

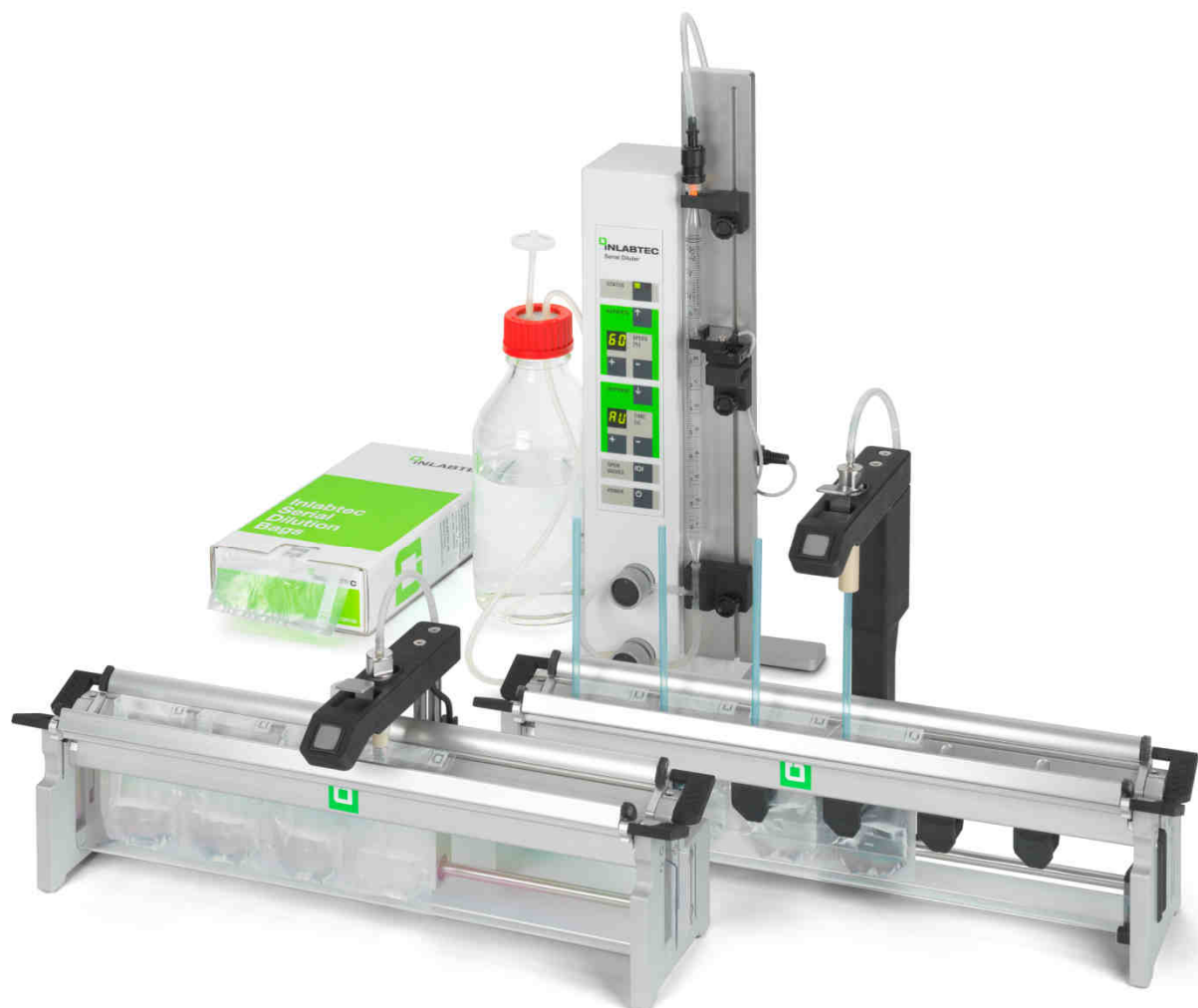
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## Operation Manual 100001

Version 15/ 2017.12.12

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### Inlabtec Serial Diluter TA Inlabtec Serial Diluter SA







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## **1 About this manual**

This manual contains a detailed instruction of the Inlabtec Serial Dilution Systems TA (for pipette tips) and SA (for pipette straws) and contains all information required for its safe operation and to maintain it in good working order. The manual is made by using the Serial Diluters TA. The differences to Serial Diluter SA are described in addition where present.

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 the Inlabtec Homepage [www.inlabtec.com](http://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.  
It is available in other languages and can be downloaded from the Inlabtec Homepage [www.inlabtec.com](http://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 System has been developed for the use in laboratories for microbiological analysis. It is designed for preparing serial dilutions for viable cell counts.

Every other application as well as applications which do not comply with the technical data (see section 3 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 Instrument-related hazards

Pay attention to the following safety notices:

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



## 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 Duty of 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 be used

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 Inlabtec Serial Diluter complete

Number/ Description	Article number	Illustration
1x Serial Diluter TA incl. external Power Supply	100000	
<b>or</b>		
1x Serial Diluter SA incl. external Power Supply	110000	
1x Serial Dilution Bags	100100	
1x Bag Shell	100030	
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, 250 mm intake silicone tube, silicone cap, fully autoclavable	100020	
Dispensing Nozzle to Serial Diluter TA for 1 ml standard tips, PVDF and stainless steel, fully autoclavable	100011	

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**or**

Dispensing Nozzle Straw to Serial Diluter SA for pipette straws with inner Ø 4 mm , PEEK and stainless steel, fully autoclavable 110011




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Tubing Set to Serial Diluter TA for 1 ml standard tips, 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

**or**

Tubing Set Straw, to Serial Diluter SA for pipette straws, incl. 600 mm intake silicone hose ID (inner diameter) 3 mm, 600 mm dispensing silicone hose ID 2.5 mm, 1x silicone cap intake hose, 1x silicone cap pipette connection, fully autoclavable 110010



1x Serological pipette, 10 ml




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3x 1.5 ml micro test tube, PP




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1x screw driver Torx T10 with screw M3 x 16




