

Insights into SETIS™ automation

How to program and control SETIS™ bioreactors?

SETIS™ has its own and customized Control unit.

At the control unit, compressed air is pressure-adjusted, distributed and controlled according to user specifications before reaching the bioreactors. Besides unique functions only available in our software, our SETIS™ specific software is designed to fulfil all possible Temporary Immersion functions.



SETIS™ Control Unit



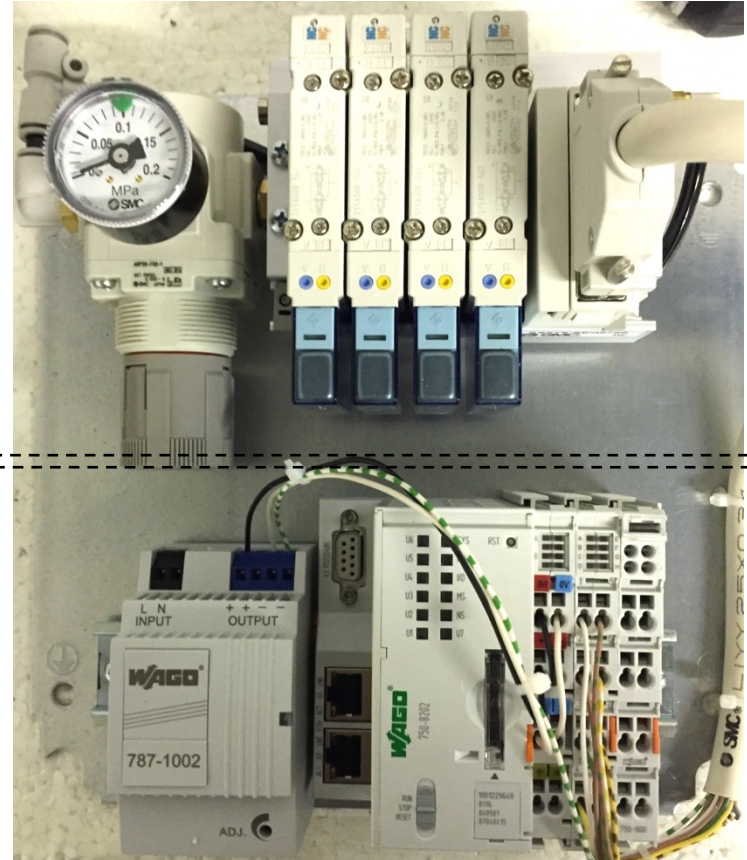
Our control unit is composed of three main elements:

- Program Logic Control (PLC) unit. WAGO, Germany (www.wago.de)
- Pneumatic unit. SMC, Japan (www.smc.eu)
- SETIS™ Software. Vervit bv, Belgium

The unit is extremely compact and dynamic on both the PLC and Pneumatic side. It's based on modular systems, allowing unlimited unit expansions and upgrades.

The Software is designed to adapt to any hardware extension, enabling a safe and simple expansion of your installation.

Pneumatics

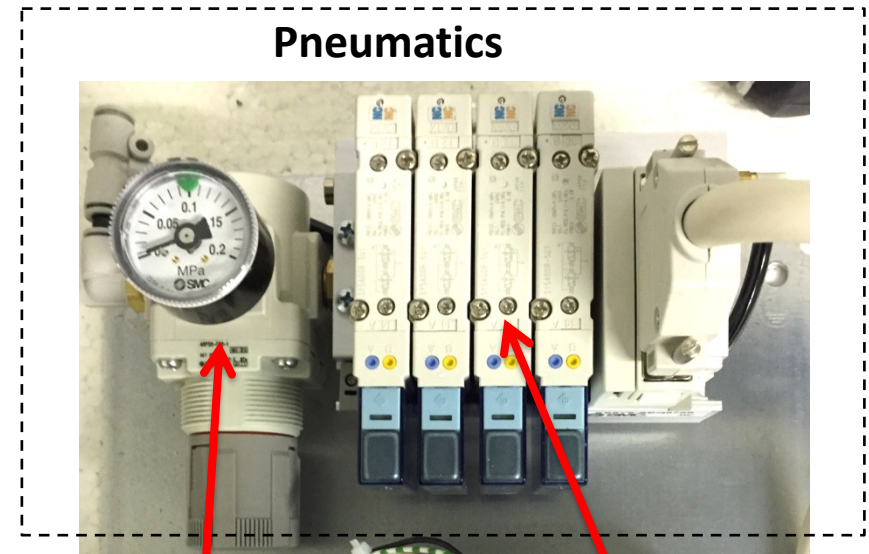


PLC

Pneumatics

The pneumatic side is composed of two main elements:

