

Autosampler III User Manual



About this guide

This manual should be used as a reference guide for the operators and technical staff who have completed the user training. This manual provides the reader with detailed information about installation, maintenance and service as well as the general use of the Autosampler III. Additional information about specific applications can be made available by your supplier. Details about software installation and protocol optimization may be provided with separate manuals. Images in this manual are intended to be used generically and may not be representative of the (product) model. This manual should be treated confidentially. The contents of this manual may not be reproduced without the permission of Hygiena®, nor used in the wrong way, nor provided to third parties.

This document consists of the following parts:

- Internal/external transport
- Installation/adjustment
- Manual
- Instructions for operation
- Maintenance instructions
- Malfunctions and solutions

The different parts are intended for:

- Transport internal/external - Transport personnel
- Installation assembly/adjustment - Technical engineers
- Manual - Operators
- Repair manual - Service engineers
- Maintenance instructions - Service engineers
- Faults and solutions - Service engineers

Privacy statement

Hygiena is constantly working on the further development of its Autosampler III. The possibility of changes in this document in terms of design, technical equipment and execution must therefore, be reserved. We therefore inform the reader and owner of this manual that no claims can be assumed from the data in this manual.

Safety symbols

The following aspects must be considered: before carrying out the work, this manual must first be carefully examined. This prevents the Autosampler III from being used incorrectly. It is also advisable to keep this manual with the Autosampler III so that the operator always has access to it.

The following symbols are used in the manual:



Warning

Refer to the user manual and pay attention



Warning

Piercing hazard



Warning

Dangerous voltage



Warning

Strong magnetic field



Warning

Risk associated with chemicals or biological material



Warning

Trip hazard



Warning

Risk associated with biological material



Warning

Automatic starting machine



Warning

Warm surface



Warning

Beware of rotating parts



Warning

Optical radiation



Warning

Beware of injuries to the hand



Note

Special explanation



Tip

Interesting tips



Reserved for certified engineers

Operations to be carried out only by certified personnel

Table of Contents

1. Introduction	9
2. Technical Specifications	10
2.1. Mechanical	10
2.2. Electric.....	10
2.3. Pneumatic.....	11
2.4. Chemicals.....	11
2.5. Sizes and Weights	11
3. Transport and Storage.....	11
3.1. Transport	11
3.1.1. Internal Transport.....	12
3.1.2. External Transport	12
3.1.3. Lifting Points.....	12
3.2. Packaging.....	13
3.2.1. Items Included with Autosampler III	13
3.2.2. Preparing for Transport.....	14
3.2.3. Packaging Exterior Autosampler III	14
3.3. Storage	14
4. Assembly and Installation	15
4.1. Installation	15
4.2. Commissioning.....	15
4.2.1. Commissioning Instructions - General	16
4.2.2. Commissioning Instructions - Electrical Components	16
4.2.3. Commissioning Instructions - Pneumatic Components.....	16
5. Machine Functions	16
5.1. Workflow	16
5.2. Load System	16
5.3. Machine Control	18
5.4. Destacking and Scanning.....	18
5.5. Smart Vision Camera.....	18
5.6. Pipetting	19
5.7. Sample Dispensing and Reagent Addition.....	19
5.8. Shaking the Sample	19
5.9. Plate Output	20
5.10. Washing Needles.....	20
5.11. Carton Box Outfeed	20
5.12. Stacklight.....	21
5.13. Emergency Stop.....	21
5.14. Doorlocks	21

5.15. Conditions of Use.....	22
5.16. Description of the Operator's Workplace	22
5.17. Personal Protective Equipment	22
5.18. Restrictions on the Use of the Autosampler III.....	22
6. Standard Operating Procedure - Autosampler III.....	23
6.1. Prepare the Compressor for Use.....	23
6.1.1. Start Up the Compressor	23
6.1.2. Shut Down of the Compressor	25
6.2. Starting Up the Autosampler III	25
6.3. Initializing the Autosampler III.....	27
6.3.1. Checklist Prior to Starting Autosampler III Initialization	27
6.4. Starting Autosampler III Initialization	32
6.5. Priming the Pumps	33
6.5.1. Checklist Prior to Start Priming the Pumps.....	33
6.5.2. Start Priming Method	34
6.6. Loading Plates.....	34
6.7. Pre-Run	36
6.8. Lock/Unlock Doors.....	36
6.9. Starting a Run.....	37
6.10. Main Run	38
6.11. Dummies	39
6.12. Manual PO.....	40
6.13. Exchange of Liquids Procedure	42
6.13.1. Pumps	42
6.13.2. Chemical Containers	43
6.14. End of Day Procedure	48
7. Daily Validation Procedure	49
7.1. Autosampler III Checks Prior to Starting Daily Validation.....	49
7.2. Starting the Daily Validation.....	49
7.3 Recover MCB Plate	49
7.4 Volume Validation Syringe Pumps.....	50
7.5 Bent Needle Check.....	51
8. Replacing Needle(s)	52
9. Cleaning the Autosampler III	54
9.1. Outside of the Autosampler III.....	54
9.1.1. See-through Parts such as Doors, Windows and Covers.....	54
9.1.2. Trespa Panels (white).....	54
9.1.3. Frame Parts	55
9.1.4. Pipetting Cabin (Powder-coated White)	55

9.1.5. Deck/Stainless Steel.....	55
9.1.6. Barcode Camera.....	55
9.1.7. HMI	55
9.2. Destacker Unit.....	55
9.3. Pipetting Cabin.....	55
9.3.1. Washing Station.....	55
9.3.2. Reagent Dispenser	55
9.3.3. Downholders.....	56
9.4. Shaker	56
9.5. Tubing.....	56
9.6. Needles.....	56
9.6.1. Regular Cleaning of Needles	56
9.6.2. Deep Cleaning of Needles.....	56
9.7. Pumps (Syringes).....	57
9.8. Conveyor Belt.....	58
9.8.1. Belt	58
9.8.2. Scraper	58
10. HMI / Xperimate Operation Panel	58
10.1. Login.....	58
10.2. Sidebar	59
10.3. Recipe Manager	60
10.4. Top Bar/Manager.....	62
10.5. General Overview	62
10.6. Plate Detail Overview	64
10.7. Alarm Manager Overview	65
10.8. Status Overview	65
10.9. User Manager.....	66
10.10. Settings	67
11. Maintenance.....	68
11.1. Preparation Maintenance	68
11.2. Maintenance Instructions - Electrical Components	69
11.2.1. Barcode Scanners and Camera	69
11.2.2. Cables.....	69
11.2.3. Switch Cabinets.....	69
11.3. Maintenance Instructions - Pneumatic Components.....	70
11.3.1. Cylinder.....	70
11.3.2. Air Service Unit.....	70
11.3.3. Couplings and Valves	70
11.3.4. Air Tubing.....	70

11.4. Maintenance Instructions - Liquid Components	71
12. Maintenance Service Panel Visualizations	72
12.1. Introduction	72
12.2. Main	72
12.2.1. Login	72
12.2.2. Logout	73
12.3. Main PLC - General	73
12.3.1. Status	73
12.3.2. Routines Init	75
12.3.3. Routines General	76
12.3.4. Settings	77
12.4. Main PLC - Actuators	78
12.5. Pipetting PLC	78
12.5.1. Routines	78
12.5.2. Pipetting Channels	79
12.5.3. Settings	80
13. Camera Jobs	81
13.1. Create New Camera Job	81
13.2. Modify Existing Camera Job	93
13.3. Parameter Overview	94
14. Pierce Tables	95
14.1. Create Pierce Table	95
14.2. Test Pierce Table	101
15. Errors and Warnings	102
15.1. General Errors	103
15.2. PLC Errors	106
15.3. Error Situations	109
16. Lockout / Tagout	110
16.1. Definitions	110
16.2. Lockout Rules	111
16.3. Sequence to Lockout or Tagout	111
16.4. Sequence to Restore the Autosampler III to Normal Production Operations	112
17. Patch Management	113
17.1. Xperimate	113
17.2. HMI	113
17.3. Windows Updates	113
17.4. Installing Software	113
17.5. List of Drivers	114

18. Spare Parts List	114
19. Tools	114
20. Decommissioning and Disposal	115
20.1. Disassemble	115
20.2. Environment.....	115
20.3. Disposing.....	115
Appendix 1: Camera Flow Including Barcode Processing.....	116
Appendix 2: Box Layout Example	118

1. Introduction

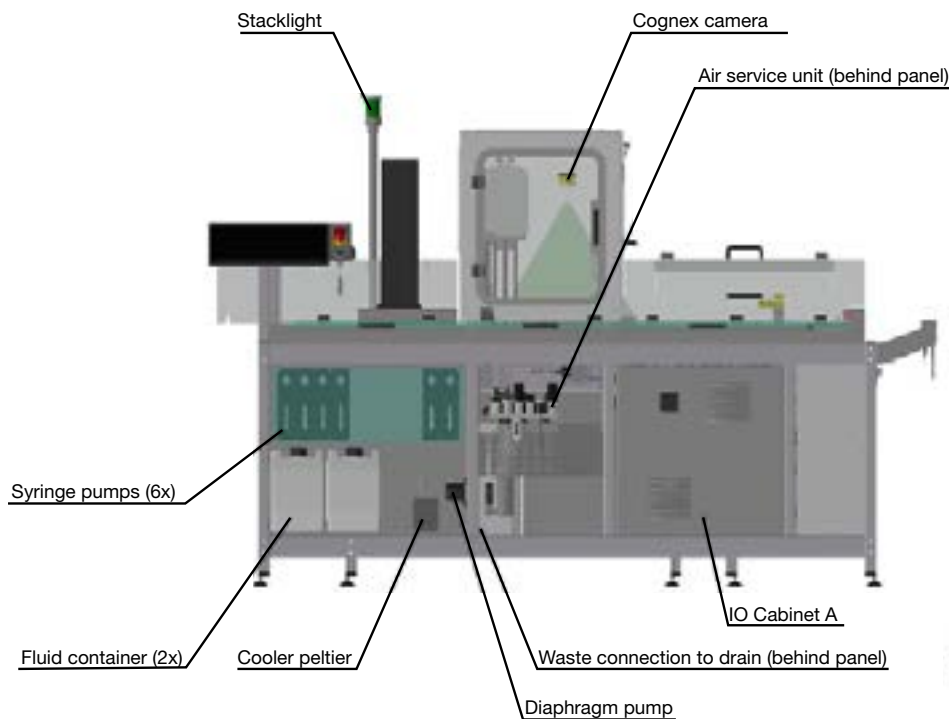
The Autosampler III aims to move liquid samples quickly, accurately and consistently from customer products to microtiter plates.

The Autosampler III is made from high quality, durable components. The surface of the Autosampler III is made from stainless steel 304 which makes for an anti-corrosive surface that is made to last. The anodized aluminum frame allows for quick and easy manufacturing and allows for adjustments when necessary. The outside of the framework is closed to minimize cleaning efforts.

The pipetting cabin is the heart of the Autosampler III. In the pipetting cabin, the samples are aspirated from the products and dispensed into microtiter plates. The pipetting cabin can be safely entered by the operator to perform cleaning and daily maintenance tasks by means of interlocks. This prevents the user from entering the Autosampler III while the system is running and forces the user to make a controlled stop of the Autosampler III. Besides the main lockable access door on the front, the user can also access the pipetting cabinet from the side and from the back. Because of this three-point access, the user has many options to enter the Autosampler III in a comfortable manner.

The electrical cabinets are not accessible for the user, they utilize special keys to only allow certified personnel to access the electrical Autosampler III. However, the user can easily power up the Autosampler III with the main electrical switch on the front of the system.

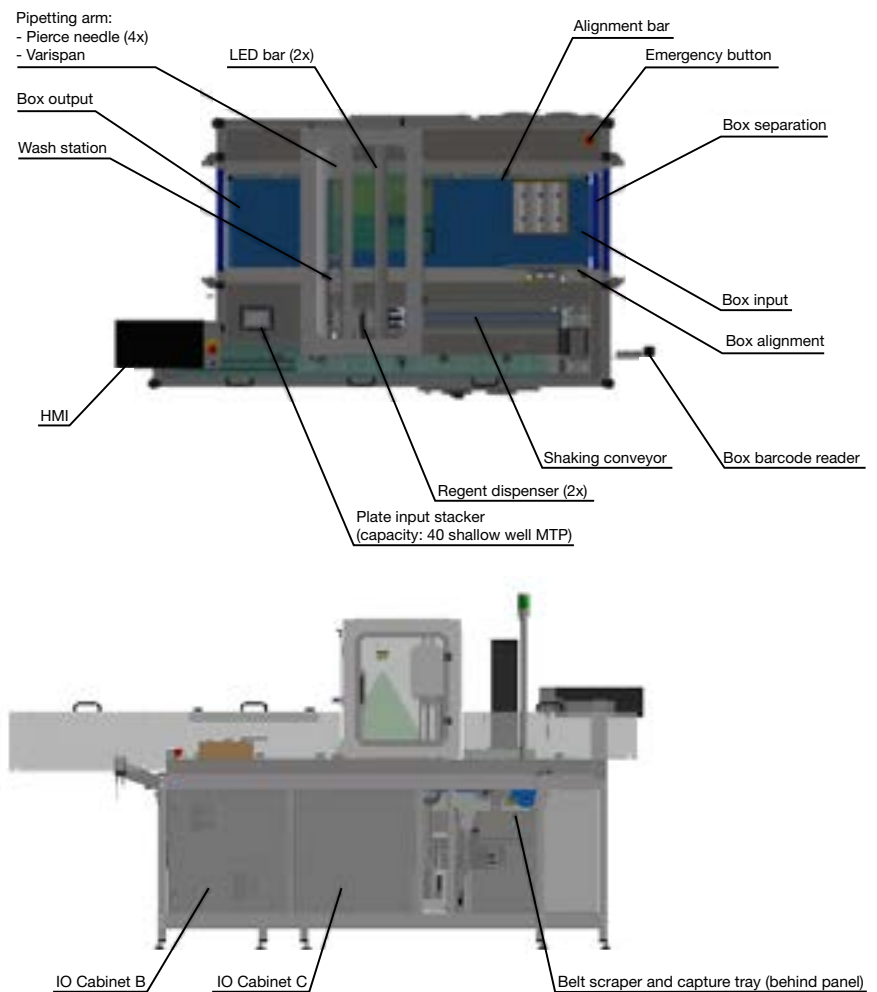
A closed conveyor feeds carton boxes containing samples into the Autosampler III. Transparent covers are implemented to shield the user from hazards, but still provide a means to visually inspect the process. If access to the conveyor is required, the access hatch on top or the several doors of the pipetting cabinet can be used. These access points should allow the user to clean the Autosampler III after a day's work.



The user can load all necessary fluids from one central place in the front of the Autosampler III. On top of this so-called fluid bay, the user loads the necessary number of plates to be processed by the Autosampler III into an automated stacker. The stacker is covered by a cover plate to ensure cleanliness of the top plate even if the stack is not emptied completely.

The user controls and receives feedback using a touch panel. Having one point of system control allows for easy and understandable workflows on the lab.

After the Autosampler III finishes the sample preparations, the finished product exits the system allowing the user to pick up the samples and place them into an Innovate for ATP testing. The whole process of sample preparation is done autonomously including the linking to the local LIMS as well as to the connected Innovate instruments.



2. Technical Specifications

The Autosampler III needs two power utilities: compressed air and electricity. In addition, for proper functioning of the Autosampler III, the system's various liquid reservoirs must be filled. Both power connections can be found on the back of the Autosampler III and are connected by means of a power plug and a pressure fitting. For correct functioning of the Autosampler III the drain of the system needs to be attached to the sewage at floor level. For alternatives to a floor level sewage please contact your supplier.

2.1. Mechanical

The Autosampler III is intended to be used in a lab or otherwise clean environment. Room temperature (0-40 °C), Humidity levels (theoretical) max 80%.

The Autosampler III is intended to be connected to an infeed supply of products and an outfeed such as roller conveyors. It is expected that products are presented at the infeed of the Autosampler III and that products once pushed out of the Autosampler III are removed.

2.2. Electric

Electrical energy supply requirements for the Autosampler III:

Rated voltage: 400 V

Rated frequency: 50 Hz

1 x CEE plug 400V 16A 5P 6H (3 Phase + N + PE) separate group.

2.3. Pneumatic

The required air quality class is 4 or 5.

The amount of air that the product uses in normal liters per unit of time is estimated at 20 L/min.

The minimum pressure is rated at 5 Bar and optimal pressure is rated at 7 Bar.

2.4. Chemicals

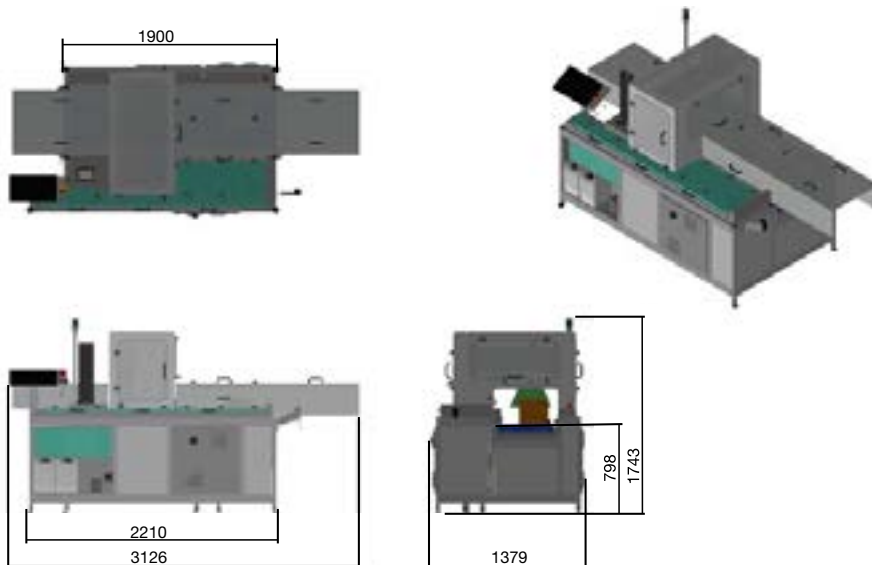
The Autosampler III is made to pipette liquids. Additional information about specific applications and their chemicals are available on www.hygiene.com. You can also access the corresponding SDS safety data sheets for ATX 200, Microwash and ATP Buffer at www.hygiene.com/documents.

The Autosampler III is designed to allow proper cleaning. The working surface is closed off as much as possible and can therefore, be cleaned properly. Connections on the worktop are resistant to alcoholic cleaning products. The Autosampler III is equipped with anodized aluminum and stainless steel. Chlorinated agents can affect these areas with prolonged use. When the Autosampler III is cleaned using wet, dry and or chemical means, the system must always be switched off by means of the main switch. Cleaning of the Autosampler III is addressed in Chapter 9 Cleaning the Autosampler III.

2.5. Sizes and Weights

The Autosampler III has the following physical properties:

- Dimensions:
 - Depth: 138 cm
 - Width: 246 cm
 - Height: 175 cm
- Weight: 800 kg
- Sound level
 - Measured average: 68 dB



3. Transport and Storage

This section contains important information about how to transport and move the Autosampler III correctly. It describes which measures should be taken during transport as well as the necessary lifting tools necessary to pick up/place the Autosampler III on and from a truck. This chapter distinguishes between internal and external transport. Internal transport refers to transport within buildings and external transport refers to transport outside buildings, for example when the Autosampler III is transported by truck.

3.1. Transport

Before any kind of transport, the product must be packed in accordance with the procedure described in 3.2.3 Packaging Exterior Autosampler III.

3.1.1. Internal Transport

A pallet lift can be used to move the Autosampler III within a building. Please note the sizes specified in this user manual. If the Autosampler III is to be moved through doors or narrow and/or low passages, this should be done at appropriate speed to avoid damage. Follow additional instructions on the packaging of the Autosampler III.

3.1.2. External Transport

When the Autosampler III needs to be transported outside, the necessary measures must be taken. Transportation should always follow local laws and regulations.

- Transport, loading and unloading of the Autosampler III may only be carried out by authorized, skilled personnel.
- The device can only be lifted from below (no lifting anchors are available). When lifting the Autosampler III utmost care must be taken to prevent injuries.
- The device must not be tilted.
- When using a forklift truck or pallet truck to move the Autosampler III it must be ensured that non-load-bearing parts cannot be damaged.
- When using pallets or other forms of formwork, these must be properly secured, and the associated safety precautions should be considered.

3.1.3. Lifting Points

There are two options available for lifting the Autosampler III. The Autosampler III can either be lifted from the rear side using a single pallet truck, or the Autosampler III can be lifted from both sides, which requires two pallet trucks.

The lifting points of the Autosampler III are based on a pallet truck with the following dimensions:

- Total width: 550 mm
- Fork width: 160 mm
- Fork length: 1150 mm



Fork placement when lifting the Autosampler III

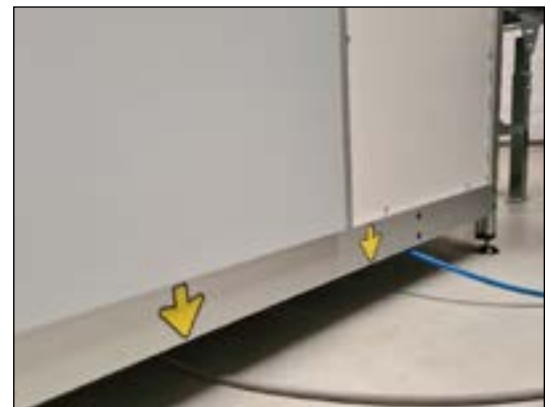
When lifting the Autosampler III, the forks of the pallet lift should be placed below the arrows, where the arrow is pointing towards the middle of the fork.



Watch out! When moving the pallet truck below the machine, move very slowly and make sure not to hit the shaker frame. Also, make sure cabling/tubing cannot get stuck between the frame and the pallet truck(s).

3.1.3.1. Lifting points rear side

Lifting the Autosampler III from the rear side can be done with a single pallet truck positioned at the lifting points on the rear side. Position the forks below the machine at 1150 mm depth to lift the machine.



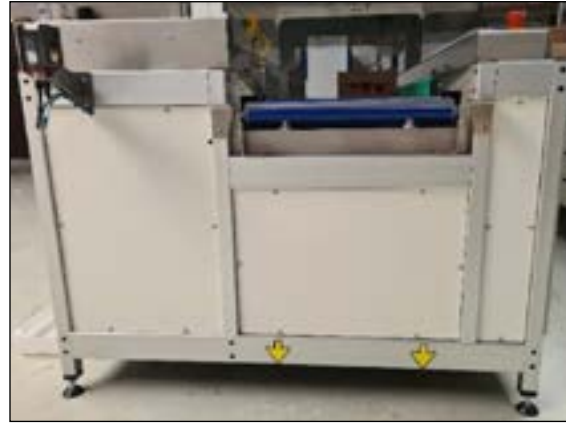
Lifting points rear side Autosampler III

3.1.3.2. Lifting points sides

The Autosampler III can also be lifted from the left and right side, which requires two pallet trucks. Position the forks of the pallet truck below the lifting points on both the left and right side of the Autosampler III. The forks of the pallet truck on the left side need to be placed at a depth of 550-650 mm. Do not exceed this depth, since this can damage the tubing and connectors below the system. The forks on the right side can be moved to a depth of 1150 mm.



Lifting points, left side Autosampler III



Lifting points, right side Autosampler III

3.2. Packaging

In order to ensure safe transport, both for the transporter and the Autosampler III, the packaging instructions must be observed. When moving the Autosampler III, remove all loose or demountable (without tool) items from the system. If chemical/biological material has been used on the Autosampler III, it must be cleaned in accordance with applicable guidelines to protect the transporter. Products that are damaged must be documented before packaging.



Keep the original packaging in order to move the Autosampler III correctly.

3.2.1. Included Items with Autosampler III

The Autosampler III has several parts that are removable and supplied separately. See table below.

Article	Quantity	Image
Needles	4	
SBS cover	1	
Compressor	Where applicable	N/A
User manual	1	N/A
CE declaration	1	N/A

3.2.2. Preparing for Transport

The moving parts in the Autosampler III must be fixed before movement to prevent damage during transport. The following steps must be followed:

1. Make sure that the machine is clean. Further guidance in doing so is described in Chapter 9.
2. The Autosampler III must be shut down as described in Chapter 6.1.2.
3. Shut down the compressed air source and bleed it down.
4. Disconnect the air supply.
5. Make sure all loose parts are removed from the Autosampler III.
6. Remove the samples and plates from the Autosampler III.
7. Remove all parts that can be dismantled without using tools.

3.2.3. Packaging Exterior Autosampler III

To prevent damage to the outside of the Autosampler III, it should be packed with the following materials.

Material	Image
Protective edge covers	
Protection strap	
(Transparent) stretch film	

The packaged Autosampler III shall be fitted with the standard packing slip.

3.3. Storage

The Autosampler III must always be stored indoors. For the proper functioning of the Autosampler III and optimal maintenance of the service life, the following environmental conditions are prescribed:

Condition	Specification
Temperature during use	0 to 40 °C
Temperature during transport	-10 to 60 °C (make sure no liquids are within the Autosampler III)
Humidity when used	20 to 80% relative humidity (no condensation allowed)
Storage environment	Cool and dry environment

4. Assembly and Installation

This chapter explains how the assembly and installation should be carried out. Please refer to this chapter when the Autosampler III has been moved.

The assembly and installation of the Autosampler III is carried out by personnel of Hygiena Partners or by an external body that has been authorized to do so by Hygiena. The final check is carried out by Hygiena Partners. The assembly and installation is carried out by qualified and experienced technicians. This chapter is written for the technicians who assemble, install and test the Autosampler III. The user of the Autosampler III can use this chapter as an information tool to verify that the installation was done properly.



Watch out! In addition to the precautions and safety instructions described on page 3, there are specific safety instructions and warnings regarding transport, loading and unloading, assembly and installation, and commissioning.

The following conditions must be met before both assembly and installation:

- Assembly and installation of the Autosampler III should only be carried out by qualified, skilled personnel.
- Only correct, undamaged and sturdy tools should be used.

4.1. Installation



**Reserved for certified engineers.
Operations to be carried out only by certified personnel.**

Before installing the Autosampler III, clearly identify where it should be installed and how the system should get to its destination. The Autosampler III must be placed in a clean and dust-free location. Before the Autosampler III can be installed, all packaging material must be removed from the Autosampler III with care. Some tools may be required to install the Autosampler III, see tool overview in Chapter 18. Before unpacking and installing, it is recommended to take a photo of the Autosampler III. After unpacking, a photo must also be taken. The photos are archived and taken by both the sending and receiving party. This is done to ensure the proper state upon receipt. In order to install the product, the following power sources must be provided:

- Voltage according to connection value
- Air pressure according to connection value

4.2. Commissioning



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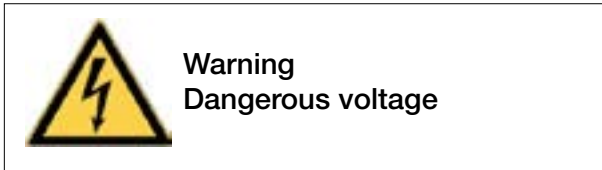
This chapter describes the steps to follow, before using the Autosampler III.

- Before starting the Autosampler III, check that all removed parts are properly mounted and secured. It is also necessary to check that there are no loose parts, such as tools and cleaning cloths, in the Autosampler III.
- There should be no personnel inside the Autosampler III when it is switched on.
- Only correct products must be used according to the specifications. If a different product needs to be processed, consult your supplier.
- Do not access a running Autosampler III with (cleaning) tools.
- While operating the Autosampler III, pay attention to unusual noises and take appropriate action if necessary.
- Before commissioning the Autosampler III, all defects must be corrected.

4.2.1. Commissioning Instructions - General

- Make sure the Autosampler III is matched to the correct products.
- In order to ensure the safe operation of the Autosampler III, the protective devices, such as the door locks and emergency stop, must be checked.
- The fixed guards such as windows and panels must be properly mounted or installed before commissioning.

