Operation Manual 140001

Version 04/ 2020.10.14

Inlabtec Serial Diluter UA / UA12

INLABTEC

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1 About this manual

This manual contains a detailed instruction of the Inlabtec Serial Diluter UA inclusive specific information for the UA12 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 2 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 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 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.

2.1 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.

2.2 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.

2.3 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 property damage, but no practices related to personal injury.

2.3.1 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

2.4 Product safety

2.4.1 Product related hazards

Pay attention to the following safety notices:

 	Warning Death or serious injuries by use in explosive environments. • 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. • 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. • Always wear protective glasses (see general hazards)

2.4.2 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.

2.5 General safety measures

2.5.1 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.

2.5.2 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.

2.5.3 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.

2.5.4 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.

3 Technical data

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

3.1 Scope of delivery

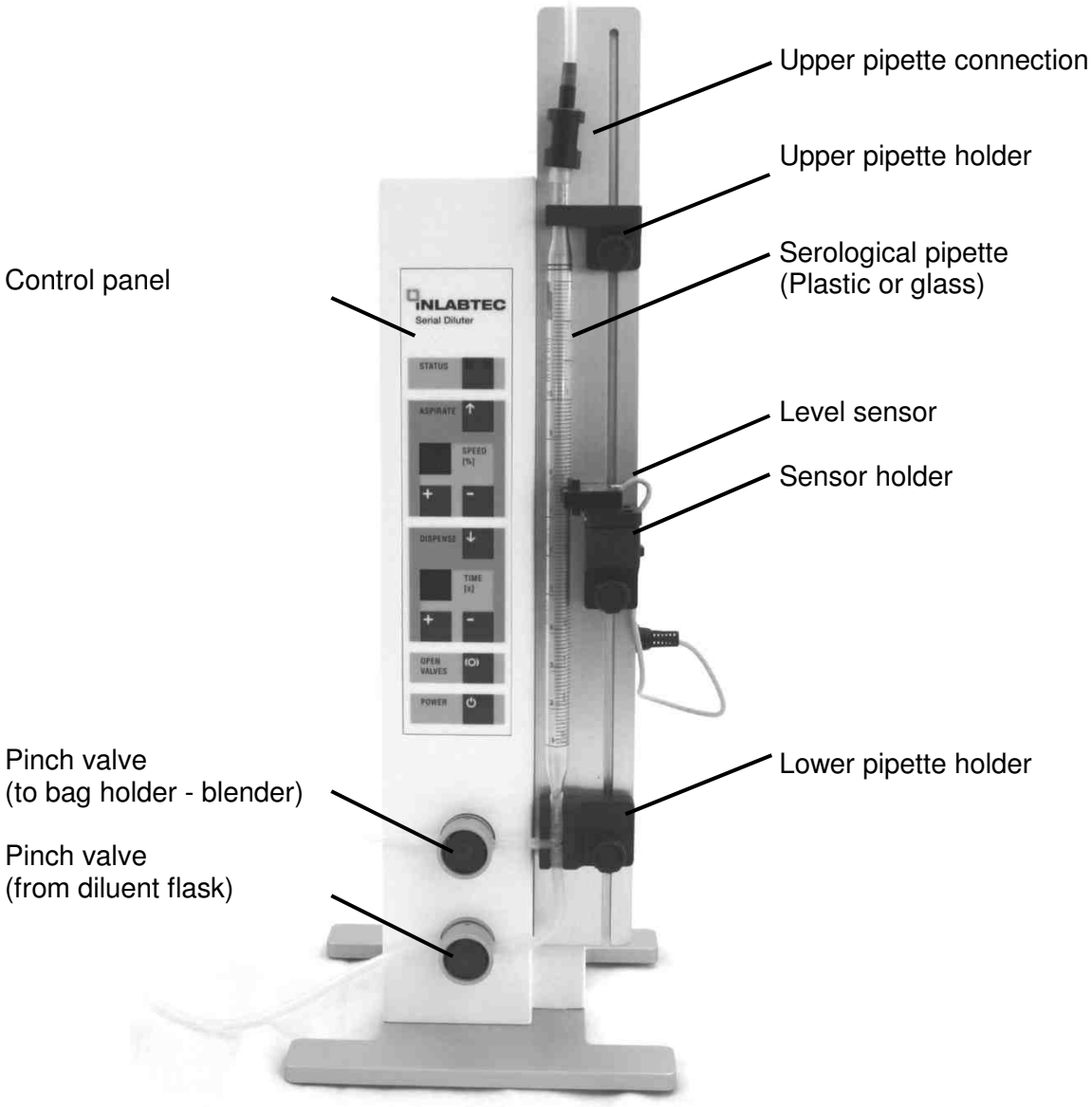
Number/ Description	Article number	Illustration
1x Serial Diluter UA incl. external power supply or 1x Serial Diluter UA12 incl. second Bag Holder – Blender , two base boards and external power supply	140000 150000	
1x Serial Dilution Bags	100100	
1x Tubing Set, incl. 600 mm intake silicone hose ID (inner diameter) 3 mm, 700 mm dispensing silicone hose ID 2.5 mm, silicone caps for intake hose and pipette connection, autoclavable	100010	
1x Dispensing Nozzle UA, PEEK and stainless steel, fully autoclavable or 1x Dispensing Nozzle UA12, PEEK and stainless steel, fully autoclavable	140011 1500011	 

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	
1x Bag Stopper UA	140022	
1x Serological pipette, 10 ml		
1x Operation manual	140001	

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

3.2 Overview Operation

3.2.1 Front



3.2.2 Functions control panel

STATUS
green: instrument ready and operation via dosing arm active.
green flashing: instrument in operation.
red: instrument not ready or malfunction, operation via dosing arm inactive.

