Innovate™ AutoSampler DUO User Manual

Product Number MCH4006



Version 1.0

Table of Contents

1. Overview 6
About this Guide 6
Privacy statement 6
Safety symbols 6
2. Introduction 8
3. Technical Specifications 11
3.1 Mechanical 11
3.2 Electric 12
3.3 Pneumatic 12
3.5 Sizes and weights 12
4. Transport and Storage 13
4.1 Transport 13
4.1.1 Internal transport 14
4.1.2 External transport 14
4.1.3 Lifting points 14
4.2 Packaging 15
4.2.1 Included items with AutoSampler DUO. 15
4.2.2 Preparing for transport 15
4.2.3 Packaging exterior AutoSampler DUO 16
4.3 Storage 16
5. Assembly and Installation 17
5.1 Installation 17
5.2 Commissioning Instructions – General 17
5.2.1 Commissioning Instructions- General 18
5.2.2 Commissioning Instructions - Electrical Components 18
5.2.3 Commissioning Instructions - Pneumatic Components 18
6. Machine Functions 19
6.1 Workflow 19
6.2 Storage systems 19
6.3 Machine control 21
6.4 Robotic deck loading and scanning 21
6.5 Smart vision camera and box barcode scanner 22
6.6 Pipetting 22
6.7 Washing needles 23

6.8 Stack Light 23
6.9 Emergency stop 24
6.10 Door locks 25
6.11 Conditions of use 25
6.12 Description of the operator's workplace 26
6.13 Personal protective equipment 26
6.14 Restrictions on the use of the AutoSampler DUO 26
7. Standard Operating Procedure 27
7.1 Prepare the Compressor for Use 27
7.1.1 Start up the System 27
7.1.2 End-of-Day Shutdown 28
7.2 Starting up the AutoSampler DUO 29
7.3 Pre-Initialization of the AutoSampler DUO 30
7.3.1 Pre-Initialization Checklist 30
7.4 Starting AutoSampler DUO initialization 32
7.5 Priming the syringe pump 32
7.5.1 Checklist Prior to Start Priming the Pumps 33
7.5.2 Start Priming Method 33
7.6 Loading plates 33
7.7 (Un)lock doors 34
7.7.1 Unlocking with HMI 34
7.7.2 Unlocking Using Physical Buttons 34
7.8 Starting a Run 36
7.9 Main Run 36
7.10 Dummies 39
7.11 Exchange of Liquids Procedure 40
7.11.1 Pumps 40
7.11.2 Chemical containers 42
7.12 End of Day Procedure 44
7.13 Volume validation syringe pump 45
7.14 Bend needle check 46
7.15 Export all plate files 46
8. Replacing Needle(s) 47
9. Cleaning the AutoSampler DUO 49
9.1 Outside of the AutoSampler DUO 49
9.1.1 See-through parts such as doors, windows and covers 49

9.1.2 Trespa Panels (White) 49
9.1.3 Frame Parts 49
9.1.4 Robotic Cover (Cyan) 49
9.1.5 Deck/Stainless Steel 49
9.1.6 Barcode camera 50
9.1.7 HMI 50
9.2 Pipetting cabin 50
9.2.1 Washing station 50
9.2.2 Downholder 50
9.3 Tubing 50
9.4 Needle 51
9.4.1 Regular cleaning of needle 51
9.4.2 Deep cleaning needle 51
9.5 Syringe pump 51
9.6 Conveyor belt 53
9.6.1 Cleaning the Conveyor Belt 53
9.6.2 Scraper 54
10. HMI/Xperimate operation panel 54
10.1 Login 55
10.2 Sidebar 56
10.3 Recipe manager 58
10.4 Top bar 59
10.5 General overview 60
10.6 Alarm manager overview 62
10.7 User Manager 63
10.8 Settings 64
11. Maintenance 65
Preparation Maintenance 65
11.2 Maintenance instructions Electrical Components 66
11.2.1 Barcode scanners and camera 66
11.2.2 Cables 66
11.2.3 Switch Cabinets 66
11.3 Maintenance Instructions Pneumatic Components 66
11.3.1 Cylinder 67
11.3.2 Air service unit 67
11.3.3 Couplings and valves 67

11.3.4 Air tubing 67
11.4 Maintenance Instructions Liquid Components 68
12. Maintenance service panel visualizations 69
12.1 Introduction 69
12.2 Login (Main Page) 69
12.2.1 Login 70
12.2.2 Logout 70
12.3 Conveyor control 70
12.4 Actuator control 71
13. Create a Keyence Camera Job 73
14. Errors and warnings 90
14.1 General errors 91
14.2 PLC errors 93
14.3 Error situations 95
15. Lockout Tagout 96
15.1 Definitions 97
15.2 Lockout rules 98
15.3 Sequence to lock out or tag out 98
15.4 Sequence to restore the AutoSampler DUO to normal production operations 99
16. Patch Management 100
16.1 Xperimate 100
16.2 HMI 100
16.3 Windows Updates 100
16.4 Installing software 101
Region Settings: 101
16.5 List of drivers 101
17. Spare Parts List 101
18. Tools 102
19. Decommissioning and Disposal 102
19.1 Disassemble 102
19.2 Environment 102
19.3 Disposing 102

1. Overview

About this Guide

This manual should be used as a reference by 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 Innovate™ AutoSampler DUO. Additional information about specific applications can be made available by your supplier. Details about software installation and protocol optimization may be provided in 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 instruments. The possibility of changes to this document regarding design, technical equipment and execution must therefore be reserved. Therefore, we inform the reader and owner of this manual that no claims can be made based on the data in this manual. Changes and typos reserved.

Safety symbols

The following aspects must be considered: before carrying out the work, this manual must first be carefully examined. This prevents the AutoSampler DUO from being used incorrectly. It is also advisable to keep this manual with the AutoSampler DUO 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
Dangerous voltage



Warning
Risk associated with chemicals or biological material



Warning
Risk associated with biological material



Warning
Warm surface



Warning
Optical radiation



Warning
Piercing hazard



Warning
Strong magnetic field



Warning
Trip hazard



Warning
Automatic starting machine



Warning
Beware of rotating parts



Warning
Beware of injuries to the hand



Note
Special explanation



Tip
Interesting tips



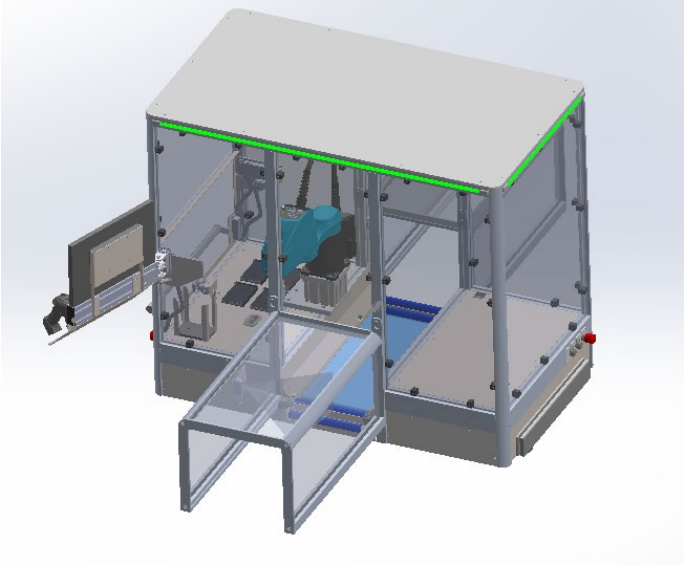
Reserved for certified engineers
Operations to be carried out only by certified personnel

2. Introduction

The Innovate™ AutoSampler Duo aims to move liquid samples quickly, accurately and consistently from packaged products to microtiter plates.

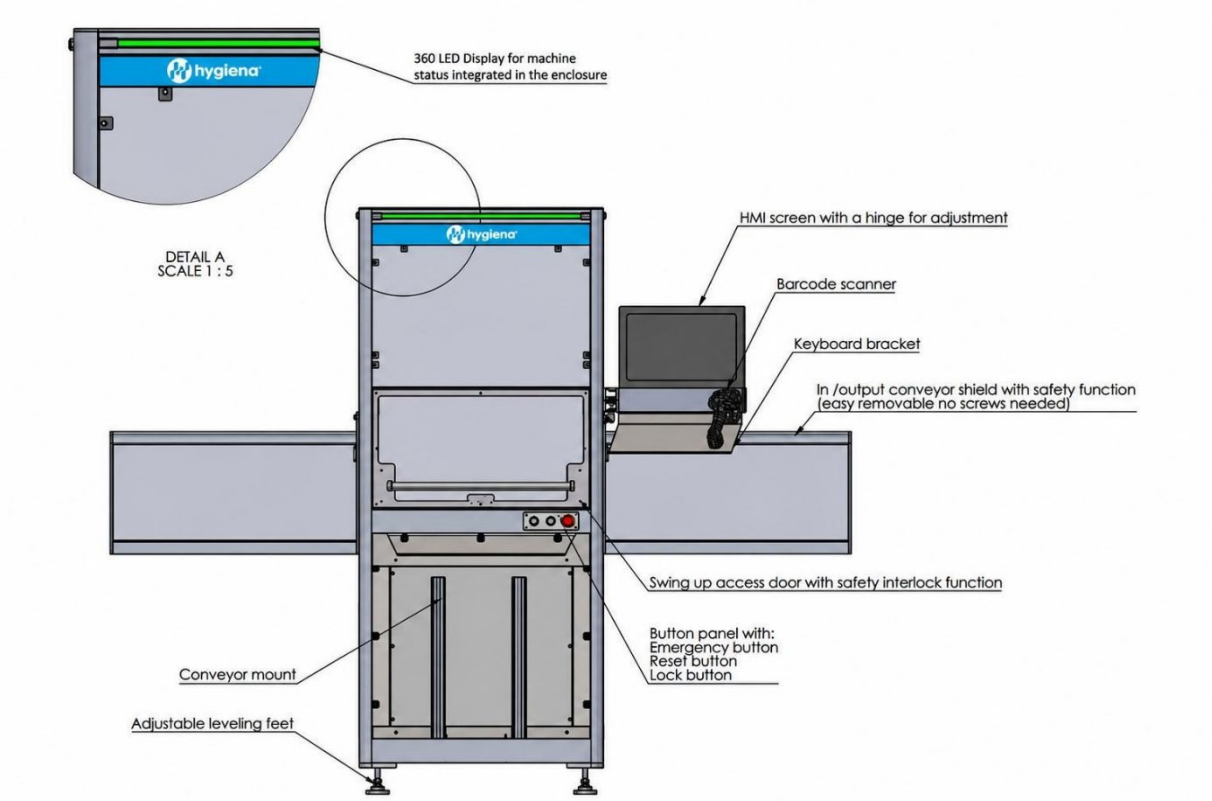
The AutoSampler Duo is made from high-quality and durable components. The surface is made of 316 stainless steel, providing a durable, corrosion-resistant finish that is built to last. The anodized aluminum frame enables quick and easy manufacturing and allows adjustments when necessary. The outside of the framework is closed to minimize cleaning efforts.

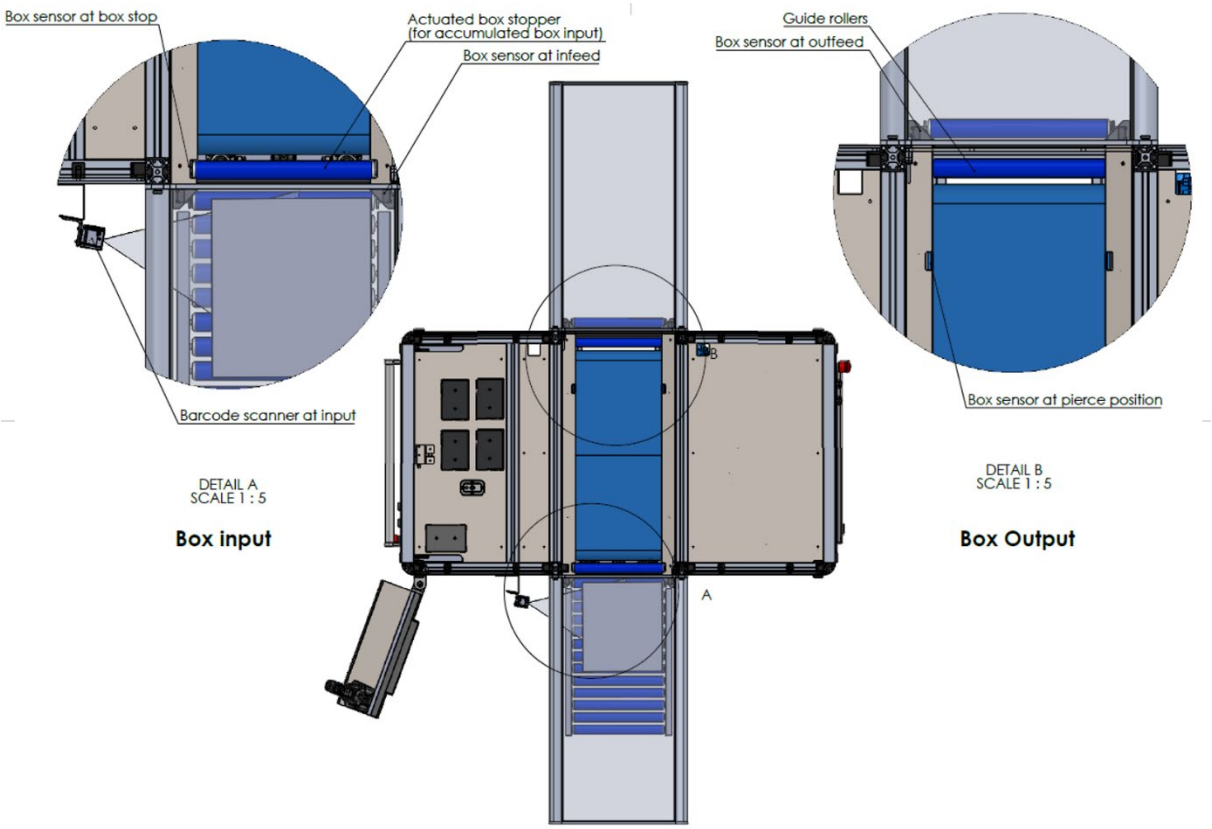
The pipetting cabin is the heart of the AutoSampler Duo. In the pipetting cabin, the samples are aspirated from the products and dispensed into microtiter plates. The pipetting cabin can be safely entered by the operator to perform cleaning and daily maintenance tasks via interlocks. This prevents the user from entering the AutoSampler Duo while the system is running and forces the user to make a controlled stop of the AutoSampler Duo. In addition to the main lockable access door on the front, the user can access the pipetting cabinet from the side and the back. With this three-point access, the user has many options for comfortably entering the AutoSampler Duo.

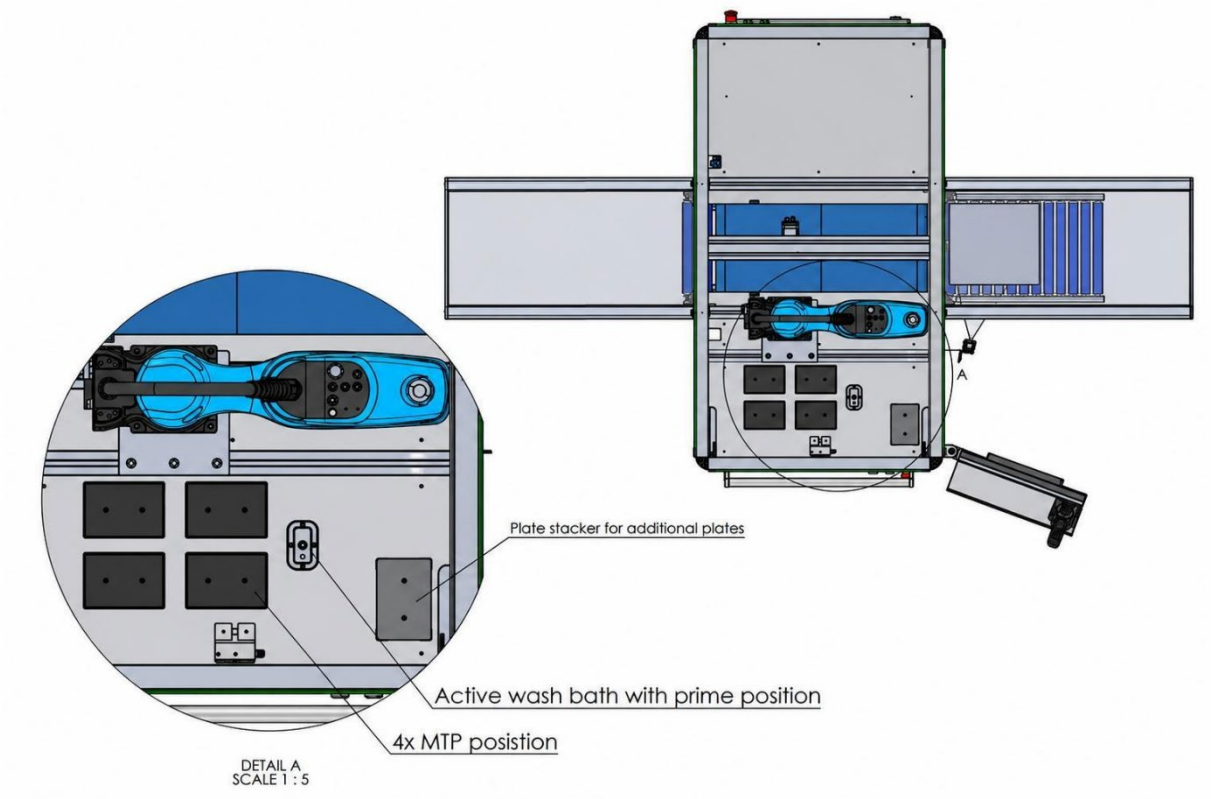


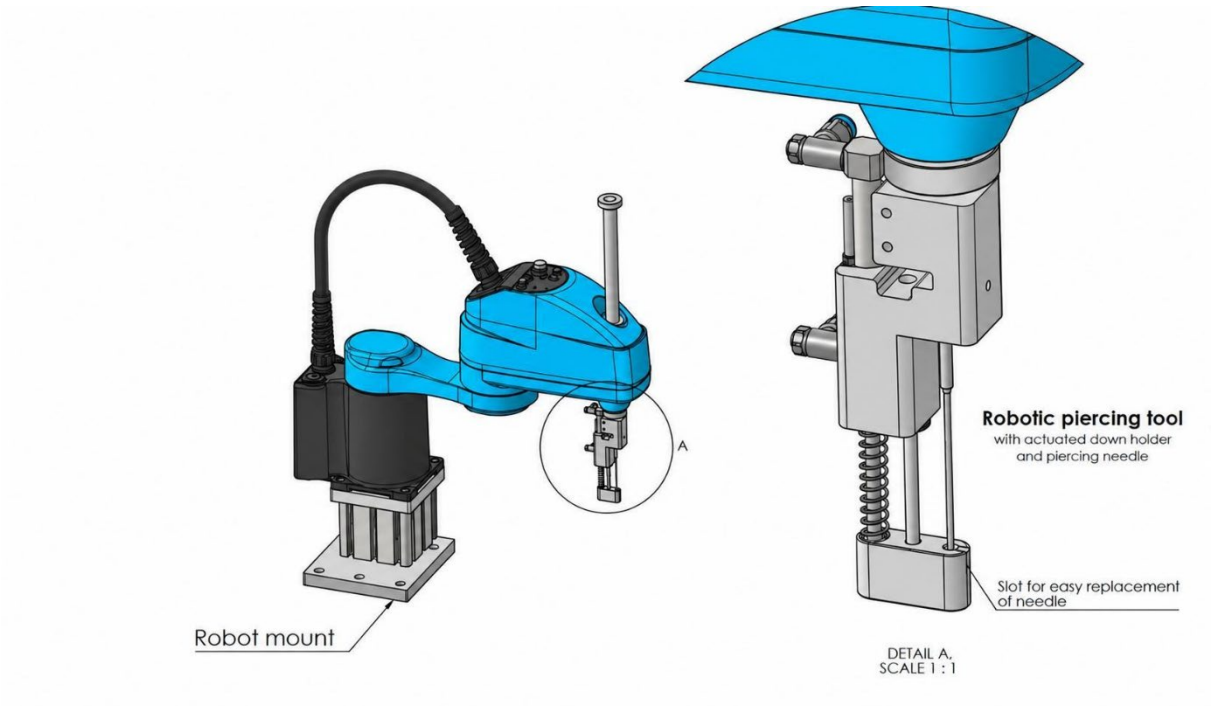
The electrical cabinets are not accessible to users; they require special keys, which only certified personnel can use to access the electrical components of the AutoSampler Duo. However, the user can easily power up the AutoSampler Duo with the main electrical switch on the front of the system.

A closed conveyor feeds carton boxes containing samples into the AutoSampler Duo. Transparent windows are installed to shield the user from hazards while still allowing visual inspection of the process. If access to the conveyor is required, the side covers can be removed. These access points should allow the user to clean the AutoSampler Duo after a day's work.


360 LED Display for machine status integrated in the enclosure
DETAIL A
SCALE 1 : 5
HMI screen with a hinge for adjustment
Barcode scanner
Keyboard bracket
In /output conveyor shield with safety function (easy removable no screws needed)
Swing up access door with safety interlock function
Button panel with:
Emergency button
Reset button
Lock button
Conveyor mount
Adjustable leveling feet


Box sensor at box stop
Actuated box stopper (for accumulated box input)
Box sensor at infeed
Barcode scanner at input
DETAIL A
SCALE 1 : 5
Box input
Guide rollers
Box sensor at outfeed
Box sensor at pierce position
DETAIL B
SCALE 1 : 5
Box Output
A
B

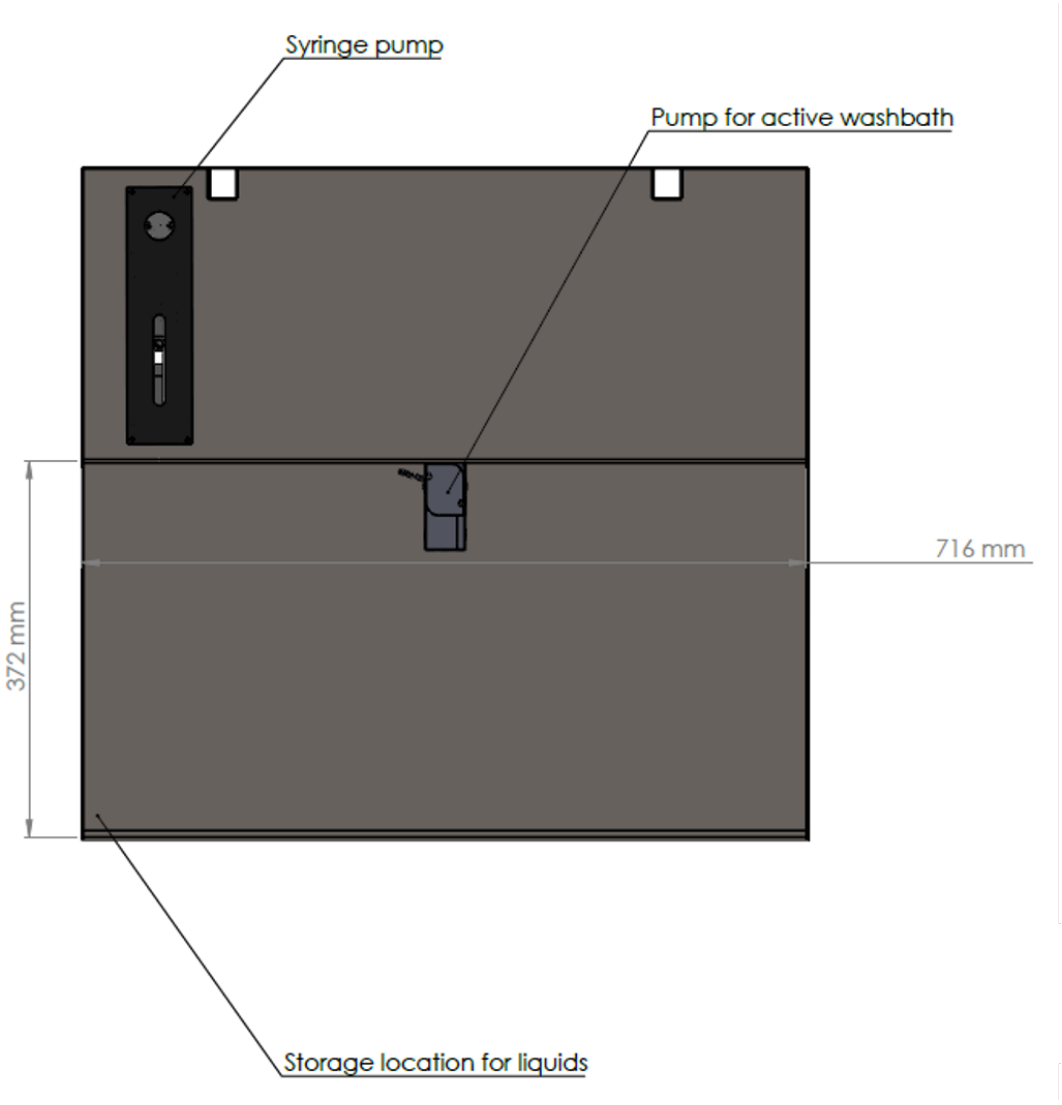




The user can load all necessary fluids from one central location in the front of the AutoSampler DUO. In this so-called fluid bay, the user loads up to 10 plates into a stacker for processing by the AutoSampler DUO. The stacker is locked near the pipetting location for a quick manual changeover when a new plate is needed.

The user controls and receives feedback using a touch panel. This single point of system control enables easy, understandable workflows in the lab.

After the AutoSampler DUO completes sample acquisition and dispensing, the finished samples exit the system, allowing the user to remove them from the conveyor belt independently of the machine's ongoing operation. The microtiter plates now containing all the samples may be safely removed and placed into an Innovate System for ATP or pH testing. The results are typically linked to the local LIMS as well as the Innovate System.



3. Technical Specifications

The AutoSampler DUO needs two power utilities: compressed air and electricity. In addition, for proper functioning of the AutoSampler DUO, the system's liquid reservoirs must be filled. The power connections on the AutoSampler DUO are connected by means of a power plug and a pressure fitting. For the correct operation of the AutoSampler DUO, the system waste needs to be connected to the waste reservoir or to the sewage at floor level. For alternatives to a floor-level sewage system, please inquire with your supplier.

3.1 Mechanical

The AutoSampler DUO is intended for use in a lab or other clean environment. Room temperature (0 to 40 °C), with humidity levels (theoretical) max 80%.

The AutoSampler 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 and that, once pushed out of the AutoSampler DUO, they are removed.

Room temperature (0 to 40 °C), Humidity levels max 80%.

3.2 Electric

Electrical energy supply requirements for the AutoSampler:

Rated voltage: 230 VAC
Rated frequency: 50 Hz

1 x CEE 7/7 plug, 230 V, 16 A, 3 P (1 Phase + N + PE) separate group.

3.3 Pneumatic

The required air quality class is 4 or 5.

The amount of air the product uses in normal operating conditions is estimated at 20 L/min.

The minimum pressure is rated at 5 bar, and the optimal pressure is rated at 6 Bar.