- Air pressure regulation
- Valves

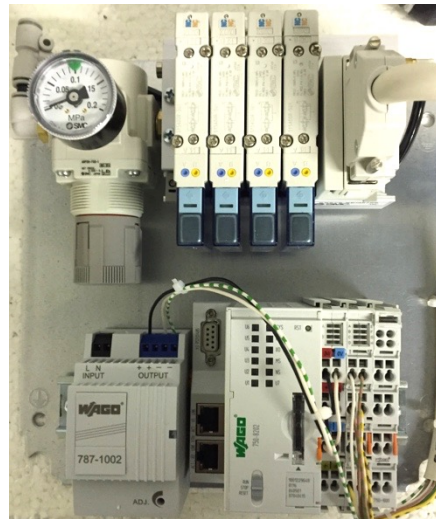


Air pressure regulation

Electro-Valves

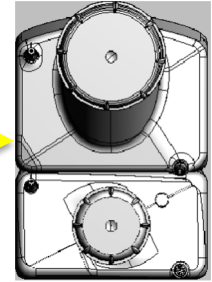
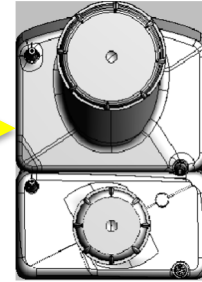
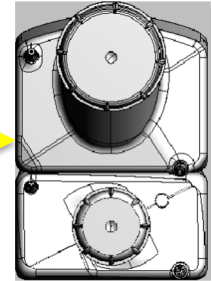
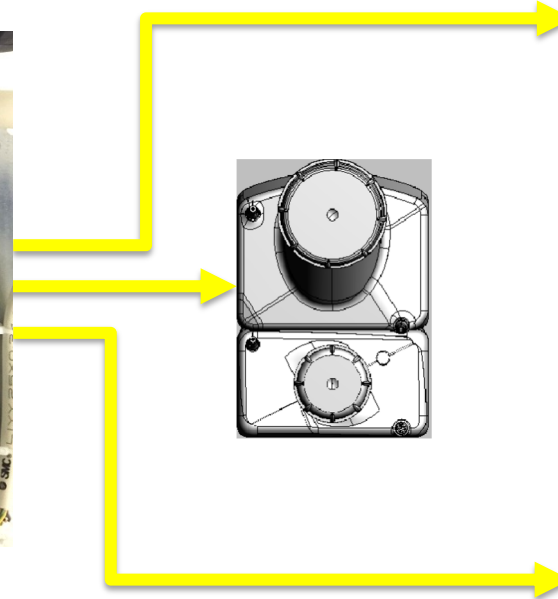
Compressed air is pressure-regulated before being distributed to all valves for later distribution to the bioreactors.

Compressed air



SETIS™ Control unit

SETIS™ bioreactors



Air pressure regulation

Compressed air coming from the compressor usually has a pressure between 3-10BAR. This pressure is highly reduced and adjusted to 0,1-02 BAR, prior entry to the valves, to be used later for both immersion and ventilation functions.

In the SETIS™ control unit, air pressure can be adjusted manually or automatically.

Manual air pressure regulation:

The same air pressure is adjusted manually for all operation functions.

Automatic air pressure regulation:

Air pressure is regulated via the SETIS™ software and can vary for each operation function.



Manual air pressure regulator



Automatic air pressure regulator

Air pressure regulation

Standard installations are delivered with manual pressure regulation. Automatic regulation (optional) can be installed/delivered on request. More info can be found in the following link:

[Automatic pressure regulator](#)

Especially when your unit controls a large number of bioreactors, it's recommended to opt for the automatic regulation to profit from all functions of the SETIS™ software.