ASPIRATE
Press: fills up pipette to level sensor.
Repeated press during filling: aspiration stops.

SPEED [%]
Aspiration speed.
Adjustable with key **+** and key **–** from 25 to 99 %.

DISPENSE
Press: dispense liquid (discharge pipette).
Repeated press: dispensing stops.
Note: DISPENSE active in all dosing arm positions.

TIME [s]
Alternating display of bL for blender and mixing time in seconds.
Adjustable with key **+** / **-** keys 0.5 to 99 seconds.

During mixing, time is displayed as countdown.

If the key **+** or **-** is pressed during mixing, the bagmixer stops and the selected mixing time is displayed.

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.

3.2.3 Functions Bag Holder - Blender

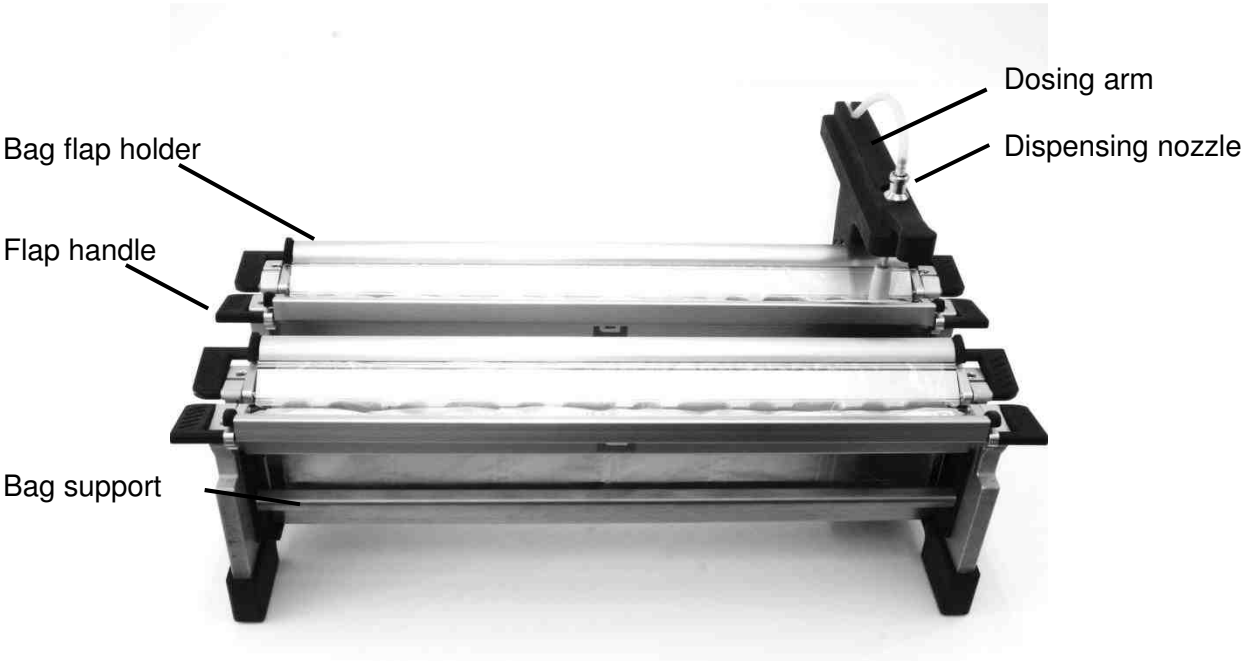


Figure: Bag Holder - blender UA12 with telescopic dosing arm allowing dilutions in the back and front row of bags. The Holder - blender UA handles one row of bags by a standard dosing arm.

In the bag holder – blender of the Serial Diluter, the Serial Dilution Bags are opened and immobilized for that dilutions can be made. By pivoting the dosing arm from the parking position (dosing arm parallel to bag flap holder) forward and placing the dispensing nozzle into the bag, the first bag is filled with diluent. After adding the sample for dilution into the filled bag the dosing arm is moved to the next bag which starts the blender for mixing as well as fills the next bag with diluent. After dispensing is completed, the pipette is automatically filled with fresh diluent and the Serial Diluter is ready again for the next dilution step (Status green on the control panel).
Lifting and lowering the dosing arm in the parking position starts mixing. If the dosing arm is lifted while dispensing into a bag, the Serial Diluter stops and the status turn red. Control by the dosing arm is inactivated and only the keys ASPIRATE and DISPENSE of the control panel rests active.

Demo video on www.inlabtec.com

3.3 Specifications

Size Diluter (WxDxH)	175 x 180 x 480	mm
Holder – Blender UA	433 x 165 x 170	mm
Holder – Blender UA12	433 x 270 x 190	mm
Minimal foodprint UA	450 x 350	mm
Minimal foodprint UA12	450 x 500	mm
Weight Dispenser	2.8	kg
Bag Holder – Blender UA	1.7	kg
Bag Holder – Blender UA12	3.9	kg
Voltage	24	VDC
Max. power consumption	18	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 Operation	for indoor use only	
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)	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)	
Safety elements	Detection of empty diluent flask, of pipette filling, of complete dispensing of diluent and position dispensing arm. Emergency stop by: Raising dispensing arm during dispensing, pressing any key within regular process. Optical and acoustical signals to support operation.	

4 Description of function

The Inlabtec Serial Diluter UA 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 test tubes are replaced by polyethylene bags, the Inlabtec Serial Dilution Bags 100100. These are supplied as sterile, prepacked consumables. The number of bags corresponding to the number of required dilution steps can be removed from a box and placed into the Bag Holder – Blender of the Serial Diluter UA.

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.