3.4 Chemicals

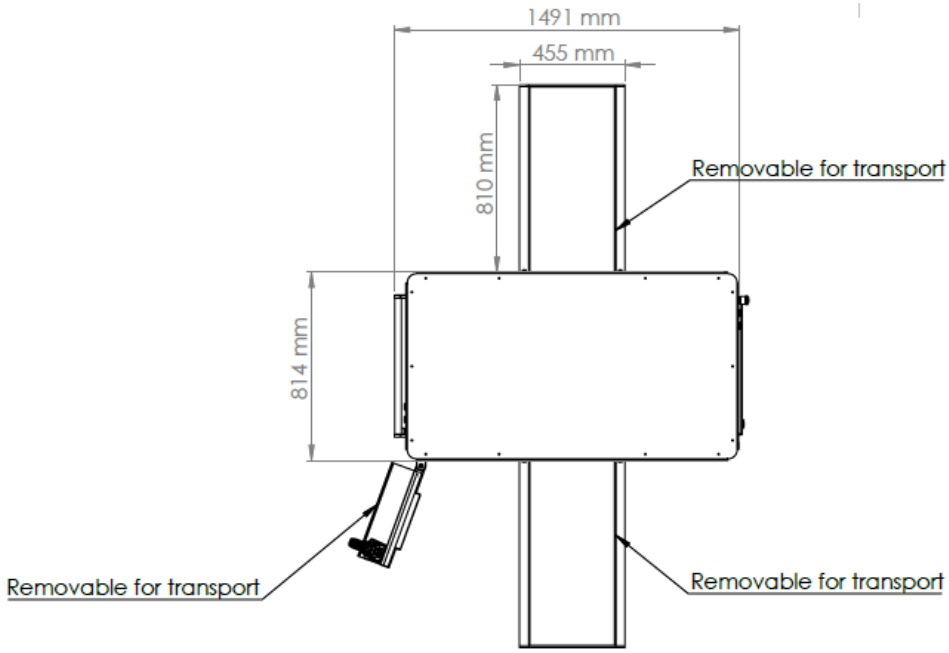
The AutoSampler DUO is made to pipette liquids. Additional information about specific applications and their chemicals can be provided by Hygiena®. You can access the necessary Safety Data Sheets (SDS) at www.hygiena.com.

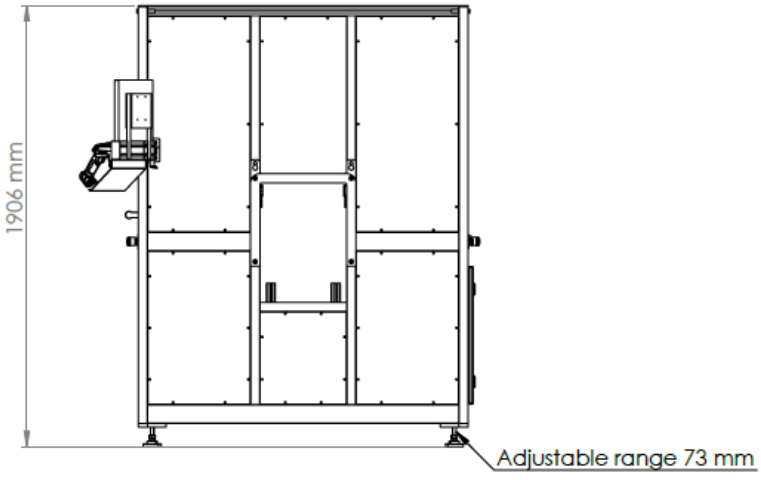
The AutoSampler DUO is designed to be easily cleaned. The working surface is closed off as much as possible and can, therefore, be cleaned properly. Connections on the worktop are resistant to alcohol-based cleaning products. The AutoSampler DUO is equipped with anodized aluminum and stainless steel. Chlorinated agents can affect these areas with prolonged use. When the AutoSampler DUO is cleaned wet, dry and/or chemically, the system must always be switched off using the main switch. Cleaning of the AutoSampler DUO is addressed in Section 10, Cleaning the AutoSampler DUO.

3.5 Sizes and Weights

The AutoSampler has the following physical properties:

- Dimensions:
  - Depth: 142.5 cm
  - Width: 80 cm
  - Height: 190 cm
- Weight:
  - 300 kg
- Sound level
  - Measured average: 68 dB





(Reagent cabinet)

4. Transport and Storage

This Section contains essential information on how to transport and move the AutoSampler DUO correctly. It describes which measures should be taken during transport, as well as the necessary lifting tools to pick up / place the AutoSampler DUO on and off a truck. This Section 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 DUO is transported by truck.

4.1 Transport

Before any transport, the product must be packed in accordance with the procedure described in Section 4.2.3, Packaging Exterior AutoSampler DUO.

4.1.1 Internal Transport

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

4.1.2 External Transport

When the AutoSampler DUO 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 DUO 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, take utmost care to prevent injury.
- The device must not be tilted.
- When using a forklift truck or pallet truck to move the AutoSampler DUO, 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.

4.1.3 Lifting Points

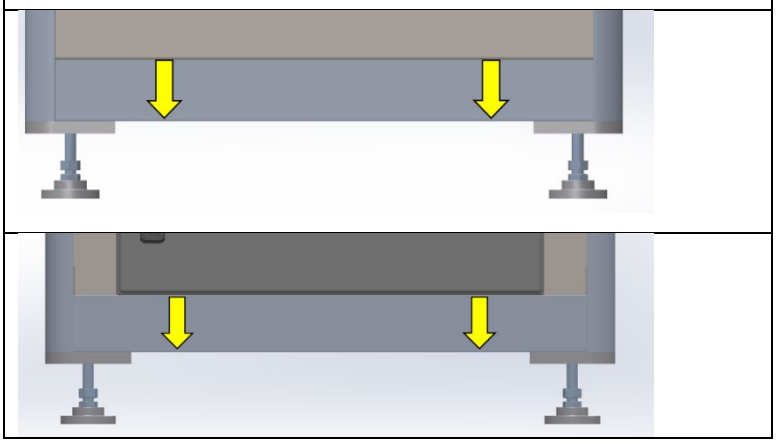
There are two options available for lifting the AutoSampler DUO. The AutoSampler DUO can either be lifted with a forklift or a pallet truck, from either of the two short ends.

The lifting points of the AutoSampler DUO are based on a pallet truck with the following dimensions:

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

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

Fork placement when lifting the AutoSampler DUO



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 cables and tubing cannot get stuck between the frame and the pallet truck(s).

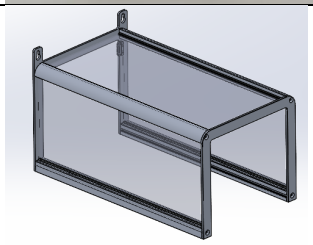
4.2 Packaging

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

Tip
Keep the original packaging in order to move the AutoSampler DUO correctly.

4.2.1 Included Items with the AutoSampler DUO.

The AutoSampler has several removable parts supplied separately. See the table below.

Article	Quantity	Image
Needles	4	
Side covers	2	
User manual	1	-
CE declaration	1	-

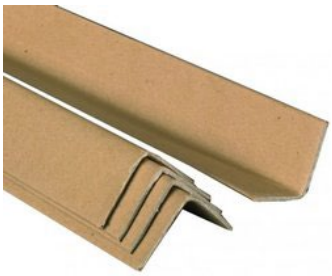
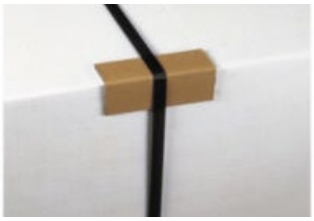
4.2.2 Preparing for Transport

The moving parts in the AutoSampler 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 on doing so is described in Section 10, Cleaning the AutoSampler DUO.
2. The AutoSampler DUO must be shut down as described in Section 7.13, End of day procedure.
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 DUO.
6. Remove the samples and plates from the AutoSampler DUO.
7. Remove all parts that can be dismantled without using tools.

4.2.3 Packaging Exterior AutoSampler DUO

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

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

The packaged AutoSampler DUO shall be fitted with the standard packing slip.

4.3 Storage

The AutoSampler DUO must always be stored indoors. For the proper functioning of the AutoSampler DUO 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 DUO)
Humidity when used	20 to 80% relative humidity (no condensation allowed)
Storage environment	Cool and dry environment

5. Assembly and Installation

This Section explains how the assembly and installation should be carried out. Please refer to this Section when the AutoSampler DUO has been moved.

The assembly and installation of the AutoSampler DUO are carried out by Hygiena personnel or by an external body authorized to do so. The final check is carried out by Hygiena. The assembly and installation are carried out by qualified and experienced technicians. This Section is written for the technicians who assemble, install and test the AutoSampler DUO. The user of the AutoSampler DUO can use this Section as an informational tool to verify that the installation went well.

Watch out!



In addition to the precautions and safety instructions described in Section 1, 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 DUO should only be carried out by qualified, skilled personnel.
- Only correct, undamaged and sound tools should be used.

5.1 Installation



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

Before installing the AutoSampler DUO, it must be clear where it should be installed and how the system should get to its destination. The AutoSampler DUO must be placed in a clean and dust-free location. Before the AutoSampler DUO can be installed, all packaging material must be carefully removed from the instrument. Some tools may be required to install the AutoSampler DUO, see tool overview in Section 20, Tools. Before unpacking and installing, it is recommended to take a photo of the AutoSampler DUO. After unpacking, a photo must also be taken. The photo is archived and made available to both the sending and receiving parties. This is done to ensure 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.

5.2 Commissioning Instructions – General



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

This Section describes the steps to follow before using the AutoSampler DUO.

- Before starting the AutoSampler DUO, 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 DUO.
- There should be no personnel inside the AutoSampler DUO 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 DUO with (cleaning) tools.
- While operating the AutoSampler DUO, pay attention to unusual noises and take appropriate action if necessary.
- Before commissioning the AutoSampler DUO, all defects must be corrected.

5.2.1 Commissioning Instructions- General

- Make sure the AutoSampler DUO is matched to the correct products.
- To ensure the safe operation of the AutoSampler DUO, 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.

5.2.2 Commissioning Instructions - Electrical Components



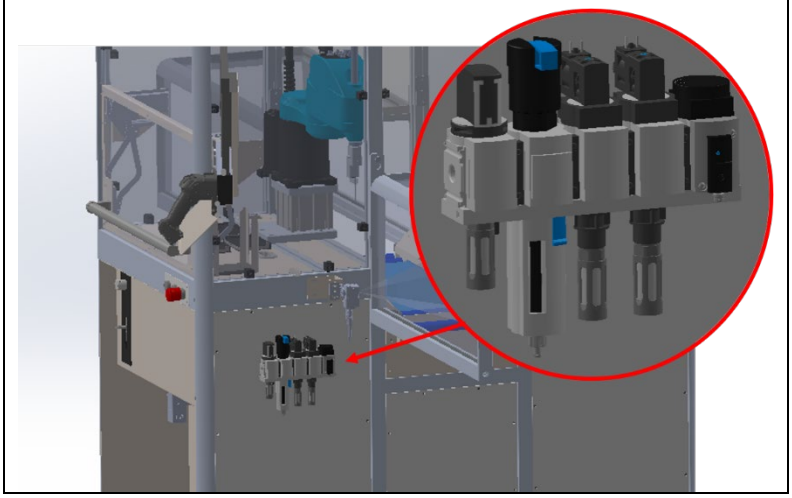
Warning
Dangerous voltage

- 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 DUO, take into consideration that certain electrical components can start to move.

5.2.3 Commissioning Instructions - Pneumatic Components

- The valve of the compressed air unit should be opened.

Compressed air valve in open state



- The air service unit must be set to the correct pressure, as indicated in the technical specification: 6 bar.
- Please note the nominal working pressure of 6 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 DUO, it should be considered that certain pneumatic components can move.

6. Machine Functions

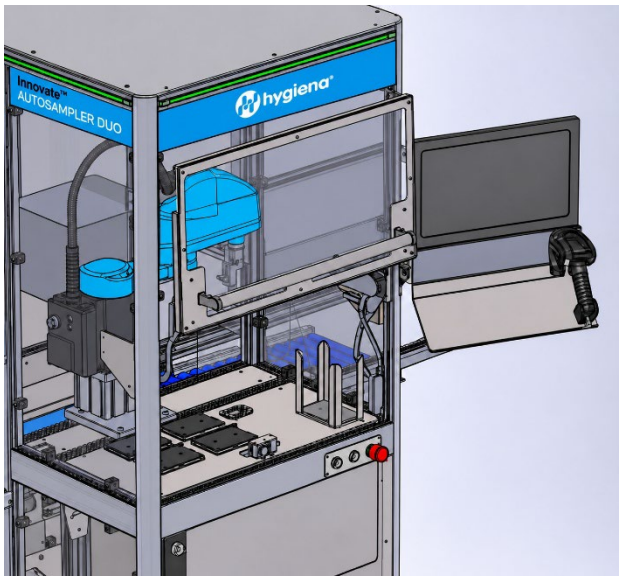
Sections 7 to 11 describe how to operate the AutoSampler DUO. This Section provides the user with information on the functions provided with the machine to help them become familiar with the subsystems before use. It is important that the user familiarizes themself with these instructions before using the AutoSampler DUO.

6.1 Workflow

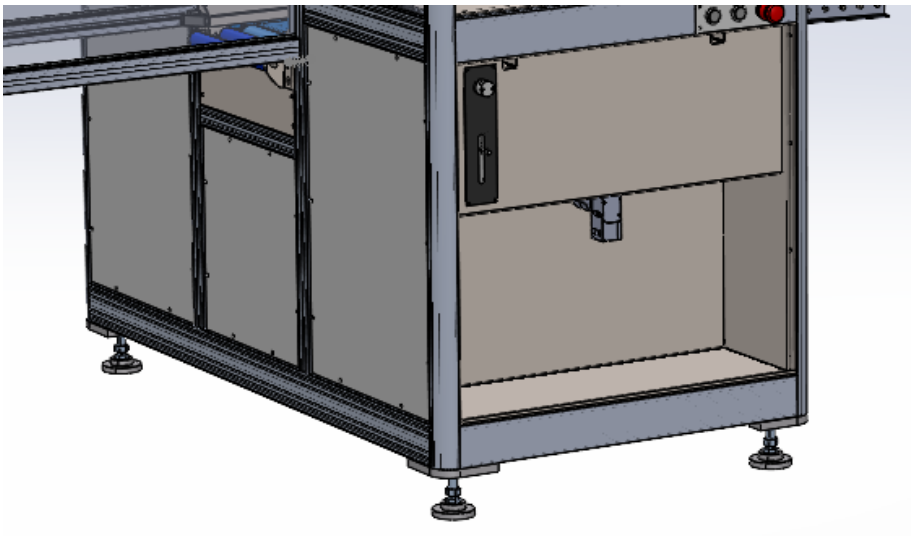
The AutoSampler has several workflows with different functionalities, which can be started via the HMI (Human Machine Interface). The main workflow is the sampling procedure. In addition, several service workflows are available for maintaining and servicing the system.

6.2 Storage systems

The user loads the system with microtiter plates into the stacker. The stacker has a capacity of up to 10 plates. These plates are stored in a stacker; the operator can pick a plate from the stacker for easy filling on the robotic deck.

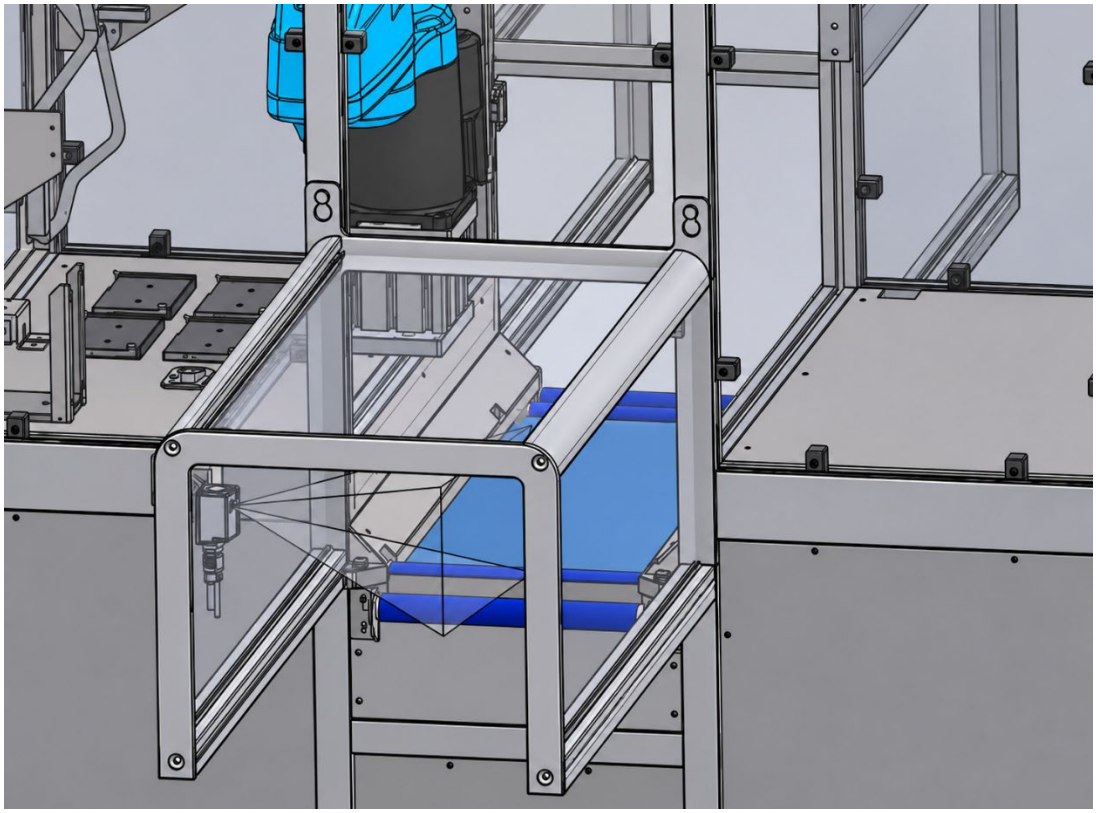


The AutoSampler has a dedicated pump bay from which all fluids used in the system originate. The fluid bay houses the pumps and fluid containers. From the fluid bay, the liquids are distributed within the system. The fluid bay has a raised edge to prevent accidental spills from falling onto the floor.



Samples enter the machine via an external roller conveyor. The system separates the cartons from one another. The separating system is equipped with sensors that detect whether a carton is still present on the conveyor, allowing cartons of various lengths to enter the system.

After loading, the conveyor moves each carton to the pick position. Once the samples have been processed, the conveyor transfers the carton to a roller conveyor on the other side of the system.

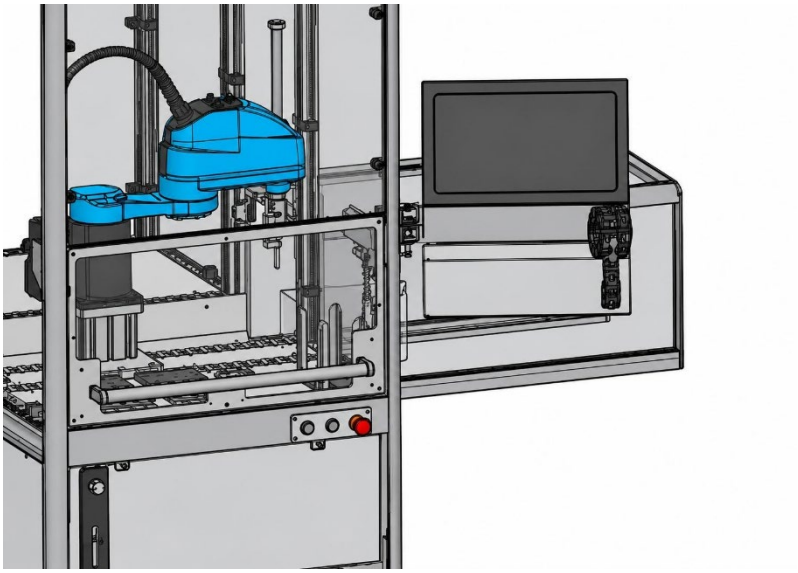


6.3 Machine control

The machine controls consist of an industrial touchscreen mounted on a pivoting arm. This allows the control panel to be moved out of the way when necessary or repositioned for easier operation.

The HMI is connected to the main computer and is used to control the system. The user can initialize, start, pause, and stop the machine via the HMI. It also provides access to the various operating modes provided by the software, including normal operation, validation routines, and maintenance tasks.

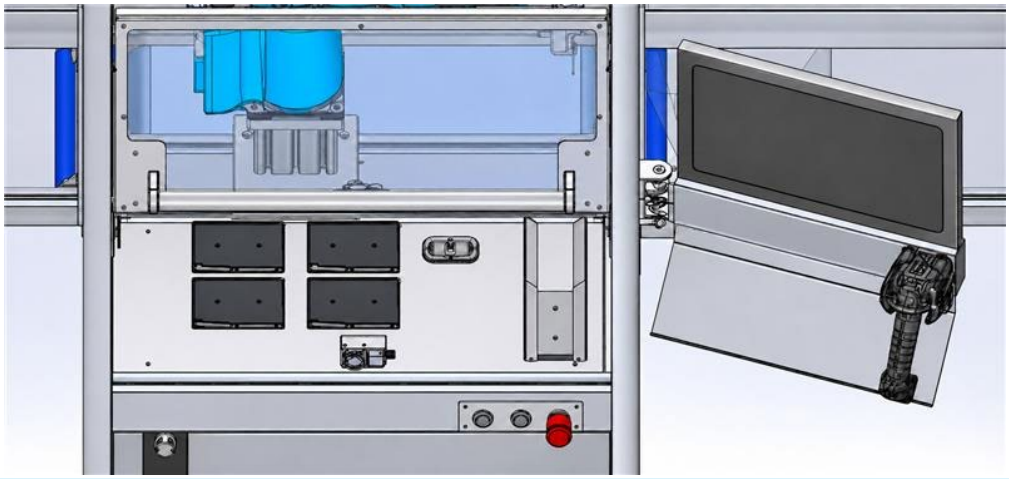
The HMI displays the machine's progress and notifies the user when action is required. It also allows user input, such as barcode entry. A barcode scanner is mounted next to the touchscreen and is used to scan microtiter plates before they are placed on the robotic deck.



6.4 Robotic deck loading and scanning

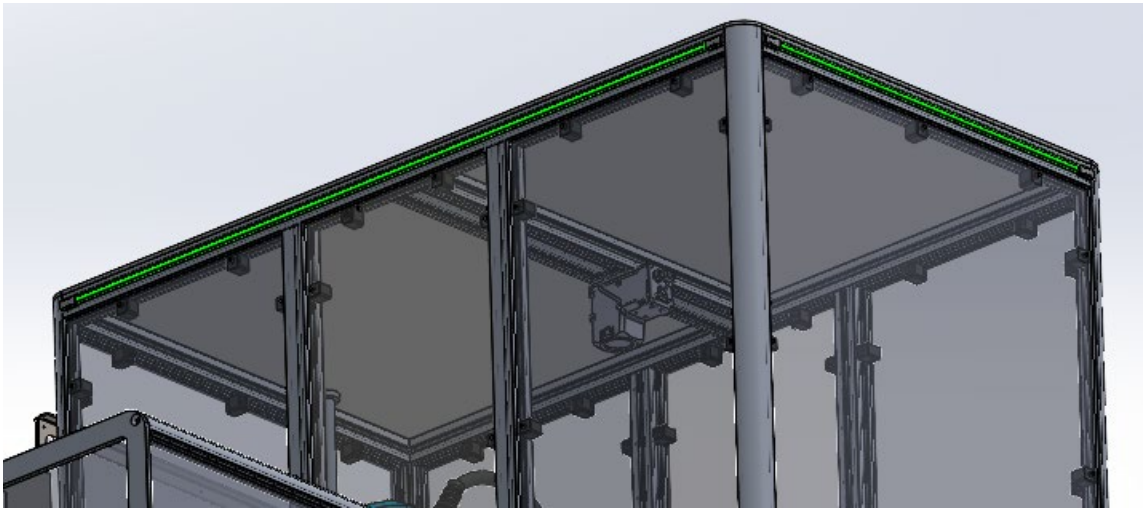
The robotic deck consists of four microtiter plate positions that serve as destination locations for the samples. An active wash bath is located to the left of these positions. The wash bath circulates the washing solution to clean the sampling needle. The plate storage location is also situated on the robotic deck.

The operator can retrieve microtiter plates from the stacker and place them in one of the four plate positions. During this process, each plate must be scanned using the barcode scanner. During normal operation, the HMI guides the operator to the correct plate position and verifies the barcode.

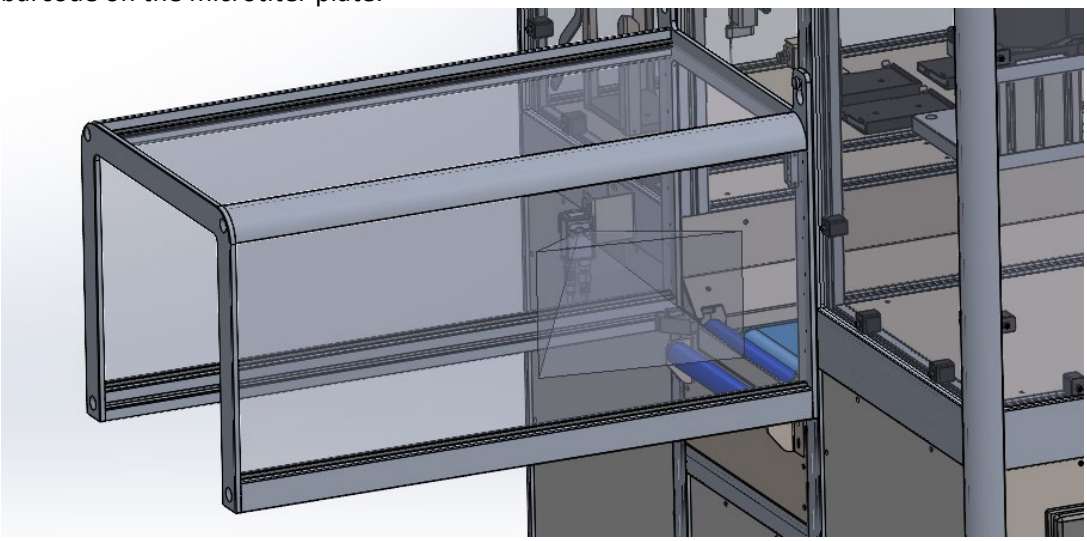


6.5 Smart vision camera and box barcode scanner

The AutoSampler DUO is equipped with a Keyence smart camera. The camera is primarily used to detect the location of the samples. Based on the camera data, the system determines the correct position at which to pierce each product.