4.2.2. Commissioning Instructions - Electrical Components



- The safety devices, barcode scanners, camera and control panel must be undamaged and clean.
- The barcode scanners and control camera must be set to the correct height.
- When starting the Autosampler III, take into consideration that certain electrical components can start to move.

4.2.3. Commissioning Instructions - Pneumatic Components

- The valve of the compressed air unit should be opened.
- The air service unit must be set to the correct pressure, as indicated in the technical specification: 7 bar.
- Please note the nominal working pressure of 7 bar. A higher working pressure will adversely affect the life of the pneumatic components.
- The water separator should be empty.
- When starting up the Autosampler III, keep in mind that certain pneumatic components can move.



Compressed air valve in open state

5. Machine Functions

Chapters 6 to 10 describe how to operate the Autosampler III.

This chapter provides the user with information about what functions are provided in the machine to get familiar with the subsystems before usage. It is important that the user familiarizes themselves with these instructions before using the Autosampler III.

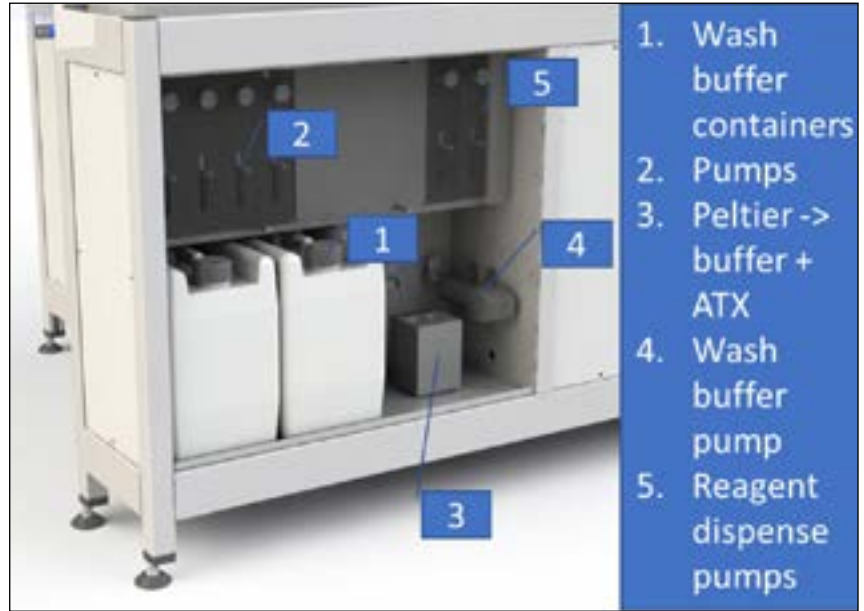
5.1. Workflow

The Autosampler III has several operating modes that can be started from the HMI interface. The sampling and manipulating procedure can differ depending on the operating mode such as sampling without adding reagents and or shaking. The machine can also just perform the manipulating tasks, reagents adding and shaking, without sampling. The daily ATP validation routine is performed the same way but has a (software) sample limitation.

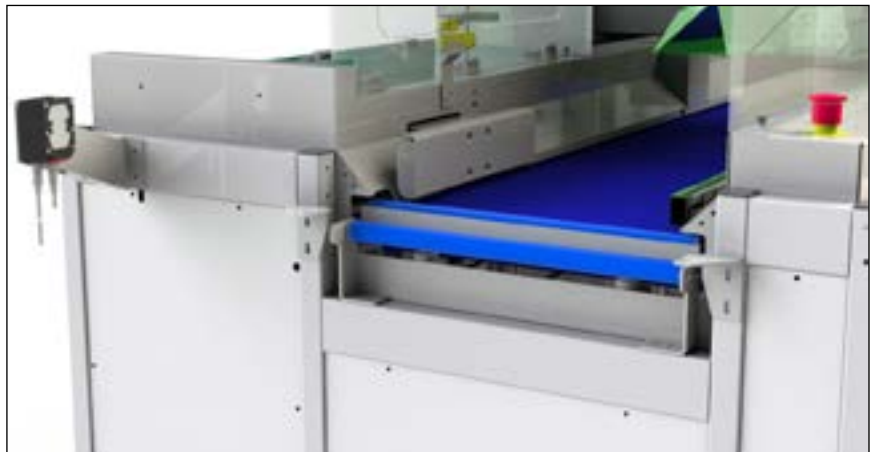
5.2. Load System

The user loads the system with microtiter plates into the destacker. The destacker has a capacity of up to 40 plates. To protect the plates in the system from external influences, the user must add the closing plate on the top of the stack. This closing plate cannot enter the machine and therefore also functions as a closing mechanism for the destacker itself. The closing plate has an edge on the sides which makes the closing plate larger than the destacker access hole.

The Autosampler III has a dedicated pump bay from which all fluids used in the system originate. The fluid bay houses the pumps, fluid containers and the cooling block. From the fluid bay, the liquids are distributed within the system. The fluid bay has a raised edge to prevent any accidental spillage from falling on the floor. The bottom of the bay has a drain plug that can be connected to the waste connection. The layout of the fluid bay can be seen in the figure below.

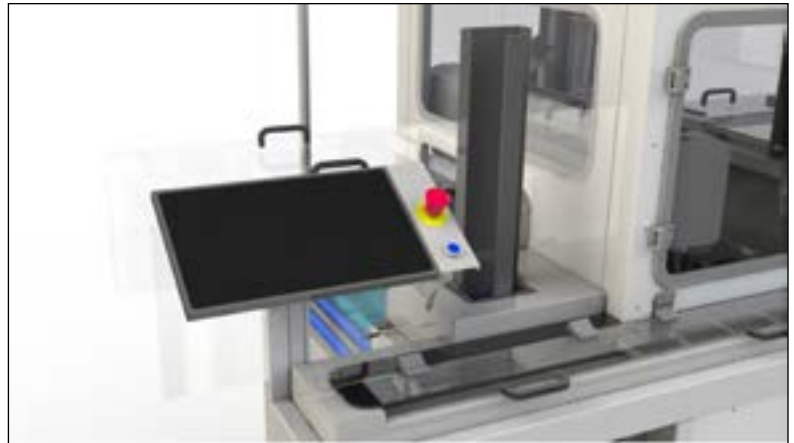


Samples enter the machine from an external rolling conveyor. The system separates the carton boxes from each other and aligns the box to the side rail (green) with a push bar (blue). This allows the Autosampler III to work with various box and sample sizes. As the cardboard box is slightly tilted at an angle, filling of the partially filled boxes with material to keep them in place may be needed. Products that are not aligned in some form may not be recognized for sampling.



5.3. Machine Control

The HMI is used to control the system and is connected to the main computer. The user can initialize, start, pause and stop the machine using the HMI. The HMI is used to start the various operation modes that the software offers such as normal operation, validation routines, but also maintenance tasks. The user gets feedback from the HMI in case actions are required but also allows the user to follow the progress of the machine. The HMI is also used in case user input is required, such as the input of barcodes. The HMI is based on an industrial touch panel. Next to the panel, an emergency stop is available as well as a button to reset the safety network.



5.4. Destacking and Scanning

The microtiter plates are fed into the system one by one by the destacking module. When a plate is destacked, the plate is located at the barcode scanning position, where the integrated barcode scanning camera scans the barcode of the plate. When the barcode is correct it is coupled to the box/sample LIMS ID.



5.5. Smart Vision Camera

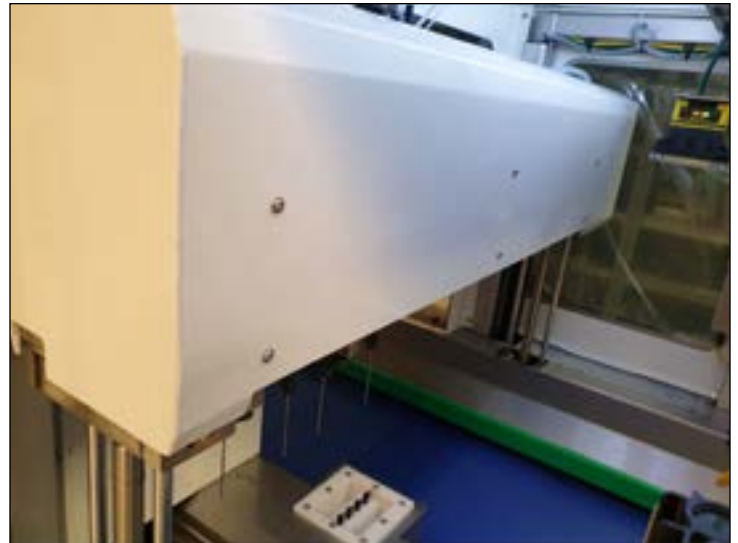
The Autosampler III is equipped with a Cognex smart camera. The camera is used to detect the piercing positions and the grid layout of a box.

A barcode camera is placed outside the pipetting cabin to read the barcodes on the boxes containing the products. The barcodes provide the system with information on what product is being processed. Using this information presets can be loaded for various functions of the system. The barcode of the box is matched with the barcode of the microtiter plate.



5.6. Pipetting

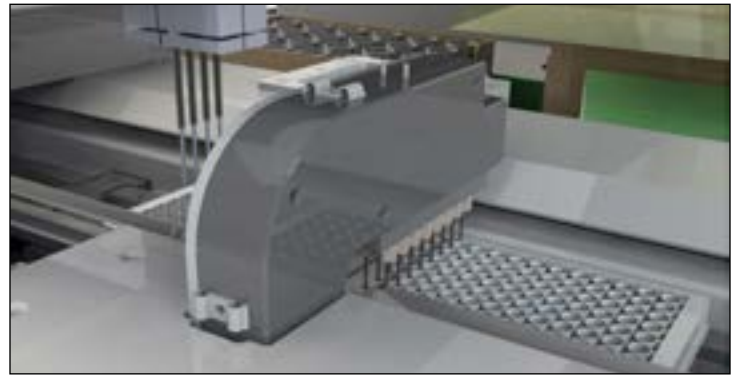
Samples are pipetted by the pipetting arm. The variable pitch allows for sampling of different products with different diameters and heights. A push off mechanism is integrated to remove the products from the needles to prevent products from getting stuck. The pipetting arm transfers the sample from the product to the microtiter plate and performs the washing steps. The conveyor aligns the new products to be sampled and the reagent dispensers add the reagents. In term of motion: the pipetting arm does the Y-Z movements and the conveyor does the X movements.



5.7. Sample Dispense and Reagent Addition

The samples are dispensed into the microtiter plate per column. When a column is filled the plate is moved one column further for the next 8 samples.

After the samples are filled in the microtiter plates, the two reagents, ATX and buffer, are dispensed on top of the sample. this is done by two 8-channel dispensers. The dispensers both add 25 microliters to the sample in the well.



5.8. Shaking the Sample

After the samples and the reagents have been added to the microtiter plate, the samples are homogenized in a shaking routine of five minutes. The shaker conveyor belt allows for each sample to have nearly the exact same chemical reaction time.

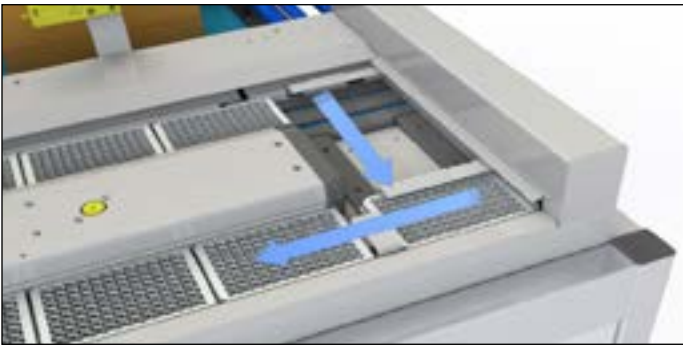


5.9. Plate Output

When the shaking has been completed the plate is pushed out of the system so that the user can bring the final product to the analyzer for analysis. A push mechanism removes the plate from the shaker and pushes it out onto the plate output buffer.

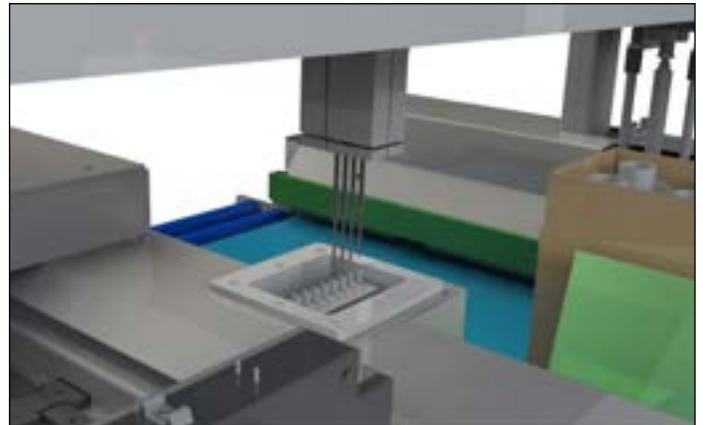
The Autosampler III has an output buffer to enable continuous processing of products. The output buffer is filled one by one with the push mechanism described above. The buffer is accessible by opening the transparent panels that close off the output buffer. The panels are used to minimize the introduction of external particles such as dust. The panels are transparent so the user can see what panel to open in order to remove a plate.

A fixed sensor is positioned at the tenth plate position to alert the user and stop the machine once the output buffer reaches 10 plates.



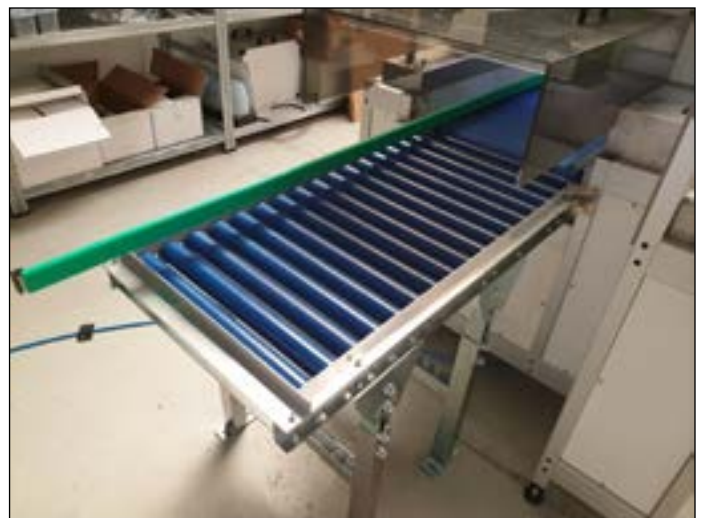
5.10. Washing Needles

The pipetting needles are washed in a washing module to prevent contamination between samples. The washing module washes both the external part of the needle as well as the inside.



5.11. Carton Box Outfeed

The outfeed of the system has two rollers to connect to an external conveyor. The system detects a correct outfeed, otherwise the system stops.



5.12. Stacklight

The Autosampler III is equipped with a stacklight stop behind the control panel. The stacklight is used to inform the user on the current status of the machine. This can be used to monitor the system's status when the user is not near the HMI panel (where this information is also displayed). The stacklight has the following colors and corresponding states:

Color	State (explanation)
Green	Running/ready
Green blinking	Paused
Orange	Not used
Orange blinking	Warning (see alarm manager)
Red	(fatal-) Error (see alarm manager)
Red blinking	"Emergency" button pressed or doors open (see alarm manager)
Blue	Idle at startup, ready to initialize
Blue blinking	Initializing or priming

5.13. Emergency Stop

The Autosampler III is equipped with an emergency stop right next to the control panel as well as on the right rear. The emergency stop must be used to prevent damage and/or injury and should only be used in an emergency. The button does not serve as a stop function of the Autosampler III.

When using the emergency stop, all dangerous movements are stopped as soon as possible, and follow-up actions are made impossible. The emergency stop causes an unscheduled stop of the Autosampler III. The current actions can no longer be restored, and a complete restart of the Autosampler III is necessary.



Emergency stop

5.14. Doorlocks



Not locked



Locked



Note: Tightly shut the doors to ensure the correct connection of the safety circuit. If not pushed properly, the safety gate light will not light up.

5.15. Conditions of Use

The products to be processed must be undamaged.

Environmental conditions:

- The Autosampler III must be set up in a clean and dry environment. In addition, the following requirements must be met:
 - Minimum ambient temperature: 0° C
 - Maximum ambient temperature: 40° C
 - Maximum relative humidity: 80%

Electrical energy requirements:

- Rated voltage: 400 V
- Power connection: 11 kVA
- Rated frequency: 50 Hz
- For further electrotechnical data see the electrical diagrams.

Requirements related to pneumatic installation.

- Rated working pressure: 7 bar.
- Compressed air quality according to DIN ISO 8573-1

5.16. Description of the Operator's Workspace

The user's workplace is indicated by the following picture. The workplace is visible in the image to the right.

5.17. Personal Protective Equipment

When using the Autosampler III, samples/recipients are used in which biological and chemical material is stored. It is up to the user to apply personal protective equipment as necessary in relation to these samples. It is advised to always wear a lab coat, gloves and safety glasses when working with the Autosampler III.



Indication of a good working environment.

5.18. Restrictions on the Use of the Autosampler III

The Autosampler III can be used for pipetting sample material from specified packaging to a shallow well plate. Liquids to be pipetted must be water-based and must not contain flammable substances.

6. Standard Operating Procedure - Autosampler III

This chapter describes the daily operations that are to be carried out in order to properly run the Autosampler III. It must be noted that working with any kind of equipment may be dangerous. The Autosampler III is equipped with safety functions that allow for safe working with the system. Make sure that whilst working the safety instructions are adhered to as well as local law and regulation.



Warning
Automatic starting machine.

To start the Autosampler III and use the basic functionality of the system, the steps below should be followed. These steps contain only instructions regarding the daily routine use of the Autosampler III. Instructions and explanations regarding settings and error handling can be found in the Chapter 11 HMI and respectively Chapter 15 errors and warnings.



Warning
Risk of exposure to hazardous chemicals.



Warning
Risk of exposure to biological material.

6.1. Prepare the Compressor for Use

Prior to the start-up of the Autosampler III please follow the following checklist:

The compressor delivered with the Autosampler III has the capacity to supply two autosamplers of compressed air. The Autosampler III needs the compressor to be operational in order to execute its functionalities.

6.1.1. Start Up the Compressor

- Check if the compressor is free from damage on the switches and valves.



Power switch



Valves

- Make sure that the air tubing is connected to both the compressor and the Autosampler III.



Connection on compressor



Connection on Autosampler III

- Make sure that the compressor is plugged into the power grid by means of the supplied connection cable.



Power cable compressor

- When all connections are made, the Autosampler III compressor can be turned on by means of the power switch.



Main switch off



Main switch on

- Make sure there is sufficient air pressure on the Autosampler III (at least 5 bar is required). This can be read from the manometer which indicates the pressure.



Insufficient pressure



Sufficient pressure >5 bar

- Make sure that the pressure valve is open towards the Autosampler III that is used.



Valve closed



Valve open

- The compressor is now operational.

6.1.2. Shut Down of the Compressor

At the end of a production day, it is advised to shut down the compressor. In order to shut down the compressor, use the following checklist:

- Make sure that all cleaning operations with the Autosampler III have been performed (please refer to cleaning in Chapter 9 and end of day procedure in Chapter 6.14)
- Close the air valve for the Autosampler III that needs to be taken out of operation.



Valve closed



Valve open

- Turn off the main switch of the compressor.



Main switch off



Main switch on

- The compressor is now turned off.

6.2. Starting Up the Autosampler III

In order to start up the Autosampler III and get the Autosampler III ready for a run, please carefully follow the steps listed below.

Step 1: Power on the Autosampler III.

Power on the Autosampler III by using the main switch on the front IO cabinet.



Step 2: Press the "Reset" button.

Press the blue "Reset" button for approximately 3 seconds after turning on the main switch. A clicking sound can be heard when the button is pressed.



Step 3: Wait for the Autosampler III to Start Up.

After pressing the "Reset" button, the Autosampler III will need up to 45 seconds to start. The status light will be blue when the Autosampler III's start-up is finished. During start-up, the status light will be blinking red, this is due to the soft start of the pressure regulator. If no air pressure is available, a soft start timeout alarm will be generated in the alarm manager of Xperimate. If a correct start-up is performed, the light will automatically turn blue after the start-up time. If the light is still blinking red after the start-up time has passed, it indicates a faulty start-up, possibly due to an "Emergency" button still being pressed, no air pressure available or an unlocked door.

Step 4: Login to the Autosampler III

When the Autosampler III is turned on, the user must log into the onboard computer in order to run the Autosampler III. The user must log into both the windows environment and the control software environment. To log into both environments please follow the following instructions:

Windows:

- Select the appropriate account: for day-to-day work please log in with (user account)
- Enter the correct windows credentials.

Xperimate:

- Double click on the Xperimate program icon on the desktop



- Fill in the username.
- Fill in the correct password.
- Change the language, if required.
- Press "OK".



- The user is now logged into the control panel of the Autosampler III. The image below shows the overview presented after logging in.



First view of control panel after login.

6.3. Initializing the Autosampler III

Before the Autosampler III can run in production mode, the Autosampler III needs to be initialized. The initialization routine is a procedure carried out by the Autosampler III to make sure all electronic parts are in a proper position and are ready to receive commands given by the Xperimate control software. As the initialization routine requires movements to be carried out, the Autosampler III needs to be free from products, dust and samples (spills).

In order to prepare the Autosampler III for initialization, the Autosampler III needs to be checked for defects, plates, samples and remaining products. The following procedure must be followed to prepare the Autosampler III for initialization:

6.3.1. Checklist Prior to Starting Autosampler III Initialization

Before initializing the Autosampler III, check the following parts.

Opening the Autosampler III doors to perform the inspection:

- Make sure all Emergency buttons are reset.



"Emergency" button pressed



"Emergency" button unpressed
(to reset turn counterclockwise)

- Press the "Reset" button next to the control panel.
- On the control panel, if not yet done, open the Xperimate control software.
- On the interface press "Unlock Doors". if the Autosampler III was locked, a clicking sound is heard from unlocking the locking pins. Also, the Autosampler III de-energizes by cutting the air supply and disabling the automatically moving parts of the Autosampler III.



Perform inspection:

- Check if the Autosampler III contains no more products on the conveyor belt.



Empty conveyor belt

- Check to confirm no plates are in the outfeed roller conveyor is clear from (jammed up) boxes of product.



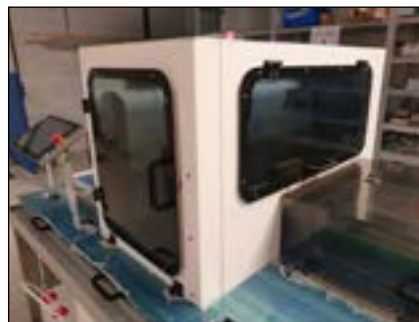
Free roller outfeed

- Check if no more plates are in the Autosampler III (excluding plate stacker).
 - Check underneath the stacker.



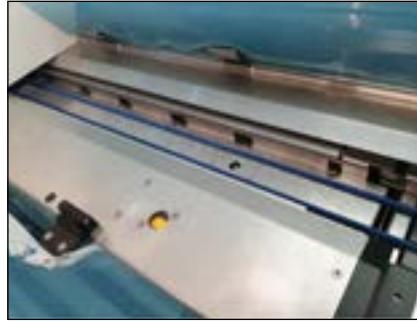
Underneath stacker

- Check within the pipetting cabin.



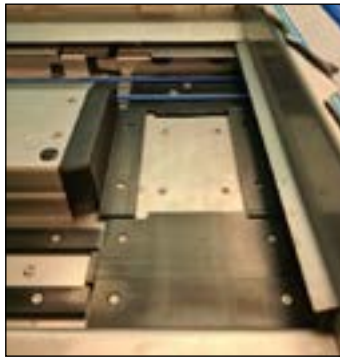
Pipetting cabin

- Check the shaker.



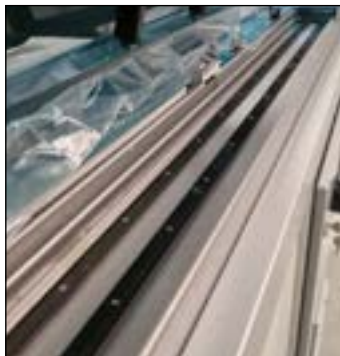
Shaker

- Check the turn module.



Turn module

- Check the plate outfeed.



Outfeed

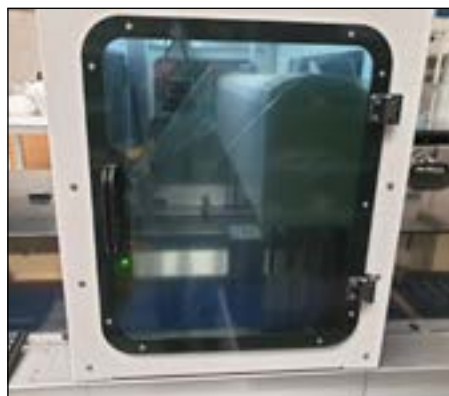
- Check to confirm surfaces of the Autosampler III are clean according to Chapter 9.
- Check that the wash bath is clean according to Chapter 9.
- Check that the needles are free from damage.
- If any of the above steps cannot be performed, please inform your (internal) contact person.
- If all checks are successful, the Autosampler III is now ready for initialization.

Close the Autosampler III:

- Close all doors and windows and make sure that all cover panels are attached:
 - Close the pipetting cabinet.



Door 1 front side



Door 2 rear side



Door 3 right side

- Close the shaker panel.

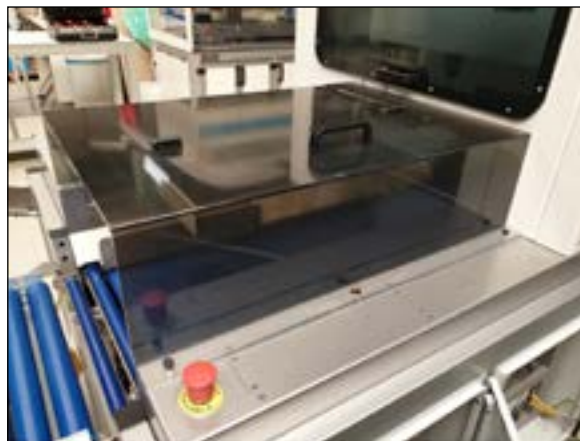


Shaker panel

- Make sure the cover panels are attached.

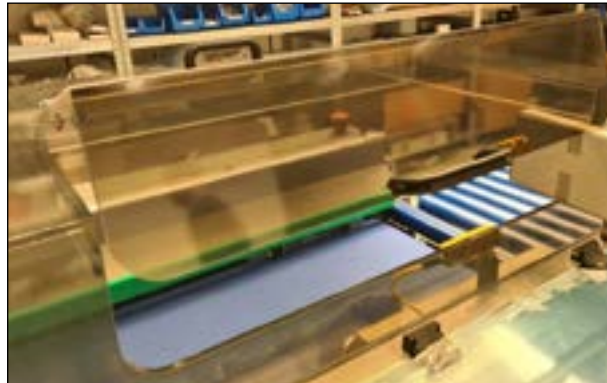


Cover panel 1 outfeed



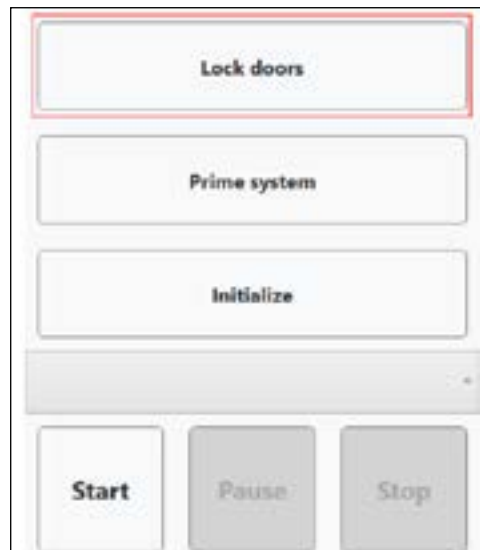
Cover panel 2 Autosampler III infeed.

- Close the access door on the Autosampler III infeed cover.