**Manual air
pressure regulator**



**Automatic air
pressure regulator**

Valves

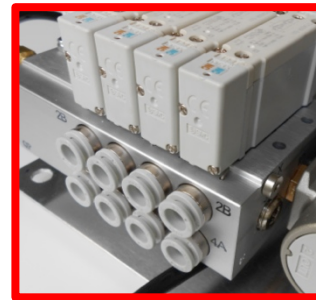
SETIS™ control unit uses 3/2 valves, assembled in a manifold. Very compact and secure.

Each **valve/slide** corresponds to one Control Point (CP - two outlets, one for immersion and one for ventilation). More information about Control Points can be found on p. 21-23.

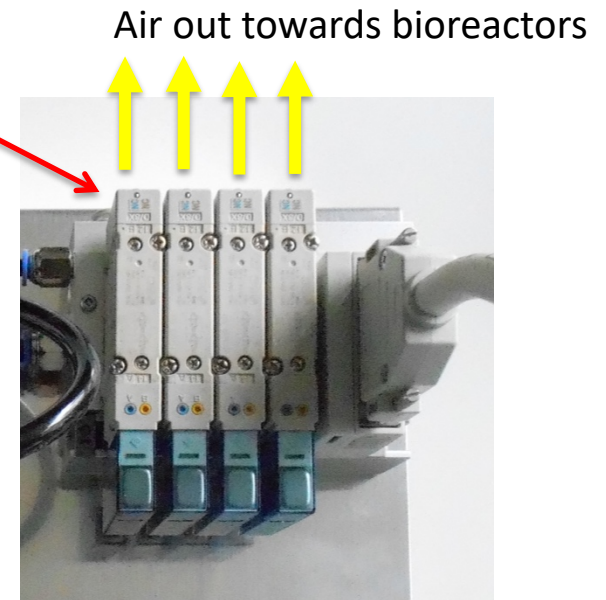
Manifolds are delivered with (minimum) 4 **slides**. Manifolds of 6, 8, 10 and 12 **slides** each, are possible as well.

Valves have been adjusted to SETIS™ bioreactor functions, allowing a maximum of 32 bioreactors per CP.

A higher number of bioreactors per CP can affect the airflow and obstruct an optimal operation of the bioreactors.