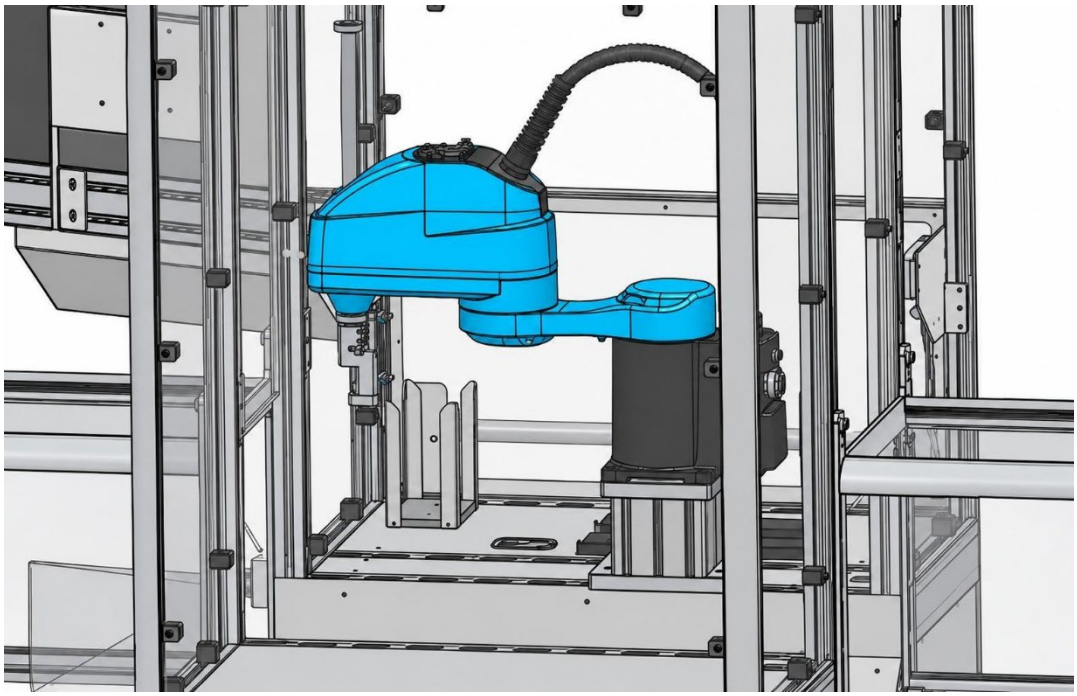


A barcode camera is placed outside the pipetting cabin to read the barcodes on the boxes containing the products. The barcodes provide the system with information on what product is being processed. Using this information, presets can be loaded for various system functions. The barcode on the box is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



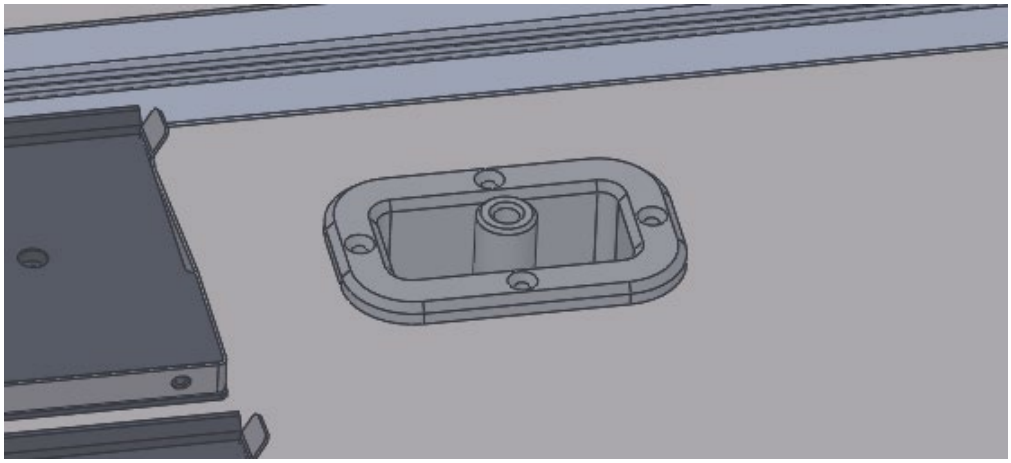
6.6 Pipetting

Samples are transferred using the pipetting arm, which consists of an industrial SCARA robot. This allows samples to be collected from a wide range of positions. A push-off mechanism is integrated to remove products from the needles and prevent them from becoming stuck. The pipetting arm transfers the samples from the products to the microtiter plates and performs the required needle-washing steps.



6.7 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 internal part.



6.8 Stack Light

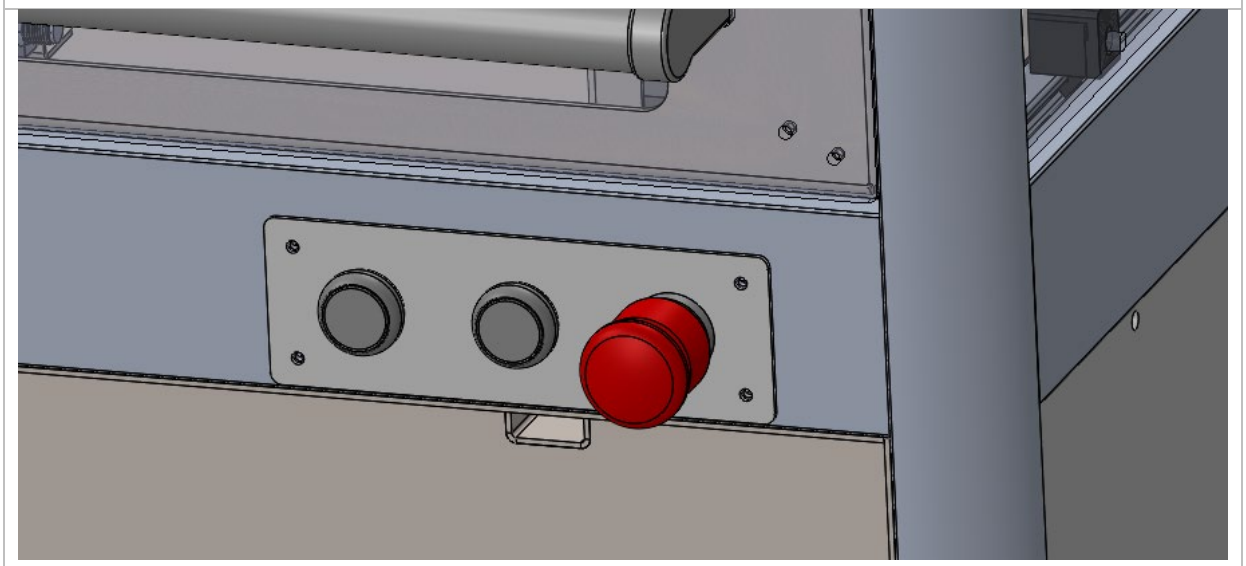
The AutoSampler DUO is equipped with LED lighting integrated into the frame. The lighting provides a 360-degree visual indication of the machine's current status. Its primary purpose is to allow users to monitor the machine's status when they are not in front of the HMI, where the same information is also displayed. The LED lighting uses the following colors to indicate the corresponding machine 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

6.9 Emergency stop

The AutoSampler DUO is equipped with an emergency stop right next to the control panel as well as one on the other side. 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 DUO.

Emergency stop

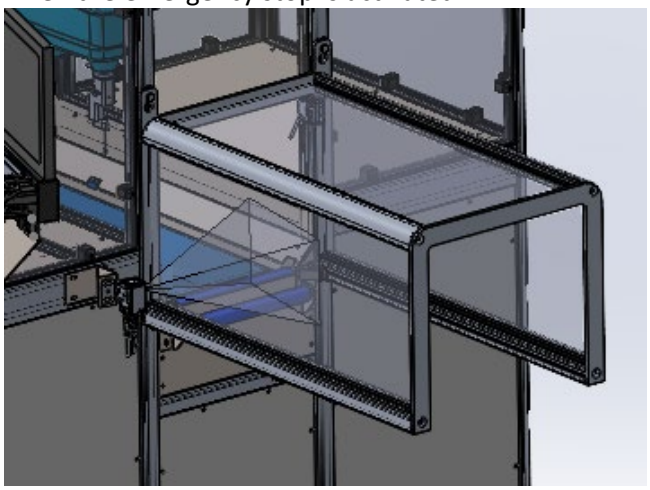


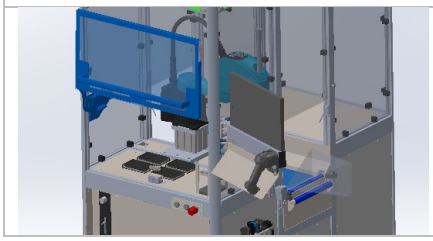
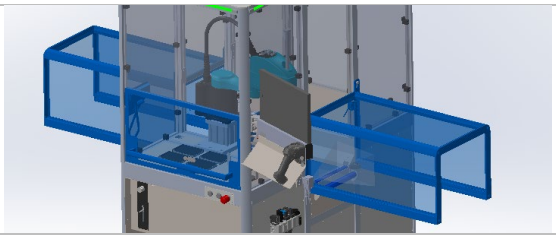
When using the emergency stop, all dangerous movements are stopped as soon as possible, and follow-up actions are made impossible. The emergency stop causes an unscheduled stop of the AutoSampler DUO. The current actions cannot be restored, and a complete restart of the AutoSampler DUO will be necessary.

6.10 Door locks

The pipetting cabin has one access door equipped with a lockable safety interlock. In addition, the infeed and outfeed conveyors are covered by safety guards. These guards restrict access to the openings while allowing only the cartons to enter and exit the system, thereby keeping the operator away from moving parts.

If the access door is opened or one of the safety guards is removed, the system stops in the same manner as when the emergency stop is activated.



Not locked	Locked
	

Note

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

6.11 Conditions of use

The products to be processed must be undamaged.

Environmental conditions:

- The AutoSampler DUO must be set up in a clean and dry environment. In addition, the following requirements must be met:
- Minimum ambient temperature: 10 °C
- Maximum ambient temperature: 30 °C
- Maximum relative humidity: 80%

Electrical energy requirements:

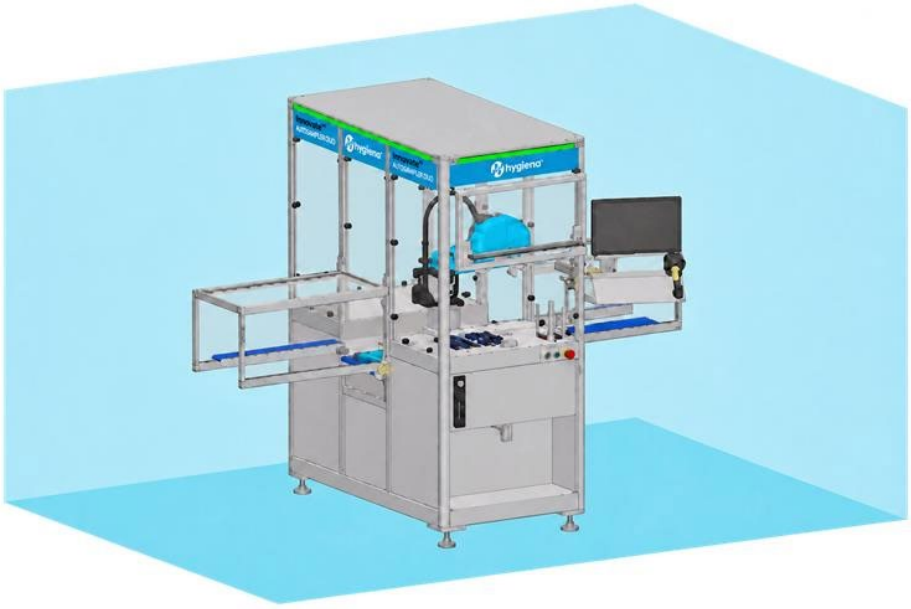
- Rated voltage: 230 VAC
- Power connection: 3.68 kVA
- Rated frequency: 50 Hz
- For further electrotechnical data, see the electrical diagrams.

Requirements related to pneumatic installation.

- Rated working pressure: 6 bar
- Compressed air quality according to DIN ISO 8573-1

6.12 Description of the operator's workplace

The user's workplace is indicated by the picture below.



6.13 Personal protective equipment

When using the AutoSampler DUO, samples/recipients are used in which biological and chemical material is stored. It is up to the user to use the personal protective equipment required when handling these samples. It is advised to wear a lab coat, gloves and safety glasses when working with the AutoSampler DUO.

6.14 Restrictions on the use of the AutoSampler DUO

The AutoSampler DUO can be used to pipette sample material from specified packaging into a shallow well plate. The samples are filled with milk or similar liquid products. Liquids to be pipetted must be water-based and free of flammable substances.

7. Standard Operating Procedure

This Section describes the daily operations to be performed to properly operate the AutoSampler DUO. It should be noted that working with any type of equipment can be dangerous. The AutoSampler DUO is equipped with safety features that enable the safe operation of the system. Ensure that, while working, the safety instructions are adhered to, as well as local laws and regulations.



Warning
Automatic starting machine.

To start the AutoSampler DUO and use the system's basic functionality, the steps below should be followed. These steps contain only instructions regarding the daily routine use of the AutoSampler DUO. Instructions and explanations regarding settings and error handling can be found in Section 11, HMI, and, respectively, Section 15, Errors and Warnings.



Warning
Risk of exposure to hazardous chemicals.



Warning
Risk of exposure to biological material.

7.1 Prepare the Compressor for Use

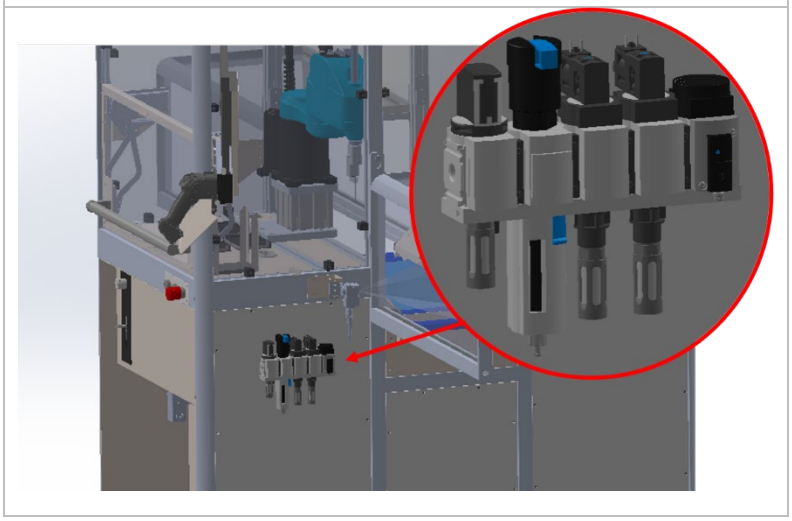
Prior to the start-up of the AutoSampler DUO, please follow the checklist below:

The compressor delivered with the AutoSampler DUO has the capacity to supply the AutoSampler with compressed air. The AutoSampler DUO requires the compressor to be operational in order to perform its functions.

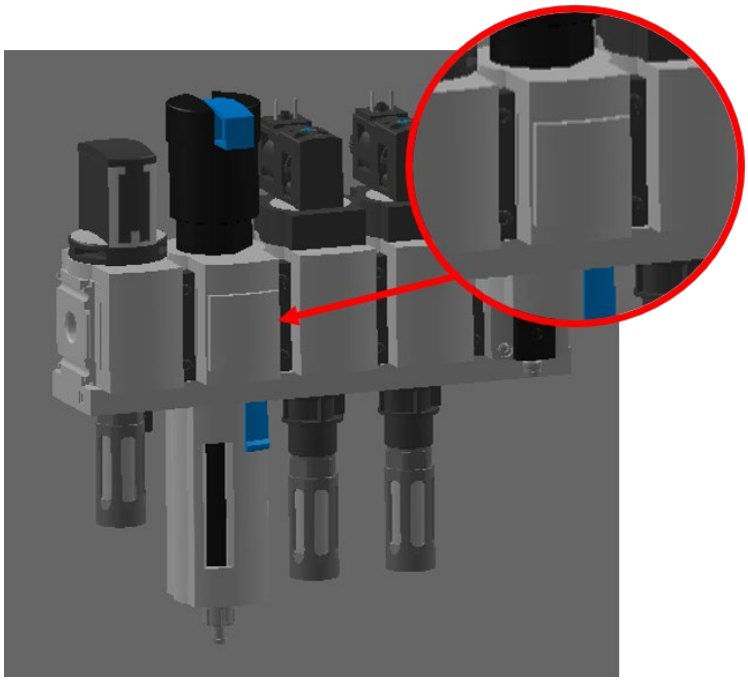
7.1.1 Start up the System

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

Connection on AutoSampler DUO



Make sure that the correct air pressure is present at the air supply.



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

Valve closed	Valve open
	

- Plug the system's main power cable into the designated power outlet.
- Switch on the system using the main power switch.

7.1.2 End-of-Day Shutdown

- At the end of each production day, it is recommended to shut down the AutoSampler DUO. Follow this checklist:
  - Ensure that all required cleaning operations have been completed. Refer to the end-of-day cleaning procedures in Sections 7.13 and 10.
  - Switch off the system using the main power switch.
  - Close the compressed-air supply valve to the AutoSampler DUO.
  - The power and compressed-air connections do not need to be disconnected.

7.2 Starting up the AutoSampler DUO

To start up the AutoSampler DUO and prepare it for a run, please follow the steps listed below carefully.

Step 1: Power on the AutoSampler DUO
Switch on the AutoSampler DUO using the main power switch on the front of the I/O cabinet.

Step 2: Wait for the AutoSampler DUO to Start Up
The AutoSampler DUO requires a few seconds to start up. During start-up, the integrated status light flashes red because the system door is not yet locked. This is normal at this stage and does not indicate a problem.

Step 3: Log in to the AutoSampler DUO
After the AutoSampler DUO has started, the user must log in to the onboard computer before operating the system. The user must log in to both the Windows environment and the control software. To log into both environments, please follow these instructions:

Windows:

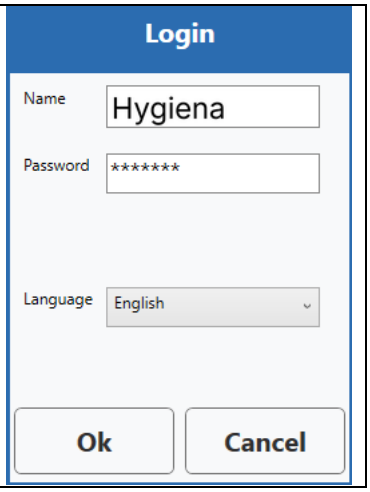
- Select the appropriate account: for day-to-day work, please log in with your user account.
- Enter the correct Windows credentials.

Xperimate:

- Double-click on the Xperimate program icon on the desktop.

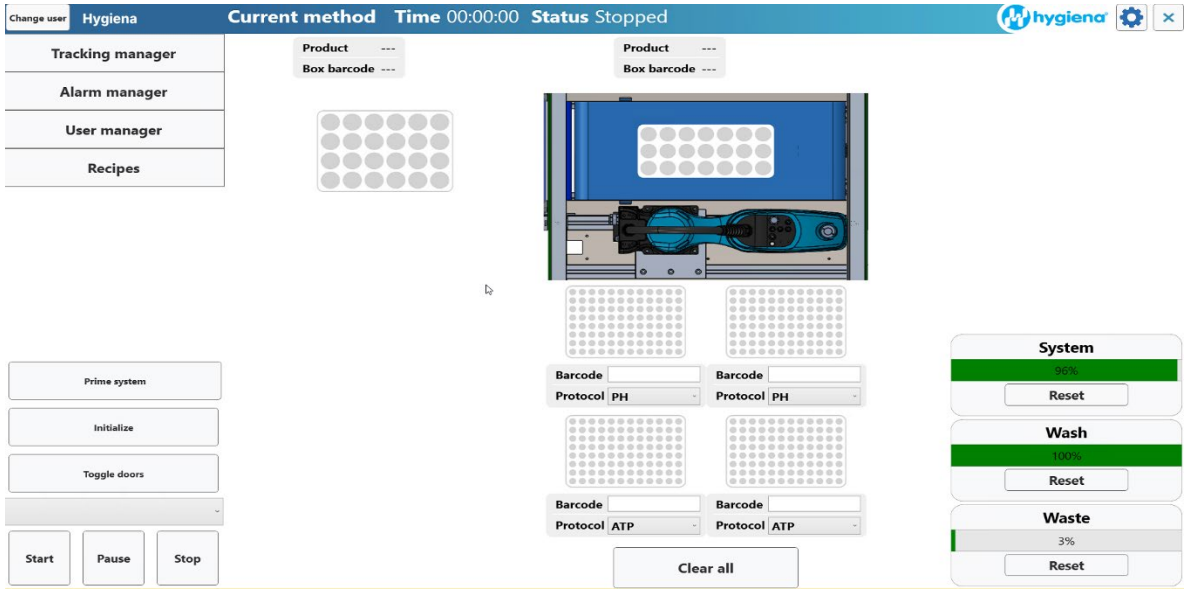
Desktop icon	Hygiena icon
	

- Fill in the username.
- Fill in the correct password.
- Change the language if required and press OK.

Log in screen Xperimate	

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

First view of the Control Panel after Login



7.3 Pre-Initialization of the AutoSampler DUO

Before the AutoSampler DUO can operate in production mode, it must be initialized. During initialization, all automated components move to known reference positions so that they can receive commands from the Xperimate control software.

Because machine movements occur during initialization, the system must first be inspected. Follow the procedure below before starting the initialization routine.

7.3.1 Pre-Initialization Checklist

Step 1: Check the emergency-stop buttons

- Ensure that all emergency-stop buttons are released.
- To release a pressed emergency-stop button, turn it counterclockwise.

Step 2: Unlock the access door

- Unlock the access door using the HMI or the physical door-unlock button.
- When the door is unlocked, a clicking sound may be heard as the locking magnet is released.
- Opening the door disables automatic movements and shuts off the pneumatic supply to the moving components.

Step 3: Check that the system is empty

- Ensure that no cartons or products are present on the infeed conveyor, internal conveyor or outfeed conveyor.
- Check that no cartons are jammed at the infeed or outfeed.
- Ensure that no microtiter plates are present in any of the four plate positions on the robotic deck.
- Ensure that no loose objects or tools are present inside the system.

Step 4: Check the plate supply

- Ensure that the plate storage location contains enough microtiter plates to complete the planned production run.
- Check that the plates are correctly positioned and are not damaged.

Step 5: Check the cleanliness of the system

- Check that the internal surfaces and robotic deck are clean and free from dust, product residue and sample spills.
- Check that the wash bath is clean and contains sufficient washing solution.
- Refer to Section 10 for the applicable cleaning procedures.

Step 6: Inspect the safety panels

- Ensure that all safety panels and conveyor guards are correctly installed and securely fastened.
- Check that the access door and its safety interlock are undamaged and operate correctly.
- If an access door is open or a safety panel is removed, the system cannot be initialized.

Step 7: Inspect the system for damage

- Check the needles for damage, deformation or contamination.
- Check the robotic deck, conveyors, camera and other accessible components for visible damage.
- Ensure that no components are loose, obstructed or incorrectly positioned.

If any of these checks cannot be completed successfully, do not initialize the AutoSampler DUO. Inform the responsible internal contact person. If all checks are completed successfully, close the access door and proceed with the initialization procedure.

7.4 Starting AutoSampler DUO Initialization

Before initializing the AutoSampler DUO, complete the following steps:

Step 1: Close and lock the access door

- Ensure that the inspection has been completed.
- Close the access door.
- Lock the door using the HMI or the physical door-lock button.
- Verify that the door is fully closed and locked.

Step 2: Reset the safety system

- Ensure that all emergency-stop buttons are released.
- Press the safety-system reset button next to the control panel.
- After the safety system has been successfully reset, the integrated status light turns blue.

Step 3: Check for active errors or warnings

Open the Alarm Manager (see Section 11.7) and check whether any errors or warnings were generated during the previous steps. If an error or warning is present, refer to the errors and warnings Section of this user manual and take the appropriate corrective action before continuing.

Step 4: Start the AutoSampler DUO initialization

Ensure that the operator is logged in and that the landing page of the Xperimate control interface is open.

- Select the '01-Initialize System' method from the method dropdown list.
- Press the **Start** button.

All relevant components of the AutoSampler DUO will now be initialized. During this process, the robotic and motorized components move to their home positions. The integrated status light flashes blue while initialization is in progress.

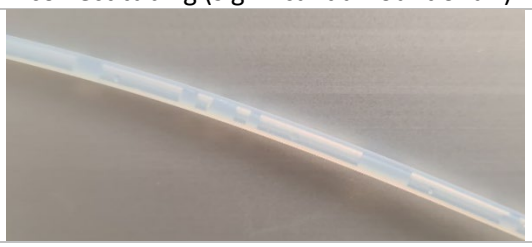
Step 5: Wait for initialization to finish

Wait until the initialization process has been completed. After successful initialization, the integrated status light stops flashing and turns green.
If initialization is unsuccessful:

1. Check the Alarm Manager for active errors or warnings.
2. Correct any reported issues and repeat the initialization procedure.
3. If the system still does not initialize, repeat the pre-initialization checks described in Section 7.2.
4. If initialization remains unsuccessful, contact the responsible internal contact person.

7.5 Priming the Syringe Pump

Before samples can be pipetted, the AutoSampler DUO needs to be primed. The priming routine in the AutoSampler DUO ensures that no air is present inside the tubing connecting the liquid containers to the pump and the pump to the pipetting needle or washing station.
As mentioned, proper priming is necessary to prevent air from entering the tubing. Please see an example of correct and incorrect tubing below. ***Note:*** Tiny air bubbles can form. This is not an issue if the bubbles don't create an air gap between two parts of the liquid.

Correct tubing (little to no air bubbles)	Incorrect tubing (significant amount of air)
	

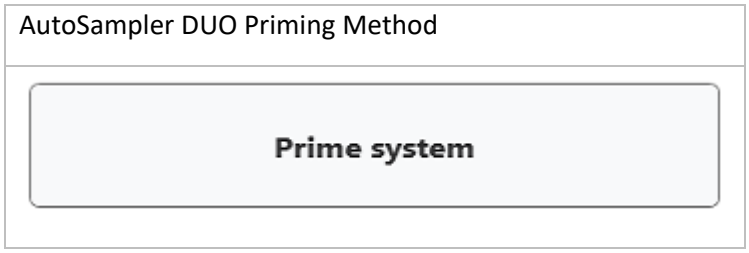
7.5.1 Checklist Prior to Start Priming the Pumps

Before priming the pumps, check the following:

- Ensure that all sample cartons have been removed from the AutoSampler DUO conveyor.
- Ensure that no moving parts are obstructed, including the pipetting arm.
- Ensure that the access door is closed and locked and that all safety panels are correctly installed.
- Ensure that all emergency-stop buttons are released.
- Ensure that the AutoSampler DUO has been initialized and is ready for operation.
- Ensure that the system-liquid tubing is correctly positioned in the appropriate reservoir.
- Ensure that the waste tubing is correctly positioned in the waste container.
- Ensure that sufficient washing solution is available to complete the priming procedure.

7.5.2 Start Priming Method

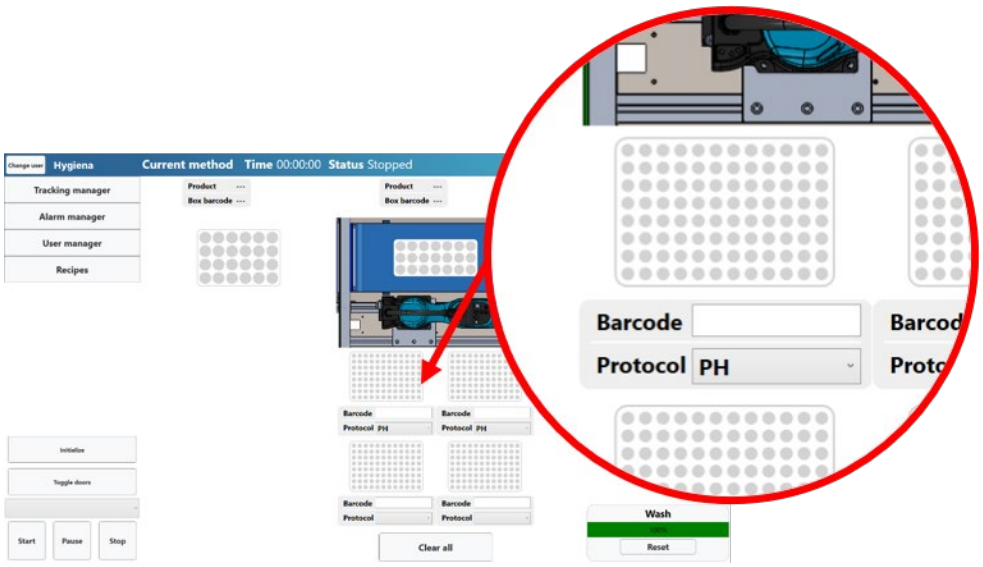
Start the pump-priming procedure by pressing the 'Prime' button on the HMI. This starts the priming procedure for the pipetting pump.
During priming, the pump transfers liquid through the tubing to fill the channels and remove any air. The integrated status light flashes blue while the priming procedure is running. When priming has been successfully completed, the status light remains green, indicating that the AutoSampler DUO is ready for operation.