Autosampler III infeed access door

- On the interface, press "Lock Doors". If the Autosampler III is locking, a clicking sound is heard from the locking pins. Autosampler III will be energized, air will flow in and moving parts will be turned on.



- The Autosampler III is now ready to be initialized and the status light should be blue.



Status light color blue

6.4. Starting Autosampler III Initialization

Before initializing the Autosampler III, check the following parts:

Step 1: Check if no errors are reported.

The operator may access the alarm manager (Chapter 10.7) to see if any errors or warning may have occurred during the previous steps. If any errors or warnings have occurred, please refer to the error and warnings chapter in the user manual and proceed accordingly.

Step 2: Start Autosampler III initialization.

As in the previous "prepare for initialization" procedure, make sure that the operator is logged into the Autosampler III and has the landing page of the Xperimate control interface open. On the Xperimate control interface, the user must run the "02-InitSystem" method.

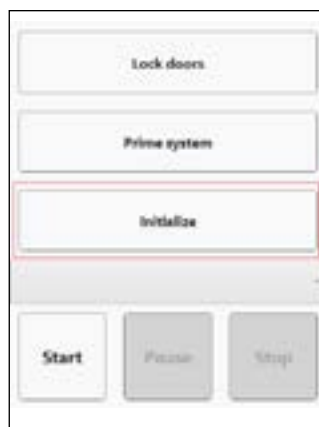
- Select the "02-InitSystem" method from the dropdown list of methods.
- Press the "Start" button.

All parts of the Autosampler III will start to initialize and move to their home positions. This means that the conveyor will move slightly forward, the pipetting channels will move up and to the back of the Autosampler III, the shaker will initialize and shake for a short duration. Then the pumps will be initialized against the input, so liquid in the syringe will be pumped back.



Note: Please make sure that ATX or buffer is not connected on system startup when the syringe is still filled with microwash as this means those will be contaminated with microwash when connected. During standard runs, the syringe will not be filled with microwash, so this will not be an issue.

The status light will blink blue during initialization.



Autosampler III initialization method

Step 3: Wait for initialization to finish.

After a successful initialization of the motors, the status light will stop blinking, indicating the Autosampler III completed initialization. In case the initialization was not successful, and no errors have occurred while performing the initialization procedure, the operator may repeat Step 1 and Step 2. If after a retry the Autosampler III still does not initialize please perform all steps from Chapter 6.3. if after repeating all steps still does not lead to a successful initialization, contact your (internal) contact person.

6.5. Priming the Pumps

Before samples can be pipetted and reagents can be dosed, the Autosampler III needs to be primed. The priming routine in the Autosampler III ensures that no air is present inside the tubing connecting the liquid containers to the pump and the pump to either the dispense manifold or the pipetting needle.

As mentioned, correct priming is needed to avoid air within the tubing. Please see an example of correct and incorrect tubing below.

Note: a tiny air bubble may form. This is not an issue if the bubble creates a small air gap between the two parts of liquid.



Correct tubing (little to no air bubbles)



Incorrect tubing (significant amount of air)

6.5.1. Checklist Prior to Start Priming the Pumps

Before priming the pumps, check the following parts:

- Sample boxes should be removed from the Autosampler III's conveyor belt.
- Plates should be removed from:
 - Underneath the destacker
 - Within the pipetting cabin (where samples are dispensed, and reagents are added)
 - The shaker
 - The outfeed-turn module
- Moving parts of the Autosampler III should not be blocked. Such as:
 - Pipetting arm
 - Pipetting channels
- All doors should be closed and locked.
- Emergency buttons need to be unpressed.
- Autosampler III should be initialized and ready.
- The tubing of both the ATX and buffer pump should be connected to the corresponding reagent bottles (Chapter 6.12)
- Reagents should be filled.
- Pipetting pumps tubing should be connected to the washing container for pipetting.
- Washing pump tubing should be connected to the washing container for was station.

6.5.2. Start Priming Method

Start priming the pumps by using the "Prime" button on the HMI. The following pumps will be primed:

- Pipetting pumps (4x)
- Reagent pumps (2x)
- Washing pump (1x)

The following methods are available to prime individual pump sections:

- 07-PrimePipettingChannels
- 08-PrimeReagentPumps
- 09-PrimeWashingPump

The priming method will initialize the pumps and pumps liquid through the tubing to prime the channels. During priming of the pumps, the status light will be blinking blue. When the pump priming is finished, the status light will be blue, indicating the Autosampler III is ready to be used.



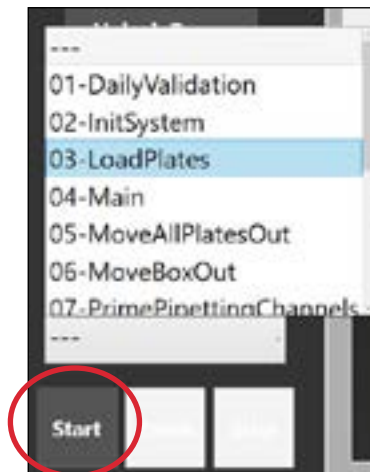
Autosampler III priming method

6.6. Loading Plates

Before the system can perform its basic operations, plates should be loaded into the system.

Step 1: Run "03-LoadPlates" method

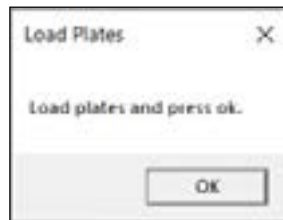
From the HMI screen, start the "03-LoadPlates" method. The destacker lift will move upward, so that the plates can be loaded.



Select method and press "Start"

Step 2: Load plates

Wait until the following message is displayed:



Load the plates in the input destacker, the plates can be placed on top of the destacker lift. Make sure the plate barcodes are facing to the right (when standing in front of the Autosampler III). Make sure that plates are properly stacked so that no plate is at an angle. (the destacker uses the skirt of the plate for destacking; therefore, the plates must align to expose the skirt to the destacker mechanism. Once the plates are in the destacker, please put the cover plate (see picture) on top of the stack. This cover plate covers the top plate, provides some weight to the last plates when destacking and closes the destacker when no more plates are available (the top plate is prevented from going down into the destacker).



Cover plate



Destacker

Step 3: Lower the destacker lift

After loading the plates, press "Ok" to resume the loading of the plates.



The destacker lift will lower and the plates are loaded. Please check if the plates are lowered correctly into the destacker. The plates should not be at an angle and no gaps should appear between the plates.

6.7. Pre-Run

Note: Depending on the agreements you have made with your supplier, this function may not be present. It is also possible that it has been implemented in a different way.

Before the Autosampler III can run day to day operations there is an additional pre-run step to perform. During this step, the ATP file is loaded from the LIMS system and made available for the Autosampler III. The ATP file is used to let the Autosampler III know which boxes should be run and information from the ATP is used to create the export file for the Innovate. Because a file is used, there is no dependency on the LIMS system during a run.

- To perform the pre-run step, press the "Pre-Run" button in the control interface.



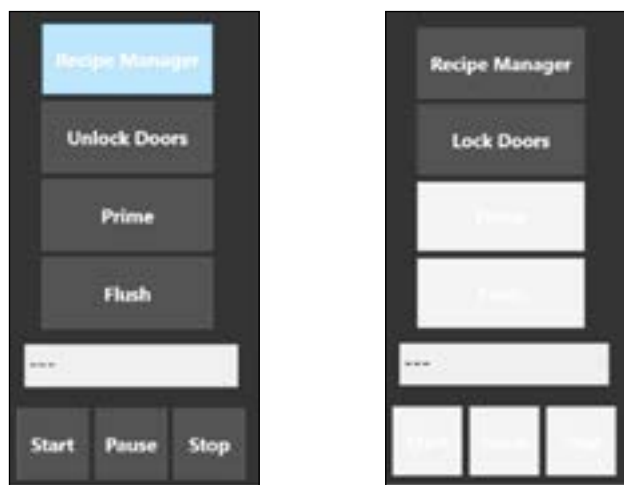
"Pre-Run" button

6.8. Lock/Unlock Doors

The Autosampler III is equipped with three automatically locking doors. This section describes how these doors can be locked and unlocked using the HMI.

Step 1: Press "Lock/Unlock Doors" button on HMI

On start-up, the Autosampler III checks if the doors are locked or opened. If the doors are locked the "Unlock Doors" button will be displayed and when the doors are unlocked, the "Lock Doors" button is displayed.



Locked Door

Unlocked Door

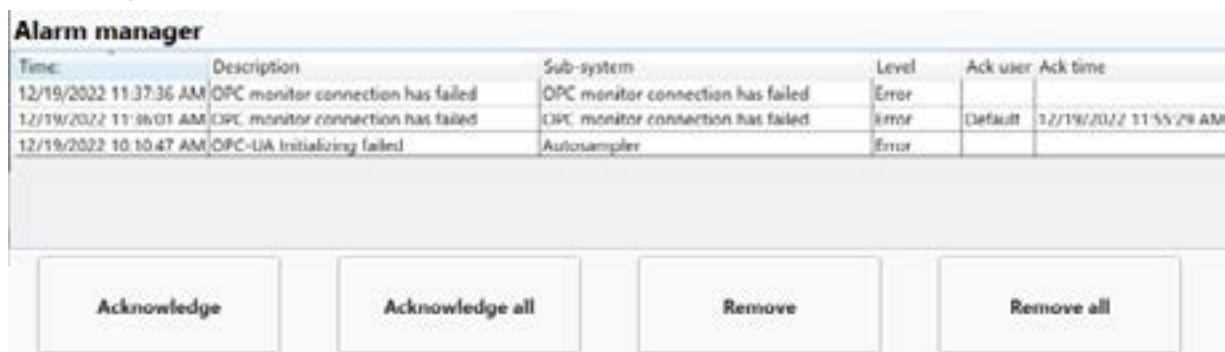
If the doors are unlocked, the "Prime", "Flush" and "Start" buttons are disabled.

Step 2: Wait for the doors to Lock/Unlock

After Locking/Unlocking the doors, the door status will be checked and updated. This takes around 6 seconds.

Step 3: Acknowledge alarm

An alarm will be generated if the doors are open. This alarm needs to be acknowledged before the doors can be locked again.



The screenshot shows the 'Alarm manager' interface. It features a table with the following columns: Time, Description, Sub-system, Level, Ack user, and Ack time. Below the table are four buttons: Acknowledge, Acknowledge all, Remove, and Remove all.

Time	Description	Sub-system	Level	Ack user	Ack time
12/19/2022 11:37:36 AM	OPC monitor connection has failed	OPC monitor connection has failed	Error		
12/19/2022 11:36:01 AM	OPC monitor connection has failed	OPC monitor connection has failed	Error	Default	12/19/2022 11:55:29 AM
12/19/2022 10:10:47 AM	OPC-UA Initializing failed	Autosampler	Error		

Step 4: Wait for Autosampler III to be ready

After the doors are locked, the operator needs to wait for the air pressure to reach proper level before being able to initialize the Autosampler III and start runs. This is indicated by a blue status light.

6.9. Starting a Run

In order to start a run, the following procedure should be followed:

- Select run from the dropdown list.
- Press "Start" button.

The following table contains the different runs that are available on the Autosampler III and their explanation:

Run	Explanation
01-DailyValidation	Used to validate the Autosampler III.
02-InitSystem	Initializes the system.
03-LoadPlates	Moves the destacker pins up, so the system can be loaded with plates.
04-Main	Default run of the Autosampler III, including sampling, adding reagents and shaking of the plates. To disable the shaker, the shake time can be set to 0 in the Xperimate settings.
05-MoveAllPlatesOut	Moves all the plates in the system out of the system.
06-MoveBoxOut	Moves a box out of the Autosampler III that is still on the belt.
07-PrimePipettingChannels	Primes the pipetting channels specifically.
08-PrimeReagentPumps	Primes the reagent pumps specifically.
09-PrimeWashingPump	Primes the washing pumps specifically.
10-ReagentsAndShake	Only adds reagents to plates and shakes plates. Assumes that the plates placed in the Autosampler III already contain samples.
11-ReplaceNeedles	Moves the pipetting channels to an easily accessible location, to make it easier to replace the needles.
12-StopShaker	Stops the shaker and releases the plate clamp.
13-WashPipettingChannels	Washes the pipetting channel needles.
14-FlushPipettingChannels	Flushes the pipetting channel needles (inside).
15-Recover_MCB_Plate	Recover last (partially) filled MCB plate.
16-VolumeValidation	Protocol to validate syringe pump volumes.
ManualPO	Used to run boxes without a barcode or rerun samples.

6.10. Main Run

After performing all the initializing steps, the Autosampler III is ready to start pipetting samples. Per batch, the following will have to be performed.

1. Fill the stacker with plates using the "03-LoadPlates" method (see Chapter 6.6 Loading plates). Make sure the plate barcodes are facing towards the right.



2. Place the boxes on the Autosampler III. Make sure the barcode on the box is facing towards the barcode scanner.



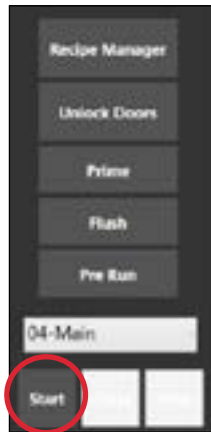
3. If doors are open, close the doors and press the "Lock Doors" button.



4. Choose the "04-Main" method from the drop-down menu.



5. Press "Start" to start the method on the Autosampler III.



After processing every plate, the software creates an export file at the set location with data that tracks the boxes with the samples pipetted into the plate.



Warning
Risk of exposure to hazardous chemicals.



Warning
Risk of exposure to biological material.



Tip when shaking is not required set "Shake Time" to 0.

6.11. Dummies

Note: This paragraph is only applicable to Autosamplers that have a build in Cognex camera.

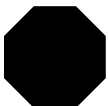
The Autosampler III expects fully filled boxes to be entered into the system. This also prevents samples from falling over. Whenever a box is not fully filled, dummies should be placed in the box to fully fill it. The camera will recognize the number of dummies and the Autosampler III will skip samples based on the number of detected dummies.

The samples that will be skipped will start from the end of the box.

Dummies should be placed from right to left, from bottom to top.

Box with dummies should be placed in the Autosampler III as shown above.

Dummies can be created using stickers with the following symbol:



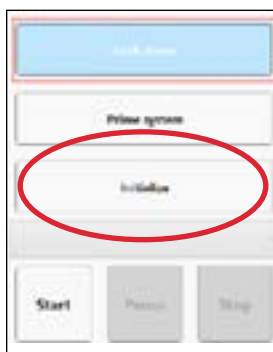
6.12. Manual PO

The Manual PO method is not standardly activated for use, to activate this method please contact the supplier. After performing all the initializing steps, the Autosampler III is ready to start pipetting samples. For manual sampling of boxes without barcodes, follow the steps listed below.

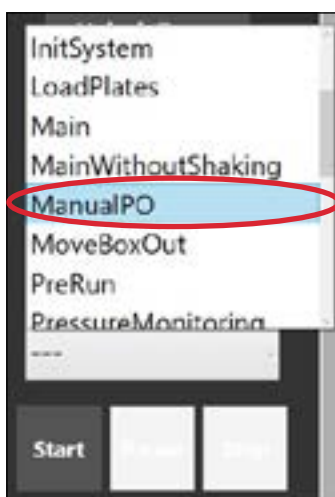
1. Fill the stacker with plates. Make sure the plate barcodes are facing towards the right.



2. Place the boxes on the Autosampler III.
3. If the doors are open, close the doors and press the "Lock Doors" button.



4. Choose the "ManualPO" method from the drop-down menu.



5. Press "Start" to start the method on the Autosampler III.



6. Fill in the PO number and the number of boxes to run. Make sure the boxes numbers are in the ATP file, otherwise the boxes cannot be processed.



7. After the manual PO is finished, the last processed box will automatically move out and the plate will continue automatically.

After processing every plate, the software creates an export file at the set location with data tracking the boxes with samples pipetted in the plate.



Warning
Risk of exposure to hazardous chemicals.



Warning
Risk of exposure to biological material.

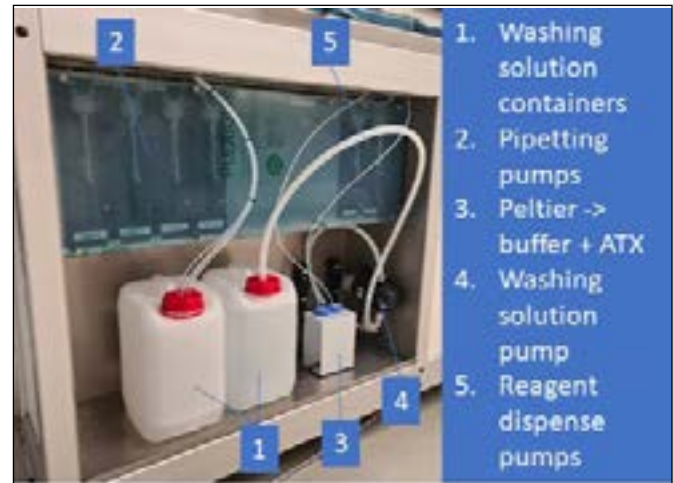
6.13. Exchange of Liquids Procedure

This section explains how liquids and or liquid containers used within the Autosampler III can be exchanged.



Be careful! Some chemicals may be hazardous; therefore, always adhere to lab regulations and wear the correct PPE such as a lab coat, gloves and safety glasses.

The Autosampler III has a dedicated pump bay from which all fluids used in the Autosampler III originate. The fluid bay houses the pumps, fluid containers and the cooling block. From the fluid bay the liquids are distributed within the Autosampler III. The fluid bay has a raised edge to prevent any accidental spilling from falling on the floor. The bottom of the bay has a drain plug that can be connected to the waste connection. The layout of the fluid bay can be seen in the figure to the right.

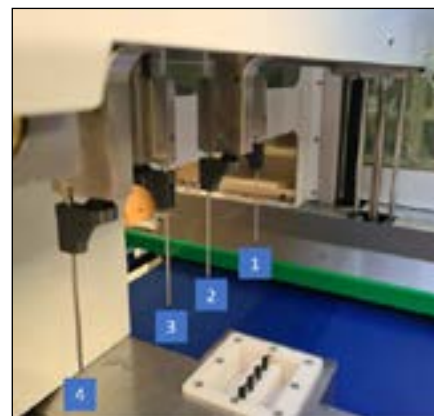


6.13.1. Pumps

The Autosampler III is equipped with various pumps to perform the liquid handling steps within the Autosampler III. This section explains which pumps are used and how to identify them. This is important to connect the correct chemical container to a pump.

6.13.1.1. Pipetting Pumps

The Autosampler III contains four pipetting pumps; these pipetting pumps are connected to the needles and to the microwash container for pipetting. From left to right, the pumps are defined as pump 1 to pump 4, which correspond to needles 1 to 4. The needle designation is from back to front 1 to 4.



6.13.1.2. Reagent Pumps

The Autosampler III contains two reagent dispensing pumps. These pumps are connected to the reagent distribution and dispense manifold and respectively to the ATX and buffer tubes. From left to right the pumps are defined as pump 1 (ATX) and pump 2 (buffer), which corresponds to the dispensing manifolds (from left to right): manifold 1 (ATX) manifold 2 (buffer).

It is important to never let the syringes run dry. When the syringes are used dry, more friction is imposed which will degrade the plunger. When the syringes are used dry, more friction is imposed which will degrade the plunger and decreases its life expectancy.

6.13.1.3. Microwash Pump

The Autosampler III contains one diaphragm pump for pumping microwash from the 4-liter microwash container to the needle wash station.



Reagent pumps

6.13.2. Chemical Containers

To run the Autosampler III in conjunction with the Innovate System, several fluids must be connected to the Autosampler III. The paragraphs below explain, in detail, what needs connected and how to do so.

6.13.2.1. Buffer

The chemical (buffer) is placed into the Autosampler III by means of a 50 ml tube. The 50 ml tube has a blue cap that has a hole through which the tubing can be fed. The 50 ml tube is placed in the cooling block.



Microwash pump



It is important to make sure that the tubing is fed through all the way to the bottom!



Position of buffer tube in the cooling block



Correct position of tubing inside the tube

The following procedure explains how to replace the buffer.



Warning: chemical exposure risk; wear proper PPE, including gloves, lab coat and glasses!

1. Remove the tubing from the buffer tube. Have a paper towel available to prevent spillage of liquids by wiping down the tubing as it is pulled out of the tube.
2. A plastic bag, tube or vial can be used to prevent liquid from flowing out of the tubing while exchanging the tube.
3. Remove the cap from the tube and replace the content of the tube so that is again filled with 50 ml of buffer. Reuse of chemicals can be requested from Hygiena.
4. When the tube contains 50 ml of buffer, the cap can be screwed back onto the tube.
5. Place the tube back into the original position.
6. Feed the tubing into the hole of the cap and make sure the tubing reaches the bottom of the tube.
7. Reset the chemical usage counter on the HMI by pressing the "RESET Buffer" button.



8. Priming may be necessary when air has entered the tubing. It is advised to always prime the Autosampler III when replacing the chemicals (Chapter 6.5)

6.13.2.2. ATX

The chemical, ATX, is placed into the Autosampler III by means of a 50 ml tube. The 50 ml tube has a blue cap that has a hole through which the tubing can be fed. The 50 ml tube is placed in the cooling block. It is important to ensure that the tubing is fed through all the way to the bottom.



Position of ATX tube in the cooling block



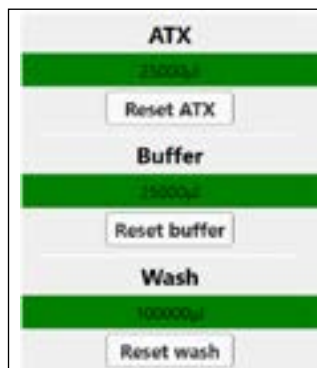
Correct position of tubing inside the tube

The following procedure explains how to replace the ATX.



Warning: chemical exposure risk; wear proper PPE, including gloves, lab coat and glasses!

1. Remove the tubing from the ATX tube. Have a paper towel available to prevent spillage of liquids by wiping down the tubing as it is pulled out of the tube.
2. A plastic bag, tube or vial can be used to prevent liquid from flowing out of the tubing while exchanging the tube.
3. Remove the cap from the tube and replace the content of the tube so that is filled with 50 ml of buffer again. Contact Hygiena for the reuse of chemicals.
4. When the tube contains 50 ml of ATX, the cap can be screwed back onto the tube.
5. Place the tube back into the original position.
6. Feed the tubing into the hole of the cap and make sure the tubing reaches the bottom of the tube.
7. Reset the chemical usage counter on the HMI by pressing the "RESET ATX" button.



8. Priming may be necessary when air has entered the tubing. It is advised to always prime the Autosampler III when replacing the chemicals. (See Chapter 6.5)

6.13.2.3. Microwash for Pipetting

The chemical, microwash, is placed into the Autosampler III by means of a 4-liter container. The 4-liter container has a red cap containing 4 holes through which the tubing can be fed. The 4-liter microwash container is placed in the fluid bay on the left side. It is important to make sure that the tubing is fed through all the way to the bottom.



Position the 4-liter container microwash

The following procedure explains how to replace the microwash for pipetting:



Warning: chemical exposure risk; wear proper PPE, including gloves, lab coat and glasses!

1. Remove the tubing from the container. Have a paper towel available to prevent spillage of liquids by wiping down the tubing as it is pulled out of the container. It is advised to remove the tubing one by one.
2. A plastic bag, tube or vial can be used to prevent liquid from flowing out of the tubing while exchanging the container.
3. Remove the cap from the container and replace the used container for a new one. Contact Hygiena for information regarding the reuse of remaining chemicals.
4. When the container is replaced, the cap with the holes can be screwed onto the new container.
5. Place the container back into the original position.
6. Feed the tubing into the hole of the cap, one by one, and make sure the tubing reaches the bottom of the container.
7. Priming may be necessary when air has entered the tubing. It is advised to always prime the Autosampler III when replacing the chemicals (Chapter 6.5).

6.13.2.4. Microwash for Needle Wash Station

The chemical, microwash, is placed into the Autosampler III by means of a 4-liter container. The 4-liter container has a red cap that contains 1 large hole through which the large tubing can be fed. The 4-liter container containing microwash is placed in the fluid bay in between the cooling block and the microwash container for pipetting. It is important to make sure that the tubing is fed through all the way to the bottom.



Position the 4-liter container microwash

The following procedure explains how to replace the microwash for the needle wash station.



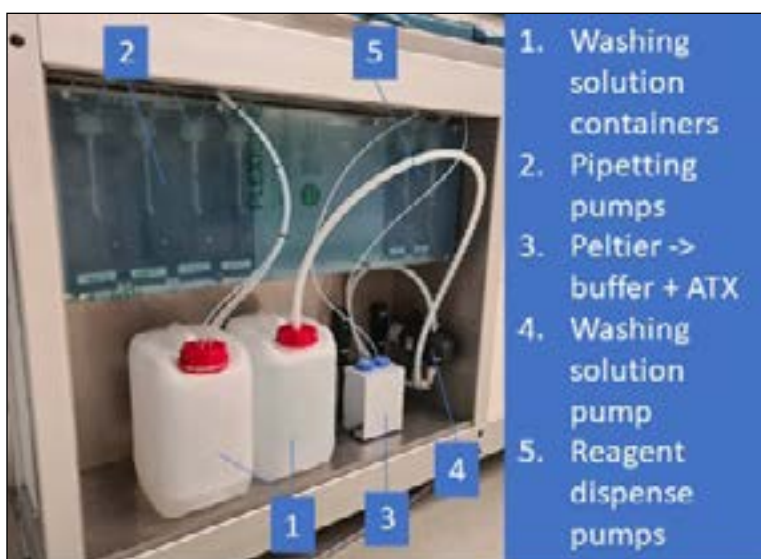
Warning: chemical exposure risk; wear proper PPE, including gloves, lab coat and glasses!

1. Remove the tubing from the container. Have a paper towel available to prevent spillage of liquids by wiping down the tubing as it is pulled out of the tube.



Due to the larger diameter of this tubing, liquids tend to flow out quicker and in larger volume compared to the small tubing. Therefore, be careful about spillage when removing the tubing.

2. A plastic bag, tube or vial can be used to prevent liquid from flowing out of the tubing while exchanging the container.
3. Remove the cap from the container and replace the used container for a new one. Information regarding the reuse of chemicals can be requested to Hygiena.
4. When the container is replaced, the cap containing the hole can be screwed back onto the new container.
5. Place the container back into the original position.
6. Feed the tubing into the hole of the cap and make sure the tubing reaches the bottom of the container.
7. Priming may be necessary when air has entered the tubing. It is advised to always prime the Autosampler III when replacing the chemicals. (See Chapter 6.5)



6.14. End of Day Procedure

This section explains how to take the Autosampler III out of production at the end of a production day. This procedure needs to be performed by the operator after 8 hours of usage or at the end of the day. This process may take up to 30 minutes to perform. The goal of this procedure, and specifically, flushing the fluid lines (tubing), is to prevent microbiological build up, crystals or precipitation of reagent within the fluid lines. All these effects may interfere with test results as well as the continued performance of the Autosampler III.

- Clear the Autosampler III from samples, plates and fluid spills. To do this perform the steps described in the Checklist prior to starting Autosampler III initialization (Chapter 6.3).
- Initialize the Autosampler III (Chapter 6.3) in order to pump the remaining ATX and buffer in the syringes back into the tubes.
- Replace the tubes with buffer and ATX with microwash. Replacing liquids is described in (Chapter 6.12).
- Prime the Autosampler III (Chapter 6.5.2), so the tubing is flushed. Use demineralized water to prevent clogging.
- Flush the Autosampler III with microwash (for anticipated longer shutdown, demineralized water is preferred to minimize chemical effects on the pumps)
 - Select "13-WashPipettingChannels" in the method selection overview.
 - Press "Start".
- Open the doors (Chapter 6.8)
- Clean all surfaces as described in (Chapter 9), specifically:
 - The surface underneath the reagent dispensers and the dispense position of the plate.
 - The needles used for pipetting.
 - The dispense needles on the reagent dispense manifold.
 - The conveyor belt.
 - The needle wash station.
- Check for bent needles (Chapter 7.5)
- Close the Autosampler III by locking the doors.
- Close the Xperimate application on the HMI (Chapter 10)
- Optionally: turn off the Autosampler III
 - Turn off the PC.
 - Turn off the main switch.
 - Turn off the compressor.