The diluent is automatically dispensed by the immersion of the dispensing nozzle into an empty serial dilution bag. After bag filling, the sample to be diluted is added through the adjacent bag opening and the dosing arm moved to the next bag. This will start the blender to mix the sample thoroughly with the diluent and in parallel the next bag is filled with diluent. If only mixing is required without filling another bag, the dosing arm must be swivelled back into the parking position to start mixing.

After mixing the diluted sample is aspirated through the second opening in the bag, which has been released by the dosing arm for plating and for the next dilution step.

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 6.2.

Demo videos on www.inlabtec.com

5 Installation

5.1 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.

5.1.1 Sterilising the diluent

Put the connector cap GL 45 (included) on a flask with a GL45 thread (e.g. Schott 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.

5.1.2 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. Rins tubing set and dispensing nozzle with water before autoclavation. See also 6.4 Disassembly of tubing set and pipette

5.2 Installation site

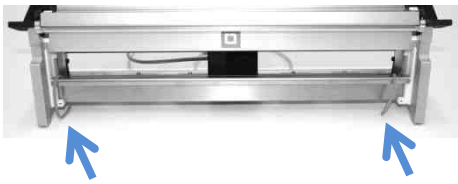
Place the instrument on a stable, horizontal work surface readily accessible for handling and with a good view of the display.

5.3 Removal transport lock of bag support

For that Serial Dilution Bags can be inserted into the Bag Holder and the blender works, the transport lock of the bag support has to be removed.

1. Place the dosing arm in position 3 (middle of the bag holder) and remove the rubber bands (arrow) on both sides of the back.

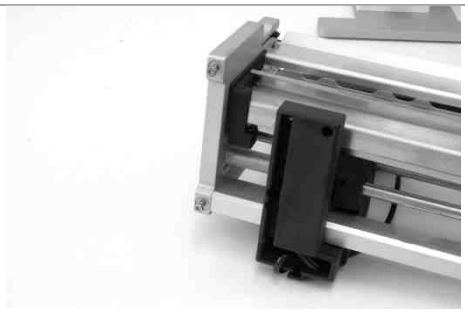
2. Lift the bag support and remove it to the front.



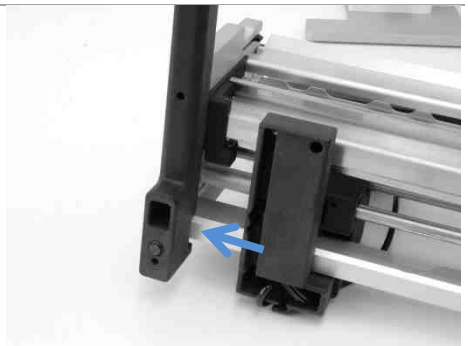
3. Remove the rubber bands, reinstall the bag support and check if mixer rocker moves freely (See 7.4 Bag support and mixer rocker)

5.4 UA 12: Mounting of the base boards

To put the Serial Diluter UA12 into operation, the baseboards must be mounted first on the bag holder with the telescopic dosing arm.

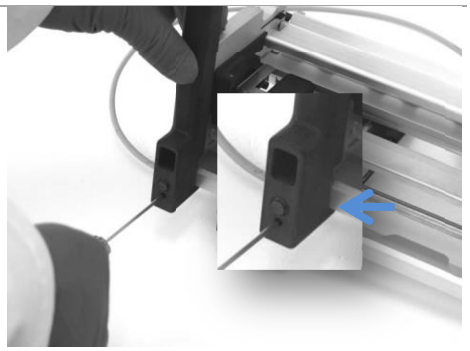


Remove the bag support and place the bag holder on the back.



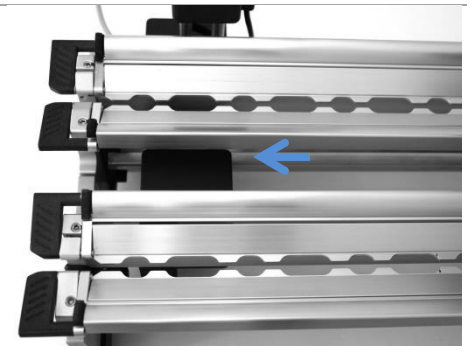
Push the base boards with the groove (arrow) towards the inside on the side wall and screw heads.

Pull the base boards up to the stop (arrow) and tighten the screws with the enclosed Torx T10 key.

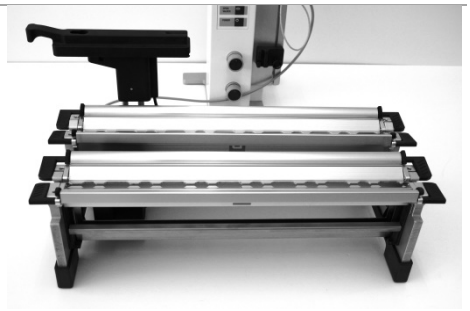


Place the assembled bag holder on the table and reinsert the bag support. Check whether the mixer rocker can move freely (see Section 7.4).

The second front bag holder can now be placed into the base boards. Note that the front bag holder must be placed such that the two mixers are mechanically and electrically connected (arrow). Check whether the front mixer rocker can also move freely (see Section 7.4).



The UA12 ready to put into operation.