7.6 Loading Plates

Before the system can perform its basic operations, the microtiter plates must be loaded onto the robotic deck. Follow the procedure below:

1. Use the Unlock Door button on the HMI toggle door function or the physical door-unlock button to unlock the access door.
2. Open the access door.
3. Ensure that the Xperimate control software is running.
4. Select the barcode text field corresponding to the required plate position.
5. Take a microtiter plate from the plate stack and scan its barcode using the barcode scanner.
6. Place the scanned plate in the corresponding position on the robotic deck. Ensure that the plate is correctly oriented and that the letters and numbers are not upside down.
7. In the field below the barcode, select the test to be performed on the samples: **ATP** or **pH**.
8. Repeat these steps until all required deck positions have been filled.
9. Close and lock the access door before continuing.



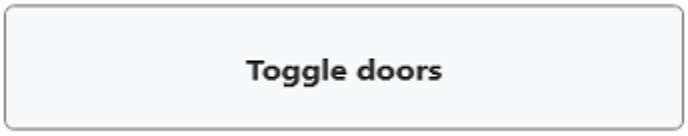
7.7 Unlocking Doors

The AutoSampler DUO is equipped with locking doors.

7.7.1 Unlocking with HMI

This section describes how to lock and unlock the AutoSampler DUO doors using the HMI.

Step 1: Press the toggle doors button on the HMI



Step 2: Wait for the doors to (un)lock

Step 3: Wait for AutoSampler DUO to be ready
After the doors are locked, the operator must wait for the air pressure to stabilize before initializing the AutoSampler DUO and starting runs. This is indicated by a blue status light.

7.7.2 Unlocking Using Physical Buttons

The AutoSampler DUO is equipped with a physical door-lock button and a blue safety-reset button. The indicator lights show the status of the door lock and safety system.

Step 1: Check the emergency-stop buttons
Ensure that all emergency-stop buttons are released. Turn any pressed emergency-stop button counterclockwise to release it.

Step 2: Close and lock the access door
Close the access door and press the physical door-lock button. Wait until the door-lock button remains illuminated, indicating the door is locked.

Step 3: Reset the safety system
When the door is locked, the blue safety-reset button flashes. Press this button to reset the safety system.

Step 4: Check the system status
After a successful reset, the blue safety-reset button remains continuously illuminated. This indicates that the door is locked and the safety system has been reset.

Button indications lock:

- **Continuously illuminated:**
  The access door is closed and locked.
- **Flashing:**
  The access door is open or unlocked.

Blue safety reset button indications:

- **Flashing:**
  The door is locked, but the safety system has not yet been reset. The reset button must be pressed.
- **Continuously illuminated:**
  The safety system has been successfully reset and the system is ready.

If an emergency stop button is still pressed, the safety system cannot be reset. Release the emergency-stop button and then press the flashing blue reset button. The button stops flashing once the reset has been completed successfully.

Operating procedure

7.8 Starting a Run

To start a run, the following procedure should be followed:

- Select 'Run' from the dropdown list.
- Press the 'Start' button.

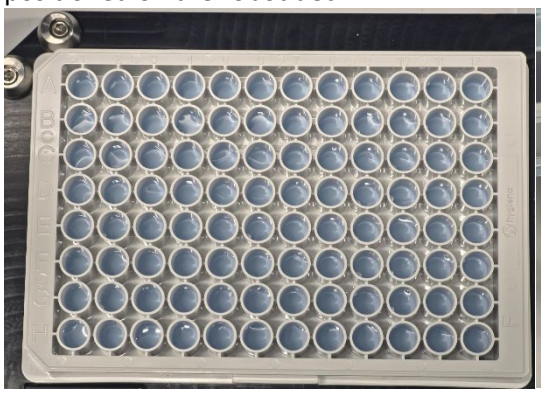
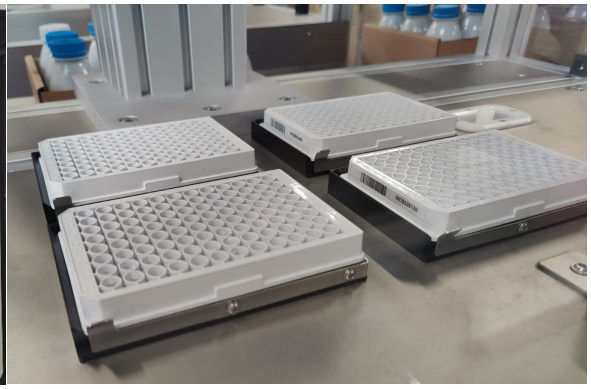
The following table contains the different runs that are available on the AutoSampler DUO and their explanation:

Run	Explanation
01-Initialize System	Initializes the system.
02-PrimeSystem	Primes the pipetting pump and the washing pump.
03-Duo-Sampling	Default run of the AutoSampler DUO, sampling of the plates.
04-Single-Sampling	An AutoSampler run that only samples to one plate.
05-MoveBoxOut	Moves a box out of the AutoSampler DUO that is still on the belt.
06-Load-Fixed-PO	Loads a fixed PO list.
07-WashNeedle	The needle will be washed.
08-FlushNeedle	The needle will be flushed.
09-VolumeValidation	The AutoSampler will fill 2 plates to validate the volumes.
SERVICE-HomeRobotManual	Initializes the robot and moves to its home position.

7.9 Main Run

After performing all the initialization steps, the AutoSampler DUO is ready to start pipetting samples. Per batch, the following must be performed.

1. Load the system with plates. The plate barcodes should be scanned by a handheld barcode scanner, and the corresponding protocol should be selected on the HMI. Make sure that the plates are correctly positioned on the robot deck.

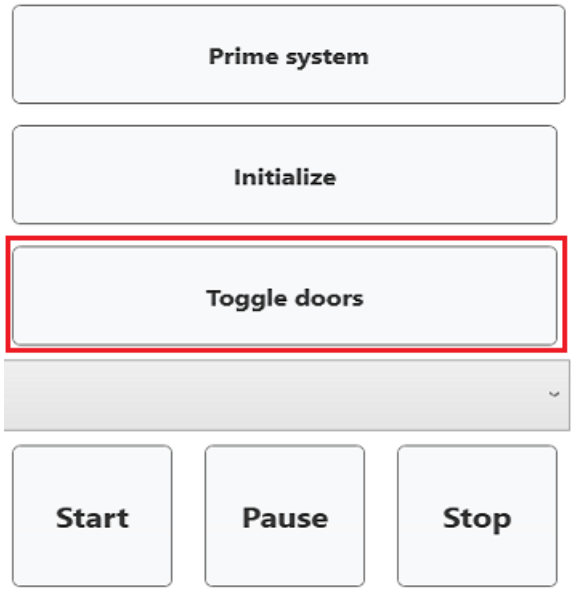
2. *Optional*: Load the plate stacker with spare plates to easily change plates later.



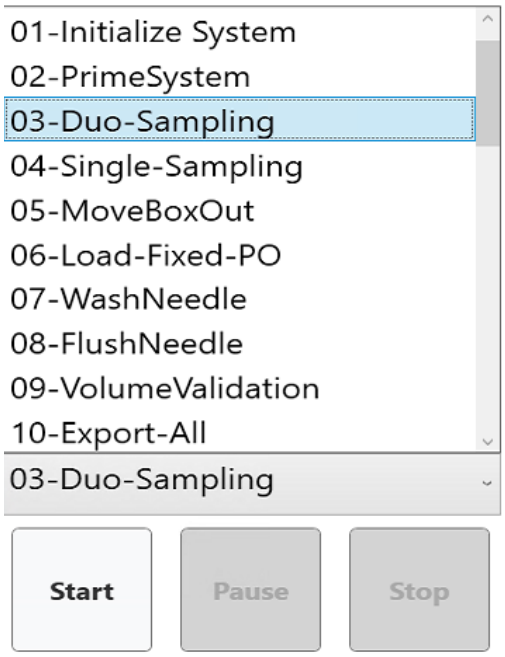
3. Place the boxes on the AutoSampler DUO. Make sure the barcode on the box faces the barcode scanner.



4. If doors are open, close the doors and press the ‘Lock Doors’ button.



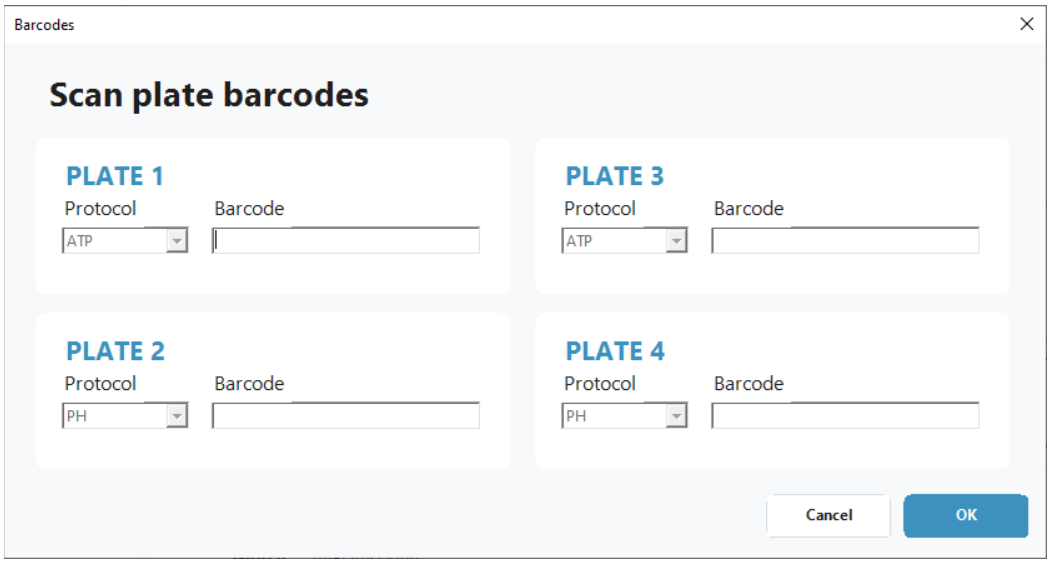
5. Choose the '03-Duo-Sampling' method from the drop-down menu for DUO sampling. Choose the '04-Single-Sampling' method from the drop-down menu for single sampling.



6. Press 'Start' to start the method on the AutoSampler DUO.



7. If all the plates on the deck are done, the HMI will show a pop-up to change the plates. The new plates are easily exchanged by taking new plates from the plate stacker. For each new plate, its barcode must be scanned, and the corresponding protocol must be selected.



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



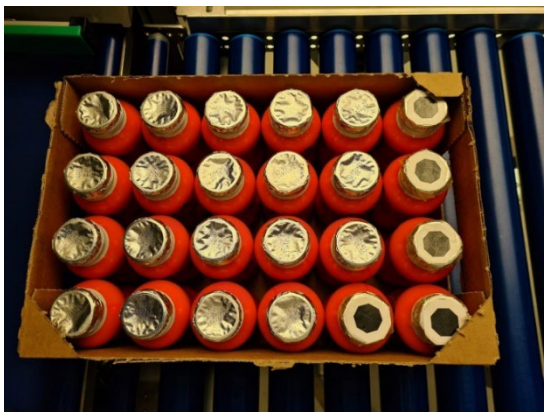
Warning
Risk of exposure to hazardous chemicals.



Warning
Risk of exposure to biological material.

7.10 Dummies

The AutoSampler DUO expects fully filled boxes to be entered into the system. This also helps to prevent samples from falling over. Whenever a box is not fully filled, dummies should be placed in the box to fill all locations. The camera will recognize the number and location of the dummies. The AutoSampler DUO will skip the samples with a dummie sticker.





Dummie stickers should be placed on top of the samples.

Boxes with dummie stickers should be placed in the same way as normal boxes in the AutoSampler DUO.

Dummies stickers can be created with the following symbol:

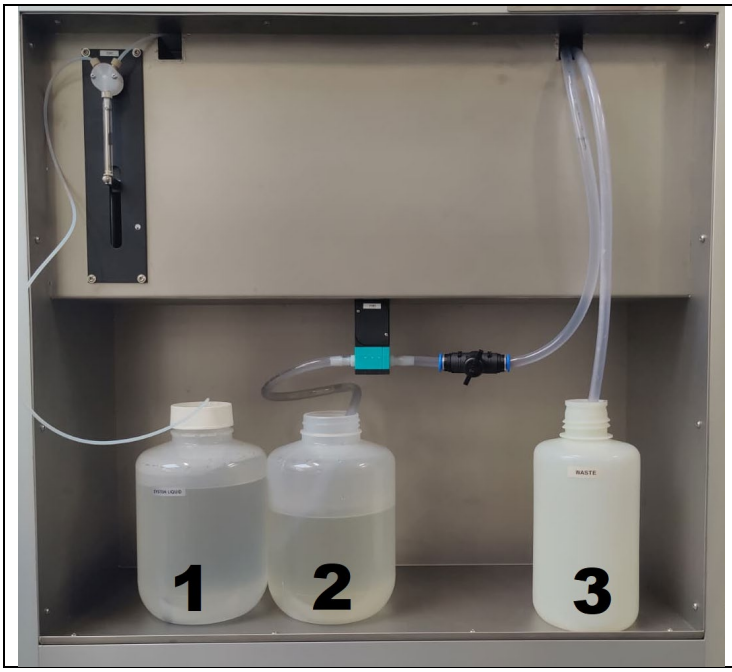


7.11 Exchange of Liquids Procedure

This section explains how liquids and/or liquid containers used within the AutoSampler DUO can be exchanged.

Be careful, as some of the chemicals that may be used are hazardous; therefore, always adhere to lab regulations and wear the correct PPE such as a lab coat, gloves and safety glasses.

The AutoSampler has a dedicated pump bay from which all fluids used in the AutoSampler DUO are originate. The fluid bay houses the pumps, fluid containers. From the fluid bay the liquids are distributed within the AutoSampler DUO. The fluid bay has a raised edge to prevent any accidental spilling from falling on the floor. The layout of the fluid bay can be seen in the figure below.



1) System Liquid Container
2) Wash Container
3) Waste Container

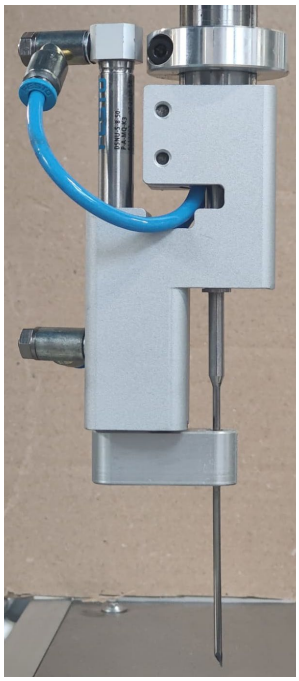
7.11.1 Pumps

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

7.11.1.1 Pipetting pump



The AutoSampler DUO contains one pipetting pump; the pipetting pump is connected to the needle for pipetting.



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

7.11.1.2 Washing solution pump

The AutoSampler DUO contains one diaphragm pump for pumping micro wash from the washing solution container to the needle wash station. The washing solution will wash the outside of the needle.

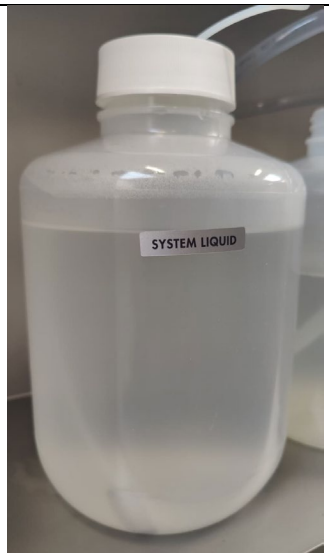


7.11.2 Chemical Containers

To run the AutoSampler DUO in conjunction with the Innovate System, several fluids are to be connected to the AutoSampler. The paragraphs below detail what is to be connected and how to do so.

7.11.2.1 Washing solution for pipetting

The chemical named Washing Solution is placed onto the AutoSampler DUO using a 4L container. The 4L container has a red cap that has 1 hole through which the tubing can be fed. The 4L container containing washing solution is placed in the fluid bay on the left side. It is important to ensure that the tubing is fed through all the way to the bottom.

Position the 4L container of washing solution


The following procedure explains how to replace the washing solution for pipetting:

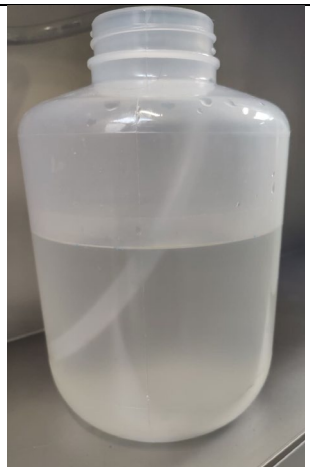


Warning: chemicals, wear gloves, lab coat and glasses!

1. Remove the tubing from the container. Have a paper towel on hand to prevent liquid spillage by wiping down the tubing as it is pulled from 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 changing the container.
3. Remove the cap from the container and replace the used container with a new one. Reuse of chemicals and the interval between uses can be requested from Hygiena.
4. Once the container is replaced, the cap with 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, one by one, making 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 DUO when replacing the chemicals (Section 7.5)

7.11.2.2 Washing Solution for Needle Wash Station

The chemical named Washing Solution is placed into the AutoSampler DUO using a 4L container. The 4L container has a red cap fitted with 1 large hole through which the large tubing can be fed. The 4L container containing washing solution is placed in the fluid bay between the cooling block and the washing solution container for pipetting. It is important to ensure that the tubing is fed through all the way to the bottom.

Position the 4L Container Washing Solution


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

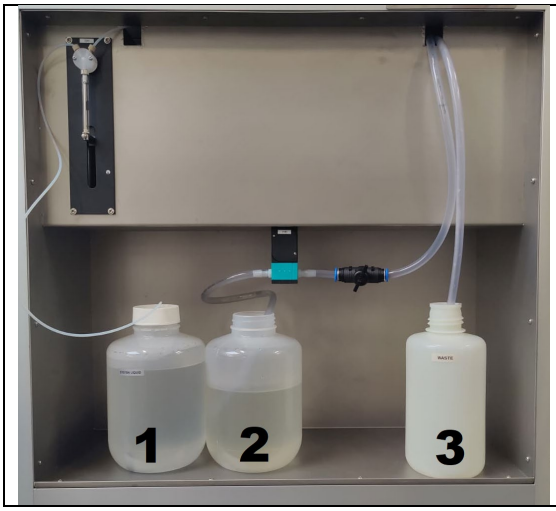


Warning: chemicals, wear gloves, lab coat and glasses!

1. Remove the tubing from the container. Make sure to have a paper towel on hand to prevent liquid spillage 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 more quickly and in larger volumes 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 with a new one. Reuse of chemicals and the interval thereof can be requested from Hygiena.
4. When the container is replaced, the cap fitted with 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 always advisable to prime the AutoSampler DUO when replacing the chemicals (Section 7.5).



1) System Liquid Container
2) Wash Container
3) Waste Container

7.12 End of Day Procedure

This Section explains how to remove the AutoSampler DUO from production at the end of a production day. This procedure must be performed by the operator after 8 hours of use or at the end of the day. This process may take up to half an hour to perform. The goal of this procedure, specifically flushing the fluid lines (tubing), is to prevent microbiological buildup, crystals or reagent precipitation within the fluid lines. All these effects may interfere with test results as well as the continued performance of the AutoSampler DUO.

- Clear the AutoSampler DUO from samples, plates and fluid spills. To do this, perform the steps described in the Checklist prior to starting AutoSampler DUO initialization (Section 7.3).
- Initialize the AutoSampler DUO (Section 7.4).
- Replace the liquids with washing solution. Replacing liquids is described in Section 7.12.
- Start the method ’6-WashNeedle’ from the method selection.
- Prime the AutoSampler DUO (Section 7.5.2), so the tubing is flushed.

- Replace the washing solution with demineralized water to prime again to prevent clogging if the shutdown is anticipated for a longer time (overnight) to minimize chemical effects on the pumps.
- Open the doors (Section 7.8).
- Clean all surfaces in the way that is described in Section 10 and specifically:
  - The surface underneath the reagent dispensers and the dispense position of the plate.
  - The needle used for pipetting.
  - The conveyor belt.
  - The needle wash station.
- Check for a bent needle (Section 7.16).
- Close the AutoSampler DUO by locking the doors.
- Close the Xperimate application on the HMI (Section 11).
- *Optionally*: turn off the AutoSampler DUO.
- Turn off the PC.
- Turn off the main switch of the AutoSampler and optionally the compressor.

7.13 Volume Validation Syringe Pump

This Section explains the procedure for validating the volumes of the syringe used in the AutoSampler DUO. 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 channel needs to be primed with demineralized water.
- Tubing, connections, syringe and needle must be in good condition and leak-free.

Step 1: Weigh plates

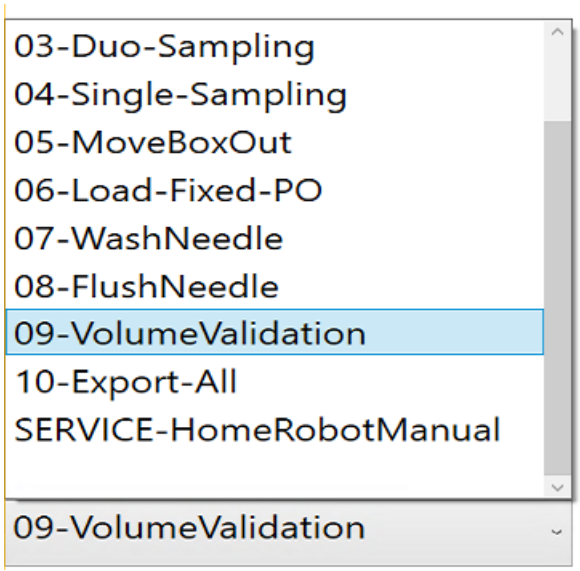
The volume validation protocol uses 2 plates for each protocol that can be used with this system. The plates that will be used for volume validation need to be weighed on a scale, and the weight of each empty plate should be recorded.

Step 2: Load plates on the system

The measured plates should be loaded on the system. Open the door and place plate one in the top left position and plate 2 in the bottom left position. If the door is locked, use the toggle doors button or the physical button on the machine.

Step 3: Start volume validation method

After loading the plates, start the method called “09-VolumeValidation”. This method will use the pump to fill several wells of each plate.



The filling procedure of the AutoSampler DUO is as follows (based on 1 channel):

Plate	Pump	Dispense	Total Volume Per Plate
1	Pipetting pump 1	10 x 50 µl	500 µl
2	Pipetting pump 1	10 x 200 µl	2000 µl

Step 4: Weigh plates again and validate volumes

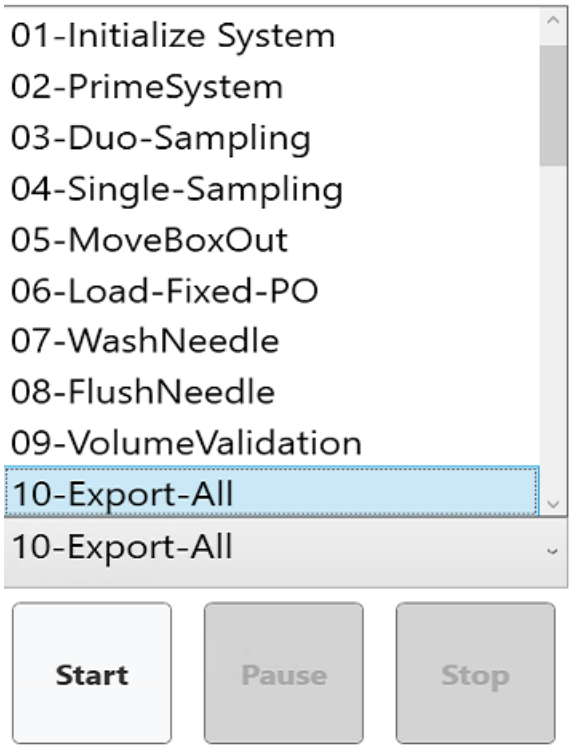
When the filling process is done, open the doors to retrieve the plates. The finished plates can be weighed again, and their volumes can be verified.

7.14 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, they should be replaced with new ones.

7.15 Export All Plate Files

It might happen that the AutoSampler DUO is unable to copy the MCB export files to the external drive, due to a network connection loss, for example. All export files are still available locally on the AutoSampler DUO PC. It is possible to move all export files at once to the external network drive at once (after resolving the connection issue). This can be done by starting the method “10-Export_All”.



8. Replacing Needle(s)

When the piercing needle is broken, bent or blunt (dull), it is recommended to replace it. 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.

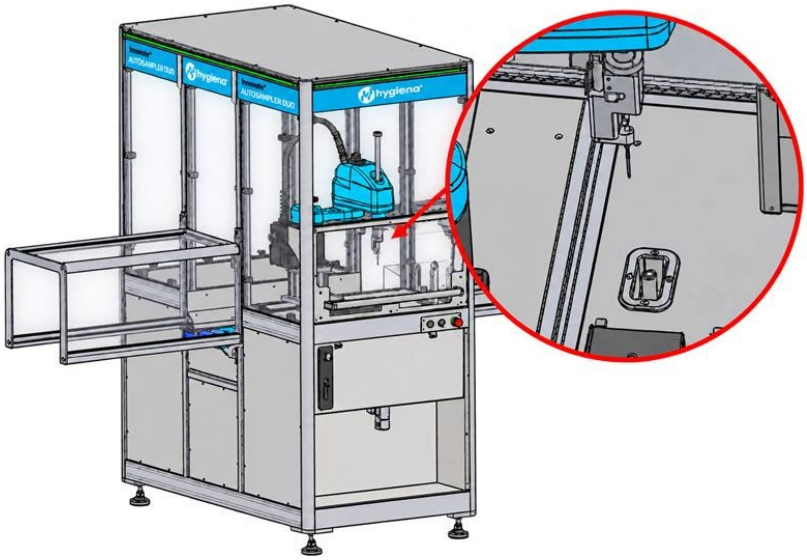


Warning
Piercing hazard

Carefully replace the needles, due to the sharpness of the needle tip.

Step 1: Make sure the AutoSampler DUO is initialized and ready
Before replacing the needles, the AutoSampler DUO should be initialized. This ensures the needles can move, so they can move towards a position where they can easily be replaced. The AutoSampler DUO should also be in idle state, indicated by the blue light.

Step 2: Check the position of the robot
After the system has been initialized, the robot should be positioned with the needle above the wash station. The piercing tool and push-off mechanism should be facing the system's access door.



Step 3: Open the access door
Unlock the access door using the physical door-lock button or the Unlock Door button on the HMI. Wait until the locking mechanism has fully disengaged and then open the access door.

Step 4: Remove the needle
Use an Allen key to loosen the adjustment screw securing the needle in the piercing tool. Carefully pull the needle out of its holder together with approximately 2 cm of tubing. Then disconnect the tubing from the needle. The needle can now be removed and replaced.
The push-off mechanism may be carefully pushed down during this procedure to provide better access to the needle.

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

Step 5: Connect the new needle to the tubing
Carefully connect the tubing to the new needle. Ensure that the tubing is pushed approximately 10 mm onto the needle connection and is securely fitted to prevent leakage or disconnection during operation.

Step 6: Insert the needle into the holder

Carefully push the needle back into the holder until it is correctly seated. Ensure that the tubing is not bent, twisted, or pinched.

Step 7: Tighten the adjustment screw

Use the Allen key to tighten the adjustment screw and secure the needle in the holder. Do not overtighten the screw, as this could damage or deform the needle. Verify that the needle is firmly secured and correctly aligned.

Step 8: Flush channels and check for leakage
After securing the needle, the AutoSampler DUO can be initialized. Then, the flushing method can be started to flush the needles a few times. Check for any leakage during the needle flushing process. If the needle drips or system fluid flows down to the downholder/hold-down, 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 DUO

This Section describes how and when to clean the AutoSampler DUO. For the correct functioning of the AutoSampler DUO, it is important to always keep the system clean. Before cleaning the AutoSampler DUO, turn the system off (Section 7.13).

9.1 Exterior of the AutoSampler DUO

The exterior of the AutoSampler DUO needs to be maintained to minimize system degradation throughout its lifetime. Due to the several different materials used on the instrument, 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® (plexiglass). Cleaning materials such as spiritus (denatured alcohol base) and window cleaners such as Glassex (ammonia/alcohol) 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 irreparable damage to the Perspex parts.