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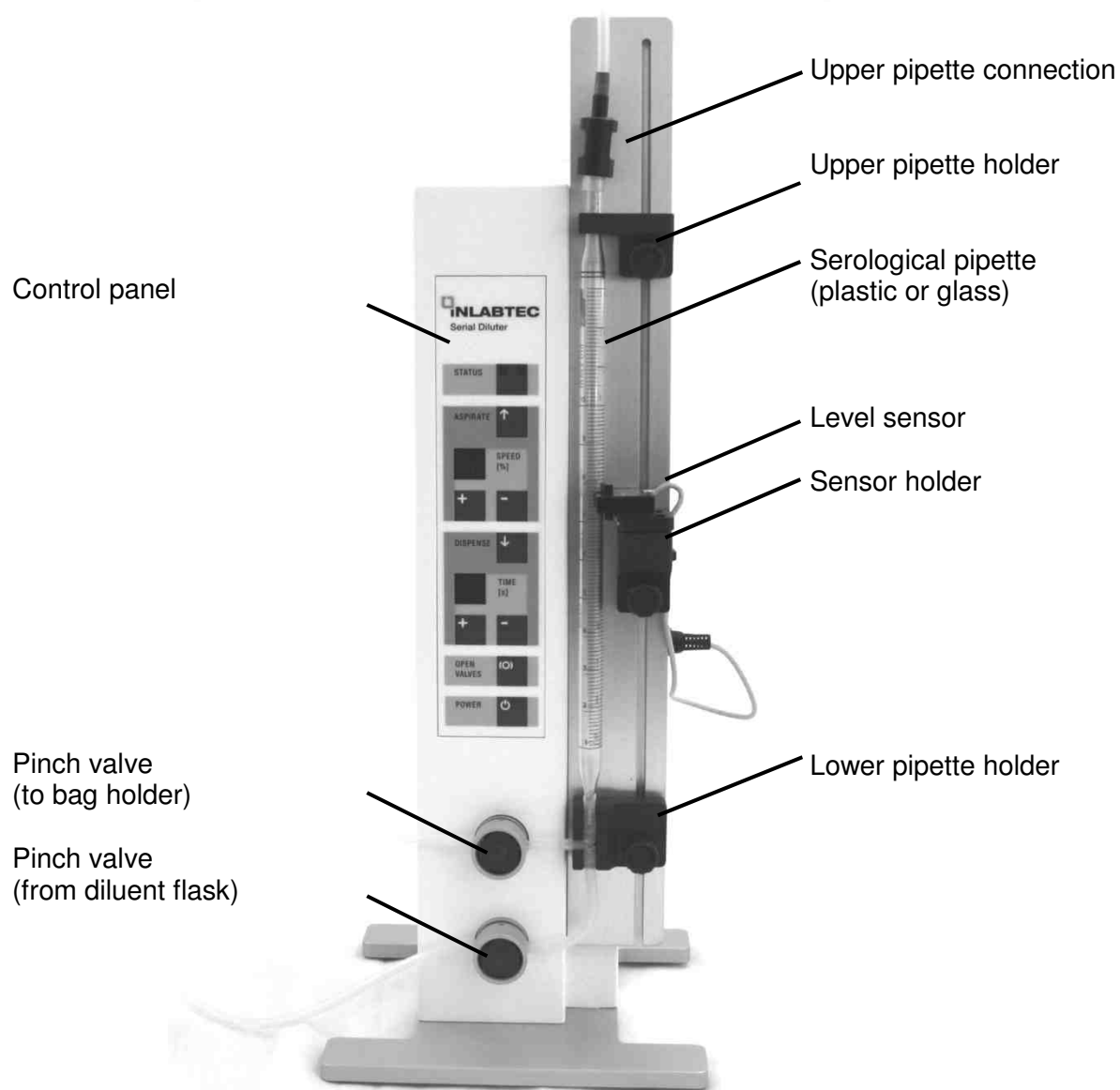
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For detailed information on the listed products see [www.inlabtec.com](http://www.inlabtec.com).

## 3.2 Overview

### 3.2.1 Front



### 3.2.2 Control panel

#### STATUS

green: ready for dispensing  
green flashing: dispensing in operation  
red: not ready

#### ASPIRATE

Press: fill pipette up to level sensor.  
Repeated press: aspiration stops.

#### SPEED [%]

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

#### DISPENSE

Press: dispense liquid (discharge pipette)  
Repeated press: dispensing stops

#### TIME [s]

Dispensing and mixing time.  
Adjustable with key + and key – from AU (automatic)  
and 0.5 to 99 seconds.

**In normal operation for serial dilution TIME [s] is set to automatic AU.** With the AU setting dispensing the liquid is finished with a mixing cycle of 1 second, irrespective of the dispensing time.

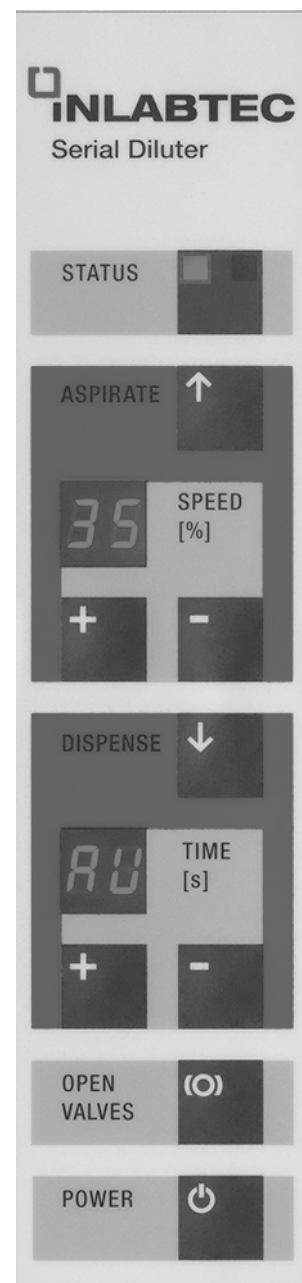
With the manual setting the dispensing and mixing can be adjusted to special requirements/ applications.

#### OPEN VALVES

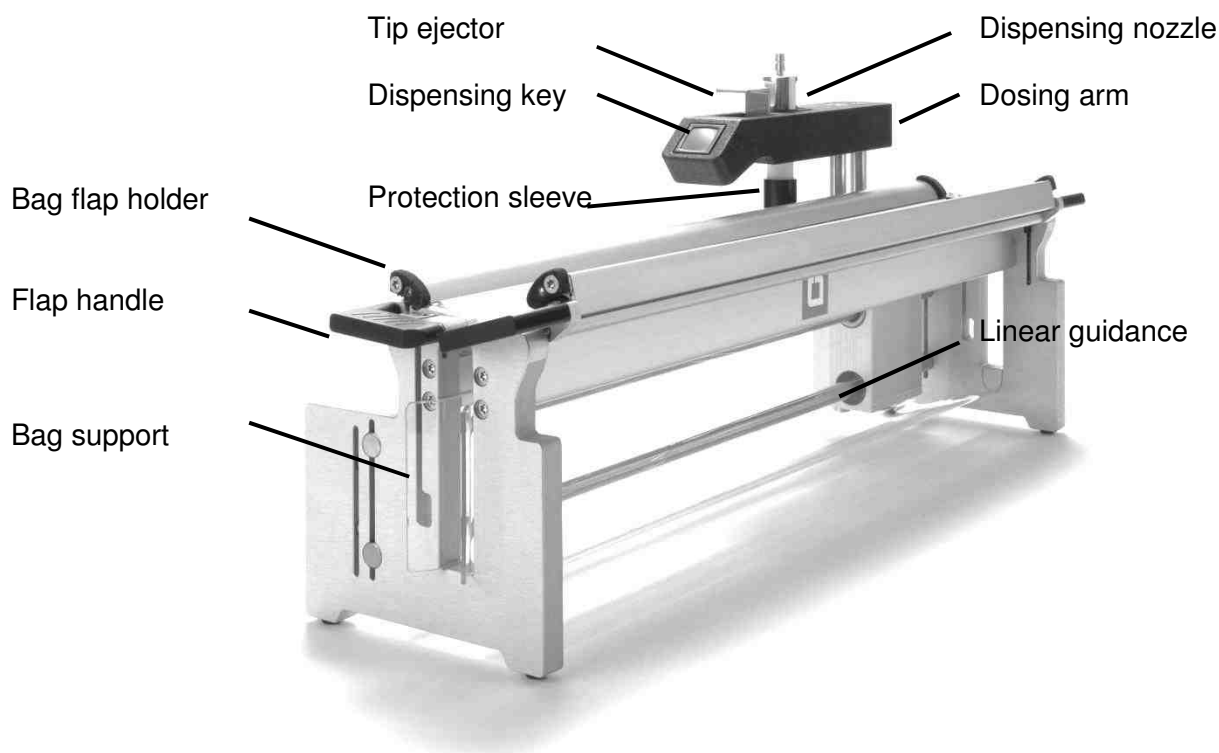
Opening and closing of the pinch valves for inserting and removing the silicone tubes.  
1<sup>st</sup> Press: Valves open and Display PU (purge) in field ASPIRATE. Press ASPIRATE to deliver liquid in aspiration tube back into bottle.  
2<sup>st</sup> Press: Valves close

#### POWER

Switching on an off



### 3.2.3 Bag Holder: Example for TA and SA



### 3.2.4 Function of dispensing key of bag holder

By pressing the dispensing key 9 ml diluent are dispensed, if the status LED shows green (ready for dispensing). After dispensing fresh diluent is aspirated and the diluter is ready for the next dispensing step.

If the dispensing key is pressed during dispensation the process stops and the status LED shows red.

The process cannot be restarted by pressing the dispensing key again (emergency stop function).