7. Daily Validation Procedure

This chapter explains how to perform the daily validation procedure.

7.1. Autosampler III Checks Prior to Starting Daily Validation

Prior to starting the daily validation of the Autosampler III please follow the following checklist:

- Autosampler III and compressor start-up are performed according to the SOP (Chapter 6.1 and 6.2).
- At least one plate is loaded into the destacker.
- The Autosampler III is initialized according to the SOP (Chapter 6.3).
- The Autosampler III is primed according to the SOP (Chapter 6.5).
- Set up the correct shaker time and speed in the HMI settings (Chapter 10.10).
- A box containing 4 uncapped PBF200 bottles is prepared. The bottles should be placed in the first row of the box.



7.2. Starting the Daily Validation

In order to start the daily validation of the Autosampler III, please follow the steps listed below carefully.

Step 1: Load the box onto the box input

Load the box for the daily validation run into the Autosampler III. The box should contain 4 uncapped PBF200 bottles, placed in the first row of the box.



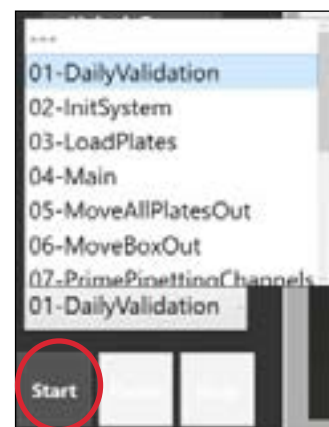
The daily validation method uses fixed positions for sampling. Make sure the 4 samples are uncapped and correctly placed in the first row of the box to prevent the Autosampler III from failures.

Step 2: Run "01-DailyValidation" method

From the HMI screen, select the "01-DailyValidation" method and press "Start".

Step 3: Remove plate from output

If the daily validation run is finished, the sampled plate can be removed from the plate output and is ready for analysis.



7.3. Recover MCB Plate

After the occurrence of an error, it is possible to recover the unfinished plate that is positioned in the pipetting cabin. The plate can be filled with reagents and sent to the output. Follow the steps listed below to recover the last (partially) filled plate in case of an error.

Step 0: Check position of the unfinished plate

Check the position of the unfinished plate. The plate must be stopped before the reagent dispense manifold. If the plate is already below the reagent dispensers, do not use this method, since the dispensing actions will overflow the wells.

Step 1: Resolve the error

If required, the error that caused the system to stop needs to be resolved first. Refer to the Errors and Warnings list (Chapter 15) on how to resolve the error.

Step 2: Initialize the Autosampler III

Initialize the Autosampler III (Chapter 6.3) to bring all moving axes to their home positions.

Step 3: Start routine “15-Recover_MCB_Plate”

Start the routine “15-Recover_MCB_Plate” to fill the unfinished plate with reagents. All remaining plates will be moved out of the system automatically after the plate is filled.



Step 4: Shake the plate

The plate is not shaken during the recovery method. If shaking is required, use an external shaker to shake the plate for the desired shaking time.

Step 5: Copy the MCB file to the network drive

Close the Xperimate application and manually copy the MCB-file from the “MCB” folder to the “transfer” folder (shortcuts to both folders are on the desktop)

Step 6: Restart the application

Restart the application. A new run can now be started.

7.4. Volume Validation Syringe Pumps

This chapter explains the procedure that can be used to validate the volumes of the syringes used in the Autosampler. The steps below need to be followed to validate the pump volumes. A few requirements need to be met before starting the volume validation process:

- System needs to be initialized.
- Pipetting channels need to be primed with demineralized water.
- Reagent channels need to be primed with demineralized water.
- Tubing, connections, syringes and needles must be in good condition and leak-free.
- At least one plate is loaded into the destacker.

Step 1: Weigh plates

The volume validation protocol uses 1 plate for each pump in the system. This means that for a 4-channel system with 2 dispense manifolds, a total of 6 plates are used. The plates that will be used for volume validation need to be weighted on a scale, write down the weight of each empty plate.

Step 2 : Load plates in the stacker

The measured plates can be loaded in the stacker, if the plate weight is linked to the barcode of the plate, the order of plates does not matter. Loading plates into the stacker can be done using the “Load plates” method (see Chapter 6.1).

Step 3 : Start volume validation method

After loading the plates start the method called “16-VolumeValidation”. This method will destack the plates one by one and use each pump to fill several wells of a plate.



The filling procedure of the Autosampler is as follows (based on 4 channels and 2 reagent pumps):

Plate	Pump	Dispense	Total Volume Per Plate
1 - 4	Pipetting pump 1-4	10 x 50 µL	500 µl
5 - 6	Reagent pump 1-2	5 x 8 x 25 µl	1,000 µl

Step 4 : Weigh plates again and validate volumes

Filled plates are automatically send to the output buffer. The finished plates can be weighted again and the volumes can be verified.

7.5.. Bent Needle Check

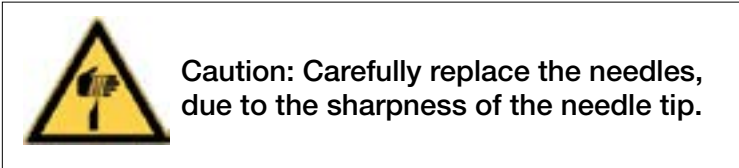
Bent needles can cause a misalignment in piercing, pipetting or positioning above the washing bath. A bent needle can potentially also cause a crash. It is therefore important to check if the needles are not bent at least once a day. It is recommended to check if the needles are bent at the end of the day, after cleaning the outside of the needles. If the needles are more than 1.5 millimeters off center, the needle should be replaced with a new one.

8. Replacing Needle(s)

When needles are broken, bent or blunt it is recommended to replace them.

To replace a needle, follow the steps described below. The following tools are required for replacing the needles:

- Allen key (size 2)
- A small piece of sandpaper

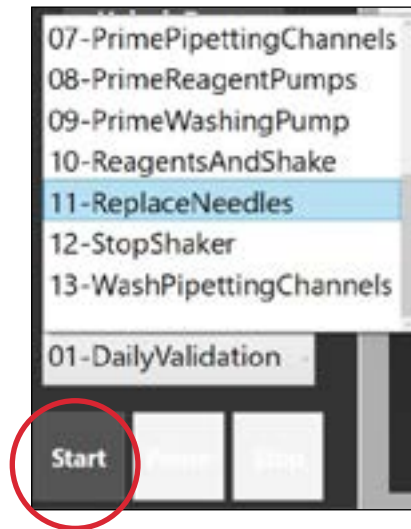


Step 1: Make sure the Autosampler III is initialized and ready

Before replacing the needles, the Autosampler III should be initialized. This ensures the needles can move to a position where they can easily be replaced. The Autosampler III should also be in an idle state, indicated by the blue light.

Step 2: Start "11-ReplaceNeedles" routine

Start the "11-ReplaceNeedles" routine from the HMI. The needles will move to the replace position and the downholders will move down. After finishing the movement, the doors will automatically unlock.



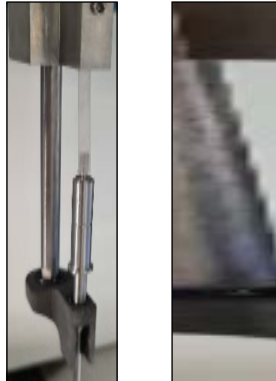
Step 3: Loosen adjustment screw

After the doors are opened, the needle(s) that need to be replaced can be removed by loosen their adjusting screw(s) with the Allen key.



Step 4: Remove the needle

Pull the needle out of the holder together with approximately 2 cm of tubing. After pulling out the needle, remove the tubing attached to the needle. The needle can now be removed and replaced by a new one.



Step 5: Connect the tubing

Connect the tubing to the top of the replaced needle.



A small piece of sandpaper can be used to create more grip on the tubing.

Step 6: Push the needle back into the holder

Push the needle back into the holder. While doing this, carefully pull the tubing on top of the channel. Make sure to not use too much force pulling the needle, otherwise the tubing can separate from the needle.



Step 7: Fasten the adjustment screw

After the needle and tubing are in place, the adjustment screw can be fastened. The doors can now be closed and the Autosampler III can be initialized again.



Step 8: Check the tubing length(s)

After securing the tubing, check if the length of tubing at the top of the channels is sufficient to move the channels from one end of the arm to the other end. Make sure that the length is adequate with some allowance but not too long. If the tubing is too long, it can get caught during movement and become detached.

It is important to ensure that the tubing is not too short as it can put strain on the connections and cause leakage or damage to the Autosampler. On the other hand, if the tubing is too long, it can get tangled and interfere with the Autosampler's operation, causing it to malfunction.



Step 9: Flush channels and check for leakage

After securing the needle, the Autosampler can be initialized. Then, the flushing method can be started to flush the needles a few times. Check during the needle flushing process if there is any leakage. If the needle drips or system fluid flows down to the downholder, the tubing is likely loose. Repeat the steps and trim a small piece from the bottom of the tubing to press it tighter onto the needle.

9. Cleaning the Autosampler III

This chapter describes how and when to clean the Autosampler III. For correct functioning of the Autosampler III, it is important to always keep the system clean. Before cleaning the Autosampler III, turn the system off (Chapter 6.14).

9.1. Outside of the Autosampler III

The outside of the Autosampler III needs to be maintained to ensure the system will perform optimally throughout its lifetime. Due to multiple chemicals and materials used, cleaning procedures must be followed accordingly.

9.1.1. See Through Parts Such as Doors, Windows and Covers

The see-through parts are made of Perspex. Cleaning materials such as spiritus and window cleaners such as Glassex are not advised as they do not dissolve dirt particles such as dust. As the particles do not dissolve, they are moved along the surface which may cause scratches. Always use a large amount of water compared with a few drops of soap. It is advised to use a lint free towel (no paper towels) to prevent scratches. A microfiber towel is preferred as it captures particles well and prevents cleaning marks. Never use aggressive cleaning materials such as bleach, acetone, alcohol or thinner as they will cause irreversible damage to the Perspex parts.

9.1.2. Trespa Panels (White)

The same cleaning method (as used for the see-through panels) applies to the trespa panels as well. For the trespa panels, a more rigorous cleaning can be performed as the surface is hardened. Therefore, the use of paper or brushes is appropriate for cleaning these surfaces.

9.1.3. Frame Parts

Again, a light soap can be used to clean the anodized aluminum frame parts. In order to prevent scratch marks, a lint free towel is recommended. Be careful with acidic cleaning materials as they may affect the aluminum surface.

9.1.4. Pipetting Cabin (Powder-coated White)

To clean the powder coated parts of the pipetting cabin, one must never use abrasive cleaning tools such as brushes or scourers. It is recommended to use a light soap. Avoid using very alkaline or acidic cleaning agents (use products that have a pH value between 5 and 8). In case of persisting stains, a polishing agent may be used, but be careful to not abrade the surface. A wax product may be used to keep the glazing effect of the powder coating. This also may protect the surface from liquid stains.

9.1.5. Deck/Stainless Steel

The stainless steel parts can be cleaned with a light soap. Prevent using bleach or chlorine-containing cleaning agents as they can cause the stainless steel to corrode. Window cleaners such as Glassex may also be used. When using ethanol, make sure that the Autosampler III is always turned off. To prevent leaving scratch marks, use a lint free towel and preferably a microfiber cloth. When the stainless steel turns dull overtime, stainless steel cleaning agents may be used to polish the surfaces and make them shiny again.

9.1.6. Barcode Camera

Use a dry, clean and lint free cloth to clear the lens of the barcode camera free from dust.

9.1.7. HMI

The HMI screen may be cleaned as is done with any computer screen. The best way to clean the screen is to use a damp or dampened microfiber cloth. Fingerprints are removed as well as dust. If fingerprints persist use a light soap. Avoid using paper to prevent scratch marks. Do not apply pressure when cleaning the screen.

9.2. Destacker Unit

The top (black) part of the destacker is made from anodized aluminum and should be cleaned in the same way as the frame parts. The plates may wear off the surface of the destacker unit leaving marks. These marks do not impact performance but may cause dust to fall off therefore it is advised to clean this part regularly.

The plastic plates that are loaded into the destacker may break a little from time to time; therefore, the destacker should be checked for loose plastic particles. Reaching into the destacker may only be done when the Autosampler III is turned off or when the doors are open.

9.3. Pipetting Cabin

Within the pipetting cabin, the stainless steel parts can be cleaned as described previously under deck. Other parts to be cleaned are the washing station and the reagent dispenser.

9.3.1. Washing Station

The washing station can be cleaned with microwash or ethanol solution. Always check to ensure the drain of the wash bath is not blocked. To check for blockages, pour 0.5 L of demineralized water in the washing station. If the water drains in a considerable amount of time, it can be assumed that the drain is working correctly. If the drain is blocked, check the connection points.

9.3.2. Reagent Dispenser

The reagent dispenser needles can be cleaned using a lint free cloth. Optionally, it can be wetted using an alcohol solution. Make sure that no residual buffer can be seen on the needles. When blocking has occurred, a fine reamer can be used to clear the blockage, or the needle may be replaced.

9.3.3. Downholders

The downholders can be cleaned using a lint free cloth with microwash or ethanol solution. When using ethanol, make sure that the machine is turned off.

9.4. Shaker

The shaker is a delicate part of the Autosampler III due to the accuracy required to shake properly. Cleaning of the shaker can be done as described in the stainless steel section. However, take care to not apply too much liquid, i.e., use a damp cloth and not a soaked cloth. Be careful about applying force. Some force may be applied (similar to that used on the HMI screen).

9.5. Tubing

Tubing may be cleaned internally with microwash and ethanol. When using ethanol to clean the tubing (internally) the Autosampler III must be turned off. Flushing can be done by removing the tubing from the pump and using a manual



Picture of what tubing to detach from the pump when using ethanol



Warning: chemical exposure risk; wear proper PPE, including gloves, lab coat and glasses!



Warning: Puncture hazard

syringe to flush the ethanol through the Autosampler III. Also, when ethanol has been used to clean the tubing, it must be followed with a manual cleaning using demineralized water to remove the ethanol of the Autosampler III.

9.6. Needles

Clean needles are vital to the correct functioning of the Autosampler III. The goal of this procedure, and specifically flushing the needle, is to prevent microbiological build up, crystals or precipitation of reagent within the fluid lines. All these effects may interfere with test results as well as the continued performance of the Autosampler III.

9.6.1. Regular Cleaning of Needles

The needles of the Autosampler III can be cleaned from both the inside and outside. To clean the needles from the inside, start the "Flush" method from the HMI. For cleaning the outside of the needles, the "13-WashPipettingChannels" method can be started from the dropdown menu. This already happens during every wash cycle after sample has been pipetted, but there is a manual option in the HMI as well.

9.6.2. Deep Cleaning Needles

For deep cleaning of the pierce needles, the needles must be taken out of the system. In order to do so, follow the steps listed below.

1. Follow the replace needles procedure (Chapter 8) in order to remove the needles from the system.
2. Place in container of ethanol.

9.7. Pumps (Syringes)

After 3 months of usage or when markings are present or performance declines, the syringes need to be replaced.

For optimal performance check the fluid connections on a regular basis. The fittings, also known as lock nuts, should not be wet nor have visible precipitation of chemicals. The syringe glass should not have markings. A tiny amount of liquid may be present underneath the plunger a small hole is present to allow for air to enter and for some evaporation to occur. If liquid persists to be underneath the syringe or a pool of fluid is formed, the syringe needs to be replaced.

When the lock nuts are wet, or crystals have built up around the connectors, inspection is due. Remove the couplings as follows:

1. Remove the cover plate using a size T20 Torx screwdriver.



Picture of cover plate and screw points

2. Turn the locknut counterclockwise and have a lint free towel available to capture any fluid that is inside the locknut.
3. Clean the inside of the locknut using a lint free towel. Demineralized water can be used. Optionally, ethanol can be used, but only when the Autosampler III is turned off. The goal of the cleaning is to remove any particles such as formed crystals or dust.
4. Check the ferrule for wear. A correct ferrule should not be deformed and has a conical shape.
5. Replace the ferrule, if needed, so that it is attached as pictured below.
6. Insert the tubing so that the flat part of the ferrule sits against the back of the port.
7. Screw the lock nut in place by turning it clockwise. Screw until hand tight, no tools are needed.

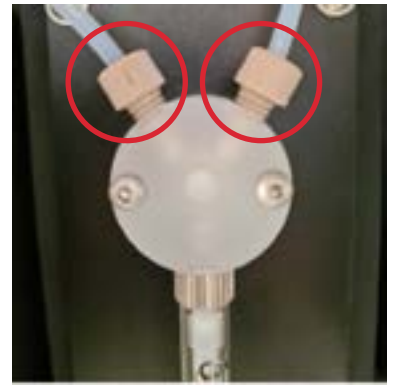
Replace the syringe.



Ferrule attached correct

To replace the syringe, the following steps must be performed.

1. Start the "replace syringe routine" in the interface. This moves the plunger down.
2. Remove the cover plate in front of the syringes.
3. Remove the screw on the plunger by turning it counterclockwise.
4. Remove the syringe barrel by turning it counterclockwise.
5. Attach a new syringe by turning it clockwise.
6. Attach the plunger screw by turning it clockwise.
7. Reattach the cover plate.
8. Perform an initialization routine (Chapter 6.3).



Picture of one pump displaying the lock nuts



Plunger screw

9.8. Conveyor Belt

The conveyor belt is used to move the products in order to sample them. Please follow the instruction below to maintain this part of the Autosampler III.

9.8.1. Belt

We recommend that you keep your belts' adhesive qualities intact by cleaning the belt when necessary. A clean belt is necessary for proper friction. The belt's longevity may be increased by making sure the bottom of the boxes do not contain dust or sand collected from being on the floor.

Cleaning agents that may be used are:

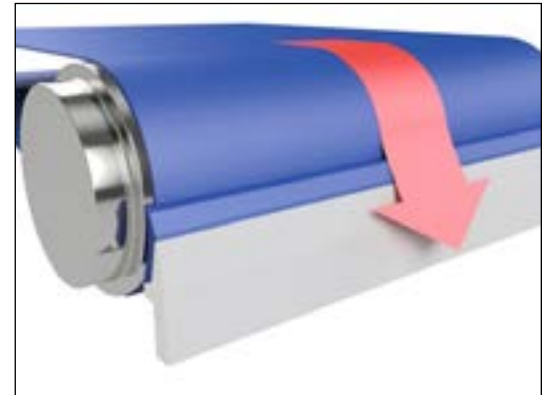
General

- Soap and water
- Borax
- Household cleaners: Many are useful, check formulation and perform a spot test.

Spot cleaning

- Ethanol

Please note: Combinations of agents may cause unpredictable damage. Do not use chlorine-based products.



Belt scraper working principle

9.8.2. Scraper

The conveyor belt is equipped with a scraper to capture fluid spills that may form when piercing products. To access the scraper, the service panel needs to be removed using a size T30 safety Torx.

10. HMI / Xperimate Operation Panel

This chapter will explain the visual parts of the HMI Autosampler III. The HMI is part of the Xperimate platform developed by Synchron. The HMI is an enclosed user interface that will not have access to all the functionalities of Xperimate.

The main difference is that Xperimate can be used to build program flows. This is not available in the HMI. However, the HMI has been optimized to make operating the Autosampler III clear and concise.

The picture to the right shows the complete HMI overview. Individual parts will be explained in their corresponding chapters.



10.1. Login

On application startup, it is necessary to login with a username and a password.

10.2. Sidebar

In the image to the right, the sidebar is displayed. This sidebar is always visible across all screens. This sidebar contains the main control elements for the Autosampler III.

At the top of the sidebar the username of the current user is visible. Next to the username is a "Change User" button. Pressing this button allows the user to login with different credentials.



There are 6 tabs. Each tab will display additional information about the current method and the status of the Autosampler III. Each tab will be explained in their corresponding chapter.

- Tracking manager, general system overview.
- Status manager, status overview of the system.
- Alarm manager, alarm management.
- Recipe manager, management of different recipes
- User manager, create, add and remove users.
- Plate details, track & trace information of samples.

These buttons are all used to prepare the Autosampler III for a run.

- The "Unlock Doors" button will unlock all the door locks present on the Autosampler III. When the Autosampler III is unlocked, the text will change to "Lock Doors".
- The "Prime system" button will fill the pumps of the Autosampler III with liquid to remove any air bubbles from the tubing/hoses.
- The "Initialize" button initializes the entire system. This must be done before the system can start running after an error.

All buttons can be customized to fit your specific needs.

In the drop-down menu a method can be selected. This is the method that will be executed when start is pressed. The buttons are used to Start, Pause and Stop the program selected in the drop-down menu.



Buttons will be enabled and disabled at certain moments.

- Recipe Manager: Only enabled when a user with administrator rights is logged in. The button is always disabled during a run.
- Unlock / Lock Doors: Always enabled when the Autosampler III is idle and disabled during a run.
- Prime: Always enabled when the Autosampler III is idle and disabled during a run.
- Flush: Always enabled when the Autosampler III is idle and disabled during a run.
- Pre-Run: Always enabled when the Autosampler III is idle and disabled during a run.
- Start: Always enabled when the Autosampler III is idle or when a run is paused. The button is disabled during a run.
- Pause: Disabled when the Autosampler III is idle. The button will be enabled during a run.
- Stop: Disabled when the Autosampler III is idle. The button is enabled during a run or when a run is paused.



10.3. Recipe Manager

In the recipe manager all currently available recipes are visible. To add a new recipe, the empty line at the bottom of the table can be selected. This will add a new blank recipe. All cells for the new recipe, as well as for the already existing recipes, can be edited by clicking them.

The screenshot displays the Recipe Manager interface. On the left, a sidebar shows a list of recipes with 'Prot1' selected. The main area shows the configuration for 'Prot1' across several tabs: General, Sample, Flush, Buffers, Downholders, and Advanced. The 'General' tab is active, showing fields for Name (Prot1), Pierce table (PT1), Airgap (ul) (20), Wash cycles (1), Box settling time (0), Cognex camera job (JOB1), Enable camera (checked), and Long box (unchecked). At the bottom, there are four buttons: Save, Reset, Remove, and Copy. A plus sign (+) is visible in the bottom left corner of the main area.

- Name: The name of the product. It should be recognizable and distinctive.
- Pierce table: The pierce table that will be used to puncture through the sample.
- Airgap: The amount of air that will be taken up before and after the sample.
- Wash cycles: How many times the wash step will be performed for this specific sample.
- Box settling time: The amount of time the box gets to stabilize after being moved onto the belt.
- Congex job name: Name of the camera job when sample detection camera is used.
- Enable camera: Checkbox to enable or disable using the camera.
- Sample volume: The sampling volume in μl .
- Aspiration volume: The additional volume that is taken up to ensure that there is enough sample in the needle. This is added to the amount of sample volume.
- Aspiration height: The height that the arm of the pipette needles reaches to aspirate a sample. This is measured in mm above the belt.
- Flush time: The time that the needles flush after each sample. This time is set in milliseconds.
- Sample Rows: The number of rows in a box of samples.
- Internal flush volume: The volume used to flush the needle.
- ATX volume: The amount of ATX added to the plate after it is filled.
- Buffer volume: The amount of buffer added to the plate after it is filled.
- Downholders default down: If this option is active, the downholders will go down before the sample is pierced.

- Use downholders: If this option is active, the downholders will be used to push the sample off the needles.
- Pump aspirate speed: The speed at which the pumps take up the sample into the needles. 0 is the fastest and 40 is the slowest. For high viscous samples, it is recommended to use a slower pump speed (larger than 20).
- Pump dispense speed: The speed at which the pumps dispense the sample from the needles. 0 is the fastest and 40 is the slowest.
- Pre aspiration delay: Delay before aspirating the sample. Settling time for the needle in the liquid.
- Post aspiration delay: Delay after aspiration of the sample, before moving upward.
- Needle settling time: The time the system waits to uptake after a sample is pierced.
- Pierce speed: The speed at which the samples are pierced.
- Cognex job: The camera task used to detect samples. This name can only be selected from a predefined list.
- Long Box: This setting determines whether a box is longer than normal and therefore needs to be processed differently.

Pressing the "Reset" button will undo all changes. Pressing the "Save" button will apply all changes to the Autosampler III. To remove a recipe, press the "Remove" button.

When testing a new recipe, set the height well above the product to prevent collisions.

Parameter	Unit	Minimum	Maximum	Default
Air gap	µl	0	75	25
Wash cycles	µl	1	5	1
Box settling time	ms	0	2,000	0
Sample volume	µl	10	100	50
Aspiration volume	µl	0	50	10
Sample height	mm	20	290	290
Flush time	ms	0	5,000	500
Internal flush volume	µl	200	850	500
ATX volume	µl	0	50	25
Buffer volume	µl	0	50	25
Pump aspirate speed	-	1	40	2
Pump dispense speed	-	1	40	2
Pre aspiration delay	ms	0	2,000	0
Post aspiration delay	ms	0	2,000	0
Pierce speed	%	25	100	100

10.4. Top Bar/Manager



In the top bar of the application the following is visible:

- Name of the current method.
- Time it has been running.
- Status of the method.



The buttons above are as follows:

- Configuration (Chapter 10.10)
- Exiting the application (the application cannot be exited during the run of a method)

10.5. General Overview

In the general tab, a simplified overview of the Autosampler III is visible.

In this overview, the data of three boxes will be displayed:



- Previous box
- Current box
- Next box

The following parameters can be seen for both:

- Product, according to scanned barcode
- Box barcode, according to input of scanned barcode

Product	Sample
Box barcode	2569874

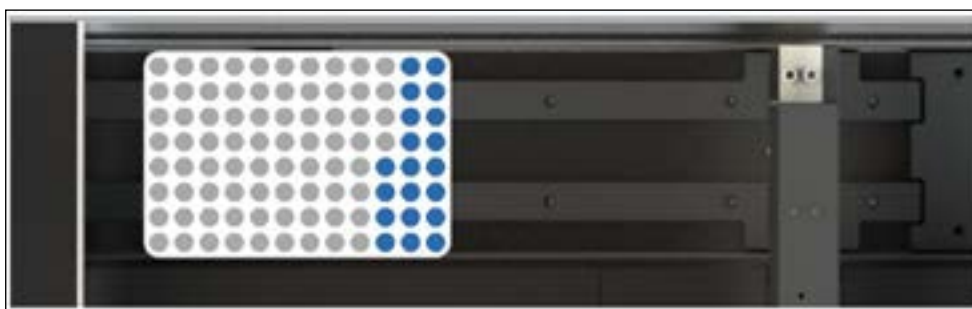
This is a simplified view of boxes that show which samples are already sampled for the current and previous box.



These fields show the currently loaded recipe, based on the scanned box barcode and the barcode of the current plate.



A shallow well plate is displayed at the bottom. This visualizes which wells have been filled.



Clicking the well plate opens an overview of the well plate and indicates what is in each well - sample and box sources.

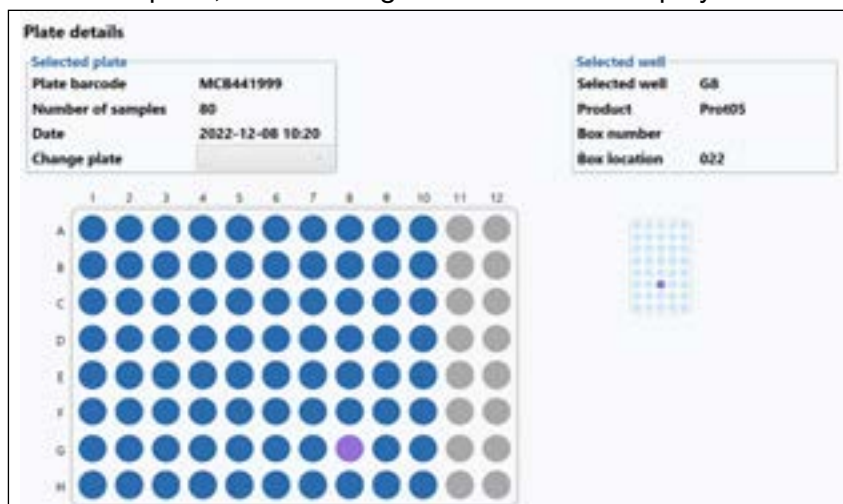


These progress bars represent the volume of the reagents.