9.1.2 Trespa Panels (White)

The same cleaning method as the see-through panels applies to the Trespa® (high-pressure laminate) panels as well. For the Trespa panels, more rigorous cleaning can be performed as the surface is hardened. The use of paper or brushes is therefore also appropriate for cleaning these surfaces.

9.1.3 Frame Parts

A light soap can be used to clean the anodized aluminum frame parts. To not leave scratch marks, a lint-free towel is recommended. Be careful with acidic cleaning materials, as they may affect the surface of the aluminum.

9.1.4 Robotic Cover (Cyan)

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 with a pH value between 5 and 8). In case of persisting stains, a polishing agent may be used, but be careful not to abrade the surface. A wax product may be used to maintain 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 light soap. Avoid 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 DUO is always turned off. To prevent leaving scratch marks, use a lint-free towel and preferably, a microfiber cloth. When stainless steel turns dull over time, cleaning agents may be used to polish the surfaces and restore their shine.

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 damped microfiber cloth. Fingerprints are removed as well as dust. If fingerprints persist use a light soap. Prevent using paper to prevent scratch marks. Do not apply pressure when cleaning the screen.

9.2 Pipetting Cabin

Within the pipetting cabin the stainless-steel parts can be cleaned as described in the previous paragraph under deck. Other parts to be cleaned is the washing station.

9.2.1 Washing Station

The washing station can be cleaned with a washing solution or an ethanol solution. Always check to ensure the wash bath drain is not blocked. To check for blockages, pour half a liter of demineralized water into 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.

9.2.2 Downholder(Hold-Down)

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

9.3 Tubing

Tubing may be cleaned internally with washing solution and ethanol. When using ethanol to clean the tubing (internally), the AutoSampler DUO must be turned off. Flushing can be done by removing the tubing from the pump and using a manual syringe to flush the ethanol through the AutoSampler DUO. Also, when ethanol has been used to clean the tubing, it is mandatory to repeat the manual cleaning with demineralized water to remove the ethanol from the AutoSampler DUO.

Image showing what tubing to detach from the pump when using ethanol



9.4 Needle



Warning: chemicals; wear gloves, lab coat and glasses!



Warning: Puncture hazard

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

9.4.1 Regular Cleaning of the Needle

The needle of the AutoSampler DUO can be cleaned from the inside and outside. To clean the needle from the inside and the outside, start the “7-WashPipettingNeedle” method from the HMI. This will also happen during every wash cycle after the sample has been pipetted. But there is a manual option in the HMI as well.

9.4.2 Deep Cleaning of the Needle

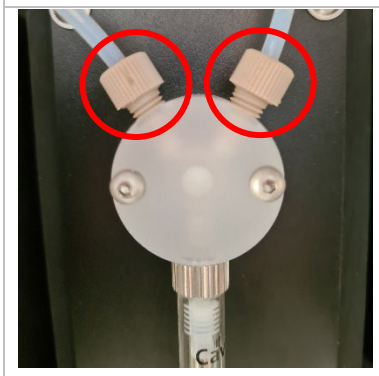
For deep cleaning of the piercing needle, the needle must be removed from the system. To do so, follow the steps listed below:

- Follow the replace needle procedure (Section 9) to remove the needle from the system.
- Place needle in a container of ethanol.

9.5 Syringe Pump

After 3 months of use, or when markings are present, or when performance is lost, the syringes need to be replaced.

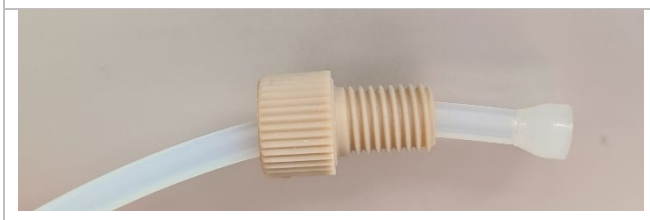
For optimal performance, check the fluid connections regularly. The fittings, also known as lock nuts, should not be wet or show visible chemical precipitation. The syringe glass should not have markings. A tiny amount of liquid may present itself underneath the plunger (a hole is present to allow for air to enter, but also for some evaporation. If liquid persists beneath the syringe or a pool of fluid forms, the syringe needs to be replaced.

Picture of one pump displaying the lock nuts


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

1. Turn the locknut counterclockwise and make sure that a lint-free towel is on hand to capture any fluid that is inside the locknut.
2. 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 DUO is turned off. The goal of the cleaning is to remove any particles, such as formed crystals or dust.
3. Check the ferrule for wear. A correct ferrule should not be deformed and should have a conical shape.
4. Replace the ferrule, if needed, so that it is attached as pictured below.
5. Insert the tubing so that the flat part of the ferrule sits against the back of the port.
6. Screw the lock nut in place by turning it clockwise. Screw the connection hand tight; no tools are needed.

Ferrule attached correctly



Replace the syringe.

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.

Plunger screw



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 (see Section 7.3).

9.6 Conveyor Belt

The conveyor belt is used to move the products for sampling. Please follow the instructions below to maintain this part of the AutoSampler DUO.

9.6.1 Cleaning the Conveyor Belt

We recommend that you keep your belt's adhesive qualities intact by cleaning the belt when necessary. A clean belt will exhibit its frictional properties properly.

Regular cleaning helps maintain the belt's function and extends its service life. Before loading cartons, ensure that their undersides are free of dust, sand, and other contaminants.

Refer to **Section 12.1 – Maintenance Service Panel Visualizations** for instructions on manually operating the conveyor.

Approved cleaning agents
General cleaning:

- Soap and water.
- Borax.
- Suitable household cleaners. Check the product formulation and perform a spot test before use.

Spot cleaning:

- Ethanol.

Important: *Do not mix cleaning agents, as this may cause unpredictable damage to the belt. Do not use chlorine-based cleaning products*.

Cleaning procedure
Step 1: Prepare the system

- Ensure that the conveyor and the entire system are free from cartons, samples, plates, and other objects.
- Stop the machine and press the emergency-stop button before removing a safety panel.

Step 2: Remove the safety panel
Remove the safety panel covering the section of the conveyor belt to be cleaned.
Step 3: Clean the accessible section
Clean the accessible section of the conveyor belt using an approved cleaning agent. Do not apply excessive liquid and prevent the cleaning solution from entering electrical or mechanical components.
Step 4: Reinstall the safety panel
Reinstall and securely fasten the safety panel before moving the conveyor. Never operate the conveyor while a safety panel is removed.
Step 5: Move the conveyor belt

- Ensure that all persons and cleaning materials are clear of the conveyor.
- Release the emergency-stop button and reset the safety system.
- Open the conveyor controls on the maintenance service panel.
- Select **Mode 2** and press **Start**. The conveyor will move at the default speed.
- Adjust the speed if necessary.
- Move the belt until an uncleaned section becomes accessible and then stop the conveyor.

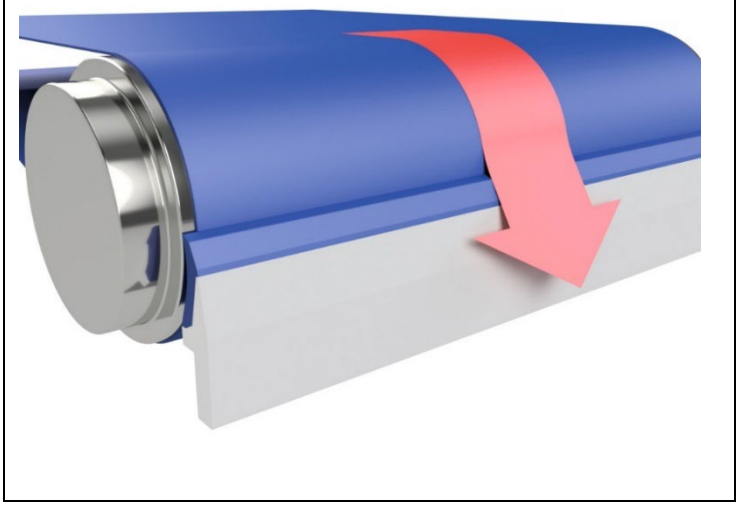
Step 6: Clean the next section
Press the emergency-stop button, remove the safety panel, and clean the newly accessible section. Reinstall the safety panel before moving the conveyor again.
Step 7: Repeat the procedure
Repeat Steps 3–5 until the entire conveyor belt has been cleaned. Approximately three to four movements are recommended to access the complete belt surface.
Step 8: Complete the procedure

- Ensure that the complete belt is clean and free from cleaning-agent residue.
- Confirm that all safety panels are correctly installed and securely fastened.
- Remove all cleaning materials from the system.
- Release the emergency-stop button and reset the safety system before returning the AutoSampler DUO to operation.

9.6.2 Scraper

The conveyor belt AutoSampler DUO is equipped with a scraper to capture fluid spills that may form during product piercing. To access the scraper, the service panel needs to be removed using a safety Torx® size 30.

Belt Scraper Working Principle

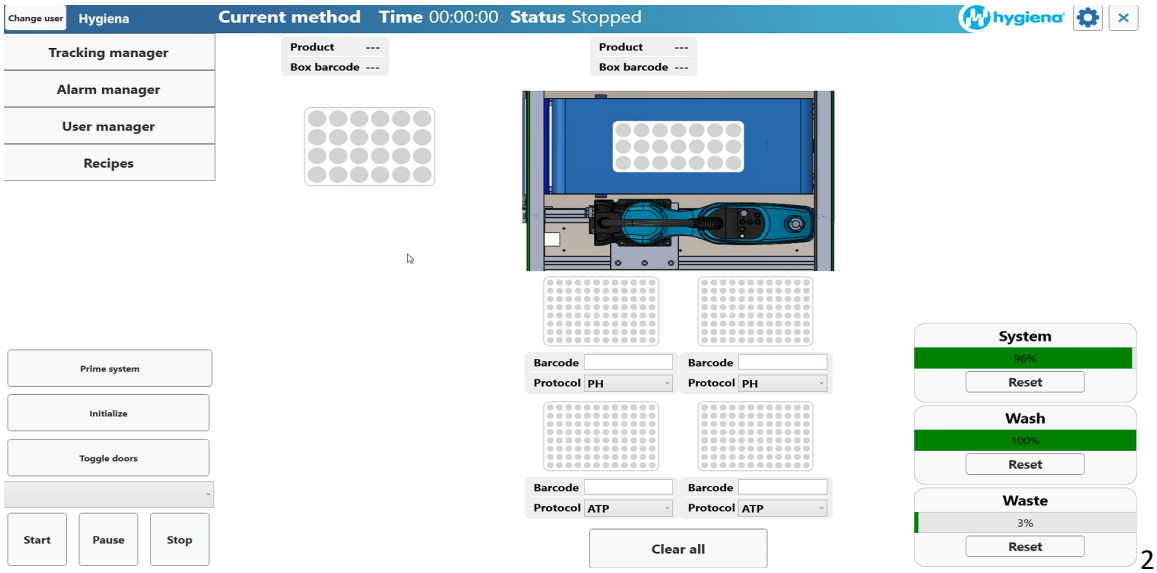


10. HMI/Xperimate Operation Panel

This Section explains the visual components of the AutoSampler DUO HMI. The HMI is built on top 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.

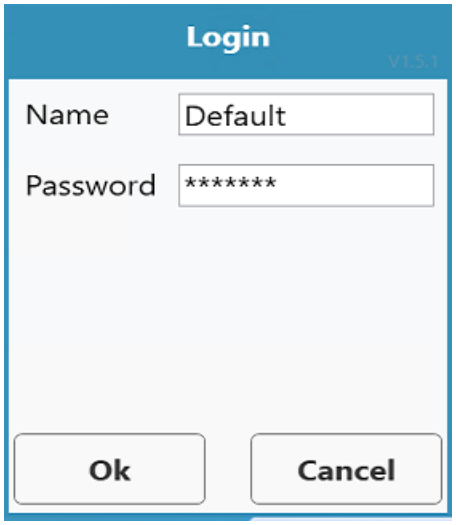
The main difference is that Xperimate can be used to build program flows. This is **not** available in the HMI. However, the HMI has been optimized to make operating the AutoSampler DUO clear and concise.

The following picture shows the complete HMI overview. Individual parts will be explained in their corresponding Sections.



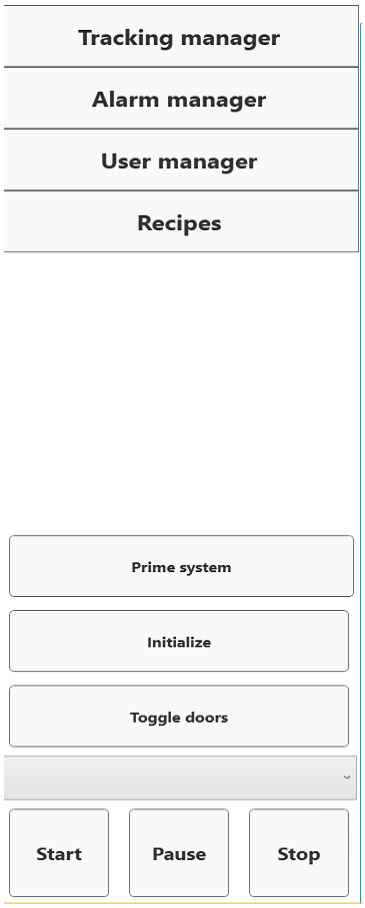
2

10.1 Login



At application startup, it is required to log in with a username and password. The application language can also be set.

10.2 Sidebar



In the image above, the sidebar is displayed. This sidebar is always visible across all screens. This sidebar contains the main control elements for the AutoSampler DUO.

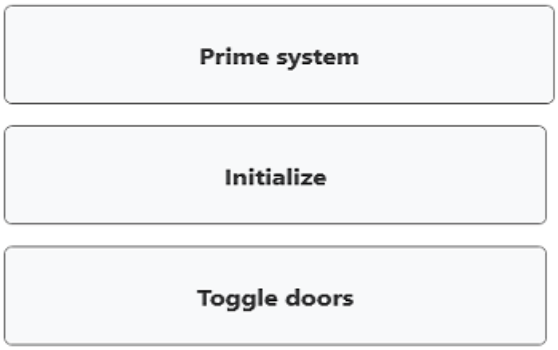


At the top of the sidebar, the username of the current user is visible. Next to the username is a change user button. Pressing this button allows the user to log in with different credentials.



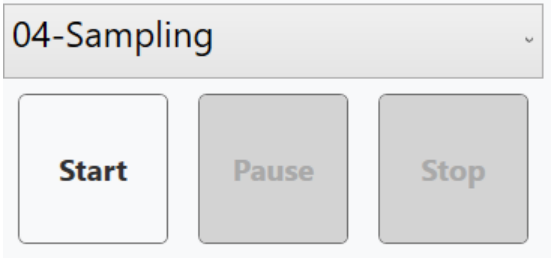
There are 4 tabs. Each tab will display additional information about the current method and the status of the AutoSampler DUO. Each tab will be explained in its corresponding Section.

1. Tracking manager: general system overview.
2. Alarm manager: Alarm management.
3. User manager: create, add and remove users.
4. Recipe manager: management of different recipes.



These buttons are all used to prepare the AutoSampler DUO for a run.

- The 'Toggle Doors' button unlocks or locks all door locks on the AutoSampler DUO.
- The 'Prime system' button will fill the pumps of the AutoSampler DUO with liquid to remove any air bubbles from the hoses.
- The 'Initialize' button initializes the entire system. This must be done before the system can start running or after an error occurs.



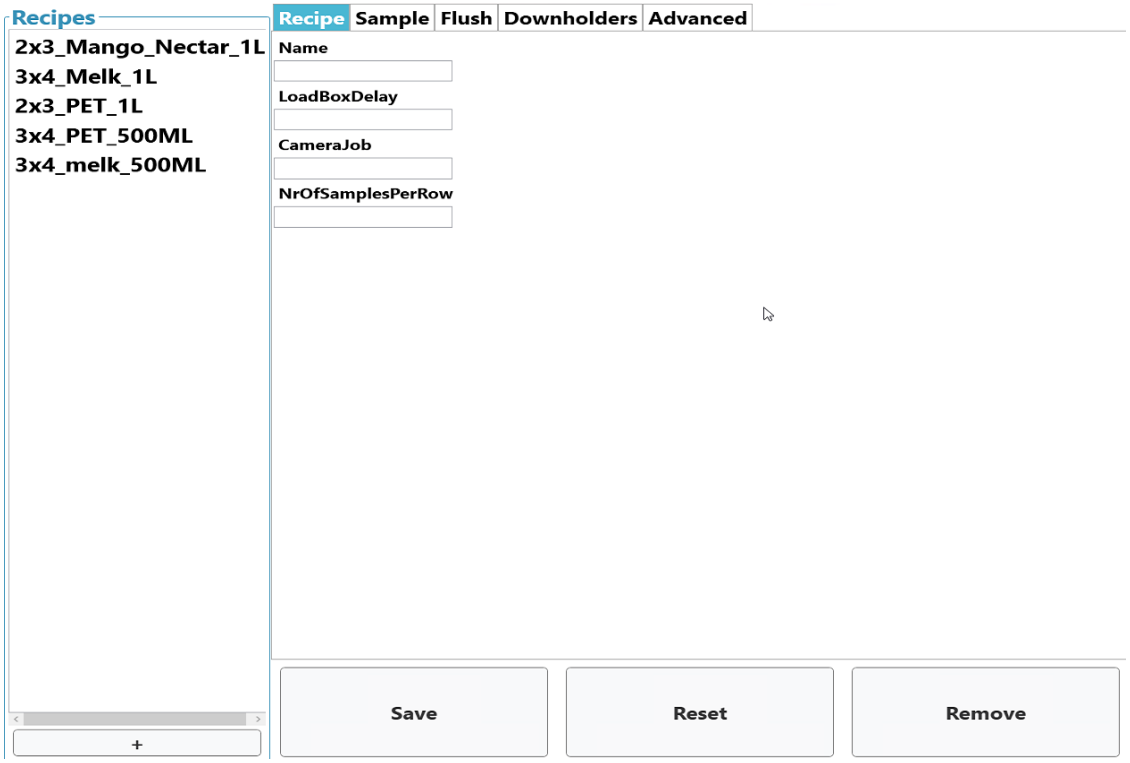
In the drop-down menu, a method can be selected. This is the method that will be executed when the Start button is pressed. The buttons are used to start, pause and stop the program selected in the drop-down menu.

Buttons will be enabled and disabled at certain moments.

- Recipe Manager: Only available when a user with administrator rights is logged in. The button is always disabled during a run.
- Toggle Doors: Always available when the AutoSampler DUO is not active and unavailable during a run.
- Prime: Always available when the AutoSampler DUO is not active and unavailable during a run.
- Start: Always available when the AutoSampler DUO is not active or when a run is interrupted. The button is not available during a run.
- Pause: Not available when the AutoSampler DUO is not active. The button is available during a run.
- Stop: Not available when the AutoSampler DUO is not active. The button is available 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, press the "+" button at the bottom of the left bar. This will add a new empty recipe. All cells for the new recipe, as well as for the existing recipes, can be edited by adjusting the desired field and pressing "Save".



- Name: The name of the product. It should be recognizable and distinctive.
- Load box delay: Timer for the stopper to come back up. If it is a short box, the timer should be lowered and for long boxes, the timer should be longer.
- Camera job: Name of the camera job for sample detection.
- Nr of samples per row: Number of samples per row in a box.
- Airgap: The amount of air that will be taken up before and after the sample.
- Aspiration height: The height that the arm of the pipette needle reaches to aspirate a sample. This is measured in mm above the belt.
- 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.
- pH volume: The PH volume to be dispensed in the plate.
- ATP volume: The ATP volume to be dispensed in the plate.
- Internal flush volume: The volume used to flush the needle.
- Flush time: The time that the needles flush after each sample. This time is set in milliseconds.
- Wash cycles: How many times the wash step will be performed for this specific sample.
- Use downholders (hold-downs): If this option is active, the downholders will be used to push the sample off the needles.
- Cutoff value 1: Cutoff value 1 for the Innovate System.
- Cutoff value 2: Cutoff value 2 for the Innovate System.
- Pierce speed: The speed at which the samples are pierced.

- 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 highly 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.
- Box settling time: the amount of time the box gets to stabilize after being moved onto the belt.
- Pre-aspiration delay: Delay before aspirating the sample. The settling time for the needle in the liquid.
- Post-aspiration delay: Delay after aspiration of the sample, before moving upward.

Pressing the 'Reset' button will undo all changes. Pressing the 'Save' button will apply all changes to the AutoSampler DUO. 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	2000	0
Aspiration volume	µl	10	800	350
pH volume	µl	10	500	200
ATP volume	µl	10	200	50
Aspiration height	mm	-210	-60	-60
Flush time	ms	0	5000	500
Internal flush volume	µl	200	850	500
Pump aspirate speed	-	1	40	2
Pump dispense speed	-	1	40	2
Pre-aspiration delay	ms	0	2000	0
Post-aspiration delay	ms	0	2000	0
Pierce speed	%	25	100	100

10.4 Top Bar



In the top bar of the application, the following are visible:

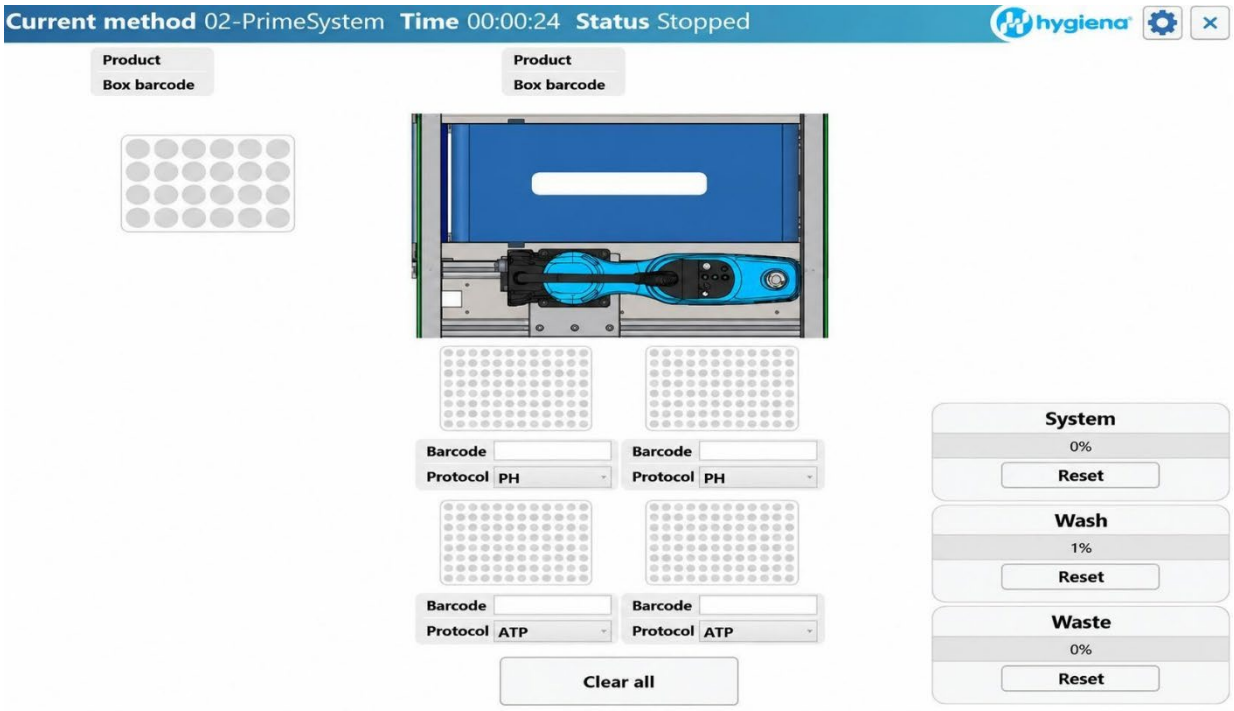
- Name of the current method.
- Time it has been running.
- Status of the method.



The buttons to the right are as follows:

- Configuration (Section 11.10)
- Exiting the application (Note: the application cannot be exited during the run)

10.5 General Overview



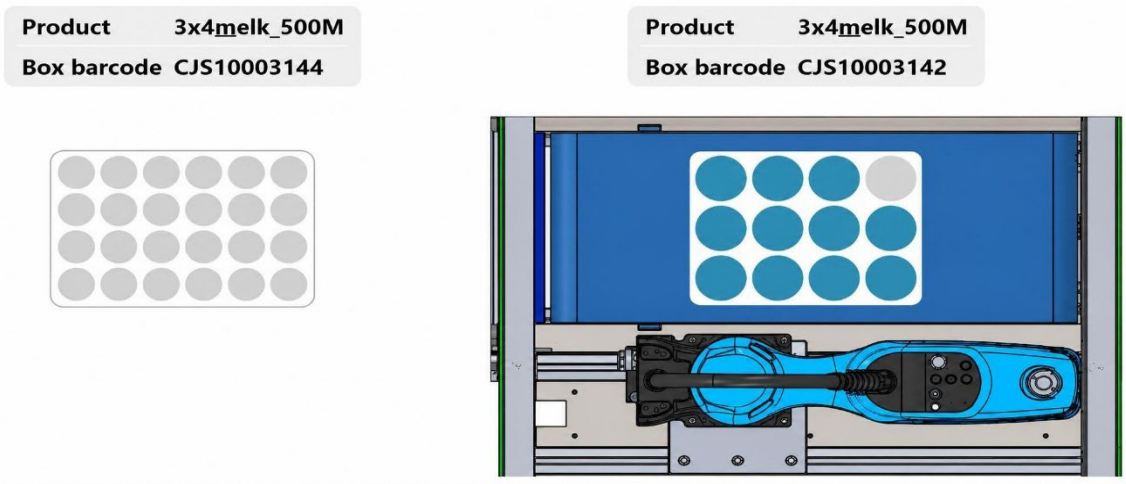
In the General tab, a simplified overview of the AutoSampler DUO is visible. In this overview, the data from two boxes will be displayed:

- Previous box.
- Current box.

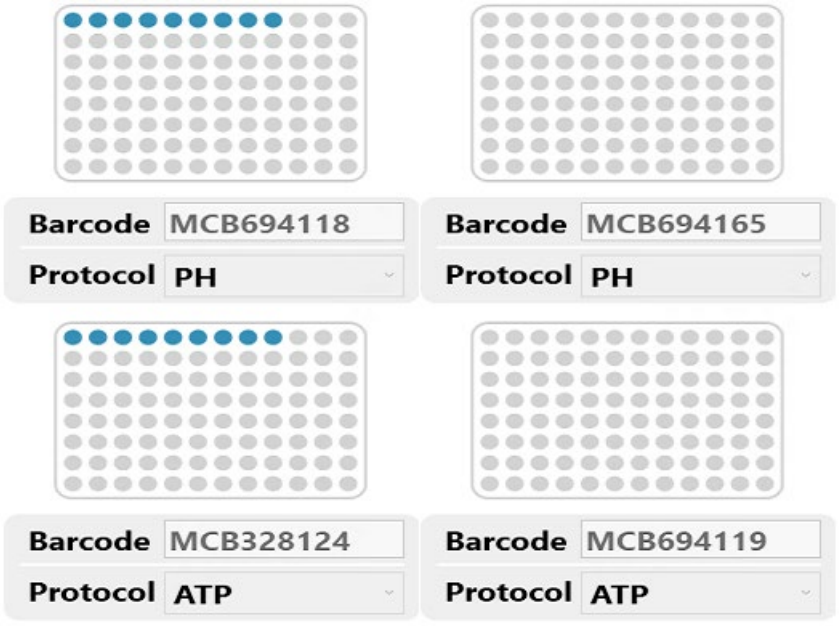


The following parameters can be seen for both:

- Product, according to the scanned barcode
- Box barcode, according to the input or scanned barcode



This is a simplified view of boxes showing which samples have already been sampled for the current and previous boxes.