5.5 Electrical connections

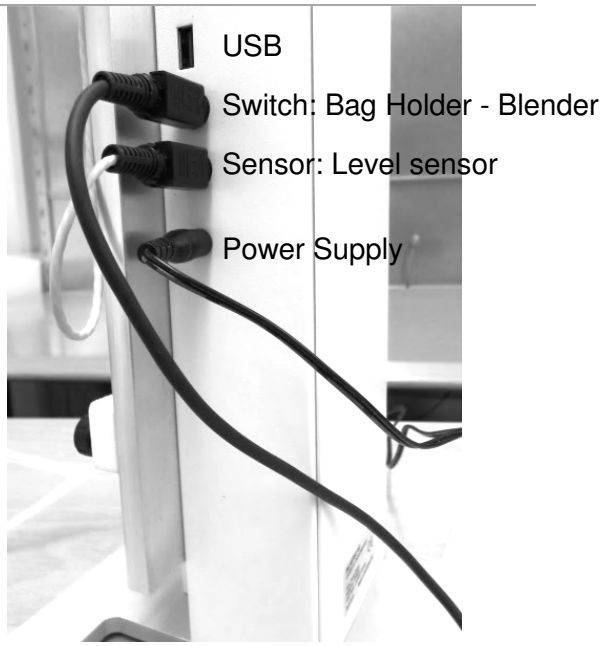
In addition to the power supply the level sensor and bag holder must be connected prior to working.

1. USB socket: For software update (see Chapter 10).

2. Switch socket: Connecting cable to Bag Holder - Blender.

3. Sensor socket: Level sensor Serial Diluter.

4. 24V DC socket: 24V plug in 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!

5.5.1 Check level sensor

Check the correct function of the level sensor before you continue installation of the Serial Diluter.

1. Switch dispenser on by pressing POWER key.

2. Press ASPIRATE. The pump starts running.

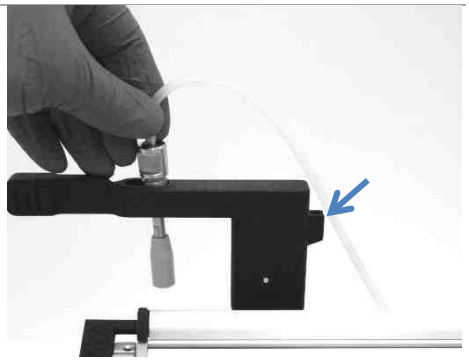
3. Put a finger in the detection zone of the level sensor. A red LED on the sensor lights up (arrow).

4. Pull finger away from sensor. The lower pinch valve closes. After a few seconds the STATUS display shows green and the test is completed. Continue the installation in chapter 5.4 Assembly tubing and graduated pipette.

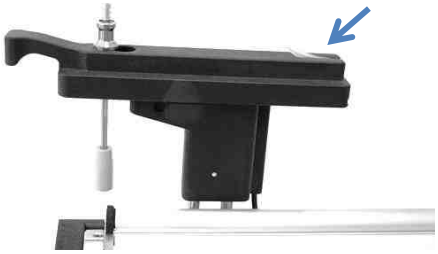
If the test cannot be finished successfully check whether the level sensor is connected properly and repeat the test.

If the fault persists please contact your distributor.

5.6 Assembly tubing set and graduated pipette



UA 12



Dosing arm in parking position. Insert the dispensing nozzle. Fix the tube in the holder on the back side of the dosing arm (arrow).

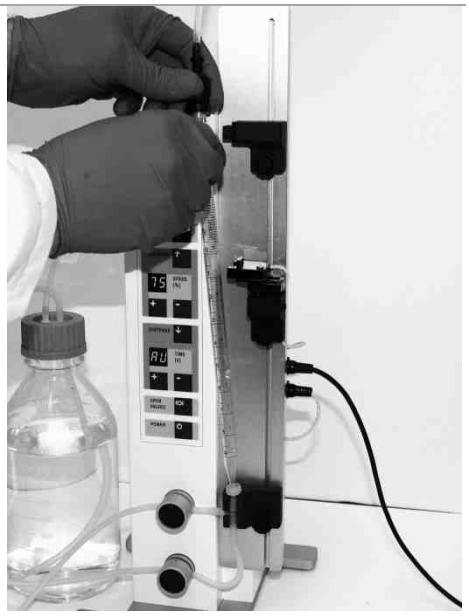
Insert T-piece tubing connector of tubing set in the lower pipette holder.
Do not remove the cap yet (arrow)!

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.

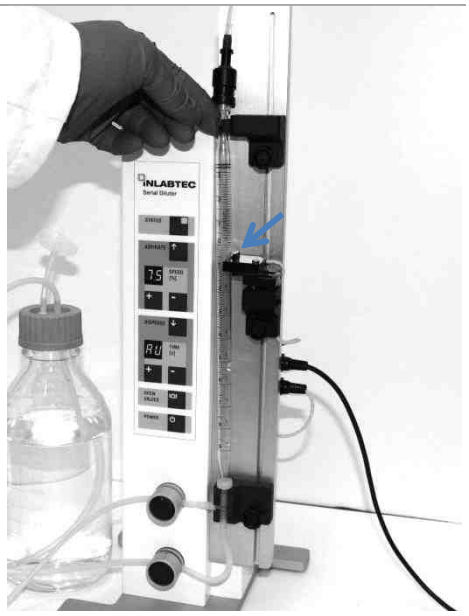
Remove the cap from the T-piece and insert a sterile graduated pipette.

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.

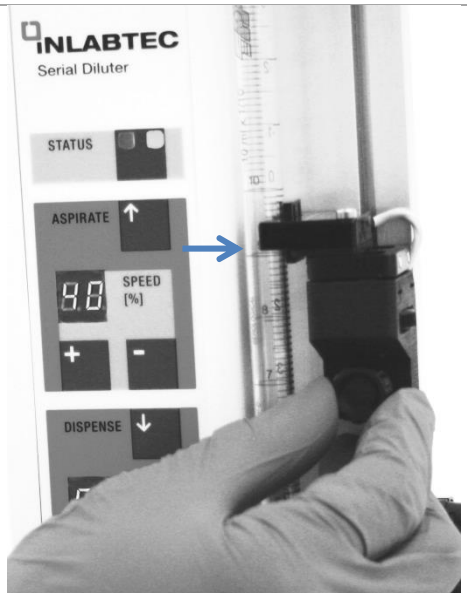
Note: check whether the optical sensor touches the pipette (arrow).