The process can be continued using the ASPIRATE or DISPENSE key on the control panel.

The dispensing key is active again as soon as the status LED shows green, i.e. when the correct level of solvent is achieved.

### 3.3 Specifications

Size Serial Diluter (WxDxH)	175 x 180 x 480	mm
Size Bag Holder to TA (WxDxH)	433 x 165 x 170	mm
Size Bag Holder to SA (WxDxH)	433 x 165 x 285	mm
Size Bag Shell (WxDxH)	385 x 70 x 51	mm
Weight Serial Diluter	2.8	kg
Weight Bag Holder	1.7	kg
Weight Bag Shell	0.2	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	100-240V $\pm 10$ %	
Mains frequency	50-60Hz $\pm 10$ %	
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)	with 10 ml graduated pipette, class A: $\pm 0.5$ % with 10 ml graduated pipette, class B: $\pm 1$ % with serological pipette, polystyrene (PS): $\pm 2$ %	
Random error	$\leq 0.6$ % for Serial Diluter TA $\leq 1$ % for Serial Diluter SA	
Safety elements	detection of empty diluent flask and filling pipette monitoring of diluent dispensation emergency stop function of dosing key on Bag Holder optical and acoustical signals	
Dimension packaging complete system (WxDxH)	570 x 410 x 250	mm
Weight complete system with packaging	7	kg

#### **4 Description of function**

The Inlabtec Serial Dilution System has been developed for the use in laboratories for food analysis. It is designed for preparing serial dilutions for viable cell counts according to ISO 6887-1.

The Inlabtec Serial Dilution System simplifies the preparation of serial dilutions.

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

Adding the diluent and mixing the probe is executed with the Inlabtec Serial Diluter. The diluent is aspirated in a standard 10ml 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 probe to be diluted is transferred with a standard 1ml pipette tip (Serial Diluter TA) or with a pipette straw (Serial Diluter SA) into the first bag together with the pipette tip, respectively pipette straw. After positioning the dispensing nozzle onto the pipette tip 9ml of diluent are dispensed through the pipette tip/ straw by pressing the dispensing key. The diluent and the sterile air following flush any residue from the pipette tip/ straw and thoroughly mix the probe.

For plating and preparing the next dilution step, the diluted probe is aspirated through a second opening in the bag. Up to six dilution steps can be prepared quickly, reliably and comfortably.

For storage and disposal, the bags are placed into the Inlabtec Bag Shell.

For aspirating and dispensing probes a 1 ml air displacement pipette is used. For the Serial Diluter TA the use of wide orifice tips is recommended (see chapter 6.2).

A more detailed description of the process can be found in chapter 6.2. Serial Dilution Process.



## 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 and the contents of the flask stay sterile.



### 5.1.2 Sterilising tubing set and dispensing nozzle

Sterilise tubing set with dispensing nozzle after checking the adjustment of the pipetting table (see 5.3 One time adjustments).

For sterilising all surfaces in contact with the diluent the tubing set and dispensing nozzle are autoclaved. 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 disposal bag. The dispensing nozzle is packed in aluminium foil to prevent contamination during unpacking for installation.



## 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 One-time adjustments

### 5.3.1 Adjustment of pipetting table of bag holder

The pipetting table is preadjusted to Inlabtec LO pipette tips (Serial Diluter TA) or for pipette straws  $\varnothing$  4mm (Serial Diluter SA). If 1ml pipette tips from other manufacturers are used or pipette straws with a different diameter, the setting of the pipette table must be checked and if necessary corrected.

To maximise speed of dilution and mixing 1ml wide orifice pipette tips should be used. The wide opening also prevents clogging by larger particles in the probe. Standard 1ml tips have orifices with a diameter of approx. 0.8mm. Wide orifice pipette tips have an orifice with a diameter between 1.5 and 1.9 mm. The Inlabtec LO pipette tips have a orifice diameter of 1.9 mm. Various manufacturers offer wide orifice tips under labels like wide bore, wide orifice etc. More information is available on request.

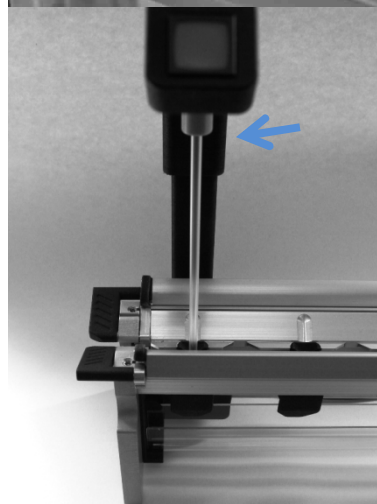
#### 5.3.1.1 Adjustment of pipetting table

The diameter of the opening in the pipetting table can be adjusted to hold 1ml pipette tips from different suppliers.

The opening is adjusted in a way that the pipette tip hangs with its flange in the pipetting table (arrow, as in a pipette rack).



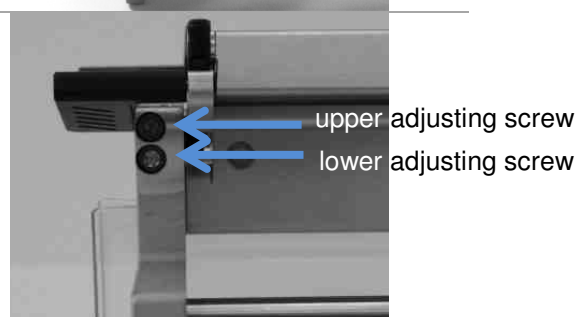
For pipette straws the opening is set in a way that the straws are as perpendicular as possible so that the dispensing nozzle can be reliably connected (arrow) and the straws don't become jammed.



1. Place the bag holder of the serial diluter on the workbench facing its backside as to gain access to the upper and lower adjusting screw.

Note: Do not place a Serial Dilution Bag in the bag holder for adjustment.

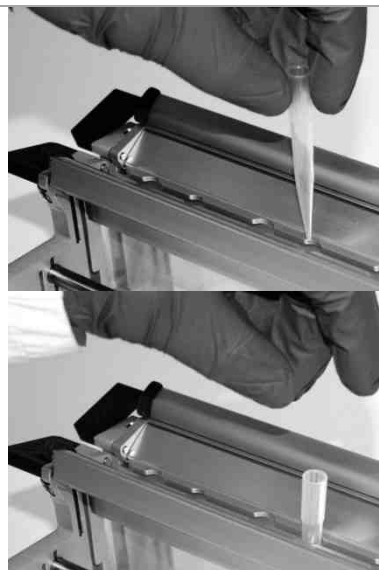
2. Insert a pipette tip or straw in the second and fifth opening (with smaller diameter) without applying any downward force.



3. Check the distance between the pipetting table and the flange of the pipette tip:

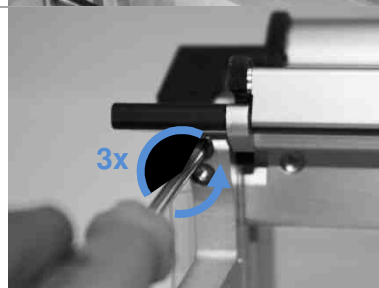
If the tips are too high (the flange does not touch the pipette table), respectively the pipette straw is jammed, then the distance of the openings must be increased. Follow step 4.

If the flange of the pipette tip touches the pipetting table easily and the tip or straw sits loosely that it can be pressed with the finger through the opening, then the diameter of the opening must be reduced. Follow step 9.

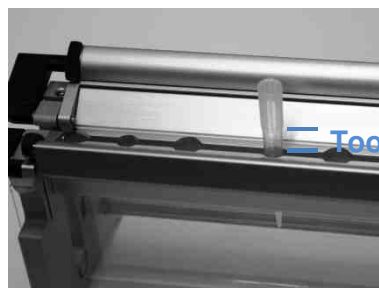


### Pipette tips are jammed

4. Loosen the upper adjusting screws on both sides by turning them 3 times in anti-clockwise direction using the Torx screwdriver supplied with the instrument.