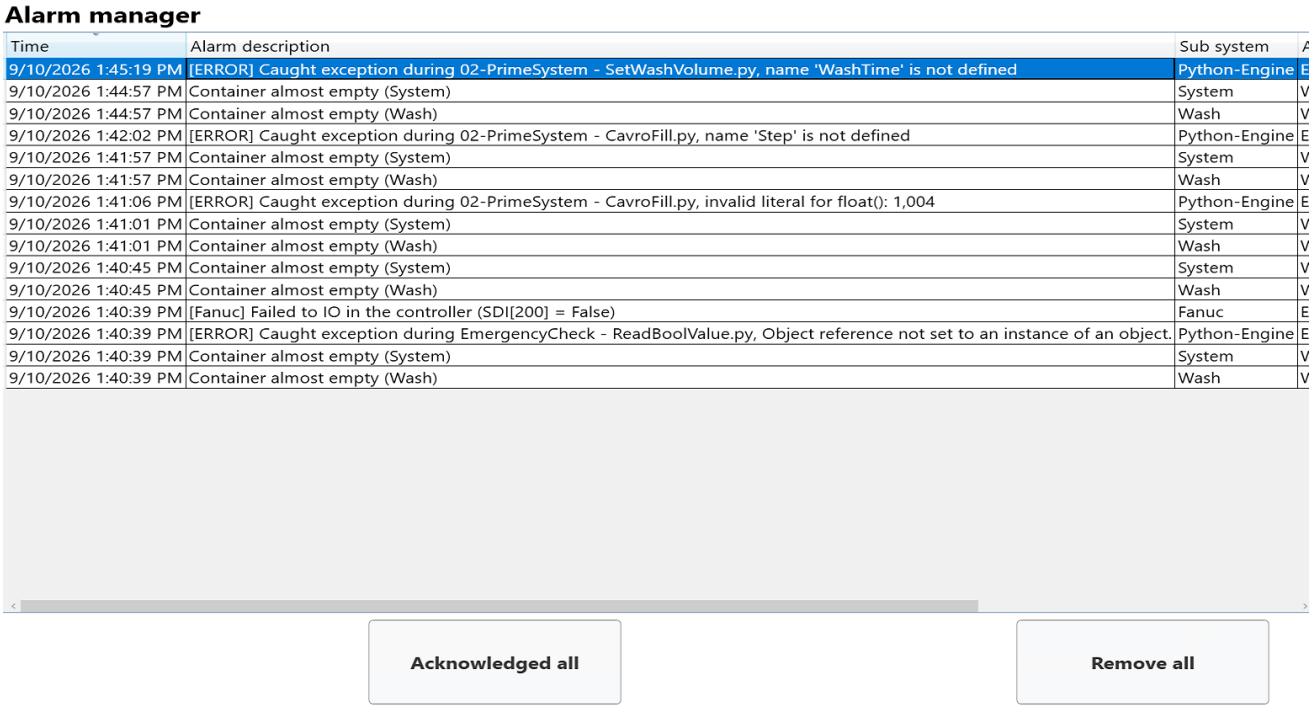


An overview of four well plates is displayed at the bottom. Here is a visualization of which wells have been filled.



These progress bars indicate the amount of liquid remaining in the system and the wash solution, as well as the filling level of the waste container. Each liquid has a warning and error parameter in the settings that determines when a warning or error message is displayed for low or critically low fluid levels, or for high or critically high levels. When the system or wash solution containers are empty, or the waste is full, the reset button must be pressed to let the AutoSampler DUO know that the system or wash solution has been refilled or the waste has been emptied.

10.6 Alarm Manager Overview



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 DUO, 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 DUO. Confirmed alarm messages can be cleared to keep the overview clean.

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

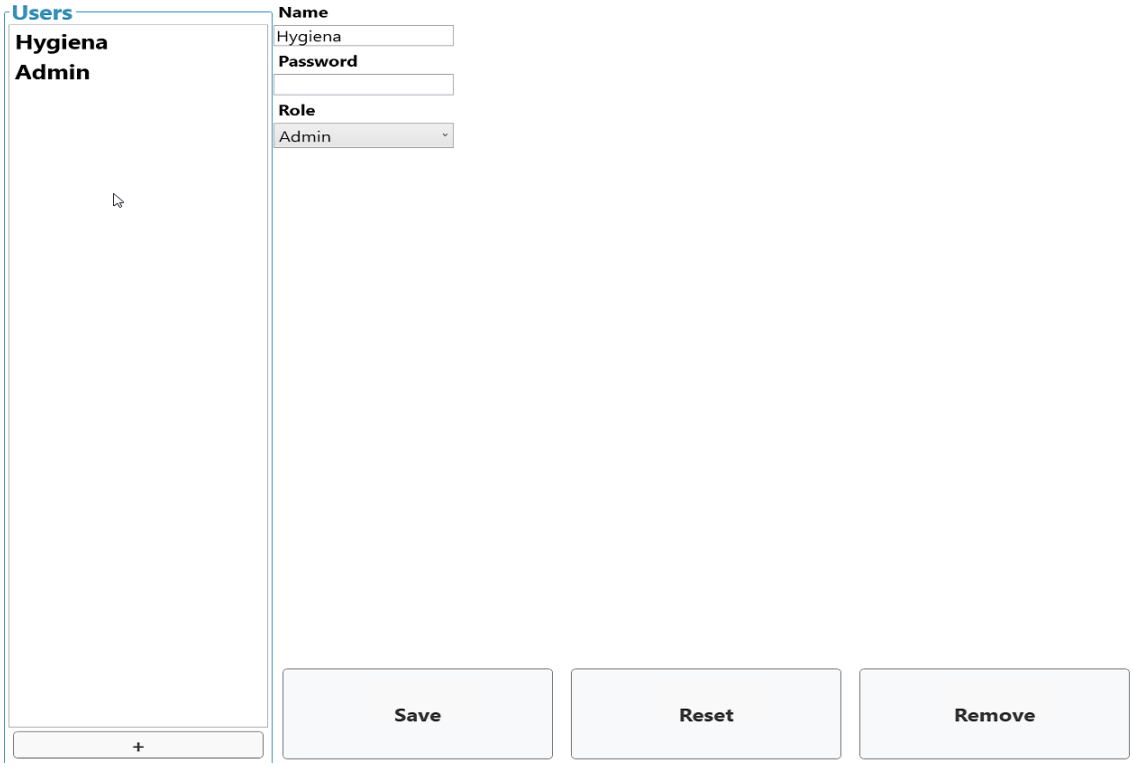
- Time of occurrence.
- Time of acknowledgment.
- Time of removal.
- Component that triggered the alarm.

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, and the system will automatically pause.
- **Error message**. The signal light will blink red; the system will automatically stop.

10.7 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 from which the specific role can be selected.

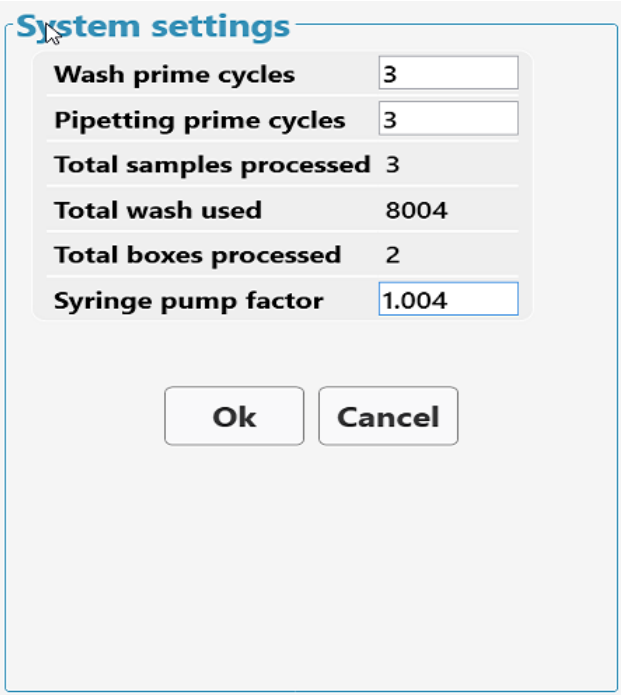
When you press 'Save', the changes will be accepted. When a user is selected, you can press the 'Remove' button to delete that user. Pressing 'Reset' will undo any changes.

Administrative rights are required to access this screen.

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

	Operator	Service	Admin
App 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

10.8 Settings



On this screen, the AutoSampler DUO's run settings can be modified.

- 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.
- 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.
- Total samples taken: the total number of samples taken by the system.
- Total (reagent x) used: the total volume of the reagent that has been consumed by the system (approximately).

11. Maintenance

This Section explains when and how maintenance should be carried out, which materials should be used, and which special tools are needed.

Maintenance Preparation

Before performing maintenance on the AutoSampler DUO, the following safety instructions and warnings must be followed.

- The AutoSampler DUO must be switched off. A warning sign must be hung on the control unit and the installation must be protected against accidental switching on, for example, by pressing the emergency stop or turning off the main switch.
- The installation must be pressure-free locally before removing the covers from the AutoSampler DUO to carry out work on the system.

Shut-off valve; compressed air in closed position


- Before maintenance is carried out on an electrical installation, it must be made voltage-free. To do this, the installation must be switched off and secured, and the voltage freedom must be 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 being switched 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 appropriate personal protective equipment (PPE) such as protective clothing, goggles and gloves.
- Handles and the floor around the AutoSampler DUO should be free of dust and liquids to prevent slipping.
- Broken or damaged parts must be replaced as soon as possible; consult your supplier.
- 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 DUO is back in service, that the protective devices have been installed and that there are no persons within the range of the AutoSampler DUO 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 DUO back into operation.
- Make sure that the service technician does not leave the location without a signed service receipt.

11.2 Maintenance Instructions Electrical Components



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



Warning
Dangerous voltage

The AutoSampler has several electrical parts that require periodic maintenance and need to be checked regularly for optimal use. This part of the manual goes into this in more detail.

11.2.1 Barcode Scanners and Camera

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.



Warning
Optical radiation

11.2.2 Cables

The various cables 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
Vision camera (Keyence)	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 has several pneumatic parts that require periodic maintenance and need to be checked regularly for optimal use. This part of the manual goes into this in more 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. The air service unit should also be cleaned regularly. The reducer filter 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, and in special air conditions, even daily. The original color of the filter is white. Contamination of the filter is recognizable by discoloration of the filter pattern; yellow discoloration indicates oil absorption. Check the filter pot daily, up to once per month, and drain any water that may have collected in the filter pot. When replacing the filter, pay attention to the correct filter passage of 5µ.

Air service unit



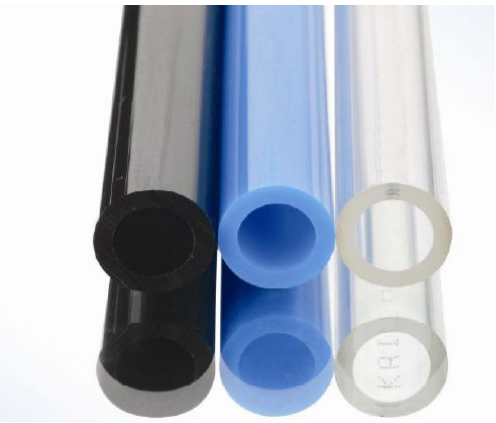
11.3.3 Couplings and Valves

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. These should therefore be replaced at a suitable time.



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 later than once per six months; frequency depending on the air condition	DO NOT clean; always replace (5µ)!!	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 components that require periodic maintenance and inspection to ensure 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
Tubing pump wash	Weekly	Daily (Prime)	/

12. Maintenance Service Panel Visualizations

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

12.1 Introduction

For maintenance and manual control purposes, individual components connected to the PLC can be controlled through the following web interface:

http://192.168.0.10:8080/AutoSampler_DUO.htm

The web interface consists of three pages:

- Login page.
- Conveyor control page.
- Actuator control page.

12.2 Login (Main Page)



The maintenance panel is password-protected and has a Login page to log in or out. On the login page, at the bottom right of the screen, the last change date for the PLC program code is displayed.

12.2.1 Login



- Press ‘Login’ to log on to the AutoSampler DUO.
- Fill in ‘Username’.
- Fill in ‘Password’.
- Press ‘Ok’ to log in.

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

12.2.2 Logout

- Press ‘Logout’ to log out of the AutoSampler DUO.

All controls will now be disabled again, and it will no longer be possible to control the AutoSampler DUO using the different buttons.

12.3 Conveyor Control

This tab contains several routines for manually controlling the conveyor system:

- **System Init:** Initializes the conveyor system and prepares it for operation.
- **Get Box:** Moves a box into the system.
- **Move Box Out:** Moves a box out of the system.

The individual system controls are explained in more detail below.

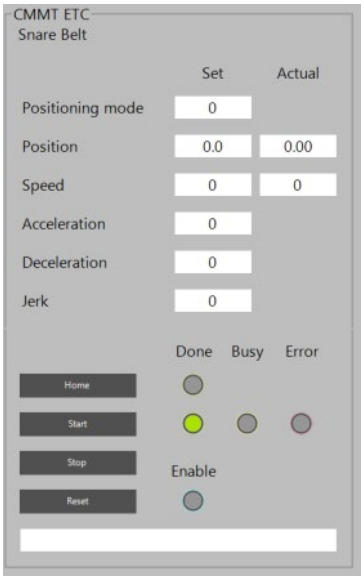
Button/Fields	Explanation
Start	Starts the routine.
Reset	Resets the routine.
Done	Light is green when the routine is done.
Busy	Light is orange when the routine is busy.
Error	Light is red when the routine is in error.
Error message	White text field below contains the error message and error code in case of an error.



12.4 Actuator Control

The Actuator Control page allows the operator to manually control the box stopper cylinder and the conveyor stepper motor.
The motor control can be used to move the stepper of the conveyor that the AutoSampler uses.

Make sure that during axis movement, the movement is not blocked to prevent damage to the robot.

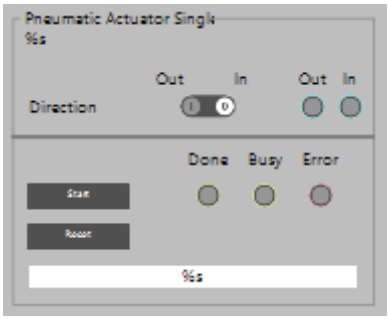


The following buttons, fields and status indicators can be used to control the motor control blocks:

Button/Fields	Explanation
Positioning mode	Positioning mode selection (0=absolute, 1=relative, 2=continuous)
Position	Position setpoint
Speed	Movement speed
Acceleration	Acceleration
Deceleration	Deceleration
Jerk	Jerk
Home	Start homing axis
Start	Starts movement with set parameters
Stop	Stops axis during continuous movement
Reset	Resets the axis (when in error)

Status indicator	Explanation
Motor name	Left top corner displays the axis name.
Done (Home)	Light is green when homing is performed successfully.
Done (Start)	Light is green when movement is finished successfully.
Busy	Light is orange when the axis is busy.
Error	Light is Red when an error occurred during homing.
Enable	Light is blue when the motor is enabled.
Error message	White text field below contains the error message and error code in case of an error.

The cylinder control can be used to move a cylinder in and out. Be careful that moving parts are not blocked to prevent damage to the system.



The following buttons and status indicators are used to control cylinders:

Button	Explanation
Direction	Determines the direction in which the cylinder moves (extending or retracting stroke)
Start	Start movement
Reset	Reset cylinder (when in error)

Status Indicator	Explanation
Cylinder name	Name of the cylinder displayed in the top left corner of the view.
Out	Light is blue when the cylinder is out.
In	Light is blue when the cylinder is in.
Done	Light is green when the movement is successfully finished.
Busy	Light is orange when movement is busy.
Error	Light is red when an error occurred during the movement of the cylinder.
Error message	White text box at the bottom of the view displays the error message in case of an error.

13. Create a Keyence Camera Job

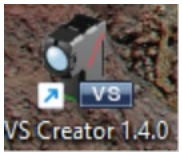
The steps described below can be used to create a new Keyence job (e.g., for a new sample or layout of an existing sample). Follow the steps described below very carefully.

Step 1: Make sure the machine is turned on and initialized.

Check that the AutoSampler (and optionally the compressor) is turned on and initialized. The AutoSampler must not be running and the HMI application must be closed before connecting to the Keyence camera.

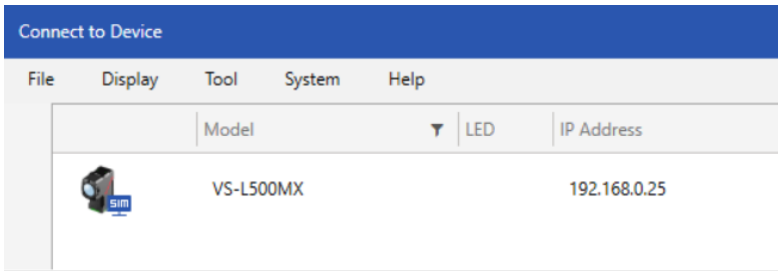
Step 2: Open VS Creator

Open the VS Creator software by clicking on the icon on the desktop.



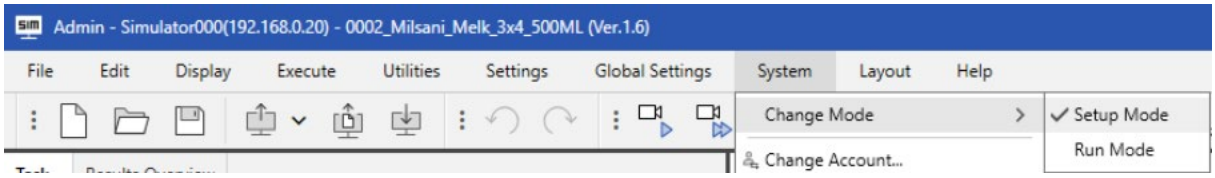
Step 3: Connect to the camera

From the menu, select the camera used (e.g., VS-L500MX) and double-click it to connect. If no cameras are found, the update button at the bottom of the screen can be used to refresh the list.



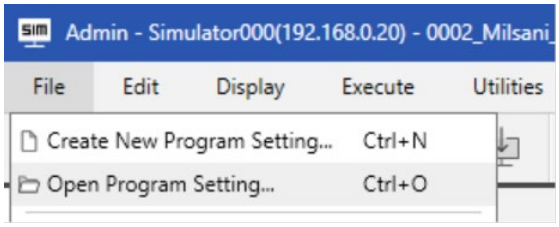
Step 4: Put the camera in setup mode

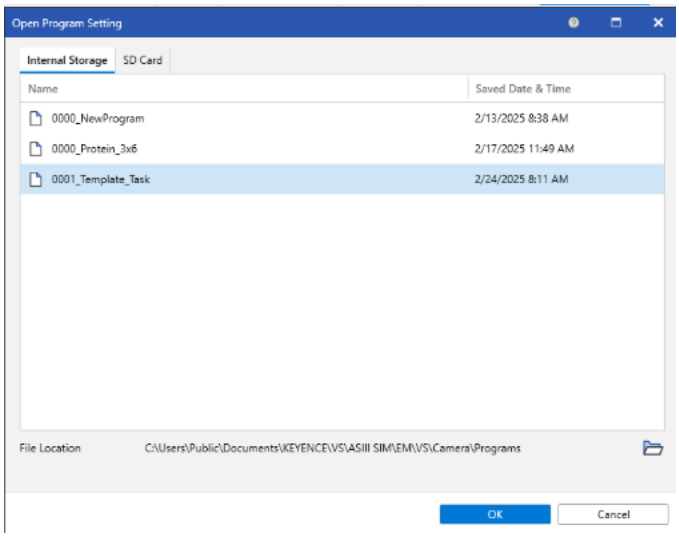
To add or change tasks, the camera must first be put into setup mode. This can be done by clicking on '*System -> Change mode -> Setup mode*'.



Step 5: Open the template task

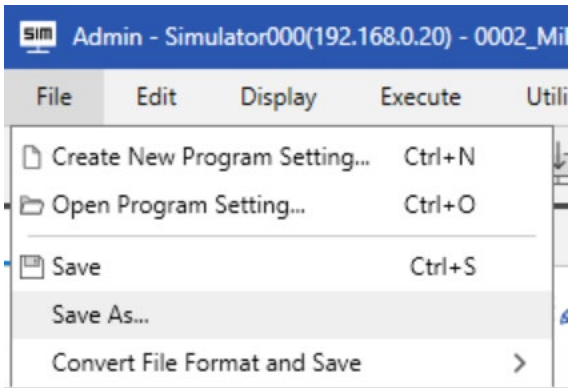
It is recommended to create a new job based on the camera job template so that the cell locations retrieved by Xperimate are already in the correct locations in the job. To create a task based on the template, click ('File' → 'Open program setting') and select the task named 'TEMPLATE Task', which is located on the camera's SD card. The template task will then open.

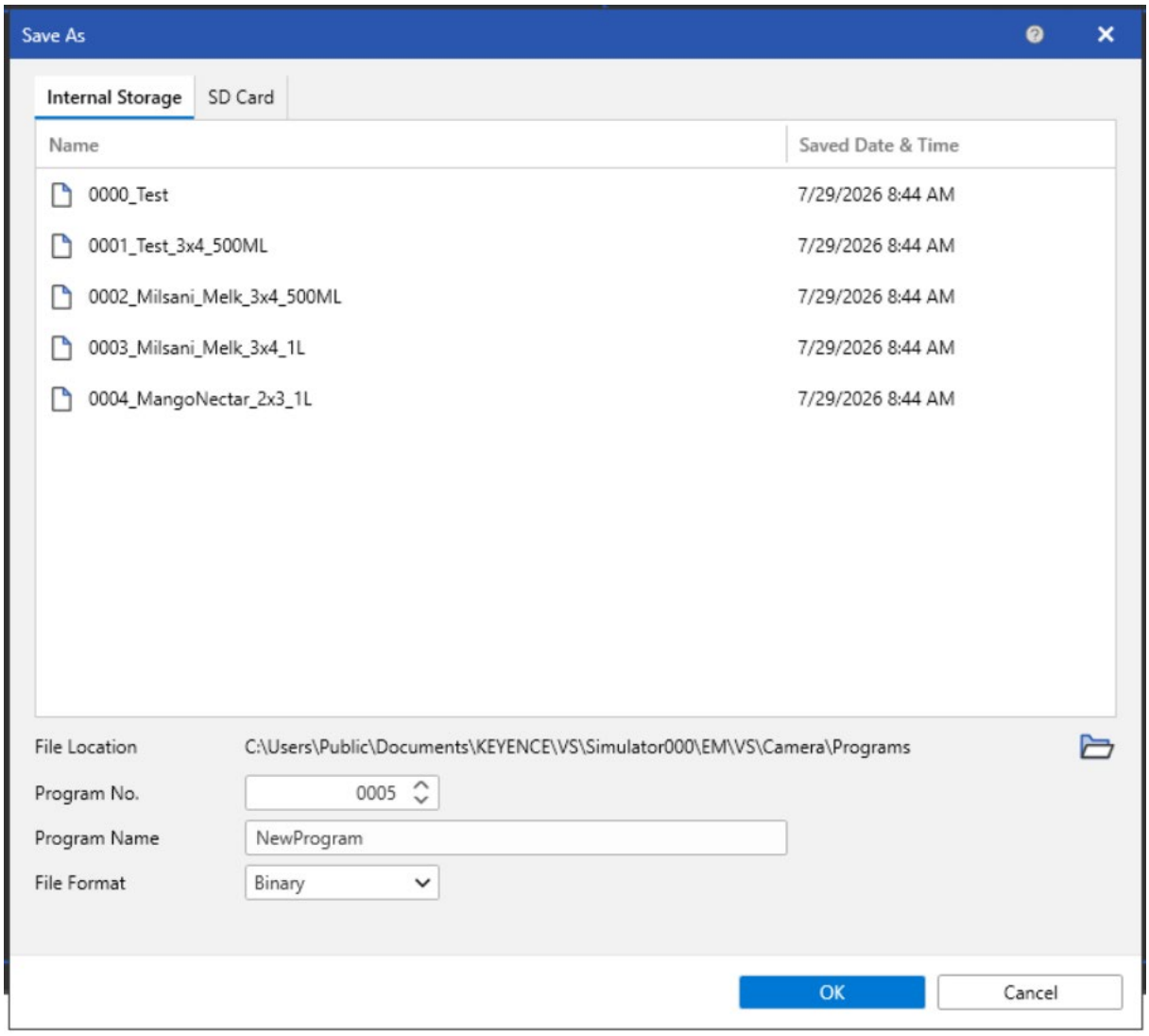




Step 6: Save the new task

Once the template task is open, first save it as a new task with the desired name. The template task itself should never be edited. Saving the task as a new task can be done by clicking ('File' -> 'Save as'). The task can now be saved with the desired name. Once the template has been saved as a new task, make sure that the new task is open and start working from there.





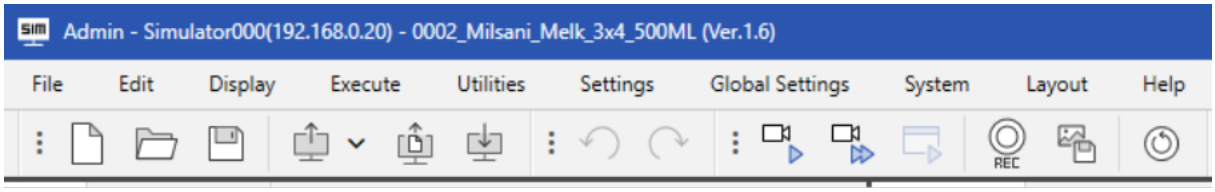
Step 7: Load samples into the system

The next step is to load the samples to teach. This can be done by using the 'get new box' functionality from the PLC maintenance panel (see Section 13 of the user manual).



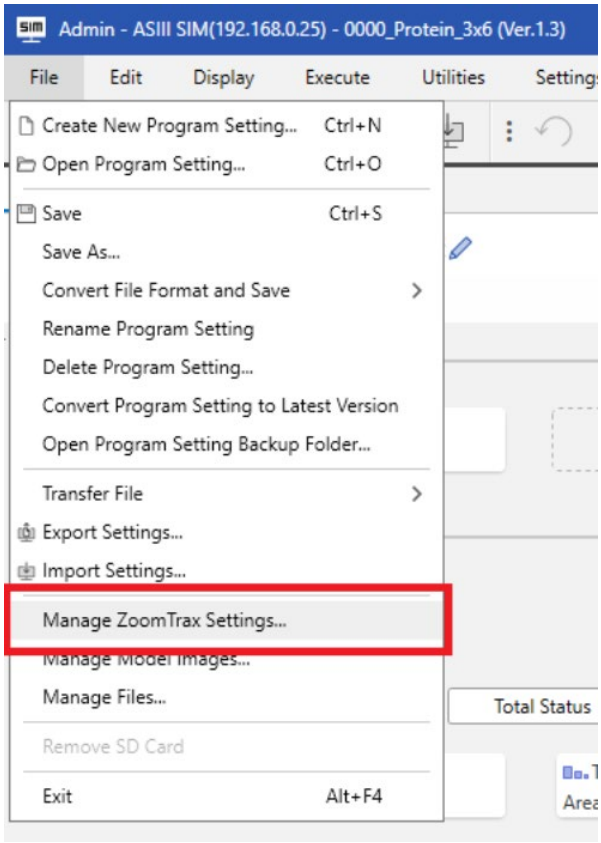
Step 8: Trigger the camera

Once the samples are loaded into the system, the camera can be activated to capture an image of the samples. This can be done by pressing the trigger button.