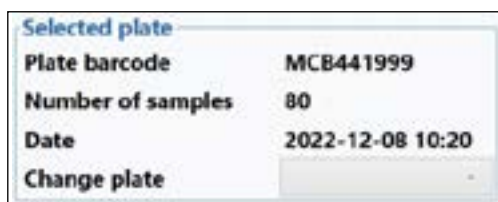
Each liquid has a warning and error parameter in the settings that determines when a warning or error message is displayed regarding the low or critically low fluid level. When the reagent holders or wash solution container are empty, the reset button must be pressed to let the Autosampler III know that the reagents or wash solution have been refilled.

10.6. Plate Detail Overview

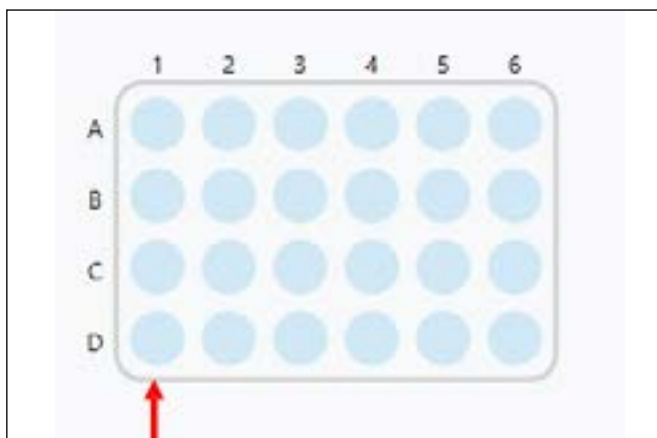
After clicking on the shallow well plate, the following overview will be displayed.



In this overview, a simplified well plate is displayed.



The "Selected plate" section displays information about the current plate. The selected plate can be changed using the dropdown menu. This dropdown list displays the 10 most recent MTPs for quick access.



The above image is an example to clarify the positions in a box. The orientation of the box corresponds to how it is processed in the machine. The barcode is located at the position of the red arrow.



To view information for a specific well position, select that position. When a well position is selected the barcode of the source box and the location of the box, the MTP location, the PO number, and the product type are displayed in the top right corner of the screen.

10.7. Alarm Manager Overview



The screenshot shows the 'Alarm manager' interface. It features a table with columns for Time, Description, Sub-system, Level, Ack user, and Ack time. Below the table are four buttons: Acknowledge, Acknowledge all, Remove, and Remove all.

Time	Description	Sub-system	Level	Ack user	Ack time
12/19/2022 11:07:36 AM	CDC monitor connection has failed	CDC monitor connection has failed	Error		
12/19/2022 11:06:04 AM	CDC monitor connection has failed	CDC monitor connection has failed	Error	Default	12/19/2022 11:06:29 AM
12/19/2022 10:10:47 AM	CDC-GR initialization failed	Autosampler	Error		

The alarm overview displays a table with all alarm messages. It shows which alarm messages have occurred and where they originated from. To start a method on the Autosampler III, all alarm messages must first be acknowledged. Acknowledging an alarm message should only be done after the alarm has been investigated and it is certain that no harm will be caused to personnel or the Autosampler III. Confirmed alarm messages can be cleared to keep the overview clean.

For each alarm message, you will see the following information:

- Time of occurrence
- Time of acknowledgement
- Time of removal
- Component that triggered the alarm

There are three types of alarms:

- **Warning.** The signal light will turn orange. The system remains active.
- **Non-fatal error.** The signal light will turn red. The system will be paused automatically.
- **Error message.** The signal light will blink red. The system will be stopped automatically.

10.8. Status overview



The status overview can be used to get more insight in the Autosampler III. The log will contain diagnostics data that can be used to follow what the Autosampler III is doing. This can provide additional information for when the Autosampler III is not behaving as expected.

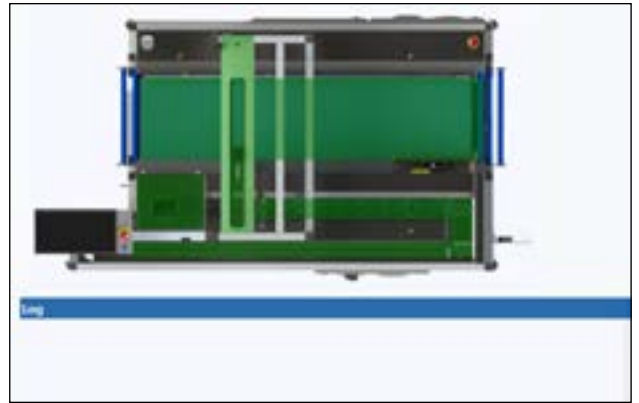
In the image to the right, each part of the Autosampler III is colored green. In the case of any errors or alarm messages, the specific component experiencing issues will be colored differently to indicate the current status.

Status colors:

- Green, No error
- Orange, Warning
- Red, Error

The different parts are as follows:

- Belt
- Pipetting arm
- Destacker
- Shaker
- Plate holder



10.9. User Manager

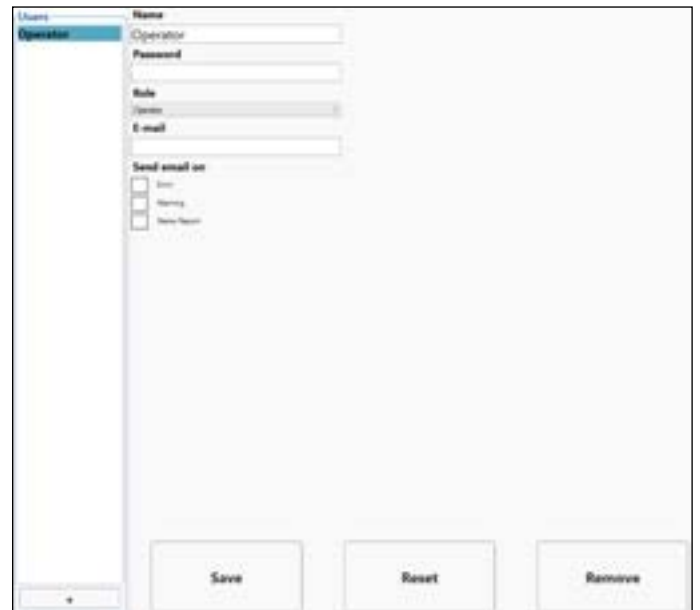
The user manager is used for adding, changing and removing users.

A user can be updated by selecting it from the list on the left. The user role is a dropdown list where the specific role can be selected.

When you press 'Save', the changes will be accepted.

When a user is selected, you can press the 'Remove' button to delete that user. Pressing 'Reset' will undo any changes.

Administrative rights are required to access this screen.



The following table shows an overview of user roles and access rights:

User roles	Operator	Service	Admin
Application access	Yes	Yes	Yes
Basic operations	Yes	Yes	Yes
Method management	Yes	Yes	Yes
Recipe management	No	Yes	Yes
User management	No	No	Yes
Configuration	No	Yes	Yes

10.10. Settings

ATX	
Maximum volume (µl)	25000
Warning at volume (µl)	10000
Error at volume (µl)	5000

Buffer	
Maximum volume (µl)	25000
Warning at volume (µl)	10000
Error at volume (µl)	5000

Prime system	
Pipetting prime cycles	2
Reagents prime cycles	2
Wash prime cycles	2

Wash	
Maximum volume (µl)	100000
Warning at volume (µl)	25000
Error at volume (µl)	10000

Consumption	
Total samples taken	145875
Total used ATX (l)	1.5
Total used buffer (l)	2.35
Total used wash (l)	20.1
Version	1.0.1

Shaker	
Time:	1000
Speed	750

In this screen, the run settings of the Autosampler III can be changed.

- Maximum volume, the volume of the reagent x container.
- Warning at volume, reagent x warning level: The percentage at which the Autosampler III warns the user that the reagent needs to be replaced or refilled.
- Error at volume, reagent x error level: The percentage at which the Autosampler III pauses a run to ensure that the reagent holder is not fully emptied.
- Pipetting prime cycles, the number of cycles the prime routine for the pipette channels will go through. Depending on the length of the tubing, this can be increased or decreased.
- Reagents prime cycles, the number of cycles the prime routine for the reagents channels will go through. Depending on the length of the tubing, this can be increased or decreased.
- Wash prime cycles, the number of cycles the prime routine for the wash pump will go through. Depending on the length of the tubing, this can be increased or decreased.
- ShakeTime, shake time: The time in seconds that a plate will spend on the shaker.
- ShakeSpeed, shake speed: The speed at which the shaker shakes the plates.
- Total samples taken, the total number of samples taken by the system.
- Total used reagents x, the total volume of the reagent that has been consumed by the system (approximately).
- Version, the software version of the HMI.

11. Maintenance

This chapter explains when and how maintenance should be carried out, which materials should be used for this purpose and which special tools are needed.

11.1. Preparation Maintenance

Before carrying out maintenance on the Autosampler III, the following safety instructions and warnings must be considered.

- The Autosampler III must be switched off. A warning sign must be hung on the control unit and the installation must be protected against switching on, for example, by pressing the emergency stop, turning off the main switch, unplugging, or placing a LOTO sign on the machine.
- The installation must be pressure free locally before removing the covers from the Autosampler III in order to carry out work on the system.
- Before maintenance is carried out on an electrical installation, it must be made voltage-free. To do this, the installation must be switched off, the installation secured, the voltage freedom determined (use a voltage meter for this purpose), only protective tools are to be used and adjacent powered parts should be sufficiently shielded.
- Before maintenance is carried out on a pneumatic or hydraulic installation, the installation must be in a pressure-free state. The installation must also be protected against switching on.
- If it is impossible to take the safety devices out of service during maintenance work, only authorized personnel can do so.
- Electrical parts should not be cleaned with water or other liquids.
- Aggressive cleaning agents should be handled with care. The guidelines of the suppliers of these agents must be followed. Wear the appropriate personal protective equipment such as protective clothing, goggles and gloves.
- Handles and the floor around the Autosampler III should be free of dust and liquids to prevent slipping.
- Broken or damaged parts must be replaced as soon as possible, consult Hygiena.
- When the maintenance work has been completed, the person responsible for this, such as the lab manager, must be satisfied that the work has been completed, that the Autosampler III is back in service, that the protective devices have been installed and that there are no persons within the range of the Autosampler III protections. Only when the maintenance work meets the above demands, can the service receipt be signed.
- When the maintenance work is complete, only a qualified person may put the Autosampler III back into operation.
- Make sure that the service technician does not leave the location without a signed service receipt.



Shut-off valve compressed air in closed position

11.2. Maintenance Instructions - Electrical Components



Reserved for certified engineers.
Operations to be carried out only by certified personnel.



Warning: Dangerous voltage

The Autosampler III has several electrical parts that require periodic maintenance and need to be checked regularly for optimal use. This part of the manual explains this in detail.

11.2.1. Barcode Scanners and Camera



Warning: Optical radiation

For all photocells, the visor and associated reflector must be cleaned regularly. Clean the visor and its reflector only with a dry, lint-free cloth.

11.2.2. Cables

The various cabling must be checked regularly for damage and cable breaks.

11.2.3. Switch Cabinets

All switch cabinets should in principle remain closed and therefore dust and moisture-free.

Electrical Components Maintenance Schedule

Part	Inspect	Clean	Lubricate
Barcode scanner (Keyence & Festo)	Weekly	Weekly	Not applicable
Control camera (Cognex)	Weekly	Weekly	Not applicable
Cables	Once every six months	Not applicable	Not applicable
Switch cabinets	Once every six months	Not applicable	Not applicable

11.3. Maintenance Instructions - Pneumatic Components



Reserved for certified engineers.
Operations to be carried out only by certified personnel.

The Autosampler III has several pneumatic parts that require periodic maintenance and need to be checked regularly for optimal use. This part of the manual explains this in detail.

11.3.1. Cylinder



Warning: Beware of injuries to the hand

A pneumatic cylinder is, by default, lubricated for the complete duration of its lifetime. However, an exposed piston rod must be cleaned regularly with a lint-free cleaning cloth. If the pneumatic cylinder is additionally lubricated, this should continue to be done regularly and consistently.

11.3.2. Air Service Unit

The water separator must be empty. Any cleaning of the air service unit should also be done regularly. The filter of the reducer on the air service unit should be checked and replaced regularly. The frequency of control depends on the air quality and must be carried out at least once a month up to once every 6 months at the least. In special air conditions, it may need checked daily. The original color of the filter is white. Contamination of the filter is recognizable by discoloration of the filter pattern; yellow discoloration indicates absorption of oil. Check the filter pot daily (or at least once per month) and drain the water that may have collected in the filter pot. When replacing the filter, pay attention to the correct filter passage of 5 μ L.



Air service unit

11.3.3. Couplings and Valves

The couplings between the various components and air hoses should be regularly checked for damage and leakage. If a defect has been detected, the relevant coupling must be repaired or replaced.



11.3.4. Air Tubing

The air tubing should be regularly checked for damage, kinks and leakage. If a defect has been detected, the air hose in question must be replaced. The air hoses are made of plastic. As the pneumatic installation ages, the air hoses can harden. This depends heavily on the operating conditions. A hardened air hose has a higher risk of leakage. Therefore, these should be replaced regularly.



Pneumatic Components Maintenance Schedule			
Part	Inspect	Clean	Lubricate
Cylinder	Monthly	Monthly	If applicable monthly, otherwise never
Air service unit	Monthly	Monthly	Monthly
Reducer filter	Min monthly, no longer than once per 6 months; frequency depending on the air conditions	DO NOT clean, always replace (5 µL)!!	Not applicable
Filter	Monthly	Removing water by draining	Not applicable
Couplings and valves	Monthly	Once every six months	Not applicable
Compressed air tubing	Monthly	Once every six months	Not applicable

11.4. Maintenance Instructions - Liquid Components



Reserved for certified engineers.
Operations to be carried out only by certified personnel.

The autosampler has several liquid related parts that require periodical maintenance and checks for maintaining optimal performance. The table below shows an overview of the liquid related components of the autosampler (pumps, tubing, etc.) and their corresponding maintenance intervals.

Liquid Components Maintenance Schedule			
Part	Inspect	Clean	Replace
Tubing pipetting channels	Weekly	Daily (Prime)	Yearly
Tubing reagent pumps	Weekly	Daily (Prime)	Yearly
Syringe pipetting pumps	Weekly	Daily (Prime)	Yearly
Syringe reagent pumps	Weekly	Daily (Prime)	Yearly
Tubing pump wash	Weekly	Daily (Prime)	/
Quick couplings waste	Weekly	Daily (Prime)	When clogged

12. Maintenance Service Panel Visualizations



Reserved for certified engineers.
Operations to be carried out only by certified personnel.

12.1. Introduction

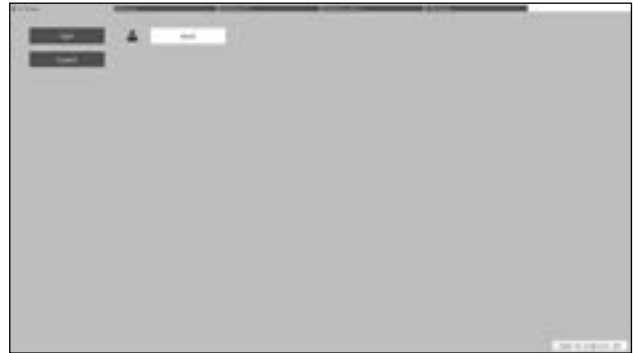
For maintenance and / or manual control purposes, individual components that are connected to the PLC can be controlled from a web interface.

There are a total of 3 pages for the different components:

- Main PLC - General - http://192.168.0.10:8080/autosampler_act.htm
- Main PLC - Routines - http://192.168.0.10:8080/autosampler_anybus.htm
- Pipetting Channels PLC - http://192.168.0.10:8080/autosampler_mot.htm

12.2. Main

Every maintenance panel is password protected and has a Login page to log in or out. On the login page in the right bottom of the screen, the last change date of the PLC program code is displayed. There are three different user levels in the maintenance panel, which all have different access rights.



User Group	Rights
Operator	Readout status and sensors
Service	Readout status and sensors, limited routine access
Admin	Readout status and sensors, full routine access

12.2.1. Login

- Press "Login" to log onto the Autosampler III.
- Fill in "Username".
- Fill in "Password".
- Press "Ok" to login



Now all the controls on the other tabs will be enabled and it will be possible to control the Autosampler III using the different buttons.

12.2.2. Logout

- Press 'Logout' to logout of the Autosampler III.

Now all controls will be disabled again, and it will no longer be possible to control the Autosampler III using the different buttons.

12.3. Main PLC - General

This maintenance panel can be used to read out statuses and sensor values, control several routines and adjust some settings in the PLC memory.

Five tabs are used in the maintenance panel:

- Login (see Chapter 12.2 Login)
- Status
- Routines init
- Routines general
- Settings

12.3.1. Status

The status tab displays the status of several components and sensors and can be used to control the status light.



The used components within this tab are:

- Motor drives
- Inputs
- Outputs
- StatusLight

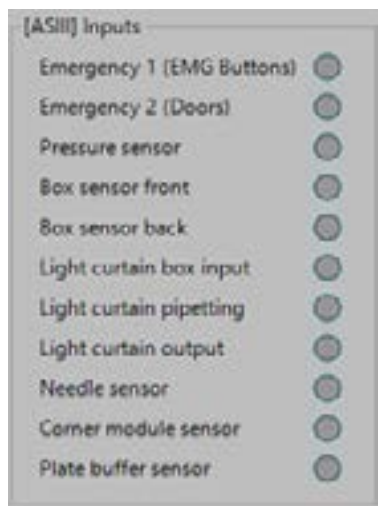
Motor Drives

This part of the visualization is used to display the status of the motor controllers. When the controllers are ready (controller powered and safety functions correct), the light will be blue.



Inputs

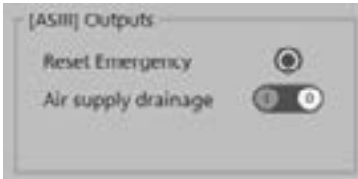
The inputs part displays the status of several PLC inputs, like sensor values and safety relay signals.



Below is a table with the available signals and a description:

Available Sensor Signals	
Part	Description
Emergency 1 (EMG Buttons)	Output signal safety relay emergency buttons
Emergency 2 (Doors)	Output signal safety relay doors
Pressure Sensor	Indicates if the available pressure is sufficient
Box Sensor Front	Front sensor below box alignment bar
Box Sensor Back	Back sensor below box alignment bar
Light curtain box input	Light curtain box detection at box separator infeed
Light curtain pipetting	Light curtain box detection at pipetting position
Light Curtain Output	Light curtain box detection at box output
Needle sensor	Indicates if sample is stuck on needle(s)
Corner module sensor	Indicates if a plate is detected at the corner module
Plate buffer sensor	Indicates if a plate is detected at the outfeed buffer sensor

Outputs



Below is a table with the available buttons and description.

Available Sensor Buttons	
Sensor	Description
Reset emergency	Reset safety circuit
Air supply drainage	Open drain valve of air pressure unit

Status Light



This part can be used to manually control the status light of the Autosampler. The desired color can be filled in in the “Color” text field and blinking can be set on or off. When pressing the “Set” button, the values are send to the status light. The status light cannot be controlled manually when the emergency circuit is not reset, then the lamp will remain red.

The following colors can be set for the status light:

- Red
- Yellow
- Green
- Lgreen
- Blue
- Ud (User defined)

12.3.2. Routines Init

The 'Routines Init' tab contains the main PLC's initialization routines, to initialize each subsystem. Initializing resets the axis of a subsystem and brings all components to their reference points.



The following routines can be controlled from this tab:

Routine	Description
Init Box Input	Initialize box infeed
Init Pipetting Z	Initialize Z-axis pipetting arm
Init Plate Output	Initialize plate outfeed (corner module)
Reset Autosampler	Reset main PLC and all of its routines
Init Plate Input	Initialize plate infeed
Init Shaker	Initialize shaker

For each block the following buttons and status indicators are available:

Buttons	Description
Start	Start routine
Reset	Reset routine (when in error)

Status indicator	Description
Routine name	The top left corner of the view displays the name of the routine
Done	Done light is green when the routine is successfully finished
Busy	Busy light is orange when the routine is running
Error	The error light is red when an error occurred during the routine
Error message	The white box at the bottom of the view displays the error message when an error occurred.

12.3.3. Routines General

The 'Routines General' tab has some general routines of the Autosampler that can be controlled.



The following routines can be executed via this maintenance view:

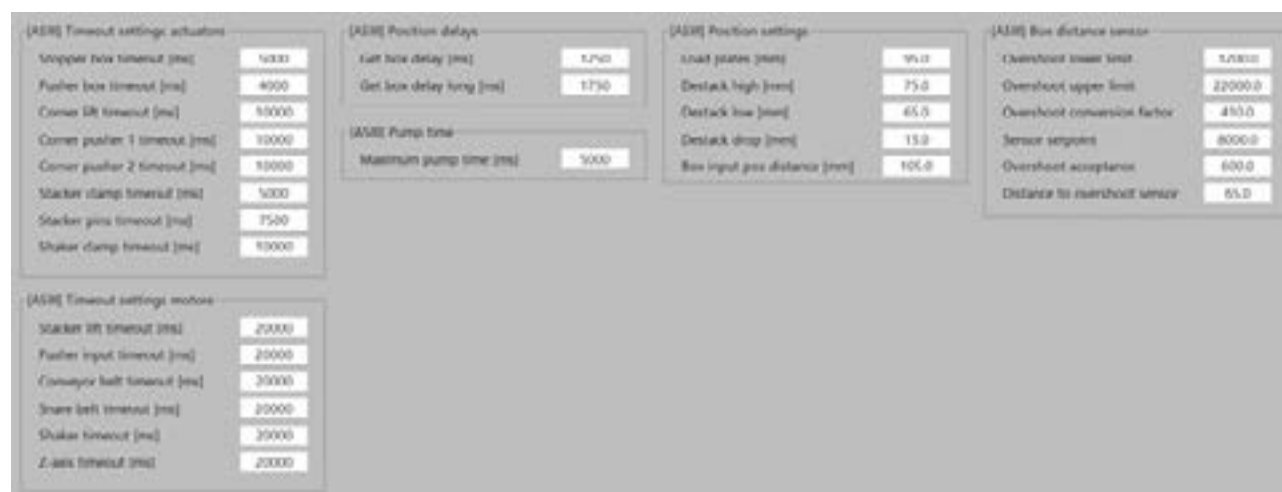
Routine	Description
Destack plate	Destack plate from the plate input stacker
Load plates	Load plates in plate input stacker
Move plate out	Move plate out of the system from corner module
Get new box	Retrieve new box at box input and position at pipetting position
Barcode camera stacker	Scan barcode of the plate
Pump wash	Start washing pump

The control and status buttons of these routines are equivalent to the control of the init routines. Several routines have additional buttons/status indicators:

Routine	Button/Field	Description
Load plates	Resume	Resume the destack routine after lift is brought to the upper position
Get new box	Long box	Checkbox to check when loading a long box from the maintenance panel
Pump wash	Pump time	Set pump time of the washing pump
Barcode camera stacker	Result	Displays the scanned barcode

12.3.4. Settings

The settings tab contains several settings of the Autosampler regarding (timeout) times and positions. The settings on this page are all stored inside the PLC's memory.



The following settings are available:

Settings	Description
Timeout settings actuators	Movement timeout for time motors, when movement not finished within time, an error will be generated
Timeout settings motors	Movement timeout for time cylinders, when movement not finished within time, an error will be generated
Position delays	Delay settings when retrieving box at input, time the box separator is waiting at the lower position
Pump time	Maximum pump time can be set
Position settings	Position settings for destacker and conveyor belt
Box distance sensor	Box distance overshoot sensor settings

12.4. Main PLC - Actuators

This maintenance panel can be used to control the motors and actuators of the main PLC individually. A total of 6 tabs are available:

- Login (see Chapter 12.2 **Login**)
- Box infeed
- Plate infeed
- Pipetting arm
- Shaker
- Plate outfeed

Every page contains the possibility to individually control motors and actuators of the corresponding subsystems.

12.5 Pipetting PLC

This maintenance panel can be used to control the motors and actuators of the main PLC individually. A total of 4 tabs are available:

- Login (see Chapter 12.2 **Login**)
- Routines
- Pipetting channels
- Settings

12.5.1. Routines

The routines tab can be used to control the pipetting channels. Channel 1 is the channel closest to the initialization point and channel 4 the one closes to the wash bath. When positioning the channels, the lowest possible spacing between each channel is 9 mm. The pipetting channels can only move to absolute positions.



The following buttons, fields and status indicators are used to control the pipetting channels:

Button/field	Explanation
Position CH 1	Position setpoint channel 1
Position CH 2	Position setpoint channel 2
Position CH 3	Position setpoint channel 3
Position CH 4	Position setpoint channel 4
Speed	Movement speed
Acceleration	Acceleration
Deceleration	Deceleration
Home	Start homing pipetting channels
Start	Start movement
Reset	Reset motor (when in error)

Status Indicator	Explanation
Motor name	Left top corner of the view displays the name of the routine
Done (Home)	Light is green when homing is performed successfully
Done (Start)	Light is green when movement is finished successfully
Busy	Light is orange during movement
Error	Light is red when an error occurred during movement
Error message	Lower white text box displays the error message in case of an error

12.5.2. Pipetting Channels

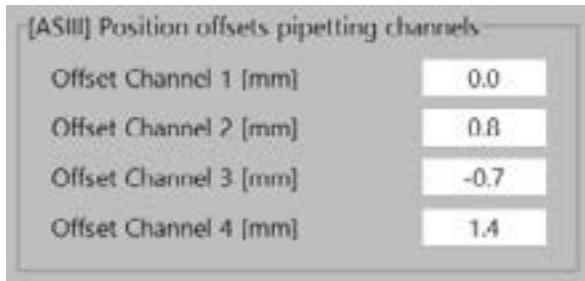
The pipetting channels tab can be used to control each pipetting channel individually. However, this is not recommended due to the fact that positions of other channels are not taken into account, which might result in a crash. Also, the position is defined in motor steps instead of millimeters in this control box.

The control of the channels is similar to the control of other motors, as described in chapter 13.4.2.



12.5.3. Settings

The settings tab can be used to change the settings in the PLC memory. The available settings are the offsets of each pipetting channel with respect to the homing sensor. The offsets make sure that the pipetting channels all have the same absolute positions.



Be careful! When adjusting the offsets, all positions of the respective channel will shift. This might result in crashes.

13. Camera Jobs

The following chapter describes how to create new and adjust existing camera jobs using the Cognex software. In addition, a list of changeable camera parameters is added to the chapter.



Reserved for certified engineers.
Operations to be carried out only by certified personnel.

13.1. Create New Camera Job

The steps described below can be used to create a new Cognex job (i.e., for a new sample or a new layout of an existing sample). Follow the steps as described below very carefully to create a camera job for a product.

Step 1: Make sure the machine is on and initialized

Make sure the Autosampler III and the compressor are switched on and initialized. The Autosampler III should not be running and the Xperimate application needs to be closed, before connecting to the Cognex camera.

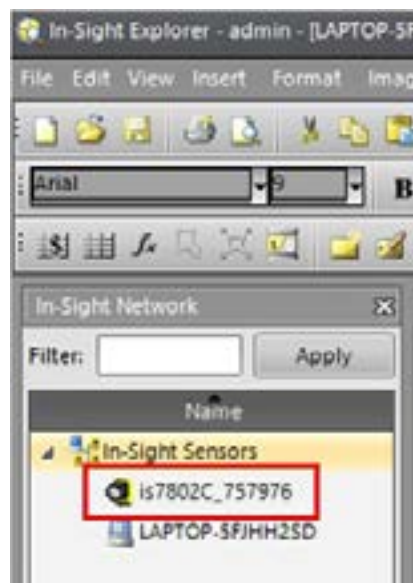
Step 2: Open In-Sight Explorer

Open the In-Sight Explorer camera software by clicking at the icon located on the desktop.