5. Turn the lower left adjusting screw slowly in clockwise direction until the pipette tip on the left side slides downward and rests with its flange on the pipetting table (arrow). Lift pipette tip and let go several times.



6. Repeat the process on the right side.

7. Check again on the left side. If the tip sits too loose slightly turn the lower adjusting screw in anti-clockwise direction.



8. Tighten the upper adjustment screws by turning them in clockwise direction to finish the process.

### Pipette tips are too loose

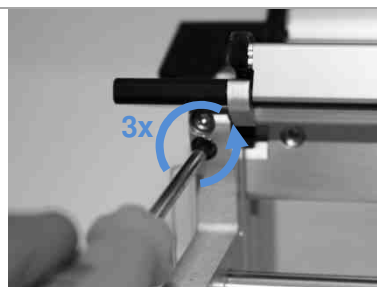
9. Loosen the lower adjusting screws on both sides by turning them 3 times in anti-clockwise direction using the Torx screwdriver supplied with the instrument.

10. Turn the upper left adjusting screw slowly in clockwise direction until the pipette tip rests with its flange on the pipetting table (arrow). Lift pipette tip and let go several times.

11. Repeat the process on the right side.

12. Check again on the left side. If the tip sits too high and the flange does not touch the pipetting table any more slightly turn the upper adjusting screw in anti-clockwise direction.

13. Tighten the lower adjustment screws by turning them in clockwise direction to finish the process.



### Checking the adjustment

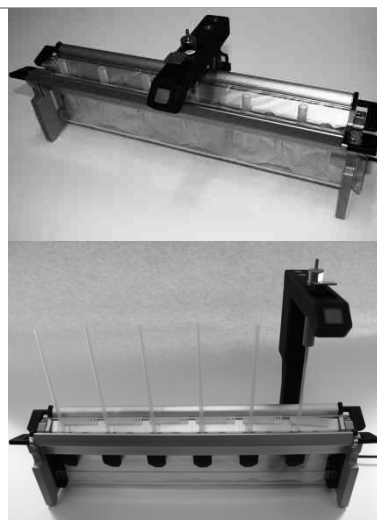
1. Place the Bag Holder in its normal operating position. Insert six Serial Dilution Bags and open them (see 6.2 Preparing serial dilutions).

2. Place a 1ml pipette tip or pipette straw in every input opening.

3. Place the dosing arm in sequence on every tip or straw and press it down.

- If the flange of the pipette tips are cramped the openings are too wide. Go to **Adjust pipette table: reduce opening**

- If the pipette tips are stuck and the bags get cramped and cannot be lifted out easily the openings are too tight. Go to **Adjust pipette table: increase opening**

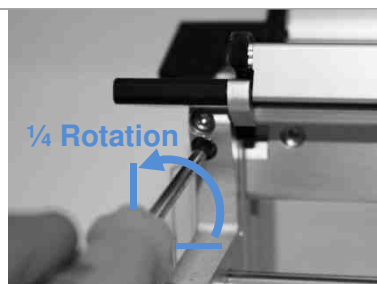


### Adjust pipette table: reduce opening

4. Loosen the lower adjusting screws on the backside by a quarter turn (anti-clockwise).

5. Tighten the upper adjusting screws on the backside by a quarter turn (clockwise).

Recheck the adjustment (Step 3)

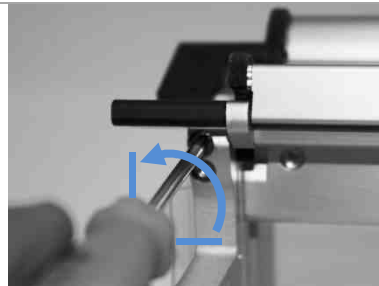


### Adjust pipette table: increase opening

6. Loosen the upper adjusting screws on the backside by a quarter turn (anti-clockwise).

7. Tighten the lower adjusting screws on the backside by a quarter turn (clockwise).

Recheck the adjustment (Step 3)



## 5.4 Electrical connections

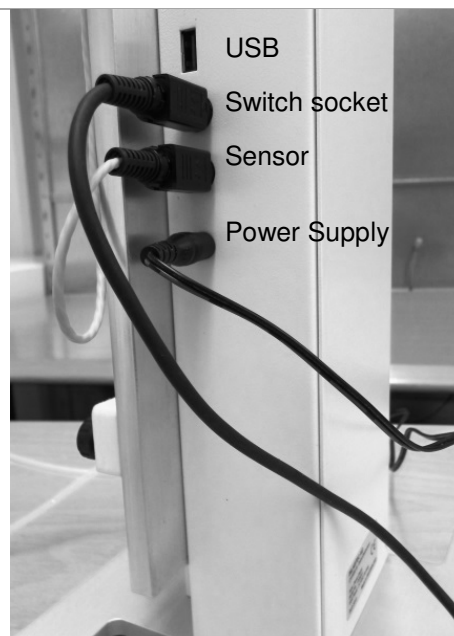
In addition to the power supply the level sensor and bag holder must be connected prior to working.

1. USB socket: For software update (see Chapter 8.1.4).

2. Switch socket: Connecting cable to Bag Holder.

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!



### 5.4.1 Check level sensor

Check the 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 5.5 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 the Inlabtec Service.

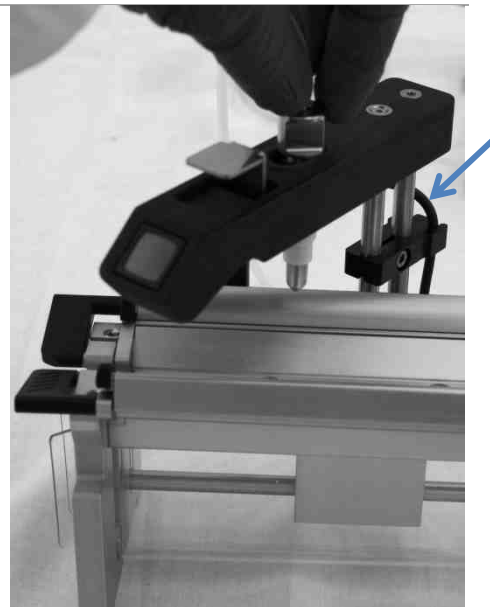


## 5.5 Assembly tubing set and graduated pipette

Assembly of the tubing set and graduated pipette is the same for Serial Diluter TA as for the SA.

Lift the dosing arm, rotate 45 degrees and mount the dispensing tip. It is fixed in the working position with a magnet. Fix the tube in the holder on the back side below the dosing arm adjacent to the cable connection (arrow). Move the dosing arm back to its parking position where the front end of the dispensing nozzle is protected by the protection sleeve in case of the Serial Diluter TA.

The protection sleeve of the Serial Diluter TA can be removed for cleaning and/ or autoclaving. The dispensing nozzle straw of the Serial Diluter SA has already an integrated protective sleeve function.

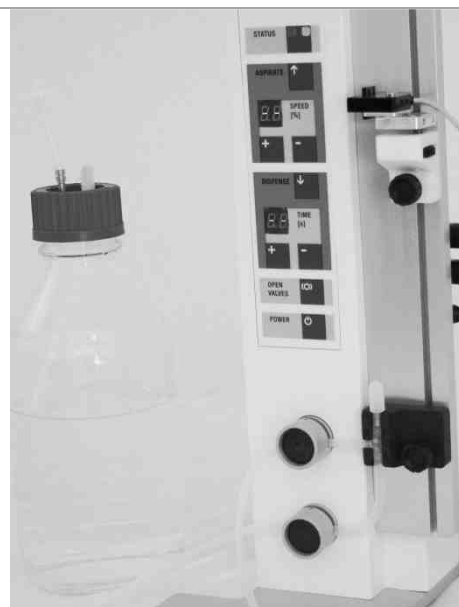


Switch Dispenser on by pressing the POWER key. Insert T-piece tubing connector of tubing set in the lower pipette holder. Do not remove the silicone cap yet.