6 Operation

6.1 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 the ASPIRATE key. Is the pipette filled accordingly, STATUS lights green and the device is ready for dispensing and mixing.

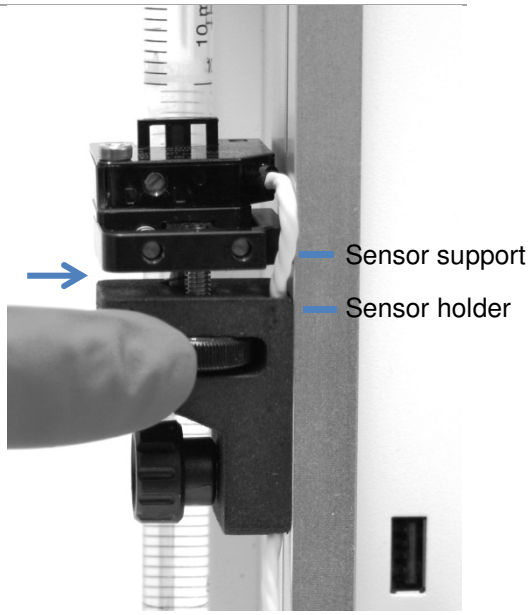


If the level inside the graduated pipette differs from the level required it can be fine tuned by turning the knurled nut at the side of the sensor holder.

After fine tuning the sensor position refill the pipette by pressing the ASPIRATE key.

Note:
Dispense at least once in an empty bag or flask to prime all tubes to ensure accuraccy of the first dilution.

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



Notice

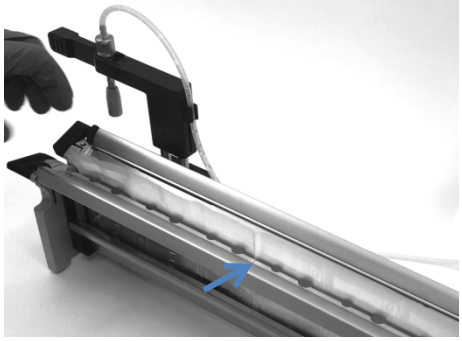
To form a meniscus in the pipette for an exact volume adjustment, the diluent aspirated into the pipette must be able to flow back into the reservoir bottle. Because of that, make sure that the level of the liquid in the reservoir bottle is not higher than the adjusted liquid level in the graduated pipette.

6.2 Serial Dilution Process

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.

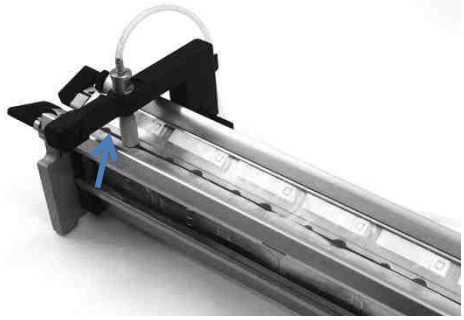
Insert the Dilution Bags in the Bag Holder <u>from the side</u>. If you use three Dilution Bags or less align the end of the bags to the engraved mark in the middle of the pipetting table (arrow). If you use more than three bags align the perforation between two bags along the engraved mark.



As an alternative to manual bag alignment, insert the Bag Stopper UA 140022 in the bag holder and align the determined number of bags at the stopper.

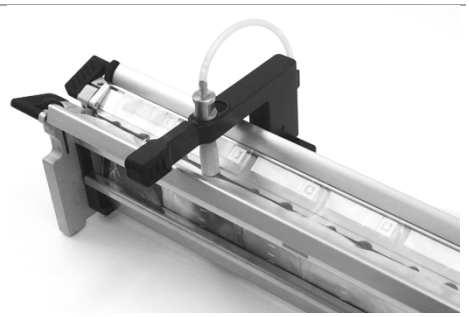
By closing and reopening of the bag flap holder the flaps of the Dilution Bags are opened and held in position.

Note: For proper opening of the bags and mixing the bag support must be positioned correctly. Make sure it firmly rests in the two lateral holders (arrow).



Lift the dosing arm from its parking position, rotate it and put it into the first bag for diluent adding into the bag.

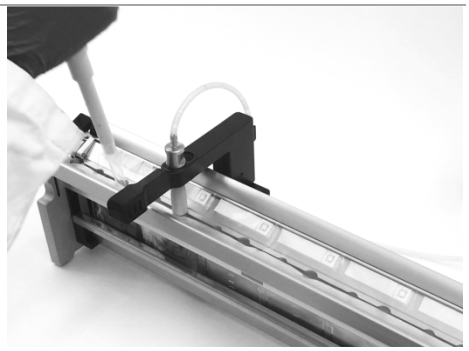
Than, add the sample for dilution into the left opening of the filled bag (arrow).



Slightly lift the dosing arm and move it to the next bag. The sample is automatically mixed in the first bag and the next bag filled with diluent.

Note:
The dosing arm only has to be raised slightly and can be lowered again at the beginning of the next position (immersion in the wrong position is prevented by the design).

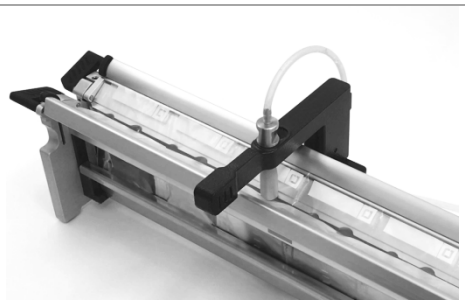
High density samples (highly concentrated sugar solutions, honey, etc.), which immediately sink to the bag bottom, can be added into the first bag during mixing and filling of the next bag. Eventually extent the mixing time to doing so.