Step 3: Connect to camera

From the In-Sight Network menu, select the used camera (is7802C_757976) and double click on it to connect.



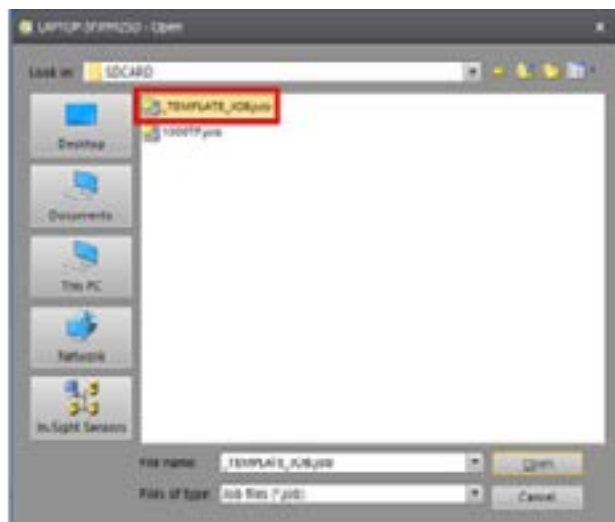
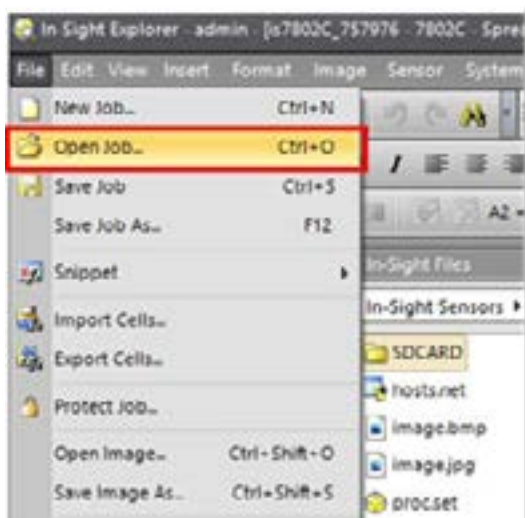
Step 4: Set the camera offline

In order to add or change jobs, the camera first needs to be set offline. This can be done by clicking on the online symbol if it is activated. If the symbol is deactivated, the camera already is offline.



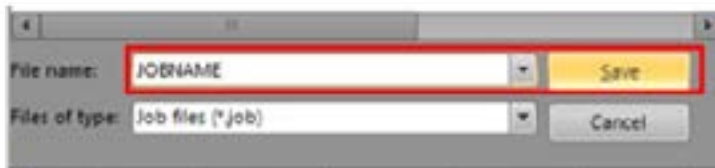
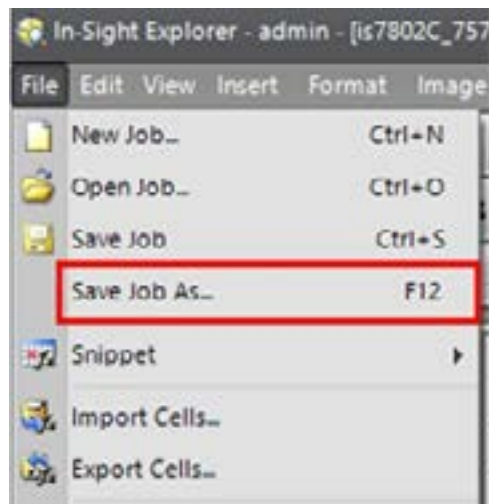
Step 5: Open the template job

It is recommended to create a new job based on the camera job template, so most of the used cell locations that will be retrieved by Xperimate are already on the correct location in the job. To create a job based on the template click on 'File' and 'Open Job' and select the job called 'TEMPLATE_JOB.job', which is located on the camera's SD card. The template job will now be opened.



Step 6: Save the new job

If the template job is opened, first save the template job as a new job with the desired name. The template job itself should never be edited. Saving the job as a new job can be done by clicking on 'File' and 'Save Job As'. The job can now be saved with the desired name. The location of the job should be on the camera's SD card, otherwise the Autosampler III will not be able to load the job. After saving the template as a new job, check if the new job is opened and start working from there.



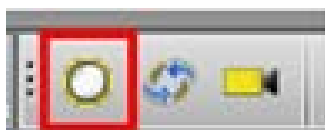
Step 7: Load samples into the system

The next step is to load the samples into the system. This can be done by using the 'Get Box' functionality of the PLC maintenance panel (see Chapter 12 of the user manual)



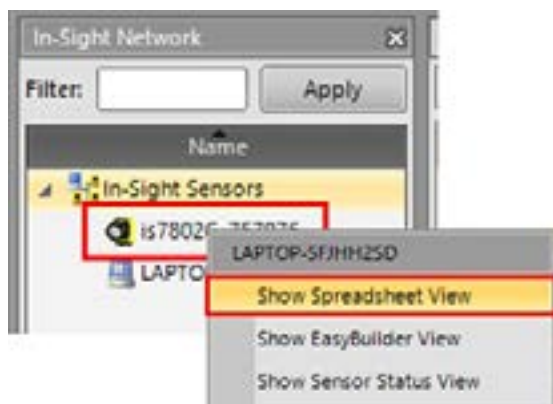
Step 8: Trigger the camera

If the samples are loaded into the system, the camera can be triggered to capture an image of the samples. This can be done by pressing the 'Trigger' button.



Step 9: Open spreadsheet view

Open the spreadsheet view of the camera (Excel sheet view) if it is not opened yet. Spreadsheet view can be opened by right clicking on the camera.



Step 10: Autofocus on the products

Use the autofocus button in the spreadsheet view to focus on the loaded products. After the camera finishes focusing, the autofocus value is displayed in C1.

	A	B	C
0	Image		
1	Setting 1	Autofocus	131
2	Exposure	25,000	
3	Light control	#ERR	
4	Acceptance	50,000	
5	Angles	-50,000	50,000
6			

Step 11: Optimize exposure settings

The exposure settings of the image can be set in cell 'B2'. The default exposure value is 25. Lowering the exposure value will result in a darker image, where increasing the exposure value will result in a brighter picture. Choose a value that results in a picture where all samples are visible and enough contrast is available to detect patterns on all samples.

If the exposure value is changed, press the 'Trigger' button to make a new image with the camera.

	A	B	C
0	Image		
1	Setting 1	<input checked="" type="checkbox"/> Autofocus	131
2	Exposure	25,000	
3	Light control	#ERR	
4	Acceptance	50,000	
5	Angles	-50,000	50,000



Tip: Use the spreadsheet icon to hide/show the Excel spreadsheet. Hiding the spreadsheet can be useful to have a better look at the image.

Step 12: Set light control (Optional)

If a sample has a lot of reflection and the internal camera lighting has a negative impact on this, the internal lights of the camera can be switched off in the light control settings. Double click on cell 'B3' to change the settings for the internal lightning. The camera lights could be switched off by unchecking the checkbox. It is also possible to lower the light intensity.



Step 13: Set acceptance criteria

The acceptance criteria can be set in cell 'B4' and is by default set to 60. The acceptance criteria is the minimum matching score the detected pattern should have with the pattern used for teaching. If the detected pattern score is 60 or higher, the camera will mark the detection as valid. The acceptance criteria should never be set lower than 50, to prevent incorrect detections.

	A	B	C
0	Image		
1	Setting 1	<input checked="" type="checkbox"/> Autofocus	131
2	Exposure	25,000	
3	Light control	#ERR	
4	Acceptance	60,000	
5	Angles	-50,000	50,000

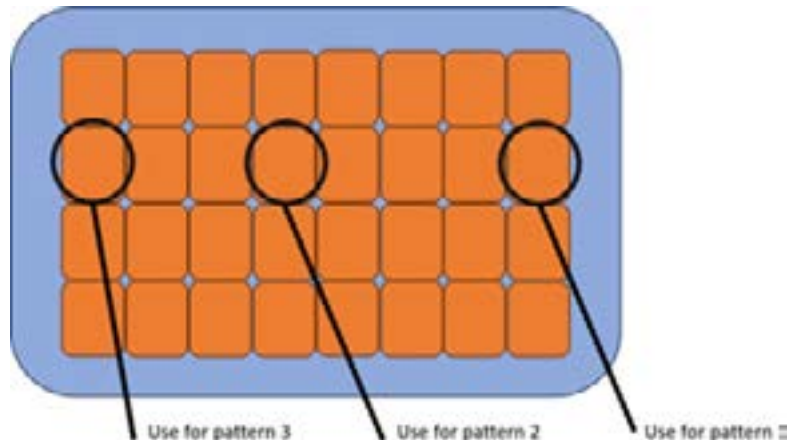
Step 14: Set angles for detection

The detection angles determine how much of an angle the product can have and is by default set to the range -50 to +50 degrees. The cells used to set the angles are 'B5' and 'C5'. When the pattern that is used for detection is a round shape for example, the angle range can be set from -180 to 180 degrees, since the orientation does not matter as long as we detect the circle within the detection area.

	A	B	C
0	Image		
1	Setting 1	Autofocus	131
2	Exposure	25,000	
3	Light control	#ERR	
4	Acceptance	60,000	
5	Angles	-50,000	50,000

Step 15: Teach pattern(s) to detect

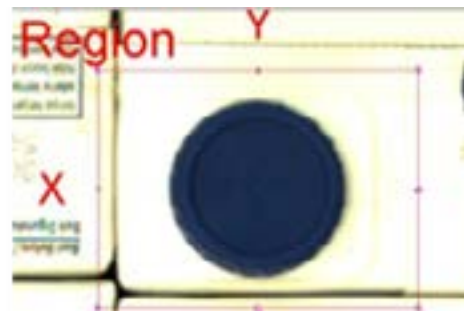
The following steps (15.1 until 15.2) describe how to teach a sample pattern to the camera. Since the view of the camera is a bit curved, it might be necessary to teach multiple patterns. For larger boxes that are using almost the full width of the camera, it is recommended to teach one pattern on the middle right side of the box, one on the middle of the box and one on the middle left side of the box.



Step 15: Teach pattern(s) to detect

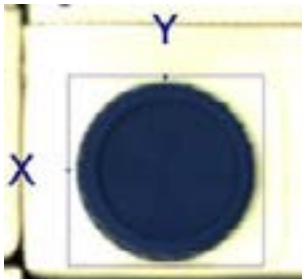
First, click on the region button on the left of the pattern to set the region where we want to look for the pattern. A region for pattern detection can be created by dragging the rectangle to the pattern position. Use a pattern that is clearly visible at every sample and that can only be detected if the product is correctly placed in the system. If the region is selected, press enter to verify the region. The region has now been set and the pattern can be adjusted.

I	J	K
	Teaching pattern(s) samples	
<input checked="" type="checkbox"/> Region	<input checked="" type="checkbox"/> Patterns	1,000
<input checked="" type="checkbox"/> Region	<input checked="" type="checkbox"/> Patterns	1,000
<input checked="" type="checkbox"/> Region	<input checked="" type="checkbox"/> Patterns	1,000
<input checked="" type="checkbox"/> Region	<input checked="" type="checkbox"/> Patterns	1,000

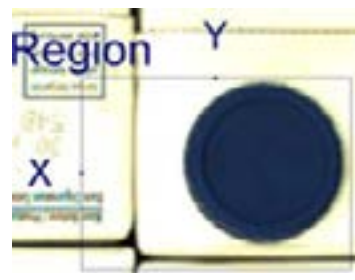


The pattern region should be set as close as possible to the outer lines of the pattern that needs to be detected, to prevent unwanted **thins** ?? (lines?) to be detected.

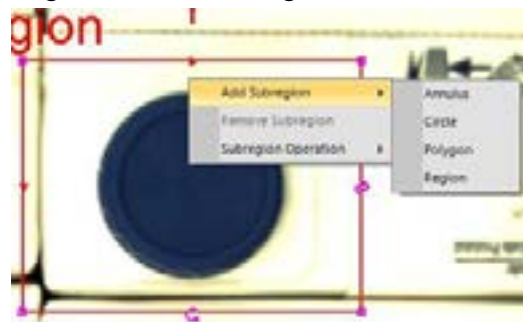
Correct region (only pattern to detect inside)



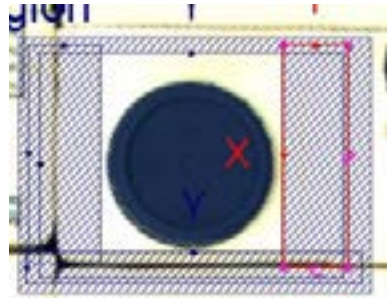
Incorrect region (too large)



Filtering out parts in the region which should not be used for pattern recognition can be done by adding a sub region to the region. Open the region, right-click on the region and select 'Add subregion'.



Adding a subregion can be used to mask certain parts of the region which should not be taken into account when determining the pattern.



The table below shows the results of the pattern with and without using the use of subregions for masking the region.

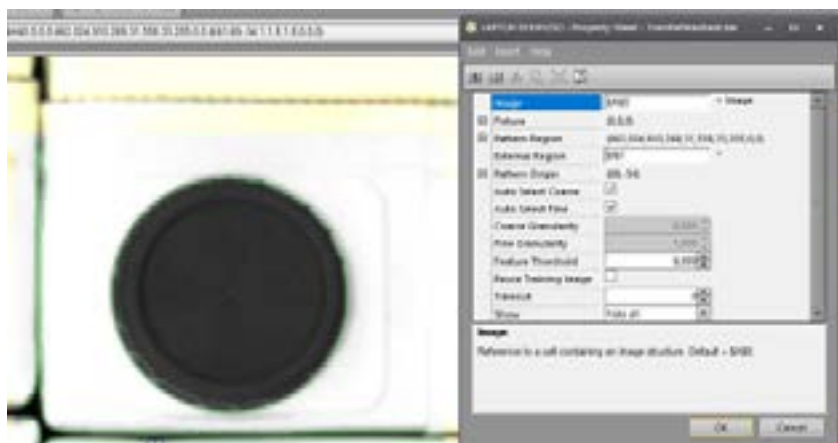
Region	Result pattern

Step 15.2: Adjust pattern detection

Double click on the pattern to see if the desired detection pattern is created. Hide the spreadsheet after the pattern settings are opened.

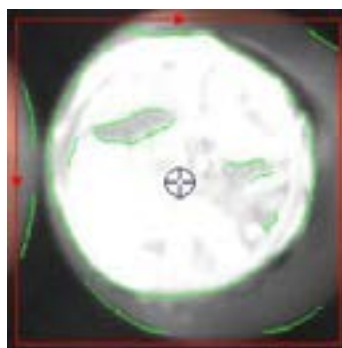
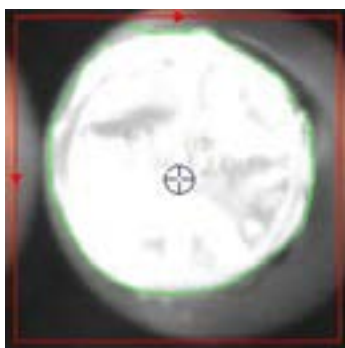
I	J	K
	Teaching pattern(s) samples	
<input type="checkbox"/> Region	<input type="checkbox"/> Patterns	1,000
<input type="checkbox"/> Region	<input type="checkbox"/> Patterns	1,000
<input type="checkbox"/> Region	<input type="checkbox"/> Patterns	1,000
<input type="checkbox"/> Region	<input type="checkbox"/> Patterns	1,000

The generated pattern is shown by the camera using green lines. Now the threshold of the pattern can be set to filter out some of the lines we do not want to detect. A lower threshold means more details (which can also include more things we do not want to detect) and a higher threshold means less details.



Correct pattern (only outlines visible)

Incorrect pattern (too much detail)

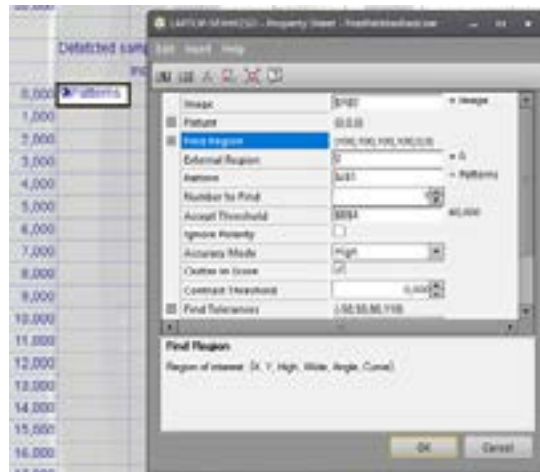


If the desired pattern cannot be created by changing the threshold, the following options are available:

1. Change the pattern region. The region set might be too large and is also detecting parts on the outside of the pattern. Making the region smaller might remove unwanted detections on outer side.
2. Add a subregion to the region which the camera will not use for pattern recognition. See step 15.1 for sub regions.

Step 16: Set find region for each sample

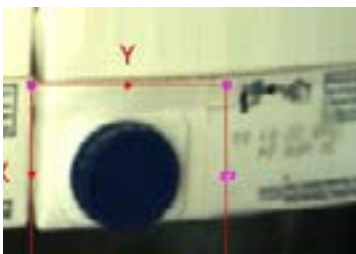
After all detection patterns have been created, the pattern detections need to be set for each sample and linked to one of the teaching patterns. Start with the first pattern in cell 'D9'. Double click on the pattern to open its menu.



In the menu that opens double click on 'Find Region' and adjust the 'Find Region' to the location where the pattern should be detected in the box for the first sample (Bottom right sample). Make sure there is a little bit of space around the detection area, since the samples might not always be in the exact same spot in each box.



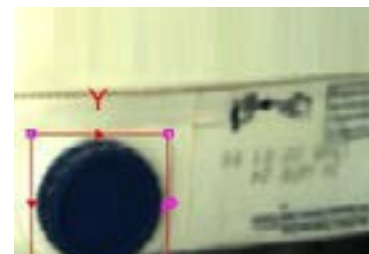
Correct detection region



Incorrect (too large)

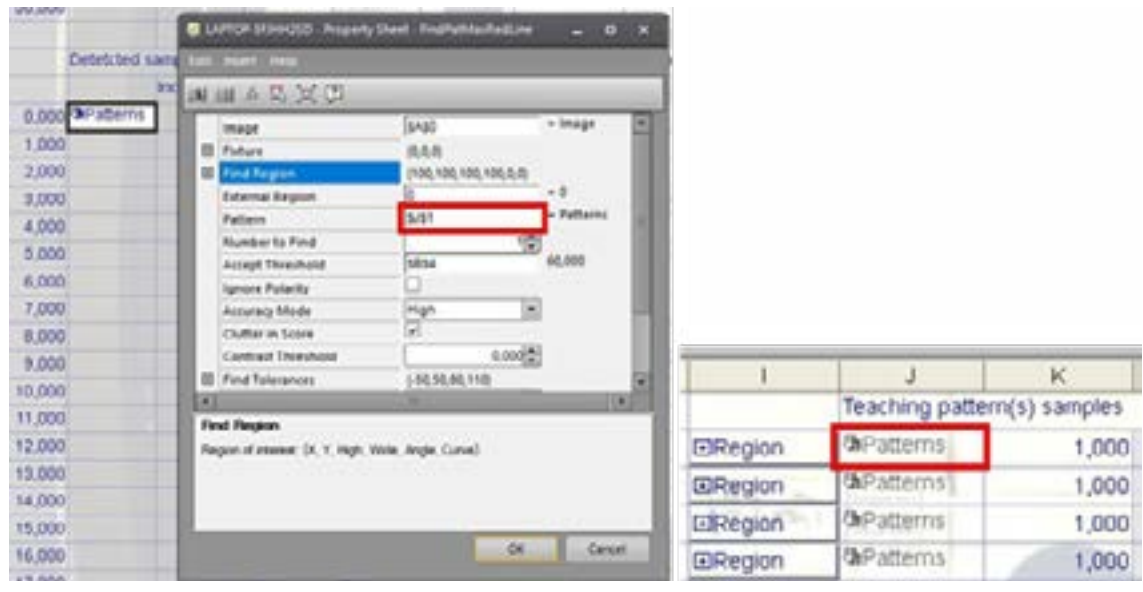


Incorrect (no tolerance)



After setting the pattern region, press enter to confirm. Now the reference to the pattern can be set in the menu. Set the reference according to the teaching pattern that will be used for the specific sample.

If for example pattern in cell 'J1' is used for samples on the right side of the box/crate, use the reference in the pattern field to '\$J\$1'.



Press enter after linking the desired pattern reference to confirm. When the pattern can be detected in the set region, the score will show up on the spreadsheet. If the score is higher than the acceptance criteria, the sample will be valid. If the sample is not valid check if the detection region is correct or the pattern needs some finetuning to match the sample. The higher the score, the better the pattern matches the teaching pattern.

Detected sample coordinates				
		Index	Score	Valid
0,000	Patterns	0,000	77,216	1,000

When the correct region is set and the pattern can be detected successfully, the pattern cell can be copied to the cell below. Select the pattern cell (in this case 'D9'), copy the cell and paste in the cell one lower (in this case 'D10').

Detected sample coordinates					
		Index	Score	Valid	
7					
8					
9	0,000	Patterns	0,000	77,216	1,000
10	1,000	Patterns	0,000	77,216	1,000

Now the pasted pattern can be opened by double clicking on it. Then by clicking on the 'Find Region', the detection region can be moved to the next sample. Enter can be pressed to confirm the region. When the region is confirmed, the reference to the teach pattern can be set and confirmed, the score should now also change. Repeat these steps for all samples in the box.



Detected sample coordinates				
	Index	Score	Valid	
0,000	Patterns	0,000	84,218	1,000
1,000	Patterns	0,000	81,733	1,000
2,000	Patterns	0,000	84,862	1,000
3,000	Patterns	0,000	87,813	1,000
4,000	Patterns	0,000	88,145	1,000
5,000	Patterns	0,000	87,838	1,000
6,000	Patterns	0,000	88,748	1,000
7,000	Patterns	0,000	88,122	1,000
8,000	Patterns	0,000	87,493	1,000
9,000	Patterns	0,000	85,829	1,000
10,000	Patterns	0,000	87,183	1,000
11,000	Patterns	0,000	85,821	1,000
12,000	Patterns	0,000	81,541	1,000
13,000	Patterns	0,000	89,828	1,000
14,000	Patterns	0,000	88,286	1,000
15,000	Patterns	0,000	87,523	1,000

Now the pasted pattern can be opened by double clicking on it. Then by clicking on the 'Find Region', the detection region can be moved to the next sample. Enter can be pressed to confirm the region. When the region is confirmed, the reference to the teach pattern can be set and confirmed, the score should now also change. Repeat these steps for all samples in the box.

Step 17: Set camera detection results

After all detection regions are set and all samples can be detected, the results need to be set that will be exported from the camera after detection.

Cell 'R1': The total amount of samples in a full box need to be set.

Cell 'R2': The acceptance percentage can be set. It is recommended to use 100.

Cell 'R3': Detected samples, use excel formula -> SUM(G9:G9+AmountOfSamples)

Cell 'R4': Detected dummies, use excel formula -> SUM(L9:L9+AmountOfSamples)

If dummies are not used, fill in 0 in cell 'R4'.

P	Q	R
Expected samples		16,000
Acceptance %		100,000
Detected samples		16,000
Detected dummies		0,000

Detected samples `Sum(G9:G24)`

Detected dummies `SUM(L9:L24)`

Step 18: Teach dummy pattern to detect

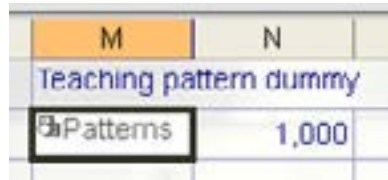
Move the previous box out of the system using the 'Move Box Out' routine in the web interface. Make sure the Z-axis is positioned at its maximum position (290 mm) before starting the 'Move Box Out' routine.



After moving the box out, add a dummy sticker on one of the samples, preferably somewhere in the middle of the box. After placing the dummy sticker, reload the box using the 'Get Box' routine. The box with the dummy sticker will be loaded into the system.



Double click on the teaching pattern for the dummy (cell 'M1') to open the pattern teaching menu for the dummy detection.



Repeat step 15.1 and 15.2 to teach the dummy pattern. Use the cells that are listed for the dummy detection. After creating the dummy pattern, copy the pattern from cell 'D9' and paste in cell 'I9'.

	B	C	D	E	F	G	H	I	J	K	L	M
0									Teaching pattern(s) samples			Teaching pat
1	Autofocus	131						Region	Patterns	1,000		Patterns
2	25,000							Region	Patterns	1,000		
3	#ERR							Region	Patterns	1,000		
4	60,000							Region	Patterns	1,000		
5	-100,000	100,000										
6												
7			Detected sample coordinates						Detected dummy coordinates			
8			Index	Score	Valid			Index	Score	Valid		
9		0,00	Patterns	0,000	84,218	1,000		Patterns	0,000	84,218	1,000	
10		1,000	Patterns	0,000	91,723	1,000			1,000	0,000	0,000	
11		2,000	Patterns	0,000	94,862	1,000			2,000	0,000	0,000	

Double click on the pattern in cell 'I9' to open the settings. The following settings need to be changed:

- Pattern -> Should be having a reference to the dummy pattern in cell '\$M\$1'
- Number to find -> Should be the same as the number of samples in a full box
- Accept threshold -> Set to 85



Now the find region can be set by double clicking on the find region. For dummy detection. The find region needs to be placed around the complete box so all samples are visible.



Step 19: Test detection on different samples

Before saving the job and setting the camera back online, it is recommended to test the new job with other types of samples, to make sure these samples will not be detected with the created job. Otherwise, this can result in damaging the system when a wrong barcode is scanned. To test the camera job with other samples, use the 'Get Box' routine from the PLC maintenance panel (see Chapter 12 of the user manual) for the infeed of new boxes.



Warning

Make sure the Z-axis is positioned at 290 mm before starting the 'Get Box' routine.

Step 20: Save job

If the detection is correct and the job is finished, the created job can be saved. Saving the job can be done by clicking on the save icon. Make sure the correct job is opened when saving.



Step 21: Set camera online

If the detection is correct and the job is finished, the camera can be set back online. This can be done by pressing the online symbol. The symbol should be activated after pressing it, indicating that the sensor is online.



13.2. Modify Existing Camera Job

The steps described below can be used to changing an existing Cognex job (i.e., when a position is off). Follow the steps as described below very carefully.

Step 1: Make sure the machine is on and initialized

Make sure the autosampler and the compressor are switched on and initialized. The autosampler should not be running and the Xperimate application needs to be closed, before connecting to the Cognex camera.

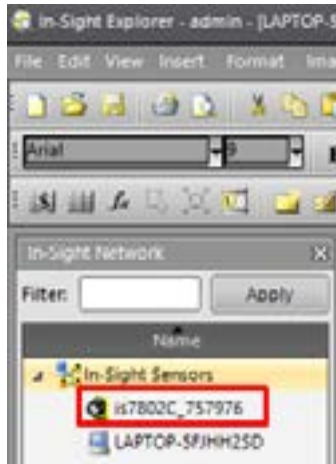
Step 2: Open In-Sight Explorer

Open the In-Sight Explorer camera software by clicking at the icon located at the desktop.



Step 3: Connect to camera

From the In-Sight Network menu, select the used camera (is7802C_757976) and double click on it to connect.