Press the OPEN VALVES key on the Serial Diluter. 2 horizontal lines appear on the lower display and the valves open. The silicone tubes can be inserted into the valves (slightly pull the tubes and press them into the opening on top of the valves). Press OPEN VALVES again to close the valves.

If the OPEN VALVES key is not pressed the valves will close automatically after one minute.

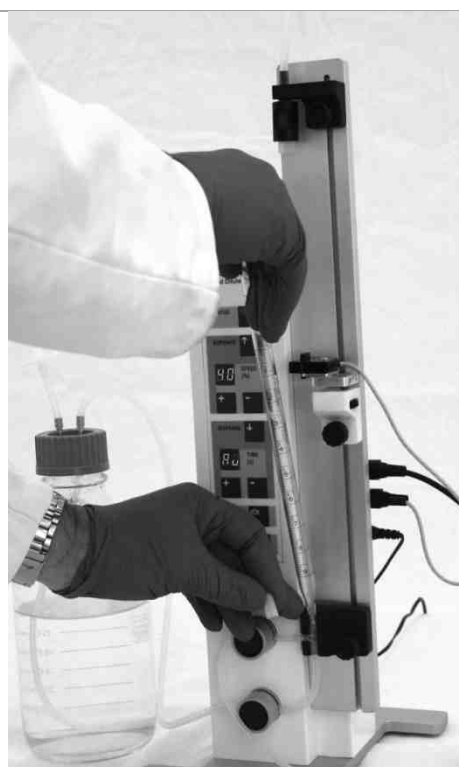




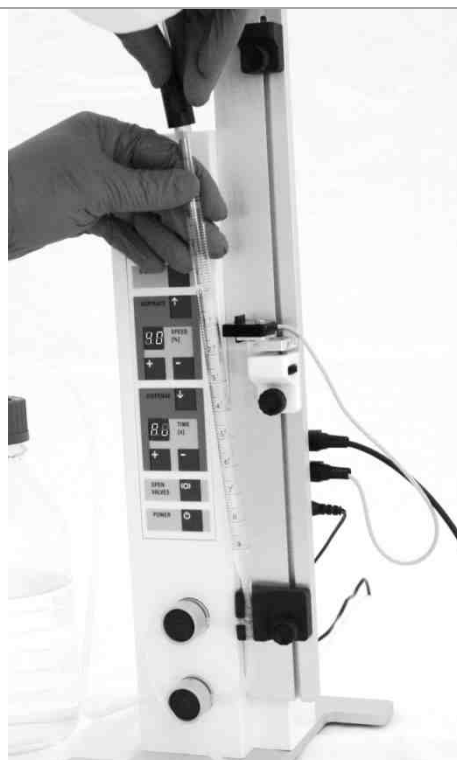
Connect the tube running through the lower valve (A) on the pipette holder to the diluter flask after removing the silicone caps on the tube and the connector cap.



Remove the silicone 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. Snap the pipette laterally into place.

Note: check whether the optical sensor touches the pipette.



## 6 Operation

### 6.1 Adjusting dosing volume

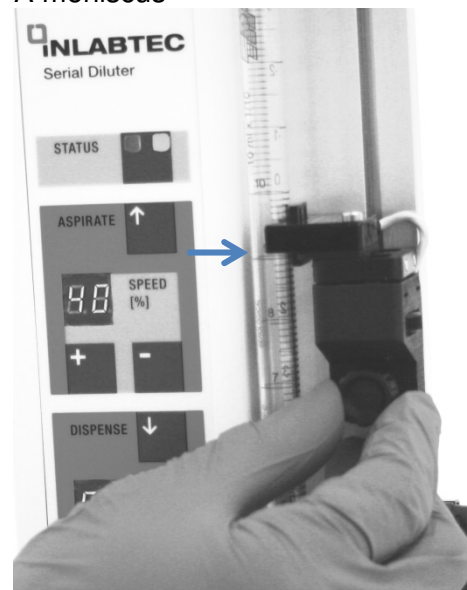


#### Notice

Before you adjust the dosing volume ensure that the dispensing nozzle points into a Serial Dilution Bag or a flask to take up the liquid.

Also, make sure that the level of the liquid in the reservoir bottle is not higher than the desired dosage amount in the measuring pipette. To form a meniscus in the pipette for exact reading of the volume a little liquid must be able to flow back into the reservoir bottle.

#### A meniscus



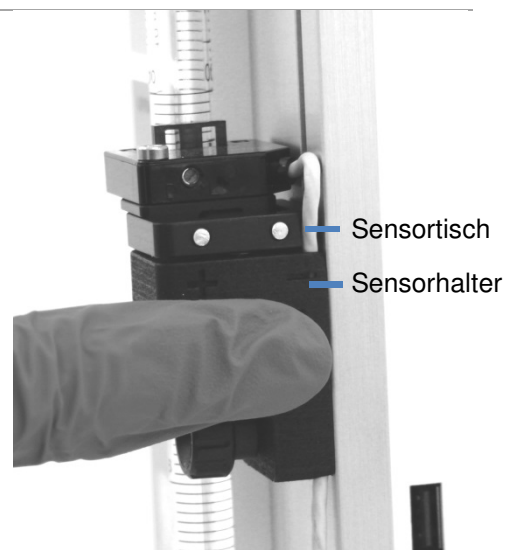
Adjust the desired amount to be dispensed by setting the level sensor along the graduated pipette. The lower edge of the sensor shows the approximate level inside the pipette. (Arrow). Tighten the clamping screw to fix the sensor and press the ASPIRATE key.

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.

Dispense at least once in an empty bag or flask to wet all tubes to ensure proper dispensing.

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



To verify the dosing volume see chapter 9 Verification of dispensed volume

## 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.

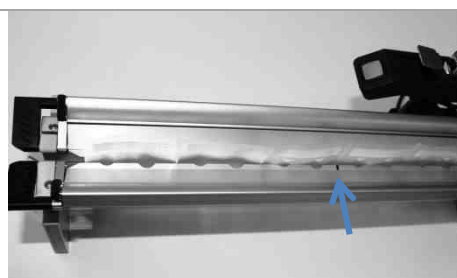


Press down the cover of the box on both sides of the recess and tear off the Dilution Bags along the perforation.

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



Insert the Dilution Bags in the bag holder from the side. If you use 3 Dilution Bags or less align the end of the bags to the mark in the middle of the pipetting table (arrow). If you use more than 3 bags align the perforation between two bags along the mark.



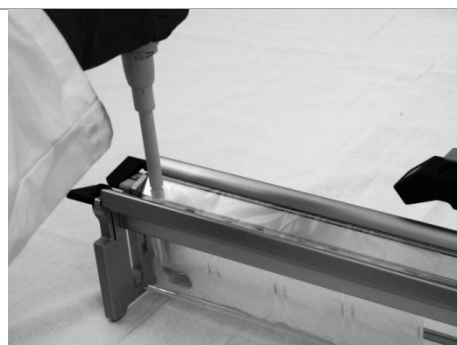
By closing and reopening of the bag flap holder the flaps of the Dilution Bags are opened and held in position.



Note: For proper operation the bag support must be positioned correctly. Make sure it firmly rests on the lower end of the openings in the side wall of the Bag Holder (arrow).



Dispense the sample into the left opening of the first bag and eject the pipette tip. The tip can be ejected directly as any remains will be flushed out with the diluent.



### Notice

Hold the pipette tips too tightly to the pipette, the direct ejection of the filled 1 ml tip can cause drops, which contaminate the pipette and thereby distort results.

If drops at the pipette are detected, the sample must be dispensed before the tip is ejected as usual or another pipette be used on which the pipette tips are not too tight. Alternatively or as a supplement, Inlabtec Pipette Filter Plugs 100220 can be used. These universal inlet filters for pipettes with a cone opening of  $\varnothing$  3 - 4.5 mm are made of highly adsorbing melamine foam and effectively protect the pipette and the samples from contaminations. Further information is available on [www.inlabtec.com](http://www.inlabtec.com).