The diluted sample can be removed with the pipette for the inoculation of Petri dishes and/or for another dilution step in the next bag.

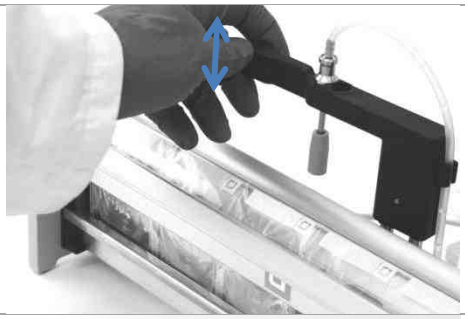
The dosing arm is again moved to the next bag. The sample in the second bag is automatically mixed. The third bag is filled with Diluent.
Repeat these steps until you have prepared the required number of dilution steps.

Note: Diluent addition is complete when the beep-beep sounds and refilling of the pipette starts. If the dosing arm is raised during dispensing, the device stops dispensing (see chapter 3.2.3 Functions Bag Holder - Mixer).

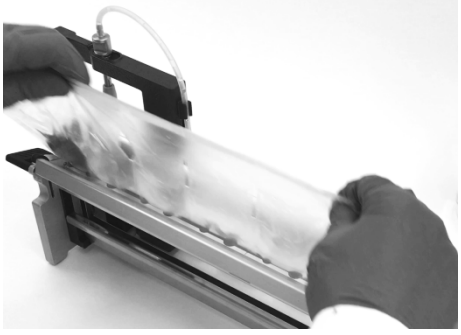


At the last bag of a dilution series mixing is triggered by pivoting the dosing arm back to its parking position.

Note: Lifting and lowering the dosing arm in the parking position restarts mixing again (arrow).



For separating and removing the Dilution Bags from the Bag Holder push the bag flap holders with both hands downward.

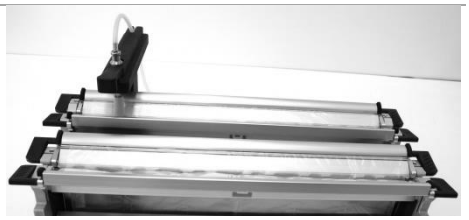
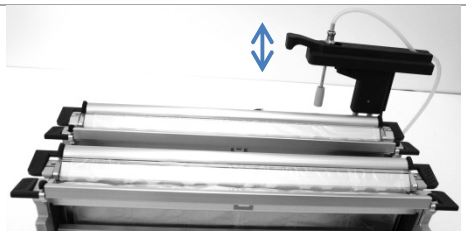
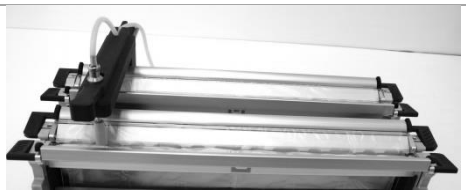
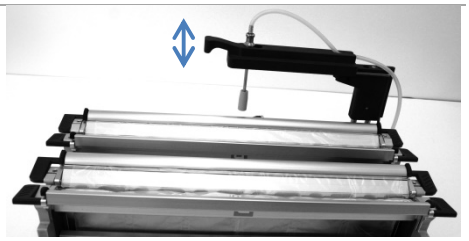


The Bags can now be lifted from the Bag Holder and set into the Bag Shell for storage or disposal.

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

6.2.1 UA 12: Serial Dilution Process

The Serial Diluter UA12 enables dilutions in two rows, each with a maximum of six bags. The following:

A magnet fixes the dosing arm in the rear position.	
At the last bag of a dilution series mixing is triggered by pivoting the dosing arm back to its parking position. Note: Lifting and lowering the dosing arm in the parking position restarts mixing again (arrow).	
To use the bags in the front row, the telescopic dosing arm must be pulled forward. A magnet locks the extended dosing arm in the correct position.	
At the last bag of a dilution series mixing is triggered by pivoting the extended dosing arm back to its parking position. Note: Lifting and lowering the dosing arm in the parking position restarts mixing again (arrow).	

Note

To ensure that the mixing in the bag takes place completely, the dosing arm may only be pushed forward or backwards after the mixing process has been completed.
If the dosing arm is pulled forwards or pushed backwards during mixing, the corresponding mixer is switched on. As a result, the sample in the bag is not completely mixed with the set time.
If the dosing arm was accidentally adjusted while mixing, raise and lower the arm in the park position to mix again.

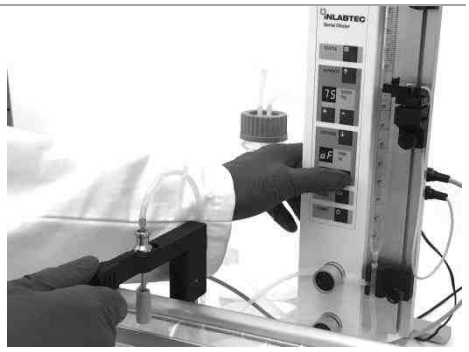
Visit www.inlabtec.com to see the UA12 demo video.

6.2.2 Parallel 1:10 Dilutions

Filling of all bags before mixing allows a 1:10 dilution of all samples in parallel, for example parallel 1:10 dilution of different samples.

Disable bagmixer
Swivel the dosing arm forward from the parking position and, before lowering the dispensing nozzle, press - in the DISPENSE field.
"BL of" is displayed and the bag mixer is deactivated.