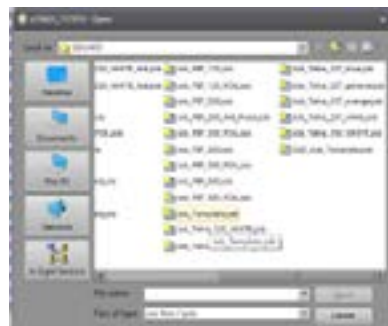
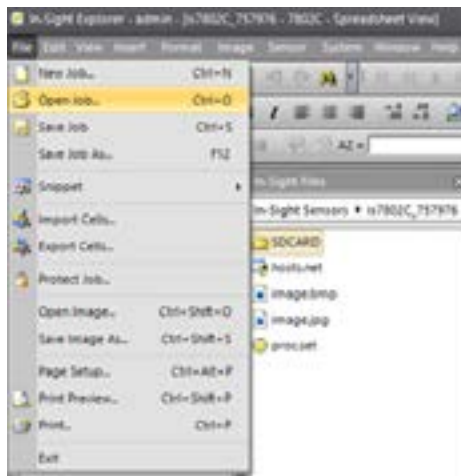
Step 4: Set the camera offline

In order to add or change jobs, the camera first needs to be set offline. This can be done by clicking on the online symbol if it is activated. If the symbol is deactivated, the camera already is offline.



Step 5: Open the job that needs change

To open a job, click on "File" and "Open Job" and select the job that needs change. The selected job will now be opened.



Step 6: Change the parameters

Change the parameters that need to be adjusted. For a list of parameters and their description see Chapter 2.

Step 7: Save job

If the detection is correct and the job is finished, the created job can be saved. Saving the job can be done by clicking on the save icon.



Step 8: Set camera online

If the detection is correct and the job is finished, the camera can be set back online. This can be done by pressing the 'Online' symbol. The symbol should be activated after pressing it, indicating that the sensor is online.



13.3. Parameter Overview

The table below shows a list of the camera job parameters that can be adjusted.

Parameter	Cell	Value range	Default	Description
Expected samples	R0	>1		Number of samples that are placed in a full box.
Acceptance %	R1	50-100%	100	Minimum percentage of samples that need to be detected in order to automatically process the box without warning user. This value should never be lower than 50.
Detected samples	R2	>=0		Amount of samples that are detected by the camera.
Deteted dummies	R3	>=0		Amount of dummies that are detected by the camera.
Exposure	B2	>0	25	Exposure time of the camera in ms. Higher exposure creates a lighter image, lower exposure creates a darker image.
Accept threshold (sample patterns)	B4	50-100	60	Acceptance threshold for pattern detection. Must be higher than 50 to prevent false detections. Using a too high value might cause some samples to not be detected.
Angle (negative)	B5	-180 - 0	-50	Angle tolerance for the pattern in negative direction.
Angle (positive)	C5	0 - 180	50	Angle tolerance of the pattern in positive direction.

14. Pierce Tables

The following chapter describes how to create new and adjust existing pierce tables. It also shows how to test a new pierce table. The pre-requirement for creating a pierce table for a new sample, is that a recipe for the sample is created (see Chapter 10.3).



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Operations to be carried out only by certified personnel.

14.1. Create Pierce Table

This chapter contains information on how to create a pierce table for the autosampler III and teach in products. Appendix II can be used as reference on how a box layout is transferred to a pierce table file, based on a 3x4 box example. Before creating a pierce table, the following preconditions must be met:

- System is powered on
- System is initialized
- Pipetting arm positioned at maximum height (290 mm)
- Fully filled box/crate with products prepared and correctly oriented at input
- Recipe prepared for the samples (sampling height to be determined later)

Step 1: Create pierce table file (PT-file)

The first step in creating a pierce table is to create a new PT-file. PT-files should be placed in the following folder: C:\Synchron\PierceData\

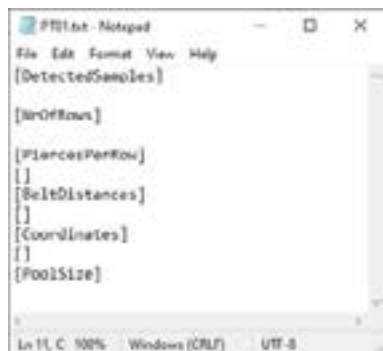
Within that folder, a template file called '_TEMPLATE_PT.txt' is located. Copy this file and paste it in the same directory as the template file. After pasting the file there should be a new file called '_TEMPLATE_PT - Copy.txt' (or similar). The name of this file can be changed to the name of the pierce table (e.g., 'PT01.txt').

Name	Date modified	Type	Size
_TEMPLATE_PT.txt	11/01/2023 15:26	Text Document	1 KB
PT01.txt	11/01/2023 15:26	Text Document	1 KB

Note: Make sure the name of the PT-file matches the name that is defined in the corresponding recipe.

Step 2: Fill in known product data

The next step is to fill in the PT-file with the known data, based on the product that will be linked to the pierce table. Open the file created in Step 1 to edit the data.



Fill in the following fields:

Field	Description
DetectedSamples	Maximum number of samples in a completely filled box/crate
NrOfRows	Number of rows in the box/crate
PiercesPerRow	Number of samples on each row, filled in per row
PoolSize*	Size of the pool when pooling. *DetectedSamples must be dividable by number of pools.

The pictures below show how the rows and pierces are defined within a box and show how the product from the picture is defined in the PT-file by using a 12-sample box.



```

PT01.txt - Notepad
File Edit Format View Help
[DetectedSamples]
12
[NrOfRows]
4
[PiercesPerRow]
[3,3,3,3]
[BeltDistances]
[]
[Coordinates]
[]
[PoolSize]
1
Ln 12, C: 100% Windows (CRLF) UTF-8
  
```

Step 3: Load box/crate into the system

After the known product data is added to the file, place a box at the input. Make sure the box is completely filled, samples are correctly in the box and the barcode on the box is facing towards the barcode camera. First, make sure the pipetting arm is at its highest position (290 mm). This can be done by homing the z-axis in the maintenance panel (<http://192.168.0.10:8080/asiii-general.htm>)

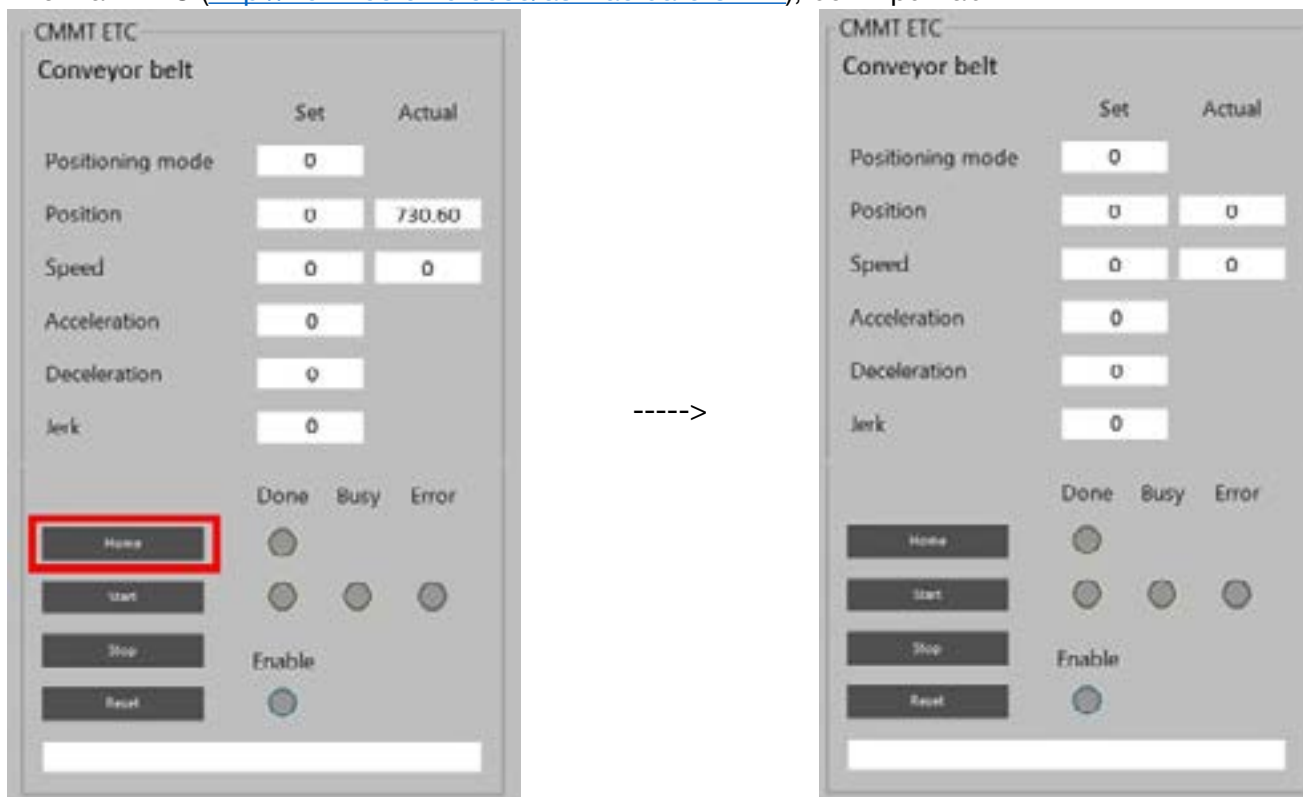
The box can then be loaded into the system using the 'Get New Box' routine from the general maintenance panel (<http://192.168.0.10:8080/asiii-general.htm>) (see ASIII user manual Chapter 12).



Step 4: Home conveyor belt

The box is now moved and positioned at the overshoot sensor, which automatically compensated the overshoot of the box. The 'BeltDistances' for the first row in the PT-file will be calculated from this point. It is therefore important to home the conveyor belt first, so the actual position is set to 0 and the box can be relatively positioned based on the zero point.

Homing of the conveyor belt can be done by pressing the 'Home' button in the actuator maintenance panel of the main PLC (<http://192.168.0.10:8080/asiii-actuators.htm>), box input tab.



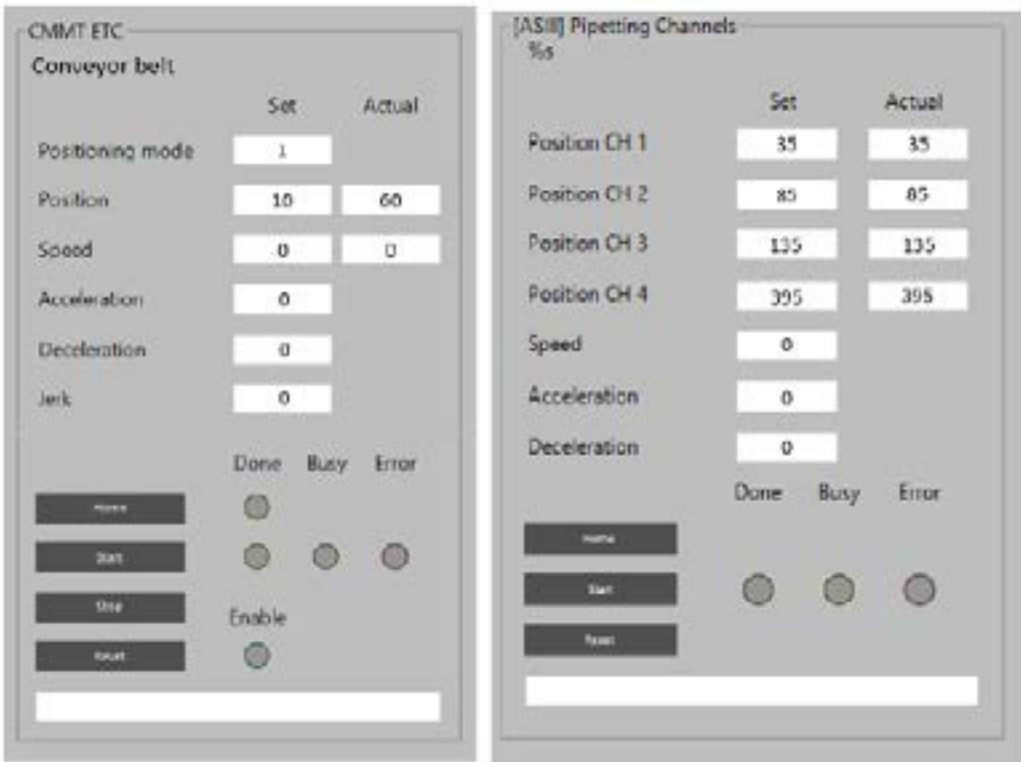
Step 5: Move needle above samples

Position the needles above the samples on the first row. This can be done using the maintenance panels. The Z height should be taught slightly above the samples, so that during the first tests the samples are not pierced for validation of the positions. The following routine controls need to be used:

- Conveyor belt (<http://192.168.0.10:8080/asiii-actuators.htm> , Box Input)
- Pipetting Arm Z (<http://192.168.0.10:8080/asiii-actuators.htm> , Pipetting arm)
- Pipetting Channels (<http://192.168.0.20:8080/asiii-pipettingchannels.htm> , Routines)

Position the box belt until the first sample row is positioned below the needles. Move the pipetting channels above each sample. The channels that are not piercing the sample (i.e. 4 needles available, but only 3 samples on the row) need to be positioned at the safe position defined in the Xperimate variables. The default safe positions are:

- Large wash bath with up to 8 wash positions:
 - Ch4 = 395 mm
 - Ch3 = 386 mm
 - Ch2 = 377 mm
- Small wash bath with safe movement reservoir:
 - Ch4 = 469 mm
 - Ch3 = 460 mm
 - Ch2 = 451 mm

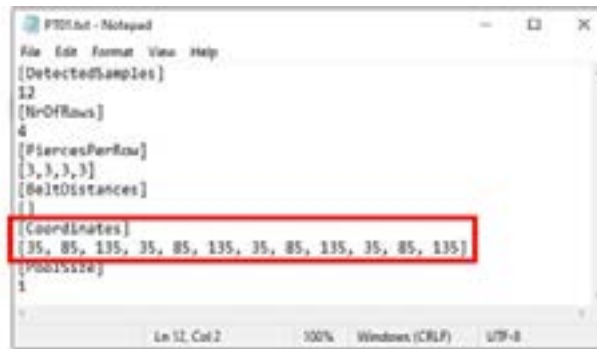


Besides positioning the needles, the z-axis also needs to be lowered to a position slightly above the samples. Write down the position of the z-axis slightly above the samples, this height will be used for initial testing of the boxes without piercing. The pierce height will be adjusted later after testing several boxes without piercing and verifying the positions.



Step 6: Fill in the Coordinates (y-positions) in PT-file

When the needles are correctly positioned above the piercing positions, the coordinates can be added to the PT-file. Only the pierce coordinates need to be filled in in the PT-file, the safe positions are default positions above the conveyor belt. Make sure the needles that do not pierce the sample can move down at the safe position safely. The coordinates for piercing need to be filled in for each row, as shown in the example below.



Note: Coordinates must be separated by a comma. Decimal values are written with a dot, for example: 35.

Step 7: Fill in BeltDistance for the first row

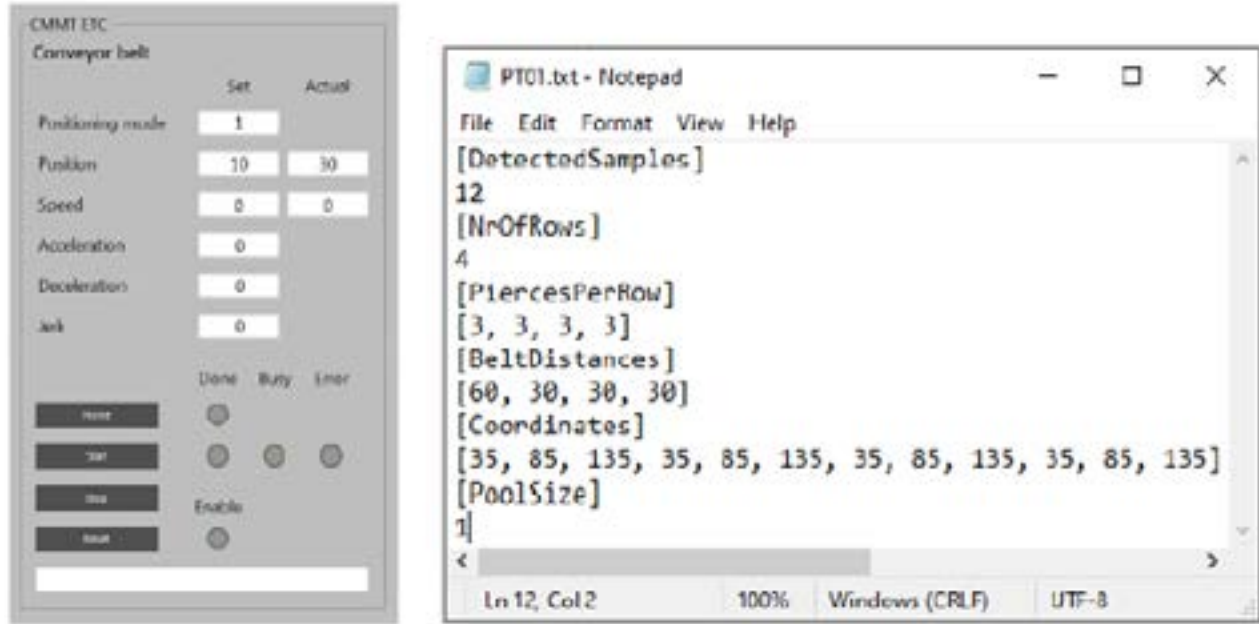
Since the conveyor belt is homed at the overshoot sensor after loading the box, the current actual position of the box is equal to the first belt distance value. This value can be filled in in the created PT-file.



Step 8: Home conveyor belt again and determine row offset

After the belt distance for the first row is determined, the belt can be homed so the actual position is set to 0 again. This is useful, since the belt distances are relative positions, respective to the previous position. So the first belt distance as determined in Step 7 is the distance between overshoot sensor position and the first row. The next values are the distances between each row of samples, which should be similar in case of an evenly divided product layout.

First, move the needles slightly up, so that in case of small deviation in sample height the needles will never touch the sample when moving the belt. Teaching can then be done by moving the box in small steps as done in Step 7. When the position is correct, the parameter can be added to the BeltDistances. Homing can be done between each row.



Tip: When samples are evenly divided in the box, the belt offsets (except first value) should be equal. Home the conveyor at row 1 and move to the last row. Then divide the distance (x) by NrOfRows-1:

$$BeltDistanceRow = \frac{x}{NrOfRows-1}$$

Step 9: Save PT-file

When all fields of the file are filled in, the PT-file can be saved. Make sure the file is saved in the correct folder (C:/Synchron/PierceData) and the file name corresponds with the name in the recipe.

Step 10: Adjust aspiration height recipe

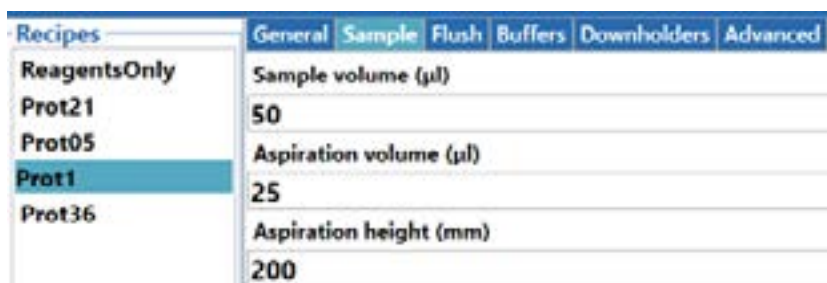
Adjust the aspiration height in the recipe. For testing, use the z height where the needles are slightly above the samples, but not touching the samples (as used in step 5). The recipe can now be tested without piercing first, which will allow to double check the positions for each sample. If needed, the PT-file can be corrected.

14.2. Test Pierce Table

After creation of both a recipe and a pierce table, it is important to test the samples. The steps below show the correct way of testing a new created recipe and pierce table.

Step 1: Set aspiration height to safe position

Adjust the aspiration height in the recipe to a height that is slightly above the top of each sample. The value should be determined during the creation of the pierce table.



Recipes	General	Sample	Flush	Buffers	Downholders	Advanced
ReagentsOnly	Sample volume (µl)					
Prot21	50					
Prot05	Aspiration volume (µl)					
Prot1	25					
Prot36	Aspiration height (mm)					
	200					

Step 2: Test boxes without piercing

Prepare several boxes for testing, make sure the boxes have the correct barcode and are filled with samples. Run the boxes through the system, with the adjusted aspiration height of Step 1, the boxes will not be pierced. During the testing, make sure that the positioning above the samples is correct for each sample. If not, adjust the incorrect parameters in the PT-file (see appendix I for information about the parameters). When all pierce positions are verified and correct (tested with multiple boxes) proceed to the next step. Testing can be done by starting the main sampling run.

Step 3: Adjust aspiration height to required position

After the positions for each sample are verified, the aspiration height in the recipe can be adjusted to the actual required aspiration height. After setting the aspiration height to a lower height, the boxes can be tested again to verify the aspiration height. When the aspiration height is correct, the next step is to optimize the recipe.

Step 4: Optimize recipe for the corresponding sample

The last step of testing is to optimize the liquid parameters. The settings of the parameters are dependent on the type of sample. The recipe parameters can be optimized in the recipe manager on the HMI.

15. Errors and Warnings

This chapter describes all the possible error scenarios including steps to resolve. . The possible errors and error situations that can occur are divided into three types: General errors, PLC errors and error situations. The errors that can occur are divided into three types of errors:

1. Warning

A warning is indicated by a blinking yellow light but does not stop the system. The Autosampler III continues to run if the warning is not blocking the Autosampler III to continue. All warnings are added to the alarm manager. If user input is required, a pop-up will appear on the HMI screen, indicating the actions that need to be taken. The status light keeps blinking orange until the alarm is acknowledged in the alarm manager.

2. Error

An error is indicated by a blinking red status light and immediately stops the Autosampler III's current run. Error messages are logged into the alarm manager and need to be acknowledged before the Autosampler III can be restarted. If the problem is related to a motor, pump or pneumatic actuator, the system needs to be re-initialized before the run can be restarted.

3. Non-fatal error

A non-fatal error is indicated by a red light and pauses the system. A pop-up will indicate the steps that need to be taken by the operator to solve the problem. After the problem is resolved, the alarm needs to be acknowledged in the alarm manager and the user can press 'Run' to continue the run.

If an error from the list below is marked with a (!), always perform the following steps before restarting the machine:

- 1) Acknowledge error:
 - a. Whenever an error occurs, acknowledge it.
 - b. If the error is frequent, report it to the service email.
 - c. Attach pictures of the system as it is during the error.
 - d. Copy the xperimate log of the current day to include in the report.
- 2) Initialize the system:
 - a. Press the "initialize" button to reset the system and prepare it for the next operation.
- 3) Plate contains sample:
 - a. Start the "recover MCB plate" routine:
 - i. This routine adds reagents to the plate that has samples.
 - ii. After adding reagents, move the plates out of the system.
 - b. Check for plates remaining in the system:
 - i. If plates are still present in the system after the "recover MCB plate" routine, initiate the "move plates out" routine.
- 4) Plate does not contain sample:
 - a. If the plate does not contain any sample, execute the "move plate out" routine to remove it from the system.
- 5) Crate still has samples to be processed:
 - a. Move products out of the crate:
 - i. Use the "move box out" routine to take the samples out of the crate.
 - b. Add products to a crate and reregister:
 - i. Place the products into a new crate and re-register them for further processing.
- 6) Start sampling routine:
 - a. After completing the necessary error handling and plate movements, initiate the "sampling routine" to continue with the regular processing.

Note: When errors keep occurring after following the steps to resolve and performing a complete restart of the system, please contact support.

15.1 General Errors

General errors are errors generated from the main Autosampler program, resulting in error or warning messages in the alarm manager or generating a pop-up for the user. General error messages do not contain an error code.

Error Message	Type	Steps to resolve
Air pressure too low	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Wait for the air pressure (max 2.5 minutes) Initialize the system If the message still occurs, check the air supply
ATP file not found	Error	<ul style="list-style-type: none"> Acknowledge in alarm manager Check if ATP file is available and in correct folder Generate ATP file if necessary using Pre-Run
Box not in ATP file	Warning	<ul style="list-style-type: none"> Box is automatically outfeed by the system without processing Check ATP file for box; if necessary, generate new ATP file
Box output blocked	Warning	<ul style="list-style-type: none"> Remove box manually from output Press "OK" in pop-up System continues
Box status invalid, moving box out <Barcode> Box status: <Status>	Warning	<ul style="list-style-type: none"> Box status invalid for processing Box automatically outfeed by the system without processing
Connection to box barcode scanner failed	Error	<ul style="list-style-type: none"> Acknowledge in alarm manager Make sure AutoID Network navigator is not running Retry starting the run If problem persists, restart system
Connection to Cognex camera failed	Error	<ul style="list-style-type: none"> Acknowledge in alarm manager Make sure Cognex camera is in "Run" mode and InSight application is not running Retry starting the run If problem persists, restart system
Detecting plate failed, please reload plates	Warning	<ul style="list-style-type: none"> Press "Ok" in pop-up to move stacker lift upward Load plates in stacker Press "Ok" in pop-up after loading to lower plate lift Autosampler III will continue
Door(s) open	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Close and lock all doors Press blue "Reset" button Initialize system
Dummies detected. Amount of dummies <n>. Press ok to sample the box or press cancel to move the box out.	Warning	<ul style="list-style-type: none"> Dummies detected by camera Pressing "Ok" in the pop-up will sample the box and skip the amount of displayed dummies Pressing cancel moves the box out without sampling
Emergency button pressed	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Unpress emergency button(s) Press blue "Reset" button Initialize system

Error. <Liquid> volume, less than <Error Level> µl available	Error	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Refill liquid reservoirs • Reset liquid reservoirs • Prime pumps if necessary • Restart run
Error <Pump> (<Error Code>)	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Resolve pump error (e.g., Unclog needle) • Initialize system • Retry starting the run • If problem persists, restart system
Error while adding samples to file	Warning	<ul style="list-style-type: none"> • Samples cannot be added to the file • Check if file exists • Check if file is not opened • Re-run the unprocessed boxes if required
Export file creation failed	Error	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Check if export folder is available, if not create folder • Check export folder if file already exists and if so, remove existing file from location • Retry starting the run • If problem persists, restart system
No recipe loaded, moving box out <Barcode>	Warning	<ul style="list-style-type: none"> • Box is automatically outfeed by the system without processing • Check if recipe exists and is linked to barcode • Create recipe and link to barcode
Not enough samples detected. Detected <n> of <Expected>. Press ok to sample the box or press cancel to move the box out.	Warning	<ul style="list-style-type: none"> • Detected samples is not equal to the amount of expected samples • Check if the amount of <ExpectedSamples> is correct and in the box/crate • Check if all products are on the correct position • Check if correct products is loaded • When all of the above are correct, user can press “Ok” to sample the amount of expected samples • When something needs to be corrected by user, press cancel and the box will be moved out without sampling
OPC-UA Initializing failed	Error	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Make sure all network cables are connected and PLC is connected • Retry starting the run • If problem persists, restart system
Pipetting + belt loop mismatch, check box for missed samples	Warning	<ul style="list-style-type: none"> • Check outfeed box if samples are missed • Re-run box if necessary
Pipetting speeds cannot be set, using default speeds	Warning	<ul style="list-style-type: none"> • Unknown/invalid pipetting speed settings in recipe, default values will be used • Correct recipe values
Plate buffer almost full, please remove plates	Warning	<ul style="list-style-type: none"> • Clear plates from plate buffer • Plate buffer will reset automatically when no plate detected
Plate buffer full, remove plates	Error	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Empty plate buffer • Retry starting run

Product not matching recipe, moving box out	Warning	<ul style="list-style-type: none"> • Box is automatically outfeed by the system without processing • Check if correct barcode is on box, products matching barcode • Check if box is filled • Check if products are detectable by camera (no damage, etc.)
Timeout during soft-start	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Make sure sufficient air pressure is available and pressure valve is opened • Make sure system is reset • If problem persists, restart system
Unable to connect to <Pump>	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Check and correct pump COM port settings • If problem persists, restart system
Unable to copy file <Filename>	Warning	<ul style="list-style-type: none"> • Autosampler continues without copying the file • Check if the output folder can be accessed and output directory exists
Unable to detect box at input	Warning	<ul style="list-style-type: none"> • Place box at input / make sure box has a barcode • Press "OK" in the pop-up to continue run and retry scanning • If problem persists, stop run and tune barcode camera
Unable to scan plate barcode	Warning	<ul style="list-style-type: none"> • Press "Ok" in pop-up to move stacker lift upward • Load plates in stacker • Press "Ok" in pop-up after loading to lower plate lift • Autosampler III will continue
Waste container full or not placed, place empty waste container and press ok to continue	Warning	<ul style="list-style-type: none"> • Remove filled waste container from system and empty • Place back empty waste container • Press "Ok" to continue the run
Waste container not detected	Error	<ul style="list-style-type: none"> • Waste container not detected, place waste container on correct position • Restart run
Warning. <Liquid> volume, less than <WarningLevel> µl available	Warning	<ul style="list-style-type: none"> • Fill liquid to maximum level • Press reset button in the HMI to reset liquid level
<Location> not initialized	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Check error location for damage, blocked movement, etc. • Retry initialization • If problem persists, restart system
Reagent 2 empty error	Non-fatal error	<ul style="list-style-type: none"> • Non-fatal error is added to Alarm Manager "Error: Reagent volume 2, less than 'volume' mL available". • Autosampler III is paused. • Fill reagent 2. • Alarm needs to be acknowledged. • Press "Start" to continue run.
Error while adding samples to file	Non-fatal error	<ul style="list-style-type: none"> • Make sure the file is not opened by another application.
Needles broken	Failure (to be observed only)	<ul style="list-style-type: none"> • Replace needles as described in this manual.