Inlabtec can also recommend the 1 ml Eppendorf Reference 2 with the single-button operation. With this pipette pipette tips are automatically discarded empty. In addition, the spring-loaded tip cone enables low effort during operation/ ejection.

Electronic pipettes are also an alternative and provide additional comfort (see [www.inlabtec.com/resources](http://www.inlabtec.com/resources)).

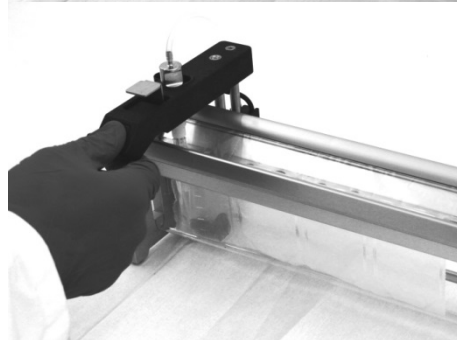
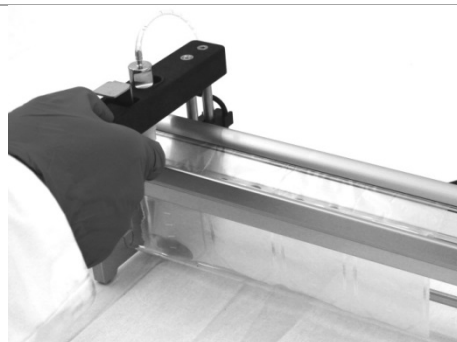
Lift the dosing arm from its parking position, rotate it and put it on the pipette tip.

By pressing the dispensing key the adjusted volume of diluent is dispensed into the bag (typically 9 ml).

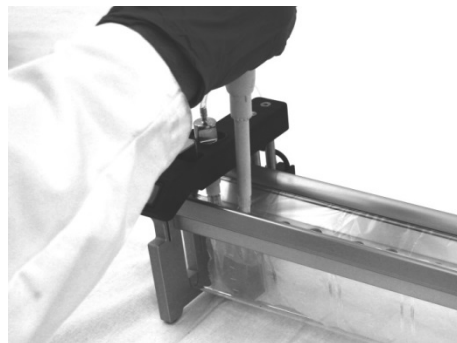
The liquid vortex generated by the flow of the diluent thoroughly mixes the probe with the diluent.

In position TIME [s] = AU sterile air will be blown for 1 second after the diluent is dispensed. This reverses the liquid vortex inside the Dilution Bag and finishes the mixing process.

The graduated pipette on the Dispenser will be refilled automatically for the next dilution step.



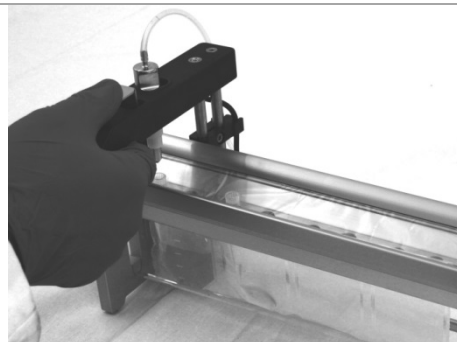
Use the 1ml pipette to plate the diluted probe into one or more petri dishes and into the next Dilution Bag for the next dilution step.



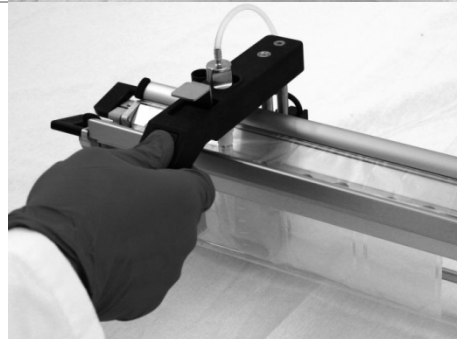
#### Notice

Beginning with software bo130625 / AP150121 (from February 2015 on), a signal is heard immediately after the blast of air (beep – beep). That signals the completion of the dilution for fastest and precise sampling. For a software update, see Chapter 10 Software Update

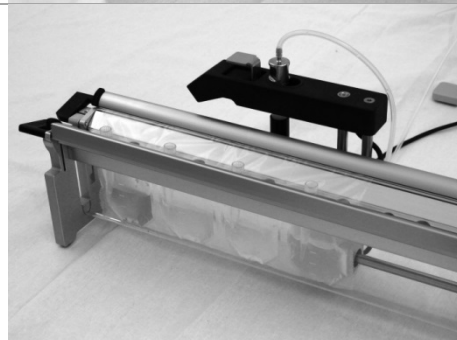
Lift the dosing arm from the pipette tip and eject the tip at the same time by pressing the tip ejector. Put the dosing arm onto the next pipette.



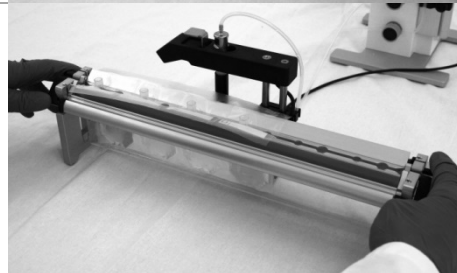
By pressing the dispensing key the adjusted volume of diluent is dispensed into the bag (typically 9 ml).



Repeat these steps until you have prepared the required number of dilution steps. Thereafter, the dosage arm is swung back to its parking position.



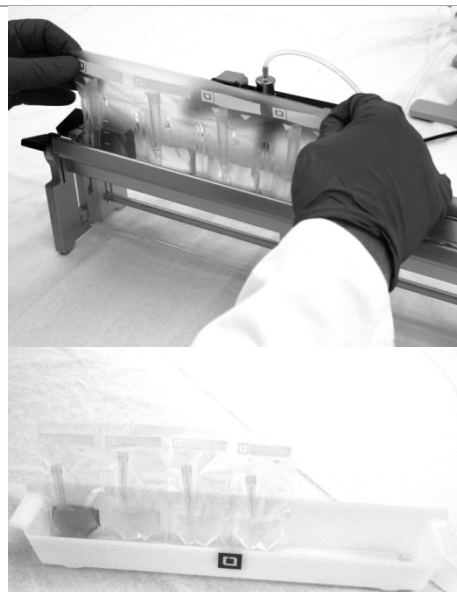
For separating and removing the Dilution Bags from the Bag Holder push the bag flap holders with both hands downward





For convenient removal of the Dilution Bags push the bags flaps back by slightly pushing upwards the bag flap holders.

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



Notice

If the Dilution Bags do not reliably separate from the bag flap holders, for example because of too strong adhesion on the grippers, so do first remove the Dilution Bags before swinging back the dosage arm to its parking position.



See a video of the preparation of a serial dilution on [www.inlabtec.com](http://www.inlabtec.com).

### 6.3 Disposal of used Serial Dilution Bags

If the probe does not have to be autoclaved the contents of the bags can be emptied into the laboratory sink and the bags and pipette tips can be disposed into the waste bin or recycled. If the probes have to be sterilised put the filled bags and pipette tips into a sealed bag and autoclave them before disposal or recycling.

## 6.4 Disassembly of tubing set and pipette

If you wish to remove the tubing set and the pipette from the Serial Diluter, first rinse the tubes and dispensing nozzle with water by connecting water to the serial diluter and aspirating and dispensing it 2-3 times. Also immerse the dispensing nozzle in water so that no salt residues lead to surface corrosion during autoclaving.

Then press OPEN VALVES. PU (purge) appears now in the top display. If you now press ASPIRATE, the contents in the pipette and in the suction tube are pressed back into the bottle until only sterile air emerges. Then you can remove the tubing set and the pipette cleanly, without any leaking fluid contaminating the workplace.