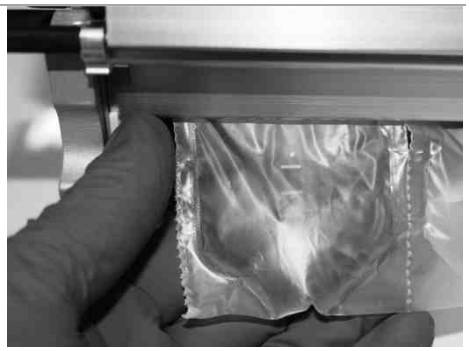
Reactivate bag mixer
After filling all bags and adding the samples, reacitvate the bag mixer by pressing + in the DISPENSE field. Mixing is started by raising and lowering the metering arm in the park position (See chap. 6.2 Serial Dilution Process).



6.2.1 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.

To check the mixing efficiency after mixing, lift the bag support and remove it to the front (see chapter 7.4). Visually inspect bag containing homogenized sample. Insert the bag support again and correct the set mixing time bL if necessary.

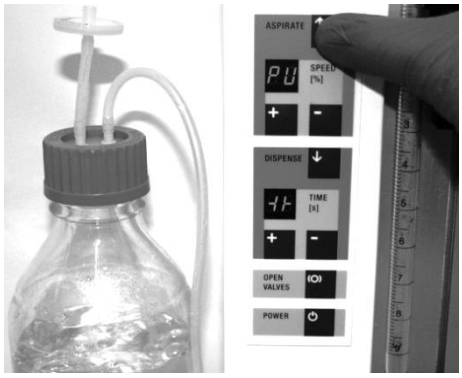


6.3 Disposal of used Serial Dilution Bags

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 a autoclavation bag or bin and sterilize them before disposal or recycling.

6.4 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 – 3 times. Immerse the dispensing nozzle in water so that no salt residues lead to surface corrosion during steam sterilization.

6.5 Using the diluent over several days

To reduce the effort needed to prepare the diluent you can install al 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 dispensing nozzle from the dispensing arm and immerse in a tube 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.

7 Cleaning

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

7.1 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 8.1.4 Cleaning and surface lubrication of the linear guiding)

7.2 Tubing

Cleaning and sterilising of tubing and pipettes is part of the preparation process and are described in chapter 5.1.

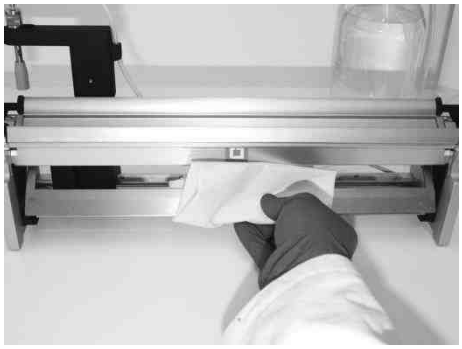
7.3 Adhesion gripper

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

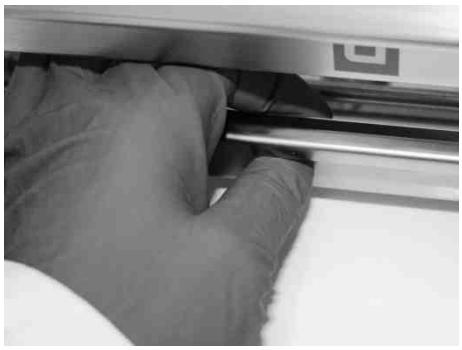
7.4 Bag support and mixer rocker

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

For the UA12 the front bagholder must be first removed so that the bag support can be removed.



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.

8 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.

8.1 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.

8.1.1 Cables and Tubing

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

8.1.2 Check sterile filter

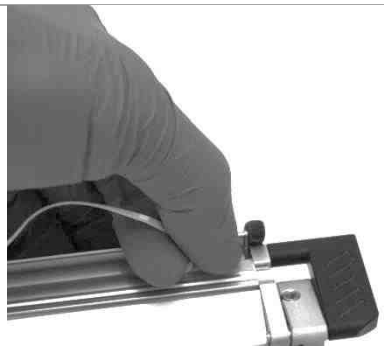
Replace the sterile filter if the pump does not fill the graduated pipette in the normal time. Tests have shown that replacing the filter is necessary under normal laboratory conditions after more than 300‘000 dispensing cycles.

8.1.3 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.

8.1.4 Maintenance adhesion gripper

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.

9 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 dicates a regular verification of dispensers.
For decadal dilutions, check that the dispensed volume is dispensed with a maximum error of 2.2% (9 ml ± 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

9.1 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

9.2 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.

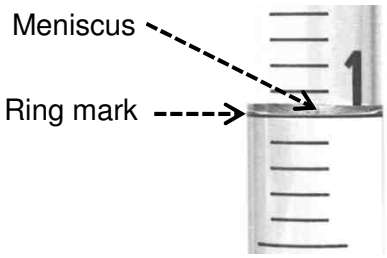
Test liquid
Distilled water (Z-factor (20°C) = 1.003) or peptone saline diluent (Z-factor (20°C) = 0.993).
The test liquids must have ambient temperature.

Operation manual
Follow the operation manual. Install the graduated pipette and the tubing set (see chapter 5.6) and connect the Serial Diluter with the test liquid.

9.3 Preparation of test

9.3.1 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.

9.3.2 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

9.4 Test procedure

Step	Action
1	Put 6 Serial Dilution Bags into the Bag Holder.
2	Dispense 9 ml test liquid with the Serial Diluter in every one of the 6 Serial Dilution Bags.
3	Take the filled Serial Dilution 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.

9.5 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 $\leq$ 2.2 % (smaller or equal 2.2 %).

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

9.6 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.

9.7 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, i.e. the systematic deviation> 1.5% for 9 ml and the imprecision <0.5%, the position of the sensor on the 10 ml pipette must be corrected for the measured systematic error. After that, the dispensed volume is within the permitted error limits. By repeating the test with additional pipettes it can be check whether the systematic error found applies to all pipettes with the same lot number.

If the imprecision, e.g. the random error, is > 0.5 % check the meniscus during several aspirations and dispensions. 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 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.