15.2. PLC Errors

PLC errors are errors that are directly related to the PLC or the devices connected to the PLC. PLC errors all start with an E<n> error code. The table below shows the PLC errors that can occur and steps on how to resolve the errors.

Error Message	Type	Steps to resolve
E001: Emergency Button Pressed.	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Unpress emergency button and make sure all doors are closed and locked Press the blue reset button Initialize the system
E002: EtherCAT not ready.	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Wait 1 minute for EtherCAT communication to start Initialize the system If problem persists, restart system and initialize again
E003: Air pressure not available.	Non-fatal error	<ul style="list-style-type: none"> Wait for the pressure, light will turn blue again Press start to resume run System continues
E003: Air pressure not available.	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Wait for the air pressure (max 2.5 minutes) Initialize the system If the message still occurs, check the air supply
E004: CAN Bus not ready.	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Wait 1 minute for CAN communication to start Initialize the system If problem persists, restart system and initialize again
Connection to box barcode scanner failed	Error	<ul style="list-style-type: none"> Acknowledge in alarm manager Make sure AutoID Network navigator is not running Retry starting the run If problem persists, restart system
Connection to Cognex camera failed	Error	<ul style="list-style-type: none"> Acknowledge in alarm manager Make sure Cognex camera is in "Run" mode and InSight application is not running Retry starting the run If problem persists, restart system
Detecting plate failed, please reload plates	Warning	<ul style="list-style-type: none"> Press "Ok" in pop-up to move stacker lift upward Load plates in stacker Press "Ok" in pop-up after loading to lower plate lift Autosampler III will continue
Door(s) open	Error (!)	<ul style="list-style-type: none"> Acknowledge in alarm manager Close and lock all doors Press blue "Reset" button Initialize system

Error Message	Type	Steps to resolve
E100: Error enabling <Location> E101: Error disabling <location> E102: Error starting (absolute/relative/continuous) movement <location> E103: Error homing <location> E104: Error resetting <location> E105: Error during movement of <location> E106: Error stopping <location> E107: Error switching on <location> E108: Error setting synchronous movement slave <location> E109: Invalid position setpoint <location> E150: Timeout homing <location> E151: Timeout during movement of <location> E152: Timeout acknowledging movement of <location> E153: Timeout switching on <location> E154: Timeout resetting <location> E200: Timeout reaching limit switch <location> E400: Timeout enabling <location> E401: Timeout triggering <location>	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Initialize the system • If problem persists, check fuses • Restart system and initialize again

Error Message	Type	Steps to resolve
E500: Timeout retrieving box at <location>	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Remove box from system • Initialize system • Place box at input and restart run
E501: No plate detected at plate sensor corner module	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Remove plate from system • Clean shaker guide if plate is stuck on shaker • Initialize system
E502: Plate detected at corner module during init	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Remove plate from corner module • Initialize system
E506: No box detected at input	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Remove box from input • Initialize system • Place box at input and restart run
E507: Box output blocked	Warning	<ul style="list-style-type: none"> • Remove box manually from output • Press “OK” in pop-up • System continues
E508: Timeout during Init Plate Output	Error (!)	<ul style="list-style-type: none"> • Acknowledge in alarm manager • Initialize the system • If problem persists, check fuses • Restart system and initialize again

15.3. Error Situations

Error situations are not related to a specific error message. An error situation can either have multiple causes that can possibly result in different error messages or can be observed by the operator only. The table below shows a list of error situations and steps to resolve.

Error Message	Type	Steps to resolve
Error during initialization (repeating error)	Error	<ul style="list-style-type: none"> Acknowledge the alarm Retry initialization, max 3 times. If problem persists, check fuses
PC/HMI screen not starting when power switched on	Error	<ul style="list-style-type: none"> Check connection cables HMI and PC Check the fuses in the electrical cabinets
One of the pipetting channels moving at a lower speed, sound of the machine is increased	Failure (observed only)	<ul style="list-style-type: none"> Stop the run Move plates and boxes out of the system Shutdown the Autosampler III Restart the Autosampler III after 15 seconds Initialize the Autosampler III and restart run
No samples in one or more wells	Failure (observed only)	<ul style="list-style-type: none"> Stop the run If air can be seen inside the tubing, the system should be primed In case the needles are clogged, try unclogging the needle(s) using the flush method (multiple times if required) If the needles stay clogged, replace the needle for a new one and put the clogged one in slightly warm demineralized water or washing solution to unclog During replacement of the needle check the connection of the tubing at the needle. If the connection is too loose, cut off a small edge at the end of the needle to fix the tubing better at the needle.
No reagent(s) in one or more wells	Failure (observed only)	<ul style="list-style-type: none"> Stop the run If air can be seen inside the tubing, the system should be primed In case the needles are clogged, connect reagents to washing solution and prime reagent channels to unclog channels If the needles stay clogged, replace the needle for a new one and put the clogged one in slightly warm demineralized water or washing solution to unclog
Needles broken	Failure (observed only)	<ul style="list-style-type: none"> Replace needles as described in this manual
Tubing leaking	Failure (observed only)	<ul style="list-style-type: none"> Check connection, clean or replace as described in this manual
Syringe leaking	Failure (observed only)	<ul style="list-style-type: none"> Inspect the pump and clean or replace as described in this manual

16. Lockout / Tagout

When the Autosampler III needs to be made inoperable, the following procedure can be followed.



Warning: Consult the user manual.
Care must be taken when working on the equipment.



Reserved for certified engineers.
Operations to be carried out only by certified personnel.

The procedure outlined in this chapter establishes the minimum requirements for the lockout or tagout of energy-isolating devices. Lockout is the preferred method of isolating the Autosampler III from energy sources. It shall be used to ensure that the Autosampler III is isolated from all potentially hazardous energy and locked out or tagged out before associates perform any servicing or maintenance activities where the unexpected energization, start-up or release of stored energy could cause bodily injury and/or damage the Autosampler III or the environment.

16.1. Definitions

Lab operator: The lab operator works with the Autosampler III and in the area where servicing or maintenance operations on the Autosampler III are performed. The lab operator does not perform servicing or maintenance on the Autosampler III and, consequently, is not responsible for implementing lockout/tagout procedures. However, an authorized associate and an affected associate may be the same person when the affected associate's duties also involve performing maintenance or service. An affected associate becomes an authorized associate whenever he or she performs servicing or maintenance functions.

Authorized associate: This is an associate who performs servicing or maintenance on Autosampler III. This associate implements lockout/tagout procedures to guarantee his or her own protection.

Capability of being locked out: An energy-isolating device is considered capable of being locked out if it meets one of the following requirements:

- It is designed with a hasp to which a lock can be attached.
- It is designed with any other integral part through which a lock can be affixed.
- It has a locking mechanism built into it.
- It can be locked without dismantling, rebuilding or replacing the energy-isolating device or permanently altering its energy control capability.

Energized: Equipment and machinery are energized when they are connected to an energy source or contain residual or stored energy.

Energy control procedure: This is a written document that contains the steps an authorized associate must follow to safely control hazardous energy during servicing or maintenance of equipment or machinery.

Energy-isolating device: This is a mechanical device that physically prevents the transmission or release of energy.

Energy source: This is any source of electrical, mechanical, hydraulic, pneumatic, chemical, steam, thermal or other energy.

Lockout: Placing a lock on an energy-isolating device according to an established procedure, that ensures that the Autosampler III cannot be energized until the lock is removed by the person who placed it there.

Lockout device: This is a device that utilizes a positive means such as a lock to hold an energy-isolating device in a safe position and prevent the energizing of the Autosampler III.

Tagout: This is the placement of a tagout device on an energy-isolating device, according to an established procedure, clearly marked by means of a tag that states who has the Autosampler III shut down and that the Autosampler III must not be operated until the tagout device is removed by the associate who place it there.

Tagout device: This is any prominent warning device, such as a tag and a means of attachment, that can be securely fastened to an energy-isolating device according to established procedure. The tag indicates that the Autosampler III, to which it is attached, must not be operated until the tagout device is removed according to the energy control procedure. The attachment method must be substantial and not easily removed.

Zero energy state: All sources of energy have been controlled and/or dissipated.

16.2: Lockout Rules



Reserved for certified engineers.
Operations to be carried out only by certified personnel.

Customers might have their own lockout tagout procedure in place which can replace the informative instructions below. Basic rules for using lockout or tagout system procedures:

- All energy sources to the Autosampler III shall be locked out or tagged out to protect against accidental or inadvertent operation when such operation could cause injury to personnel.
- Note that isolating a piece of equipment from its source may not eliminate all potential hazards. Stored energy may be present within the Autosampler III.
- Do not attempt to operate any switch, valve or other energy isolation device when it is locked or tagged out.
- Never remove a lock or tag for another associate. Only the associate placing the lock or tag may remove it. If there is a need to remove another associate's lock or tag in an emergency, only the maintenance supervisor may do so after making every effort to contact the owner of the lock or tag.

16.3. Sequence to Lockout or Tagout

Reserved for certified personnel

Actions or work to be carried out by certified personnel only

1. The supervisor shall make a survey to locate and identify all isolating devices these include:

No	Autosampler III ID	Location	Energy source
1	Autosampler	Main switch cabinet A	Electricity (400V)
2	Autosampler	Main pneumatic service unit	Compressed air

2. Verify the written energy control (shutdown/startup) procedure of the Autosampler III, make necessary changes, supply the written procedure in the absence thereof, and send a copy of the procedure or changes to an existing procedure to the FM safety manager for review.
3. The supervisor or Lab manager shall notify all affected associates that a lockout or tagout procedure is going to be utilized and the reason for that action. The authorized associate shall know the type and magnitude of energy that the Autosampler III or equipment utilizes and shall understand the hazards thereof.
4. If the Autosampler III is operating, shut it down by the written energy control (shutdown) procedure described in the manual for the Autosampler III.
5. Operate the switch, valve or other energy-isolating device(s) to ensure that the equipment is isolated from its energy source(s). Stored energy such as that in elevated machine members and air pressure must be dissipated or restrained by methods such as repositioning, double blocking and bleeding down, etc.
6. Lockout and/or tagout the energy-isolating devices with assigned individual lock(s) or tag(s). Tags shall indicate that the energy-isolated device(s) shall not be operated until after the removal of the tag.



7. After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, operate the "Start" button or other normal operating controls to make certain the equipment will not operate.
8. The equipment is now locked out and or tagged out.



**Reserved for certified engineers.
Operations to be carried out only by certified personnel.**

16.4. Sequence to Restore the Autosampler III to Normal Production Operations

After servicing and/or maintenance is completed and the Autosampler III is ready for normal operation, check the area around the Autosampler III to ensure that no one is exposed.

After all tools have been removed from the Autosampler III, guards have been reinstalled and associates are in the clear, remove all lockout or tagout devices. Notify all affected persons that the lockout or tagout has been removed. Operate the energy-isolating devices to restore energy to the Autosampler III, following the written energy control (startup) procedure.

17. Patch Management

As a rule, Hygiena will not provide any patches for the Autosampler III. If the customer deems a patch necessary, that should be discussed with Hygiena. During this discussion, a risk analysis should be done. If a patch is agreed on, a document should be produced that describes exactly what is patched and what is not.

When a patch is installed and verified, a report must be made generated, stating all changes and how they were verified. Patches can be divided into two parts: Xperimate and HMI patches.

17.1. Xperimate

Before any patch can be applied to Xperimate, a backup must be made. This backup must include a copy of the entire Xperimate folder with all its subfolders. The Xperimate folder can be found at C:\(Customer Name)\Xperimate.

When a backup is made, the required patches can be installed. When the installation is done, the Autosampler III should be verified to ensure that all components are working correctly. Changes in Xperimate will affect the behavior of the Autosampler III. During the verification, extra attention should be paid to the specific behavior changes.

Compatible with Windows 10 Professional.

17.2. HMI

Before any patch can be applied to the HMI, a backup must be made. This backup must include the entire Xperimate folder with all its subfolders together with the old version of the HMI software. The HMI folder can be found at C:\(Customer Name)\HMI.

When a backup is made, the required patches can be installed. When the installation is done, the Autosampler III should be verified to ensure that all components are working correctly. This should be done during a run of the Autosampler III. This run should be at least one full MTP. If specific behavior is changed with the patch, that behavior should also be specifically tested.

Changes to the HMI will mostly be visual, but can also include functional changes to the handling of alarms, users, settings, etc.

Compatible with Windows 10 Professional.

17.3. Windows® Updates

Automatic Windows updates will be disabled on the Autosampler III. If Windows updates are necessary, an image of the entire system must be made beforehand. This image must be saved on a separate device. These images should be created according to customer IT standards and protocols.

When a backup is made, the required updates can be installed. When the installation is done, the Autosampler III should be verified to ensure that all components are still working. To verify the Autosampler III, a test run should be done.

17.4. Installing Software

The installation process for software on the Autosampler III is simple. There will be a folder supplied by Hygiena containing all the required files. The files should be placed at the correct locations. The location the files must be placed at are the following:

- Xperimate: C:\(Customer Name)\Xperimate
- HMI: C:\(Customer Name)\HMI

Region Settings:

For correct working of the application the region settings should be configured as follows:

Decimal symbol: ","

Digit grouping symbol: "."

17.5. List of Drivers

To ensure the correct working of the Autosampler III, all the required drivers for the machine should also be installed and configured. This list can be found in the next section.

Driver name	Application/Configuration
Advantech EKI Device Configuration Utility v3.02	COM9: Pipetting pumps COM10: Reagent pumps COM11: Shaker
.Net Runtime 5.0	Xperimate HMI
Edge	Web view of the PLC

18. Spare parts list

Id	Product	Description
AUTOIII001	Needle	
AUTOIII002	Downholder	
AUTOIII003	Tubing per meter	
AUTOIII004	Pipetting pump	
AUTOIII005	Reagent pump	
AUTOIII006	Pipetting Syringe	
AUTOIII007	Reagent Syringe	
AUTOIII008	Cover plate stacker	
AUTOIII009	8-position manifold	
AUTOIII010	manifold replacement needle	
AUTOIII011	Wash station	
AUTOIII012	Interlock Lock set pipetting cabinet doors	
AUTOIII013	Interlock set deck covers	
AUTOIII014	Interlock set input cover overhang and conveyor cover door	
AUTOIII015	Safety relay card	

19. Tools

Tool	Size
Security torx:	T9, T10, T15, T20, T25, T27, T30, T40, T45
Allen key	2
Sandpaper	Any grid 5 x 50 mm
Tubing cutter	3 mm
Wrench	5

20. Decommissioning and Disposal

As a rule, Hygiena will not provide any patches for the Autosampler III. If the customer deems a patch Special operations are often necessary to temporarily put installations out of operation. Safety plays an important role in this. All necessary actions for this are described here such as precautions and technical measures.

20.1. Disassemble

If disassembly is necessary on site, this should be done from top to bottom so that the risk of falling parts is reduced as much as possible. The Autosampler III contains heavy parts. Disassembly is not necessary for normal decommissioning or disposal. Consult your supplier before disassembling the Autosampler III.

20.2. Environment

The user must be informed about the environmental aspects of the product, the correct volume of products during use but also about the materials used that can burden the environment during disposal.

Determine what measures the user can take to minimize energy consumption. Also, provide information about the responsible reuse of the product or parts thereof.

All materials used and consumed for and by the Autosampler III must be disposed of in accordance with the legal regulations of the country where the Autosampler III is placed. Think, for example, of separating:

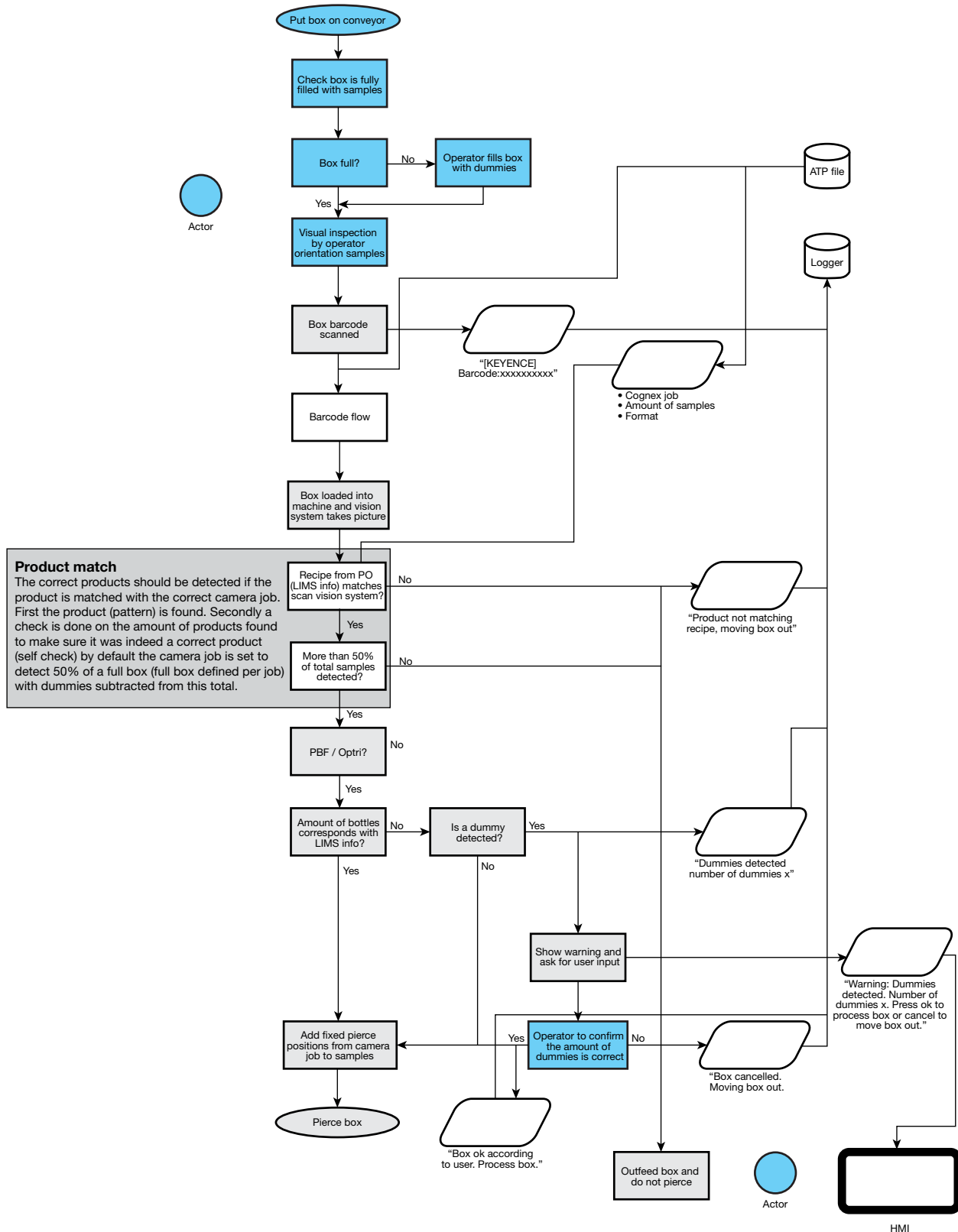
- Steel and Stainless Steel ST37
- RVS304 / RVS 303 / aluminum
- Copper/ brass
- Plastics PP / PS / HMWPE (500)
- UMWPE (1000) / PVC / PA6G
- Oils and fats
- Liquids
- The foregoing must also be observed when the Autosampler III is disposed.

20.3. Disposing

The Autosampler III should be offered as much as possible in its entirety to a specialized recycling company. Recycling must be carried out in accordance with local laws and regulations. Pay attention to the recycling of, for example, metals, batteries, etc.

Appendix 1: Camera Flow Including Barcode Processing

This appendix contains the workflow of the camera process, including the box barcode processing flow.



Context:

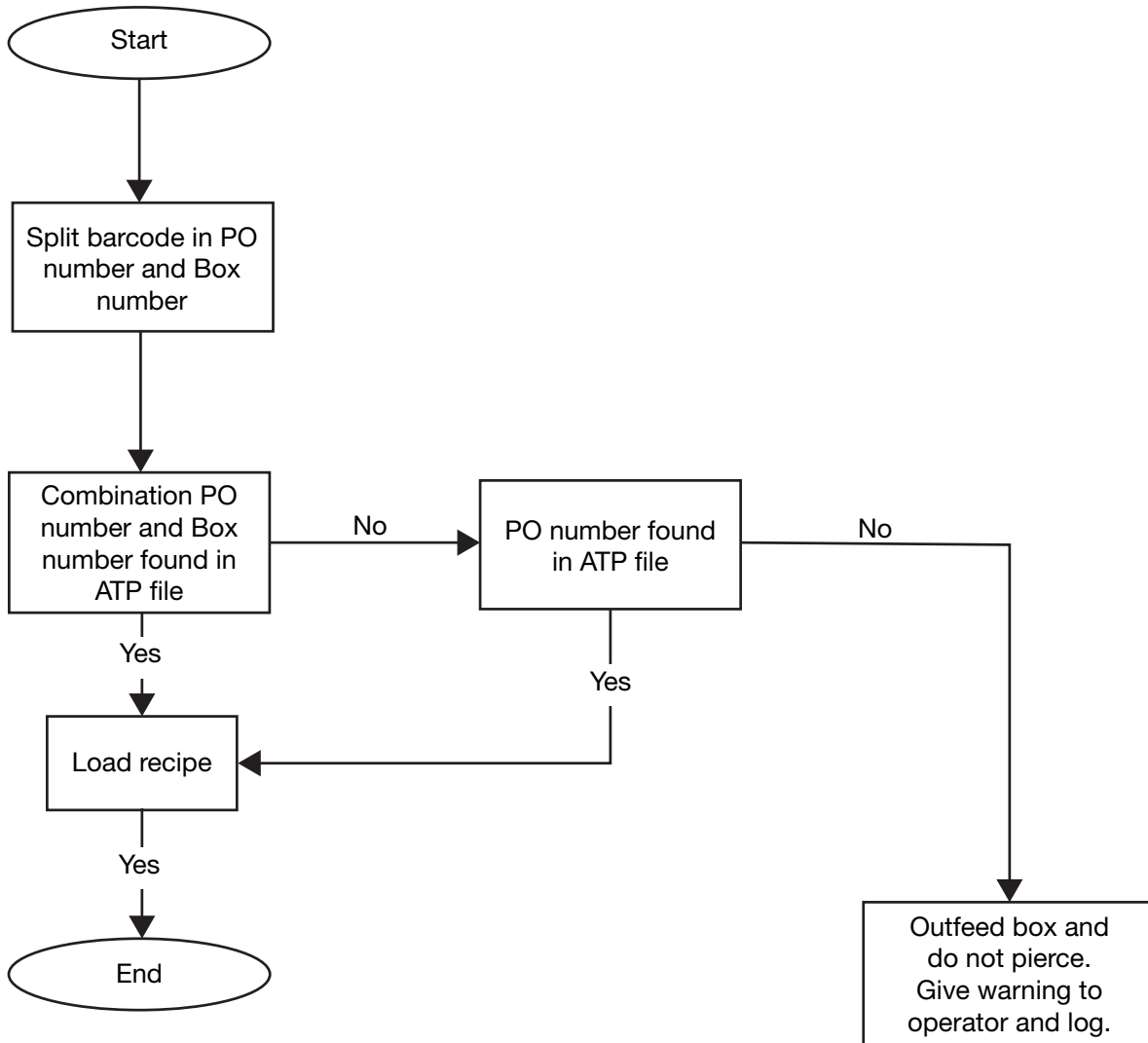
Three situations:

- Samples from LIMS (PO number + Box number)
- Samples from LIMS (PO number only)
- Samples not in LIMS (fixed PO number)

At the start of day, the system input file is generated from LIMS.

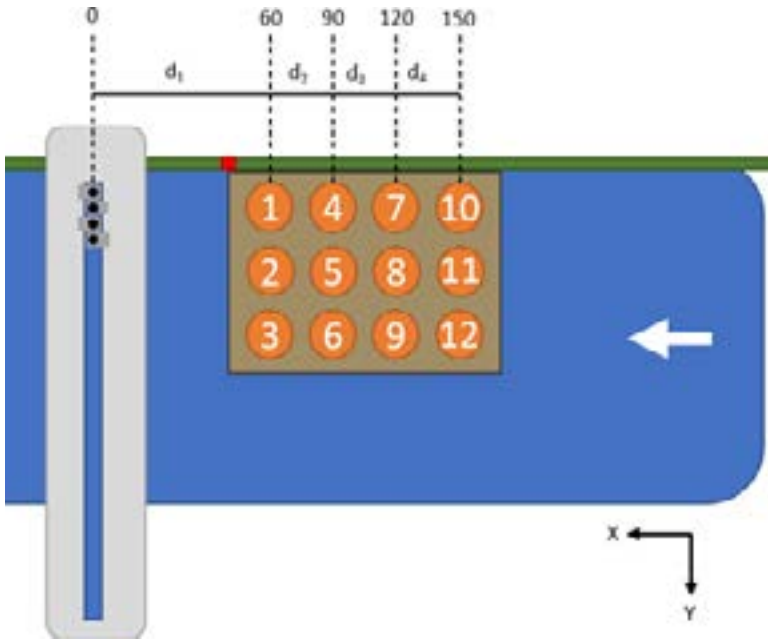
Fixed PO numbers will be added to this generated file.

This way there are only two situations the system needs to handle.



Appendix 2: Box Layout Example

This appendix displays a test example of a box and a corresponding PT-file. The example shows how the box parameters from the example are transferred to a PT-file.



Pos	X (mm)	Y (mm)
1	60	35
2	60	85
3	60	135
4	90	35
5	90	85
6	90	135
7	120	35
8	120	85
9	120	135
10	150	35
11	150	85
12	150	135

```

PT01.txt - Notepad
File Edit Format View Help
[DetectedSamples]
Total samples
[NrOfRows]
Rows (x-axis)
[PiercesPerRow]
[Samples row 1, samples row 2, etc.]
[BeltDistances]
[d1, d2, d3, d4]
[Coordinates]
[y1, y2, y3, y4, y5, y6, y7, y8, y9, y10, y11, y12]
[PoolSize]
1
Ln 12, Col 2    100%    Windows (CRLF)    UTF-8
    
```

Empty PT- file with field explanations

```

PT01.txt - Notepad
File Edit Format View Help
[DetectedSamples]
12
[NrOfRows]
4
[PiercesPerRow]
[3, 3, 3, 3]
[BeltDistances]
[60, 30, 30, 30]
[Coordinates]
[35, 85, 135, 35, 85, 135, 35, 85, 135, 35, 85, 135]
[PoolSize]
1
Ln 12, Col 2    100%    Windows (CRLF)    UTF-8
    
```

Filled in PT-file based on example above