## 6.5 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 against the risk of contamination during longer breaks you can store the dispensing nozzle in 70% ethanol.

Procedure of Serial Diluter TA:

Move the dosing arm from its parking position and put a 1.5 ml or 2 ml reaction tube filled with 70% ethanol into the protection sleeve.



Move the dosing back into the parking position and dip the dispensing nozzle into the reaction tube. The white ejector sleeve seals the reaction vessel and prevents evaporation of the ethanol for at least 48 h under standard conditions.

For performing serial dilutions remove the reaction vessel from the ejector sleeve.





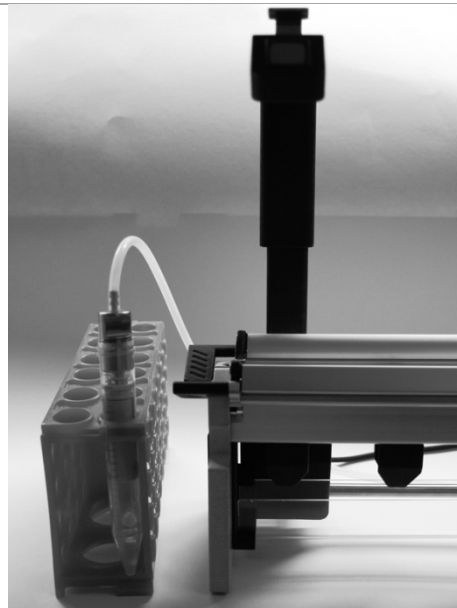
**Notice**

The dispensing nozzle should only be immersed in fresh 70% Ethanol if the Serial Diluter is not in use for a longer period of time, for example overnight, over weekend etc. In operation, the Ethanol in the reaction tube evaporates and the sterilizing effect is lost. The reaction tube must therefore be removed from the protection sleeve when performing serial dilutions. Thus, the dispensing nozzle in the parking position must remain free in the protection sleeve to be reliably protected from contamination.

**Procedure Serial Diluter SA:**

Remove the dispensing nozzle from the dispensing arm and immerse in a test tube or a 15 ml plastic tube containing 70% ethanol.

Clean the dispensing nozzle briefly with a paper towel before using it again.

**Notice**

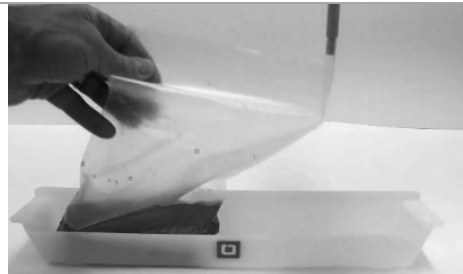
After removing the dispensing nozzle from the ethanol filled reaction tube no additional cleaning is required. The small amount of ethanol that can adhere to the nozzle will not distort the dilution significantly and will not have a significant effect on the growth of organisms.

It is recommended that the first dispensing after an interruption, eg overnight / weekend, etc. is dispensed into an empty bag and that a sample of it is used as internal control/ sterility control.

## 6.6 Remove probes from stomacher bags.

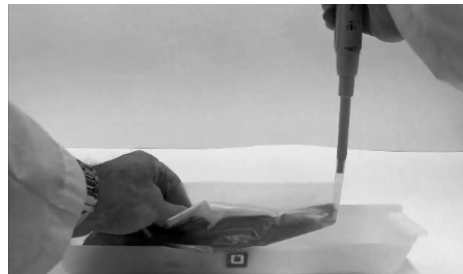
The bag shell is also very suitable as a shell for a clean sampling from stomacher bags / homogenizer bags.

For volumes inside the stomacher bag of up to approx. 250 ml the opening of the bag can be pressed down slightly with the pipette tip on one side to gain access to the liquid inside the stomacher bag



For smaller volumes put the stomacher bag down on a corner before tilting it laterally. The contents will flow more freely towards the opening and the pipette tip.

By this simple procedure, the liquid within the bag will contact the pipette tip only. This prevents any form of contamination and the whole process can be executed using a standard 1ml pipette tip.



(see demo video on [inlabtec.com](http://inlabtec.com))

For even easier and faster sampling from the stomacher bag, please use the Inlabtec Homogenizer Bags (see [www.inlabtec.com](http://www.inlabtec.com)).

## 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.

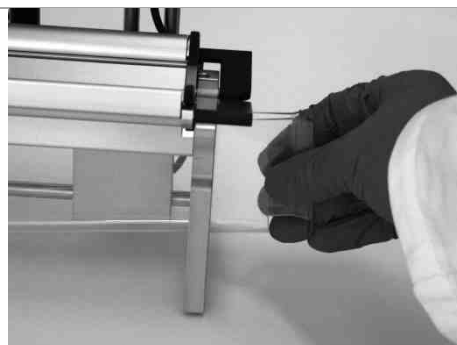
### 7.3 Adhesion gripper

If the adhesion gripper loses its adhesion clean it cautiously using water and/or 70% ethanol to remove any dust or particles. Do not strongly rub the surface as not to damage the microscopic surface structure.

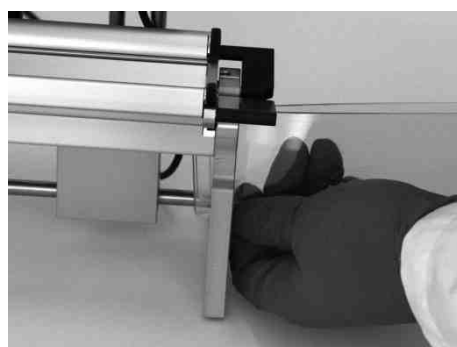
## 7.4 Bag support

Serial Diluter TA:

To remove the bag support, lift it from its position and pull it sideways from the bag holder.



To mount it press the flaps on one side and insert it.



Note: the bag support is made from unbreakable PET plastic.

Serial Diluter SA:

To remove and clean the bag support, lift it upwards and swing it outwards.



## 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

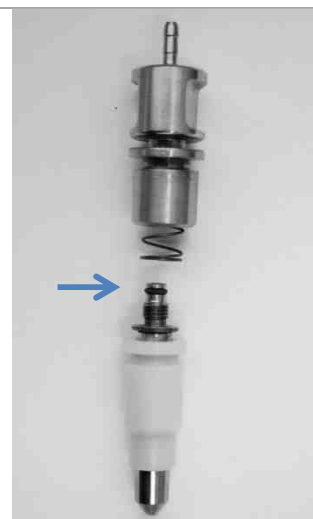
Replace the sterile filter if the pump does not fill the graduated pipette in the normal time. Tests have shown that replacing the filter is necessary under normal laboratory conditions after more than 300'000 dispensing cycles.

#### 8.1.3 Clean dispensing nozzle and check tightness

Serial Diluter TA:

The dispensing nozzle consists of an upper and lower part. If liquid escapes from the separation the connection must be tightened.

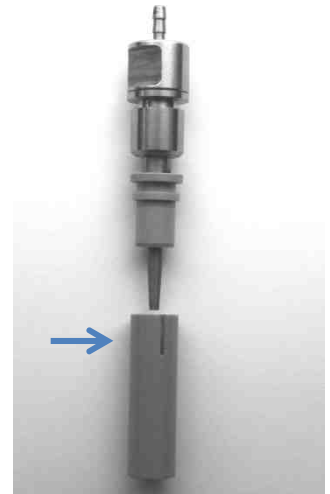
If the problem persists the O-ring (Art. Nr. 100012) sealing the connection must be replaced (arrow). Remove the worn part using a needle or knife tip and replace it.



#### Serial Diluter SA:

For the dispensing nozzle straw the wiper sleeve (part in PEEK) is in two pieces. The lower part (arrow) can be drawn off for cleaning the tip.

The mechanical design is otherwise identical to the dispensing nozzle of the Serial Diluter TA.



### 8.1.4 Cleaning and surface lubrication of the 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 oil is enough for the lubrication and protection of the steel surface.