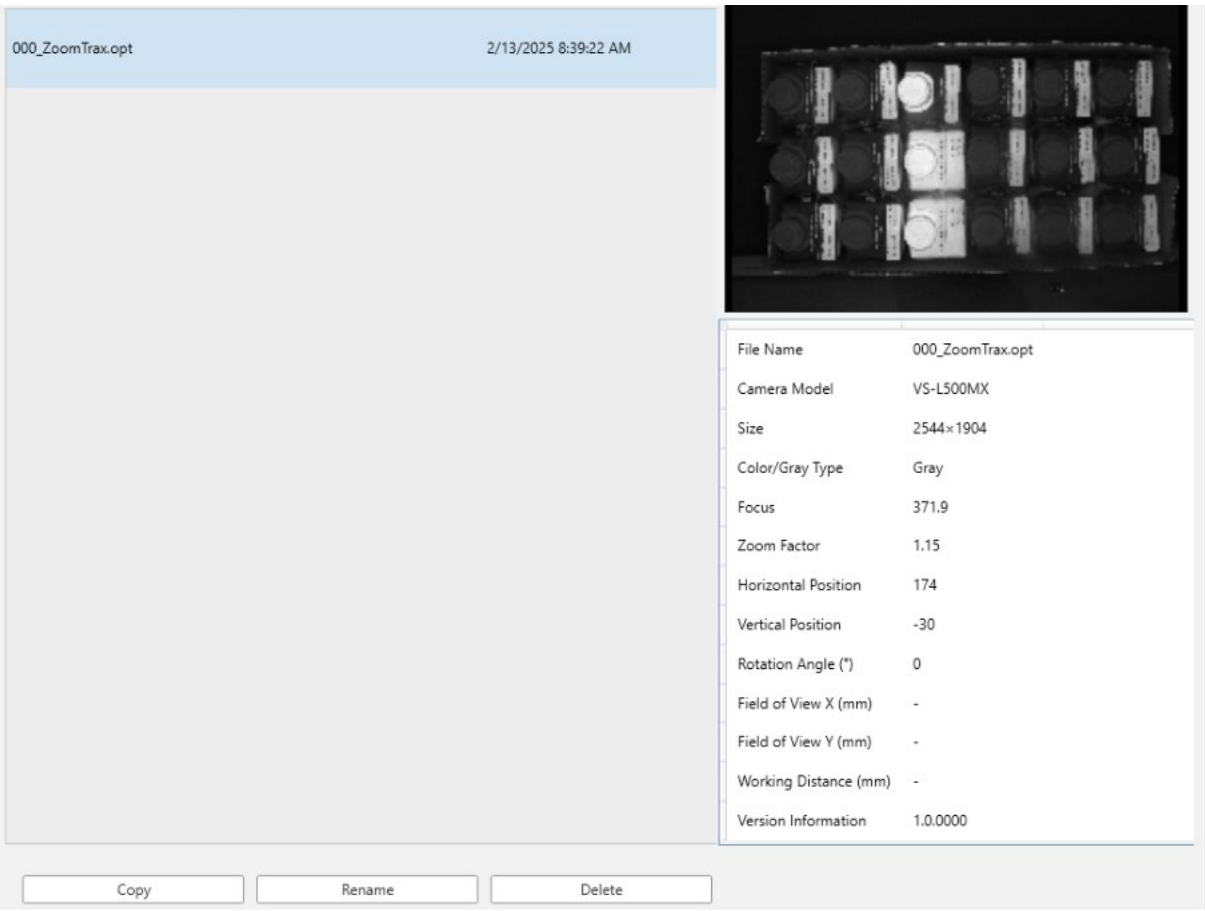


Step 9: Create new camera settings

To ensure that the camera is focused on the products, new camera settings must be made.
These settings can be made at *'File -> Manage ZoomTrax settings'.*

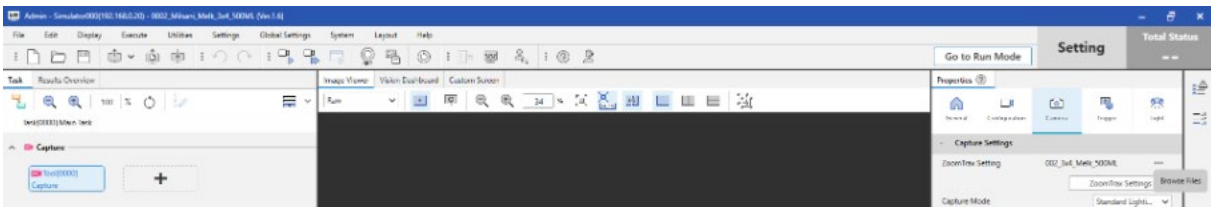


From here, you can copy an existing ZoomTrax settings file. It is most convenient to choose one that is similar to the new product.



If you copy it, you can give a name to the settings. It is useful to use a name for this that corresponds to the product that is being processed.

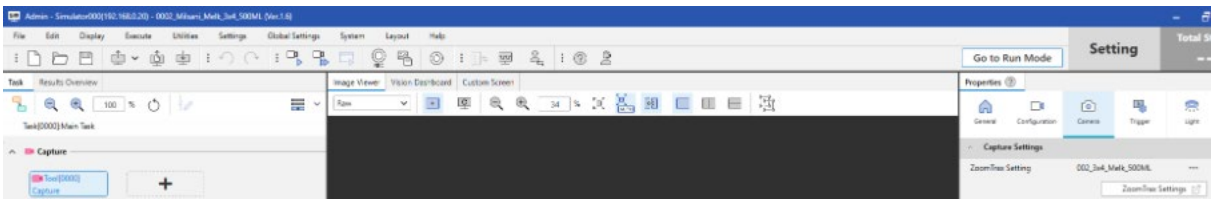
Next, these new settings must be selected for the current camera task. This can be done by navigating to '*Properties -> Camera -> Capture settings -> ZoomTrax settings -> ... -> Browse files'.*



Next, in the pop-up, select the settings file that has just been created.

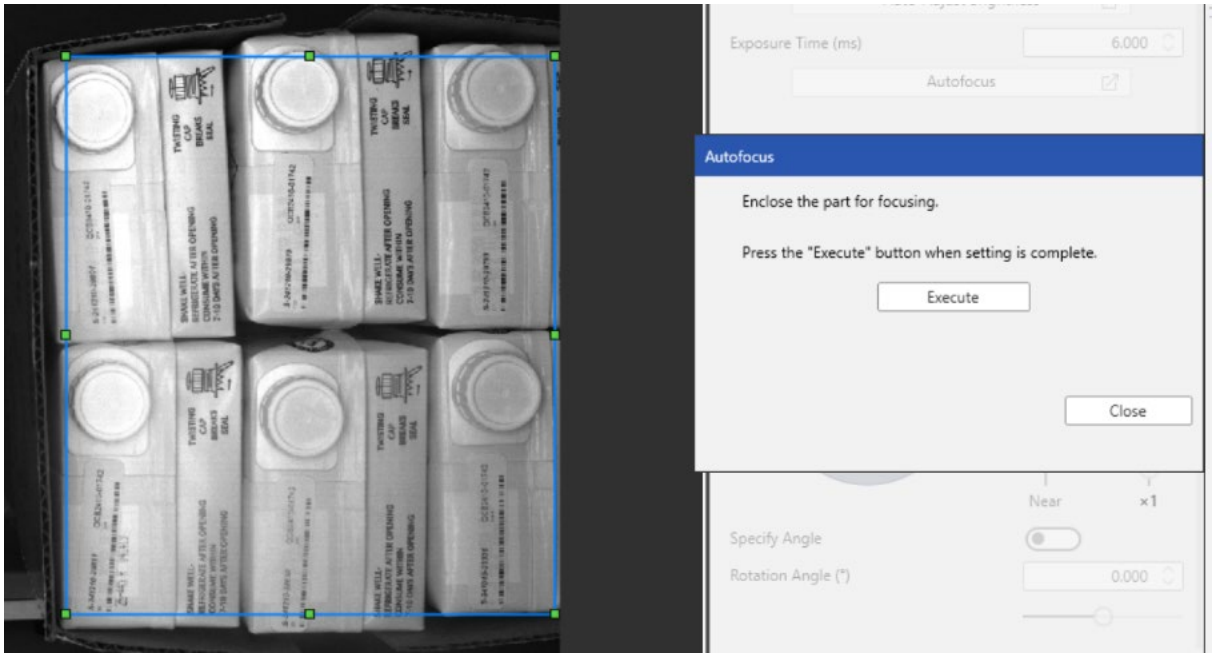
Step 10: Focus on the products

To set the focus of the camera, navigate to *'Properties -> Camera -> Capture settings -> ZoomTraxSetting -> ZoomTrax Settings'.*

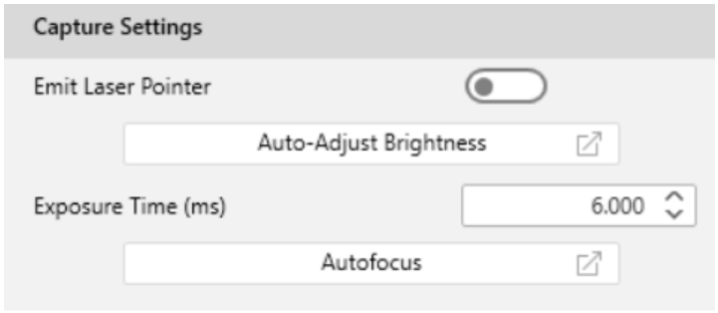


Warning
Create new ZoomTrax settings for each new camera task. Otherwise, the settings of other camera tasks will be overwritten.

On the next screen, you can then click on ‘Autofocus’ to set the focus.



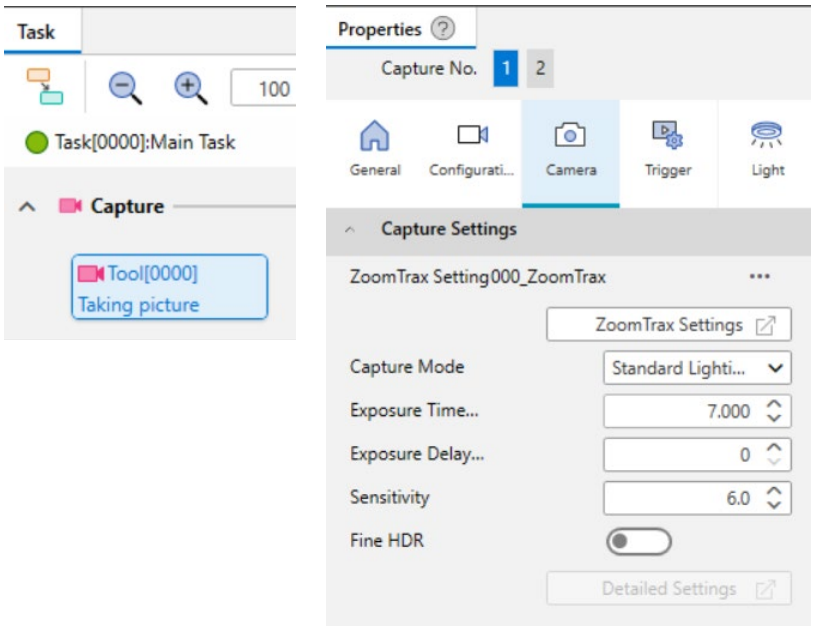
Select the entire box with the detection field (blue square). The camera will focus on this square.



Step 10: Optimize exposure settings

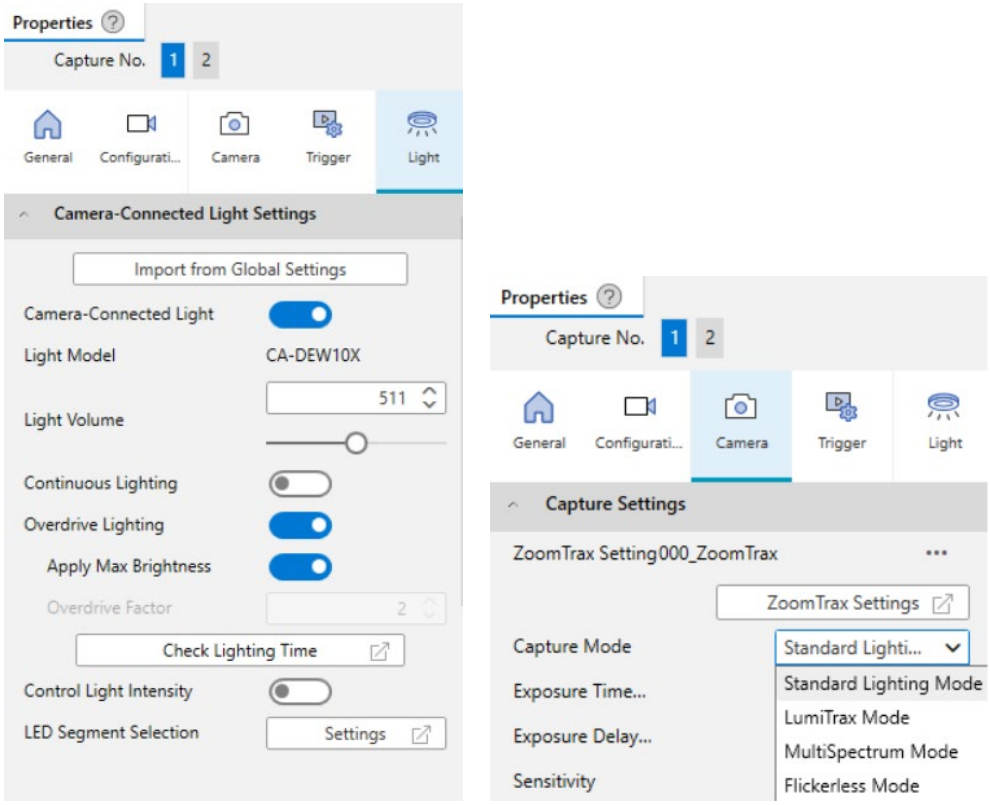
Optimize exposure settings. The image's exposure settings can be configured in the camera task ‘*Capture -> Taking picture*’. Then the exposure settings can be set on the right side of the image under ‘Properties -> Camera -> Capture settings’. The standard exposure time is 7, and the standard sensitivity is 6. Lowering the exposure value will result in a darker image, while increasing the exposure value will result in a brighter image. Choose a value that results in an image where all samples are visible and there is enough contrast to detect patterns on all samples.

If the exposure value is changed, press the trigger button ( ) to capture a new image with the camera.



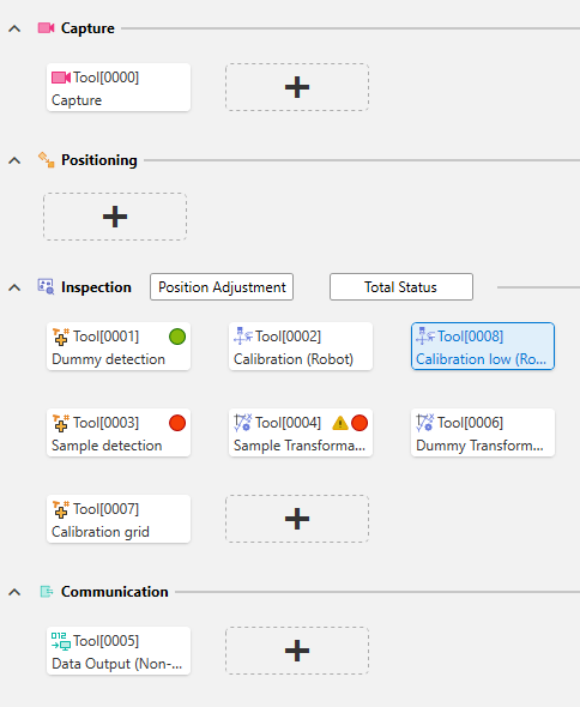
Step 11: Set up light control (optional)

If a sample has a lot of reflection and the internal camera lights are negatively affecting it, the camera's internal lights can be turned off in the light control settings. In addition, additional exposure settings are available under '*Properties -> Light -> Camera-Connected Light settings*'. Here, the amount of light (Light volume) can be adjusted. Certain parts of the flash can also be turned off via 'LED Segment Selection'.

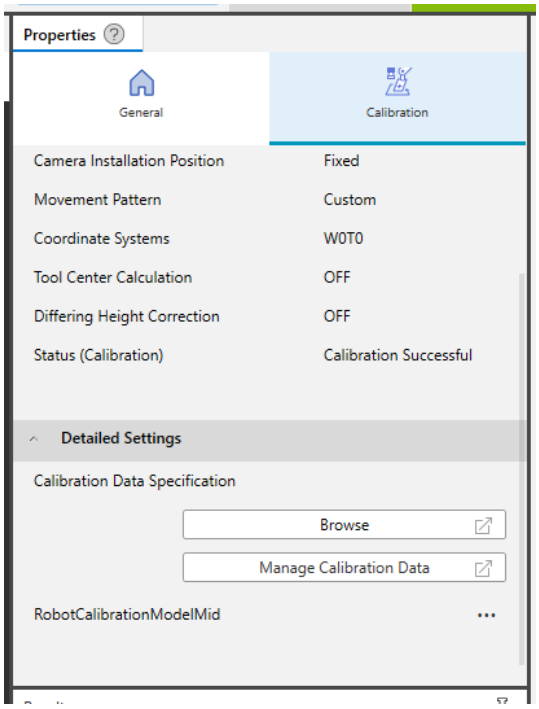


Step 12: Set Calibration

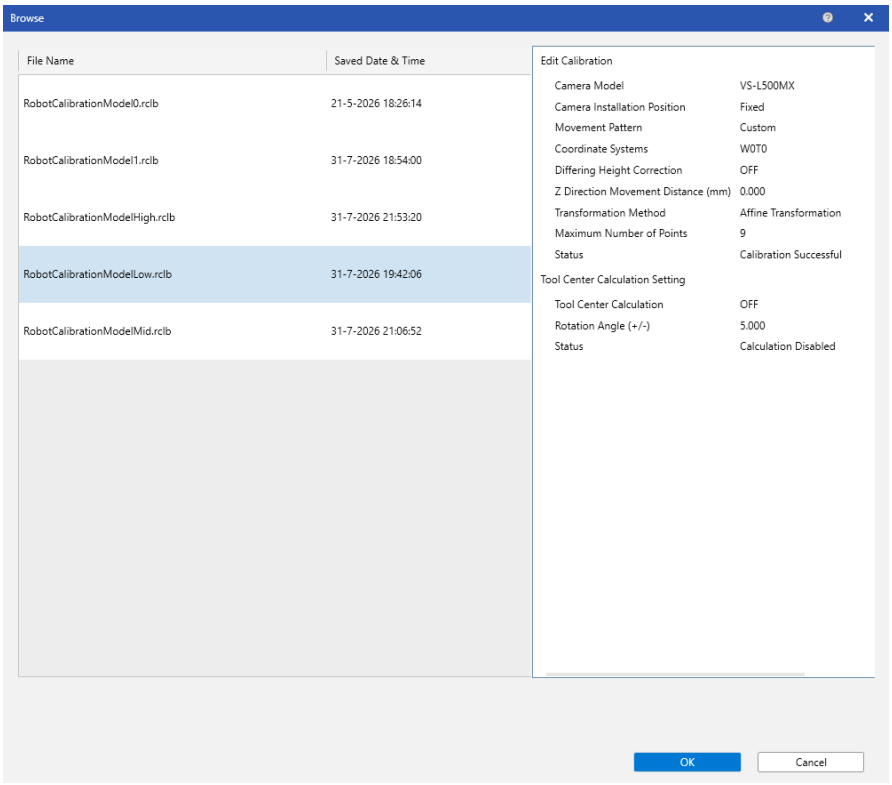
For the AutoSampler DUO, there are three calibration modes for the camera. These modes compensate for the different heights of the boxes. The three calibration options are: “Calibration Low” for low boxes, “Calibration Mid” for medium-height boxes, and “Calibration High” for tall boxes. To change the calibration mode to the correct setting corresponding to the box height, follow the steps below. Open the “Calibration (Robot)” camera task by clicking on the task on the left side of the screen.



Select the calibration tab in the properties window.



Click on ‘Browse’ under the ‘Detailed Settings’. The following window will pop up.



In this window, select the calibration mode to use for this product. Click on the ‘Ok’ button to confirm the selected calibration.

Step 13: Detect pattern(s)

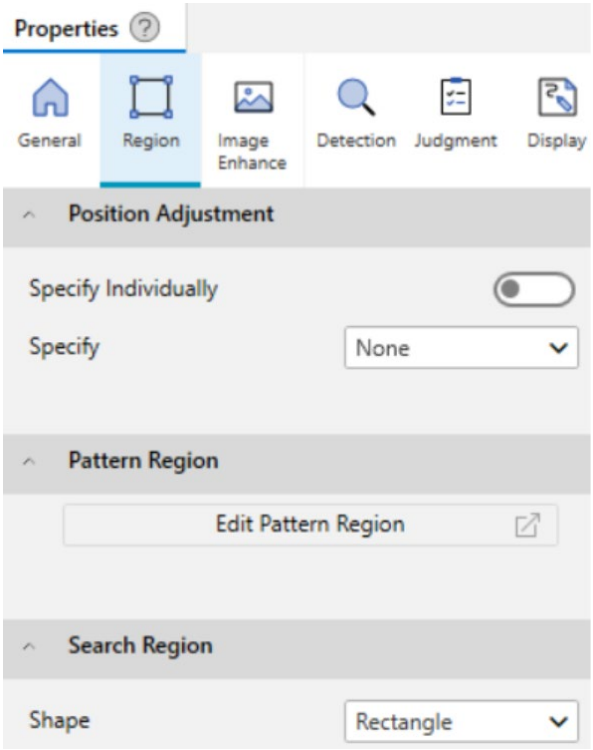
The following steps (12.1 to 12.2) describe how to teach a sample pattern to the camera.

Step 13.1: Set Pattern Area

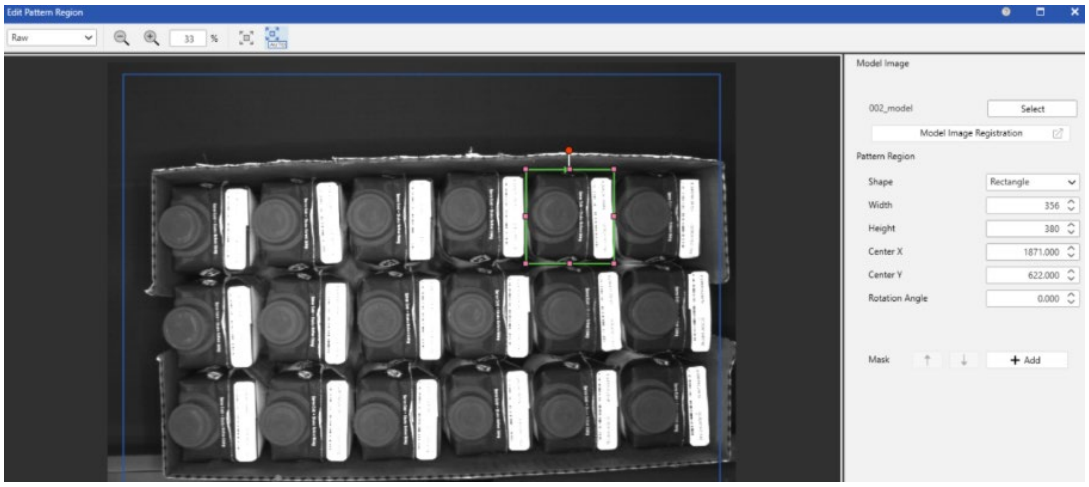
Open the ‘Sample detection’ or the ‘ShapeTrax3A’ camera task by clicking on the task on the left side of the image.

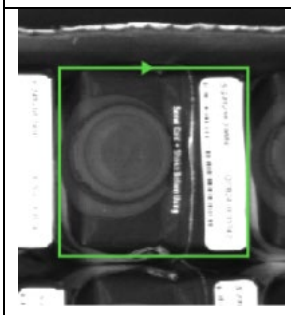
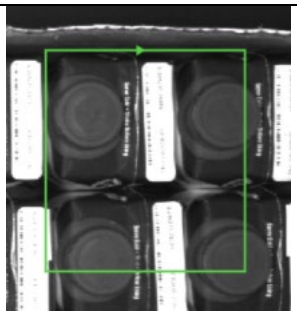
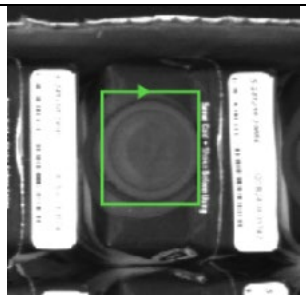


To set a pattern, the region view must be opened. This can be found at '*Properties -> Region -> Pattern region'.*



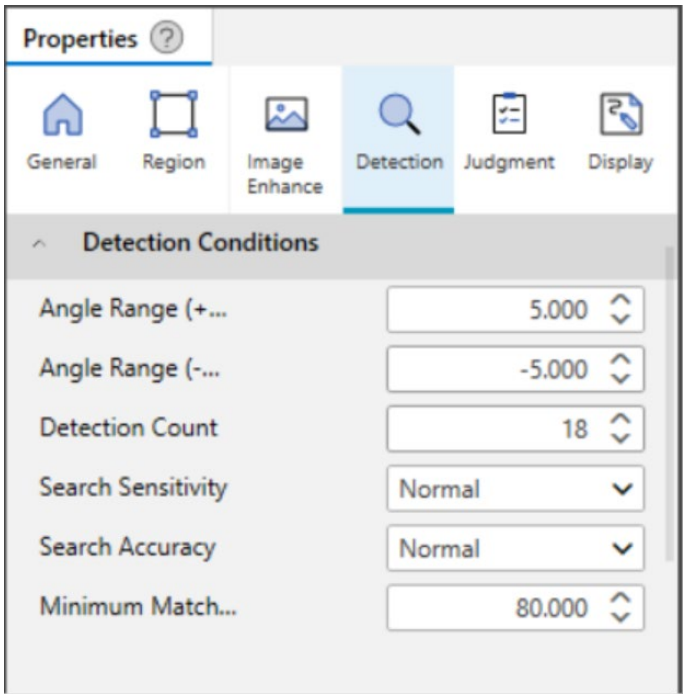
Then a region can be set. This region indicates the pattern that the camera task is looking for. Make sure that this detection includes no more than 1 product. The detection shape can be adapted to the sample shape. The more accurate the shape, the more accurate the detection will become.



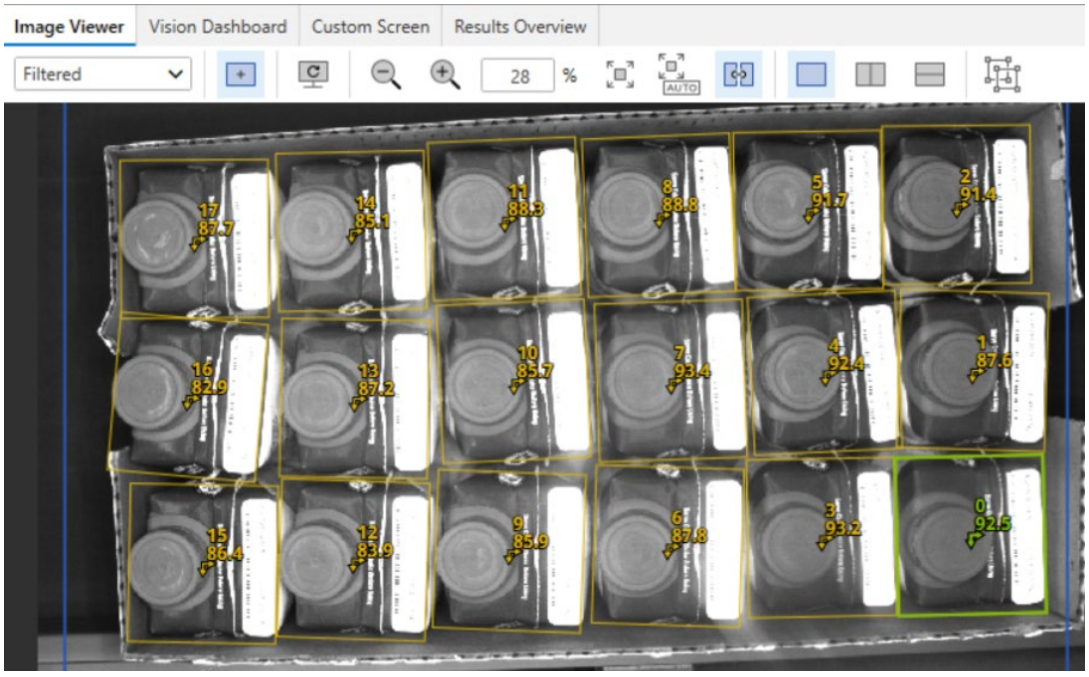
Correct detection region	*Incorrect (too big)*	*Incorrect (no margin)*
		

Then, under *'Properties -> Detection',* a number of settings can be adjusted to affect the task's results.