Air outlet as push-in connectors for a quick and safe assembly

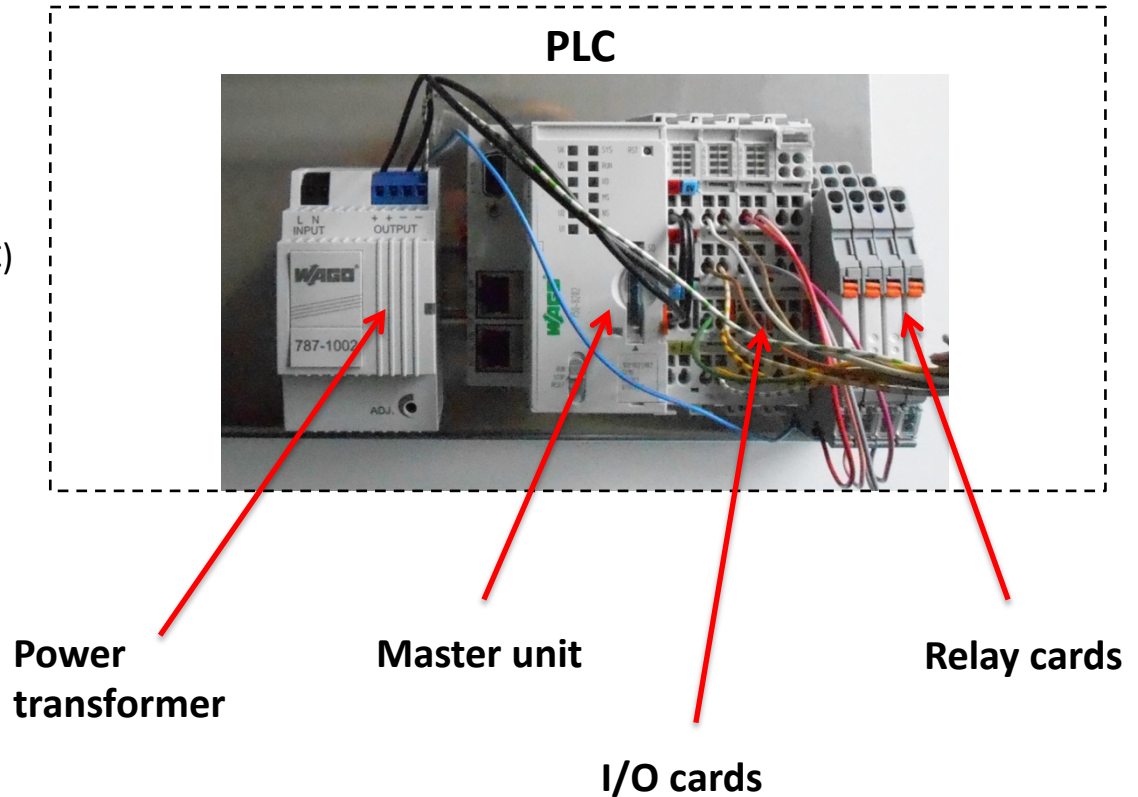


The PLC side

SETIS™ uses PLC to control all functions.

Main components:

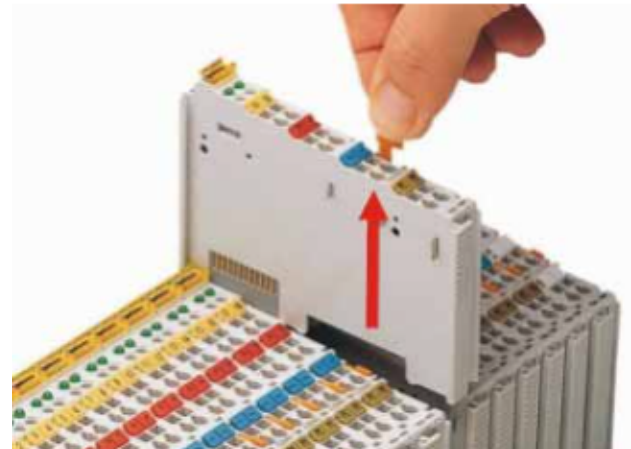
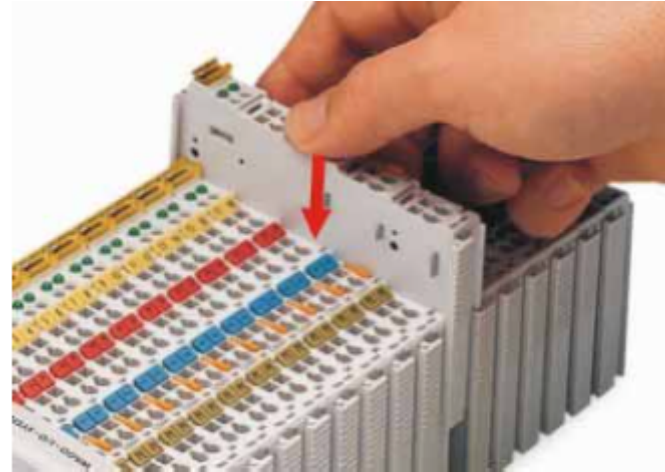
- Power transformer (110-240V to 24VDC)
- Master unit PLC
- Input/output cards
- Relay cards



The PLC side

PLC is very dynamic and flexible, as I/O cards can be added/removed from the installation without affecting the functioning of the software.