### 8.1.5 Maintenance adhesion gripper

If the adhesion grippers still don't grip the bag flaps reliably after cleaning with water or 70 % ethanol they must be replaced. Peel off the worn parts from the bag holder. If required, remove adhesive residues using petrol or acetone.

Pull the white backing foil from the replacement gripper (Art.-Nr. 100015) over approx. 30 mm and fix it to the Alu-holder.



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



After completely fixing the adhesion gripper peel off the clean protective foil from the upper surface of the gripper.



## 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 dictates a regular verification of dispensers. The maximum permissible error in measuring volumes of dilution fluid is  $\pm 2\%$ .

### 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 EN ISO 7218

#### 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.

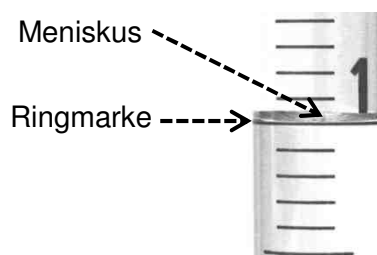
### Operation manual

Follow the operation manual. Install the graduated pipette and the tubing set (see chapter 5.5) and connect the Serial Diluter with the test liquid.

## 9.3 Preparation of test

### 9.3.1 Adjust the Serial Diluter to 9 ml

9ml are correctly adjusted when the meniscus touches the 9ml 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 via a 1ml pipette tip.
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. As an alternative the empty bags can be separated before filling.
5	Remove the pipette tip from the bag and weigh every filled bag.

## 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 measurement error 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 5:

**Random measurement error = standard deviation from mean value \***

Random measurement error 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 7218 if maximum error  $\leq 2$  % (smaller or equal 2 %).

Test failed according to ISO 7218 if maximum error  $> 2$  % (bigger than 2 %).

\*: General formula for standard deviation S

$$S = \sqrt{S^2} := \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2}$$



## 9.5 Template: Test Inlabtec Serial Diluter

Company/ Lab	iNLABTEC AG/ R&D
Date	2014-02-10
Inlabtec Serial Diluter Serial No.	1402001
Examiner	EFr
Test reason	System check

<b>Serological Pipette</b>	
Type/ Manufacturer	94010/ TPP
LOT Nr.	20110091

<b>Inlabtec Serial Dilution Bags</b>	
LOT Nr.	PE131001

<b>1 ml Pipette Tips</b>	
Type/ Manufacturer	1000WS/ UNX
LOT Nr.	299.262.206.352

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

<b>Weight Serial Dilution Bags</b>	
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%
Maximum permissible error according to ISO 7218			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.

## **9.6 Assessment of test result**

If the calculated maximum error is 2 % or lower for a dispensed volume of 9 ml the Serial Diluter complies with ISO 7218 and can be used for preparing serial dilutions.

If the calculated maximum error is above 2 % for a dispensed volume of 9ml the test has to be repeated with a pipette of the same Lot (batch number).

If the uncertainty, e.g. the systematic error, is above 1.5 % for 9 ml and the imprecision  $<0.6$  % the position of the sensor on the 10 ml pipette must be correct according to the measured systematic error. Thereafter the dispensed volume should be within the error limits using a the same type of pipette with the same batch number.

If the imprecision, e.g. the random error, is above 0.6 % check the meniscus during several aspirations and dispersions. The position of the meniscus should not vary more than 50  $\mu$ l between two cycles (using a 10 ml pipette). If the position of the meniscus varies more than 50 replace the sterile filter on the diluent bottle and repeat the test. If the random error stays above 0.6 %, contact the iNLABTEC service.

If the imprecision, e.g. the random error, is above 0.6 % 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 inner surface of the pipette is too hydrophilic this can cause a variation of the volume dispensed. Repeat the test afterwards. If the random error stays above 0.6 %, contact the iNLABTEC service.

## 10 Software Update

Using the USB-connection on the Serial Diluter a software update can be installed. Download the latest software from the Inlabtec website [www.inlabtec.com](http://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. Release DISPENSE key approx. 1 second after STATUS light shows red. All segments of display flash and the following information is shown (example):

bo 14	loaded bootloader software version
01 25	date of version
AP 14	loaded application software
02 17	date of version

### Software update process:

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 1 second. as soon as STATUS light shows 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.

## 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), 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 cycle (same volume)	Check pipette regarding drops and air bubbles and level sensor. Press ASPIRATE to adjust the volume aspirated.
A3	Cycle time too long compared to aspiration time in last cycle (same volume).	Check tubing from diluent flask. Check aeration of diluent flask and change sterile filter if necessary. Check level sensor position, press ASPIRATE to 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.
d1	Diluent is not diluted within 15 seconds, e.g. due to clogged dispensing nozzle or pinched tube.	Check tubing and repeat dilution step.
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 from 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. Replace sterile filter (Note: sterile filters should be replaced after 10 autoclavations)
L3	Level sensor defective	Check plug connection to Serial Diluter. Call Inlabtec Service if problem cannot be corrected.
C1	Bag Holder not connected	Connect Bag Holder.
C2	Level sensor not connected	Connect level sensor.
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 electrical energy as power supply is not plugged in or not connected to Dispenser	Check and 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 6.2 Serial Dilution Process)	Install bag support correctly
	adhesion gripper must be cleaned	Clean or replace adhesion gripper, see 8.1.5
Dispension does not start after pressing dispensing key	cable connection not plugged in correctly or defective	Check cable and plug and have replaced by Inlabtec service if necessary
Pipette tip cannot be inserted until flange touches pipetting table	Width of opening in pipetting table too small	Adjust distance, see 5.3.1.1 Adjustment of pipette table
Pipette tip sits too low in	Width of opening in pipetting table too wide	Adjust distance, see 5.3.1.1 Adjustment of pipette table

## 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

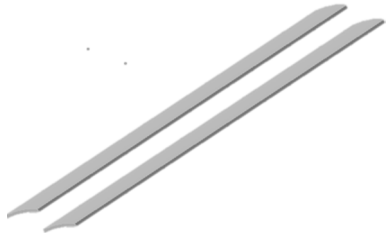

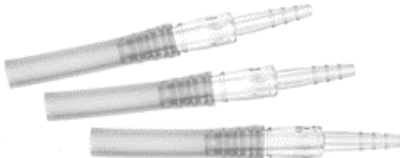



## 12.2 Disposal

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 TA for 1 ml standard tips, PVDF and stainless steel, fully autoclavable	100011	
Tubing Set, to Serial Diluter TA for 1 ml standard tips, 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	
Dispensing Nozzle Straw to Serial Diluter SA for pipette straws with inner Ø 4 mm, PEEK and stainless steel, fully autoclavable	110011	
Dispensing Nozzle Straw to Serial Diluter SA for pipette straws type Socorex with inner Ø 3.8 mm, PEEK and stainless steel, fully autoclavable	110711	
Tubing Set Straw, to Serial Diluter SA for pipette straws, incl. 600 mm intake silicone hose ID (inner diameter) 3 mm, 600 mm dispensing silicone hose ID 3 mm, 1x silicone cap intake hose, 1x silicone cap pipette connection, fully autoclavable	110010	
O-Rings, for Dispensing Nozzle, 3 mm x 1 mm, silicone, autoclavable, set of 5 pieces	100012	

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. 250 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	

## 14 Declaration of conformity

### Declaration of conformity

iNLABTEC AG  
Oberstrasse 149  
CH-9000 St.Gallen  
Schweiz

Declares, that the product

**iNLABTEC Serial Diluter**

complies with the requirements of the following European Directives:

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

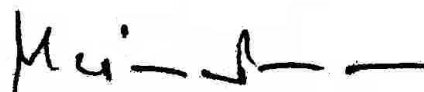
and is in accordance with the following standards:

- 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, 17.9.2013



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CEO



Martin Stamm  
CTO



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Technical data are subject to change without notice.

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