec Serial Dilution System refer to Chapter 5 in reverse steps. Bag Holder and Dispenser must be separated for transport.

Remove all liquids and other residues before packing the instrument.



Notice


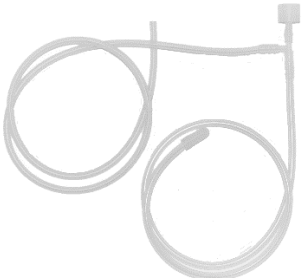
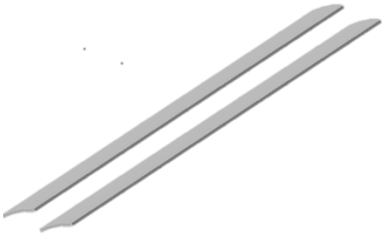

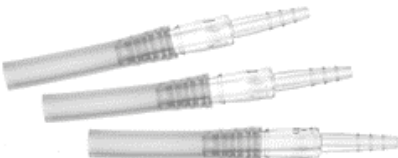
It is recommended to ship the instrument and its accessories in original packaging to reduce the risk of possible transport damages.




13.2 Disposal

The instrument is, to a large extent, made of recyclable materials (steel, aluminium). Proper separation is required for recycling.

Please follow valid regional and local laws concerning disposal.

14 Spare parts and accessories

Description	Part No.	Illustration
Dispensing Nozzle to Serial Diluter UA/UC, PEEK and stainless steel, fully autoclavable	140011	
Tubing Set, silicone, incl. 2 caps, autoclavable	100010	
Adhesion Gripper to Bag Holder, 4 mm x 370 mm, self-adhesive, with mounting instructions, set of 2 pieces	100015	
Connector Cap GL 45 cpl, for the connection of diluent in GL 45 bottles to the Serial Diluter, with PTFE sterile filter 0.2 µm, Ø 25 mm for sterile pressure compensation, with 2 hose connections for 3 mm ID (inner diameter) in polyvinylidene fluoride (PVDF), incl. 300 mm intake silicone hose, silicone cap, fully autoclavable	100020	
Tubing Adapter, set of three, for the connection of diluent with supply of ID (inner diameter) 3 - 7 mm, incl. 60 mm silicone hose ID 6 mm, autoclavable	100021	

<p>Set of Caps and Pipette Connections, 5x silicone caps for Connector Cap GL 45 cpl and intake hose of Tubing Set, 2x pipette connections for Tubing Set, 2x PVDF caps, autoclavable</p>	100013	
<p>Syringe Filter, Ø25 mm, to Serial Diluter and Connector Cap GL 45, PTFE membrane, hydrophobic, about eight times autoclavable</p>	100014	
<p>Bagshell, white, for storage and disposal of used/ filled Serial Dilution Bags, PMMA</p>	100030	

Additional spare parts and accessories on www.inlabtec.com

15 Declaration of conformity

Declaration of conformity



iNLABTEC AG
Oberstrasse 149
CH-9000 St. Gallen
Switzerland

declares, that the product

iNLABTEC Serial Diluter UC

complies with the requirements of the following directives and regulations:

2014/30/EU Electromagnetic compatibility (EMC)
2006/42/EG Machinery directive
2012/19/EC Waste electrical and electronic equipment (WEEE)
2011/65/EC Restriction of hazardous substances (RoHS)
S.I. 2016/1091 Electromagnetic Compatibility Regulations
S.I. 2008/ 1597 Supply of Machinery (Safety) Regulations
S.I. 2013/3113 Waste electrical and electronic equipment (WEEE)
S.I. 2012/ 3032 Restriction of hazardous substances (RoHS)

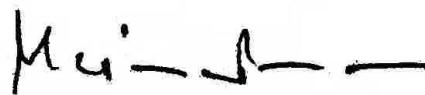
and is in accordance with the following standards:

- EN 61010-1:2020 Safety requirements for laboratory equipment
- EN 61326-1:2013 EMC requirements for laboratory equipment
- BS 61010-1:2010 Safety requirements for laboratory equipment
- BS 61326-1:2013 EMC requirements for laboratory equipment
- BS 63000:2013 Restriction of hazardous substances (RoHS)

St. Gallen, 10.8.2023



Dr. Ernst Freydl
CEO



Martin Stamm
CTO

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Technical data are subject to change without notice.

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