- **Angle range (+/-):** The angle range in which the detection should occur. It is recommended to keep this angle small so that rotated products are also detected.
- **Detection count:** The number of products that are expected. This is the number of products that are expected in a full box.
- **Minimum match:** The percentage that must match between the detection and the taught-in product. The higher this number is, the better the detections should be. However, this can lead to the rejection of good products. If this number is too low, it can lead to invalid products being approved. It is recommended to keep this around 80%.

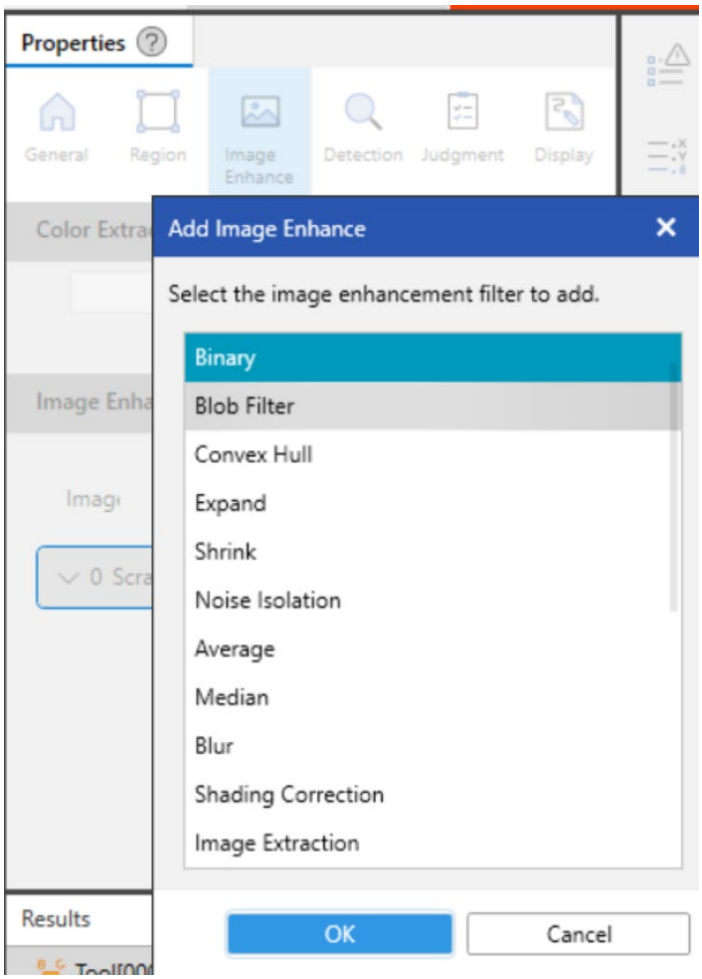


When everything is set up, a photo can be taken with the trigger button. If the camera task is selected, the result can be viewed in the 'image viewer'. All products should have been found here. All found products are selected by a square around them with a detection number. This numbering runs from the bottom right to the top left.

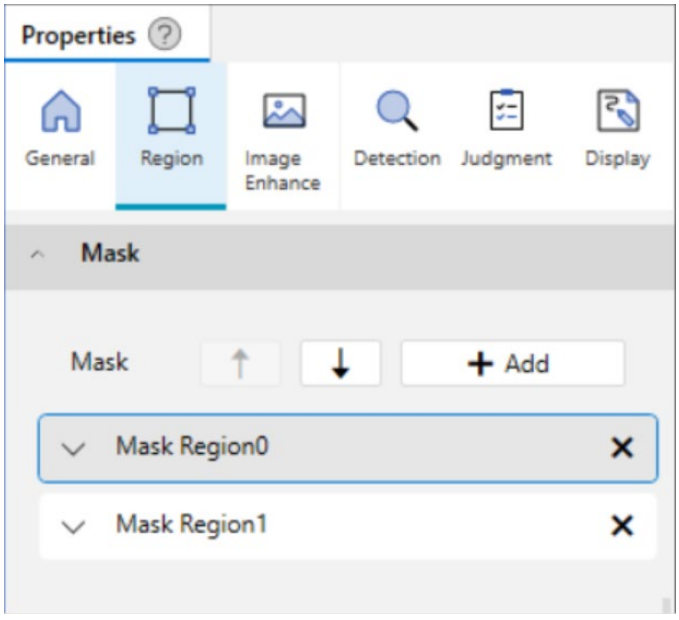


Step 13.1.1: Filter Camera

If it is difficult to achieve a good detection, you can choose to add filters to the photos. This is in '*Properties -> image enhance -> add image enhance'.* It will need to be examined at your discretion to determine whether there is a suitable filter.



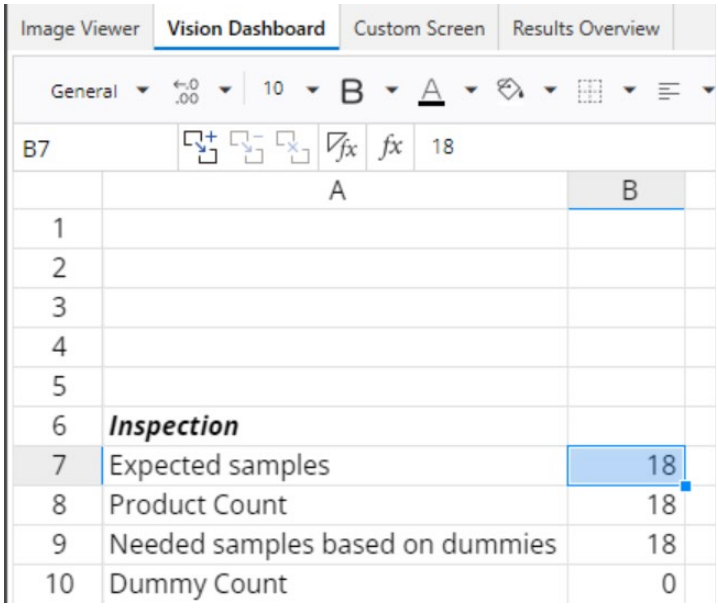
In addition, you can choose to ignore certain parts of the photo for camera detections. This can be done at '*Properties -> Region -> Mask'.* Make sure the masks are positioned in such a way that twisted products cannot be detected.





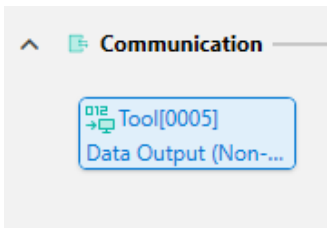
Step 14: Result processing

To ensure that Xperimate receives the correct results, some settings need to be set in the 'Vision Dashboard'. In cell "A2", the expected number of products must be set. This is the maximum number of products in a box. The other cells around this are already set by default. These are used to communicate with Xperimate.

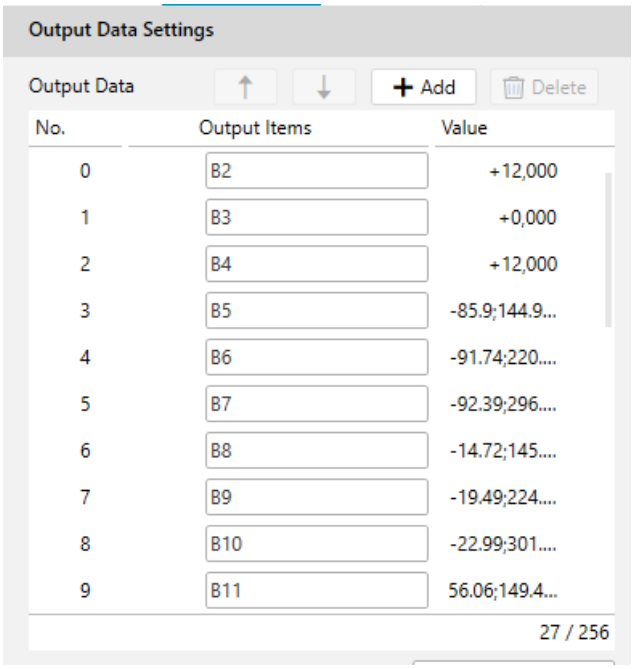


	A	B
1		
2		
3		
4		
5		
6	***Inspection***	
7	Expected samples	18
8	Product Count	18
9	Needed samples based on dummies	18
10	Dummy Count	0

To ensure that Xperimate receives this data, the "Data Output" task must be checked.



This is done at '*Properties -> Output Data -> Output data settings'.* All output data can be checked here. The output item cell numbers need to correspond with the cells in the vision dashboard.



	A	B	C	D	E
1		**Output data**			
2	**Expected**	12			
3	**Dummy Count**	0.00			
4	**Sample Count**	12.00			**Output data**
5	Samples	-85.9;144.93;-175.74		Dummy's	0;0
6		-91.74;220.78;-176.57			0;0
7		-92.39;296.23;-177.77			0;0
8		-14.72;145.8;-176.11			0;0
9		-19.49;224.92;-177.05			0;0
10		-22.99;301.55;-177			0;0
11		56.06;149.47;-177.12			0;0
12		53.89;226.74;-176.91			0;0
13		47.4;303.61;-176.87			0;0
14		125.67;154.11;-177.2			0;0
15		133.04;228.36;-177.5			0;0
16		119.46;302.57;-176.42			0;0
17					

These values will then also appear in the 'Output data settings'.

Warning
Make sure the first 3 results are always on B2, B3 and B4. If these are changed, Xperimate will receive incorrect information.

Step 15: Teaching dummy detection pattern

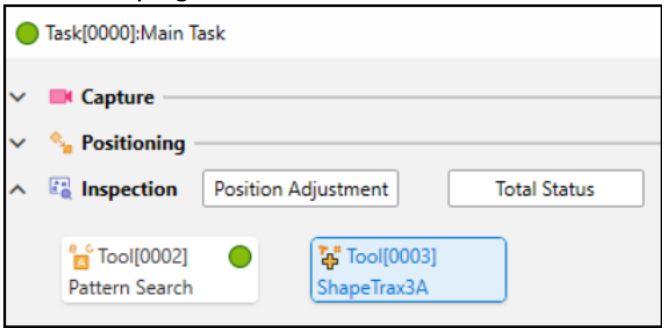
Move the previous box out of the system using the 'Move out Box' routine in the web interface.



After the box has been moved, place a dummy sticker on one of the samples, preferably somewhere in the middle of the box. Once the dummy sticker is inserted, reload the box and start the 'Move Box in' routine. The box with the dummy sticker is loaded into the system.

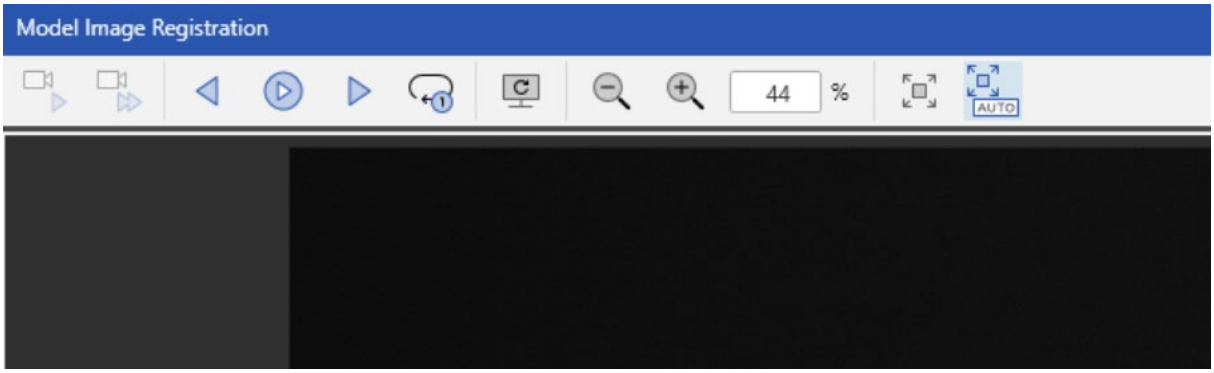


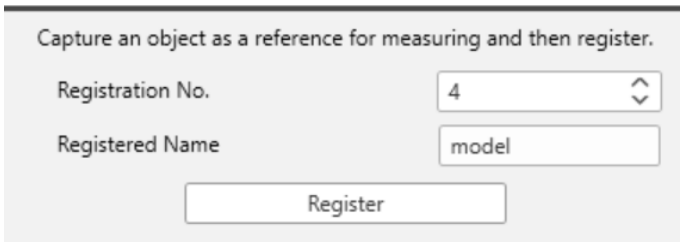
Click on the Dummy detection tool. This tool should automatically detect the dummy sticker. The detection is indicated by a green circle.



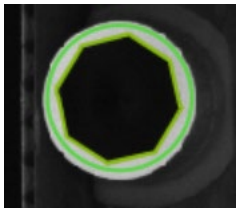


If this circle is displayed correctly on all dummies present, the setup is done. If this is not the case, this detection can be adjusted by *going into* 'Properties -> Region -> Pattern region -> Edit pattern region'.
A new photo can be registered here. This is done via 'Model image registration'.
If you click on 'Trigger' here, a photo of the current box will be displayed. Then click on 'Register'.





The photo just taken is now shown. Make sure the detection circle falls exactly over the dummy sticker.



Step 16: Test detection with multiple boxes

Before saving the job and returning the camera to run mode, it is recommended to test the new job with other sample types to ensure these samples are not detected by the job. Otherwise, it may result in damage to the system when a wrong barcode is scanned. To test the camera task with other samples, use the 'Get New Box' routine from the PLC maintenance panel (see Section 13 of the user manual) for inserting new boxes.



Warning
Make sure the robot is homed before starting the 'Get New Box' routine.

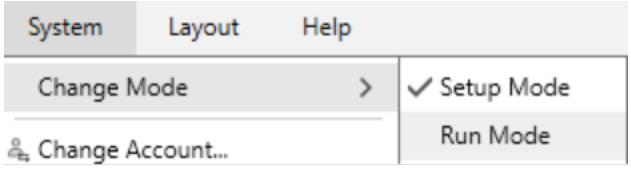
Step 17: Save

If the detection is correct and the task is completed, the created task can be saved. Saving the task can be done by clicking on the save symbol. Make sure the correct job is open when saving.



Step 18: Bring camera online

If the detection is correct and the task is complete, the camera can be returned to run mode. This is done via '*System -> Change mode -> Run Mode'.*



14. Errors and Warnings

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

1. Warning
A warning is indicated by a blinking yellow light, but it does not stop the system. The AutoSampler DUO continues to run if the warning does not prevent it from running. 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 DUO's current run. Error messages are logged by the alarm manager and must be acknowledged before the AutoSampler DUO 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 causes the system to pause. A pop-up will indicate the steps the operator needs to take to resolve 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) Remove the plates that contain the sample from the system:
    a. Open the doors and take the plates out.
3) Refill the system with new plates:
    a. Scan the barcodes of the plates and select the protocol on the HMI.
    b. Place the plates correctly in the corresponding position on the robot deck.
4) Initialize the system:
    a. Close the door and press the lock button on the HMI or use the physical button on the machine.
    b. Press the reset button on the machine.
    c. Press the "initialize" button to initialize the system and prepare it for the next operation.
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 re-register:
        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, initiate the "sampling routine" to continue with the regular processing.

If errors keep recurring after following the steps to resolve and performing a complete restart of the system, please contact support.

14.1 General Errors

General errors are those 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 (!)	• Acknowledge in alarm manager • Wait for the air pressure to improve (max 2.5 min) • Initialize the system • If the message still occurs, check the air supply
Import file not found	Error	• Acknowledge in alarm manager • Check if import file is available and in correct folder
Box not in import file	Warning	• Box is automatically outfed by the system without processing • Check import file for box; if necessary, generate new import file
Box output blocked	Warning	• Remove box manually from output • Press 'OK' in pop-up • System continues
Box status invalid, moving box out <Barcode> Box status: <Status>	Warning	• Box status invalid for processing • Box automatically outfed by the system without processing
Connection to box barcode scanner failed	Error	• Acknowledge in alarm manager • Make sure AutoID Network navigator is not running • Retry starting the run • If problem persists, restart system
Connection to Vision camera failed	Error	• Acknowledge in alarm manager • Make sure that the vision camera is in 'Run' mode • Retry starting the run • If problem persists, restart system
Door(s) open	Error (!)	• Acknowledge in alarm manager • Close and lock all doors • Press blue 'Reset' button • Initialize system
Dummies detected. Number of dummies <n>. Press 'Ok' to sample the box or press 'Cancel' to move the box out.	Warning	• Dummies detected by camera • Pressing 'Ok' in the pop-up will sample the box and skip the number of displayed dummies • Pressing Cancel moves the box out without sampling
Emergency button pressed	Error (!)	• Acknowledge in alarm manager • Unpress emergency button(s) • Press blue "Reset" button • Initialize system
Error. <Liquid> volume, less than *<Error Level>* ul available	Error	• Acknowledge in alarm manager • Refill liquid reservoirs • Reset liquid reservoirs • Prime pumps if necessary • Restart run

Error Message	Type	Steps to Resolve
Error <Pump> (<Error Code>)	Error (!)	• Acknowledge in alarm manager • Resolve pump error (e.g., Unclog needle) • Initialize system • Retry starting the run • If problem persists, restart system
Error loading box. If box is stuck at infeed, FIRST remove the box. Press 'Ok' after the box is removed	Warning	• Loading box failed, remove the box from input position • Press 'OK' after removing the box • System retries loading the box • First box will not be processed and needs to be inserted manually at input again
Error while adding samples to file	Warning	• Samples cannot be added to the file • Check if file exists • Check if file is not open • Re-run the unprocessed boxes if required
Export file creation failed	Error	• Acknowledge in alarm manager • Check if export folder is available; if not, create folder • Check export folder; if file already exists, remove existing file from location • Retry starting the run • If problem persists, restart system
No recipe loaded, moving box out <Barcode>	Warning	• Box is automatically outfed 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	• Detected samples are not equal to the number of expected samples • Check if the amount of <ExpectedSamples> is correct and in the box/crate • Check if all products are in the correct position • Check if correct products are loaded • When all the above are correct, user can press 'Ok' to sample the number 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	• 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 speeds cannot be set using default speeds	Warning	• Unknown/invalid pipetting speed settings in recipe; default values will be used • Correct recipe values

Error Message	Type	Steps to Resolve
Product not matching recipe, moving box out	Warning	• Box is automatically outfed 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.)
Unable to connect to <Pump>	Error (!)	• Acknowledge in alarm manager • Check and correct pump COM port settings • If problem persists, restart system
Unable to copy file <Filename>	Warning	• 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	• 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
Waste container full, place empty waste container and press ok to continue	Warning	• Remove filled waste container from system and empty • Replace with empty waste container • Press 'Ok' to continue the run
Warning. <Liquid> volume, less than <*WarningLevel*> µL available	Warning	• Fill liquid to maximum level • Press reset button in the HMI to reset liquid level
<Location> not initialized	Error (!)	• Acknowledge in alarm manager • Check error location for damage, blocked movement, etc. • Retry initialization • If problem persists, restart system

14.2 PLC Errors

PLC errors are those 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 (!)	• 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 (!)	• Acknowledge in alarm manager • Wait 1 minute for EtherCAT communication to start • Initialize the system • If problem persists, restart system and initialize again

Error Message	Type	Steps to Resolve
E003: Air pressure not available.	Error (!)	• Acknowledge in alarm manager • Check the air pressure • Initialize the system • If the message still occurs, check the air supply
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> E110: Max position difference between axis exceeded <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 (!)	• Acknowledge in alarm manager • Initialize the system • If problem persists, check fuses • Restart system and initialize again
E500: Timeout retrieving box at <location>	Error (!)	• Acknowledge in alarm manager • Remove box from system • Initialize system • Place box at input and restart run

Error Message	Type	Steps to Resolve
E507: Box output blocked	Error (!)	• Remove box manually from output • Press 'OK' in pop-up • System continues
E508: Box already present in system.	Error (!)	• Acknowledge in alarm manager • Initialize the system • Move the box out • If problem persists, check fuses • Restart system and initialize again
E509: No box detected at input	Error (!)	• Acknowledge in alarm manager • Remove box from input • Initialize system • Place box at input and restart run
E652: No box in system	Error (!)	• Acknowledge in alarm manager • Initialize the system • If problem persists, check fuses • Restart system and initialize again
E653: Time out moving box out	Error (!)	• Acknowledge in alarm manager • Remove box from system • Initialize system • Place box at input and restart run

14.3 Error situations

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

Error Situation	Type	Steps to Resolve
Error during initialization (repeating error)	Error	• Acknowledge the alarm • Retry initialization, max 3 times. • If problem persists, check fuses
PC/HMI screen not starting when power is switched on	Error	• Check connection cables between HMI and PC • Check the fuses in the electrical cabinets
Sound of the machine is increased	Failure (observed only)	• Stop the run • Move plates and boxes out of the system • Shut down the AutoSampler • Restart the AutoSampler after 15 seconds • Initialize the AutoSampler and restart run

Error Situation	Type	Steps to Resolve
No samples in one or more wells	Failure (observed only)	• Stop the run • If air can be seen inside the tubing, the system should be primed • In case the needle is clogged, try unclogging the needle using the flush method (multiple times if required) • If the needle stays clogged, replace the needle with 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, trim a small amount from the end of the needle to secure the tubing more firmly.
Needle broken	Failure (observed only)	• Replace the needle as described in this manual
Tubing leaking	Failure (observed only)	• Check connection, clean or replace as described in this manual
Syringe leaking	Failure (observed only)	• Inspect the pump and clean or replace as described in this manual

15. Lockout/Tagout

When the AutoSampler DUO needs to be rendered inoperable, follow the procedure below.



Warning
Consult the user manual and be careful

Reserved for certified personnel
Actions or work to be carried out by certified personnel only.

The procedure outlined in this Section establishes the minimum requirements for the lockout or tagout of energy-isolating devices. Lockout is the preferred method of isolating the AutoSampler DUO from energy sources.

It shall be used to ensure that the AutoSampler DUO 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 prevent damage to the AutoSampler DUO or the environment.

15.1 Definitions

Lab operator: The lab operator works with the AutoSampler DUO and in the area where servicing or maintenance operations on the AutoSampler are performed. The lab operator does not perform servicing or maintenance on the AutoSampler DUO 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 they perform servicing or maintenance functions.

Authorized associate: This is an associate who performs servicing or maintenance on AutoSampler DUO. This associate implements lockout/tagout procedures to ensure their 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 in accordance with an established procedure, ensuring that the AutoSampler DUO cannot be energized until the lock is removed by the person who placed it.

Lockout device: A device that uses a positive means, such as a lock, to hold an energy-isolating device in a safe position and prevent energizing the AutoSampler DUO.

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 shut down the AutoSampler DUO and that the AutoSampler DUO must not be operated until the tagout device is removed by the associate who placed it there.

Tagout device: This is any prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy-isolating device according to established procedure. The tag indicates that the AutoSampler DUO to which it is attached must not be operated until the tagout device is removed, in accordance with 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.

15.2 Lockout Rules

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 DUO 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 DUO.
- 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 it is necessary 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.

15.3 Sequence to Lockout or Tagout



Reserved for certified personnel
Actions or work to be carried out by certified personnel only

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

No	AutoSampler DUO ID	Location	Energy Source
1	AutoSampler	Main switch cabinet A	Electricity (230V)
2	AutoSampler	Main pneumatic service unit	Compressed air

2. Verify the written energy control (shutdown/startup) procedure of the AutoSampler DUO, 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 DUO or equipment utilizes and shall understand the hazards thereof.
4. If the AutoSampler DUO is operating, shut it down by the written energy control (shutdown) procedure described in the manual of the AutoSampler DUO.
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.

15.4 Sequence to Restore the AutoSampler DUO to Normal Production Operations

Reserved for certified personnel
Actions or work to be carried out by certified personnel only

After servicing and/or maintenance are completed and the AutoSampler DUO is ready for normal operation, check the area around the AutoSampler DUO to ensure no one is exposed.

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

16. Patch Management

As a rule, Hygiena will not provide any patches for the AutoSampler DUO. If the customer deems a patch necessary, that should be discussed with Synchron. During this discussion, a risk analysis should be done. If a patch is agreed upon, 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 prepared detailing all changes and how they were verified. Patches can be divided into two parts: Xperimate- and HMI- patches.

16.1 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:\Synchron\Xperimate*.
When a backup is made, the required patches can be installed. When the installation is complete, the AutoSampler DUO should be verified to ensure that all components are working correctly. Changes in Xperimate will affect the behavior of the AutoSampler DUO. During the verification, extra attention should be paid to the specific behavioral changes.
Xperimate is compatible with Windows 10/11 Professional.

16.2 HMI

Before any patch can be applied to the HMI, a backup must be made. This backup must include the entire Xperimate folder, including all its subfolders, along with the previous version of the HMI software. The HMI folder can be found at *C:\Synchron\HMI*.

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

Changes to the HMI will mostly be visual, but may also include functional changes to the handling of alarms, users, settings, etc.
HMI is compatible with Windows 10/11 Professional.

16.3 Windows Updates

Automatic Windows updates will be disabled on the AutoSampler DUO. 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 in accordance with the customers' IT standards and protocols.

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

16.4 Installing Software

The software installation process for the AutoSampler DUO is simple. A folder will be provided containing all the required files. The files should be placed in the correct locations. The locations where the files must be placed are the following:

- Xperimate:
  - *C:\Synchron\Xperimate*
- HMI:
  - *C:\Synchron\HMI*

Region Settings:

For correct working of the application, the region settings should be configured as follows:
Decimal symbol: ‘,’
Digit grouping symbol: ‘.’

16.5 List of Drivers

To ensure the AutoSampler DUO works correctly, all 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	COM5: Pipetting pumps COM6: Reagent pumps
.Net Runtime 5.0	Xperimate HMI
Edge	Web view of the PLC

17. Spare Parts List

The table below shows the most common spare parts list of the AutoSampler DUO. For a complete spare parts list, delivery times or recommended amounts of spare parts, please contact your Hygiena representative.

ID	Product	Description
MIS4200	Syringe pump	Syringe pump for needles and reagent dispensers
MIS4202	Syringe 1 ml	Syringe pipetting channels
MIS4204	Lock nuts + ferrule (1 set)	Connecting ferrule with lock nuts
MIS4205	Pierce needle	Needle for sampling the product packs
MIS4210	Dummy stickers (100 pc)	Stickers to indicate empty pack positions

18. Tools

The table below lists the tools required for AutoSampler DUO maintenance.



Reserved for certified engineers
Maintenance operations to be carried out only by certified and trained personnel

Tool	Size
Safety Torx	Size 30 (T30H or TR30)

19. Decommissioning and Disposal

Special operations are often necessary to temporarily put installations out of operation. Safety plays a significant role in this. All necessary actions for this are described here, such as precautions and technical measures.

19.1 Disassemble

If disassembly is necessary on-site, it should be done from top to bottom to minimize the risk of falling parts. The AutoSampler DUO contains heavy parts. Disassembly is not necessary for normal commissioning or disposal. Consult your supplier before disassembling the AutoSampler DUO.

19.2 Environment

The user must be informed about the environmental aspects of the product, the correct dosage during use, but also about the materials used that can burden the environment during disposal, the measures the user can take to minimize energy consumption, and the responsible reuse of the product or parts thereof.

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

- Steel and Stainless Steel ST37
- RVS 316 / RVS 304 / 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 DUO is disposed of.

19.3 Disposing

The AutoSampler DUO 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.