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.

10 Software Update

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

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 TIEM (example):

bo 19	loaded bootloader software version
06 13	date of version
AP 20	Application software
08 19	date of version
HA 00	Hardware
00. 40	Version
bH 00	Bagmixer
00.40	Version

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.

11 System communication and troubleshooting

The Serial Diluter can generate messages to facilitate simple and reliable operation. These messages are grouped in thematic categories: A (aspiration), b (bag mixer), L (level control), d (dispensing), C (connections), F (firmware).

The following messages are generated by the system communicator:

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 do check the volume aspirated.

Message	Description	Corrective measure
A2	Volume is not correct as aspiration time too short compared to the last three aspirations (same volume).	Check pipette regarding drops and air bubbles and level sensor. Press ASPIRATE to adjust the volume aspirated.
A3	Aspiration time too long compared to the last three cycles (same volume).	Check tubing from diluent flask. Check aeration of diluent flask and change sterile filter if necessary. Check level sensor position, press ASPIRATE do check the volume aspirated.
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. 7.4).
b2	Mixer turns to slow.	Check mixer rocker and bag support (see chap. 7.4).
d1	Diluent is not diluted within 15 seconds.	Check tubing and dispensing nozzle for clogging, pinched tube, etc.
d2	Dispense time to short.	Check the connection of the upper pipette connection with the pipette (see chap. 5.6), Check position of level sensor (see chap. 5.6),
d3	Dispense time to high.	Check the hose to the bag holder for kinks and constrictions (see chap. 5.6),
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 form 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 diluent bottle is blocked, resulting in a vacuum, which sucks the diluent. Replace sterile filter (Note: sterile filters should be replaced after 10 autoclavations).
L3	Level sensor defective.	Check the plug connection to Serial Diluter. Call Inlabtec Service if problem cannot be solved.
C1	Bag Holder not connected.	Connect Bag Holder (see chap. 5.5).
C2	Level sensor not connected.	Connect level sensor (see chap. 5.5),
C3	Supply voltage too low.	Check if the correct power supply is connected (see chap. 5.5),
C4	Supply voltage too high.	Check if the correct power supply is connected ((see chap. 5.5),
F1	Firmware error.	Update firmware (see chapter 8.1.4). Call Inlabtec Service if error cannot be corrected.

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 remedy the problem. More substantial malfunctions will be corrected by Inlabtec Service staff. Please contact the Inlabtec service if necessary.

Malfunction	Possible cause	Corrective action
Pumps are running but no liquid is aspirated into graduated pipette.	Tubing not installed correctly, no diluent flask connected.	Check tubing and flask.
No display after pressing ON-key.	No electricity, power supply is not plugged in or not connected to Diluter.	Check and/ or plug in.
	Plug in power supply or internal board defective.	Contact Inlabtec Service.
Bag flaps are not opened correctly.	Bag support not installed correctly (see chap. 6.2 and 7.4).	Install bag support correctly.
	Adhesion gripper must be cleaned.	Clean or replace adhesion gripper (see chap. 8.1.4).
Diluent not completely dispensed, pipette refilled before completely emptied.	Upper pipette connector not pushed tightly onto pipette.	Check the connection of the upper pipette connector with the pipette. Press the connector firmly onto the pipette (see chap. 5.6).

12 Shut down, storage, shipping and disposal

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

12.1 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

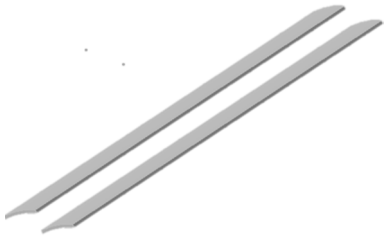
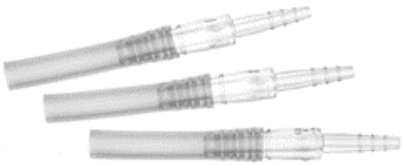
It is recommended to ship the instrument and its accessories in original packaging to reduce the risk of possible transport damages.

12.2 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.

13 Spare parts and accessories

Description	Part No.	Illustration
Dispensing Nozzle to Serial Diluter UA, PEEK and stainless steel, fully autoclavable	140011	
Dispensing Nozzle UA12, PEEK and stainless steel, fully autoclavable	150011	
Tubing Set, incl. 600 mm intake silicone hose ID (inner diameter) 3 mm, 700 mm dispensing silicone hose ID 2.5 mm, 1x silicone cap intake hose, 1x silicone cap pipette connection, fully 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	
Silicone Caps, Set, fit to Connector Cap GL 45 cpl and Tubing Set (10 pieces) and pipette connection (5 pieces), autoclavable	100013	

Syringe Filter, Ø25 mm, to Serial Diluter and Connector Cap GL 45, PTFE membrane, hydrophobic, about eight times autoclavable	100014	
Bagshell, white, for storage and disposal of used/ filled Serial Dilution Bags, PMMA	100030	

Additional spare parts and accessories on www.inlabtec.com

14 Declaration of conformity

Declaration of conformity

iNLABTEC AG
Oberstrasse 149
CH-9000 St.Gallen
Schweiz

Declares, that the product

iNLABTEC Serial Diluter UA

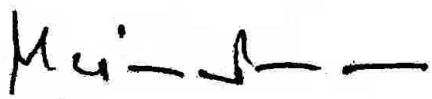
complies with the requirements of the following European Directives:

2004/108/EG EMC directive
2006/42/EG machinery directive

and is in accordance with the following standards:

- EN 61010-1:2010
  Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements (IEC 61010-1:2010 + Cor. :2011)
- EN 61326-1:2006
  Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2005)

St. Gallen, 1.7.2019



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Document number 140001 Version 04 Date 14.10.2020

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