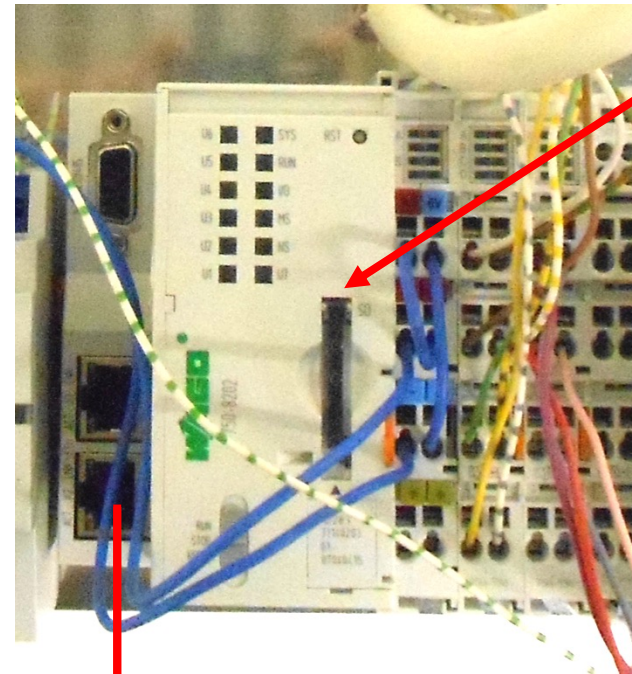
It means the installation can expand anytime according to client's wishes.



The PLC side

The master unit contains the SETIS™ software, which is stored on the SD card. No software installation is required. The software is accessed via a web-browser using the assigned IP address from your network. Read SETIS™ Software User Manual for more information.

Communication with the control unit goes via Wi-Fi or Ethernet, using one of the UTP cable slots.



SD card slot

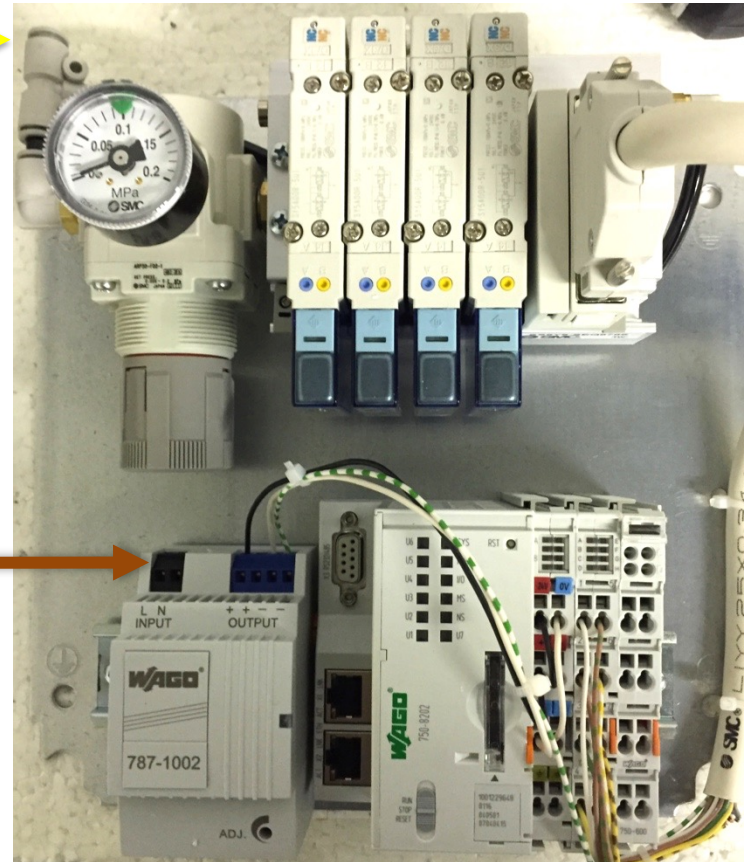
UTP port connected to local network (WI-FI communication)

UTP port connected to PC (Ethernet communication)

The SETIS™ Control unit is delivered 'ready to use'. Only a source of compressed air and electricity are required to start using the unit.

Compressed air
3-10 BAR
Dry & filtered
Use PU tube ø8mm to make this connection

Power supply
110-240V
Use three wires-cable to make this connection, attaching the Ground wire to the enclosure



Generation and handling of compressed air

To produce high quality compressed air, the installation should be composed of the following three elements.

- Air compressor
- Air dryer
- Air filtration

Air compressor



Air dryer



Air filters



Air compressor

Vervit offers high quality compressors to costumers, as part of the SETIS™ platform.

Compressor specifications

- Brand: Atlas-Copco
- Oil-free compressor
- 1,5 HP
- 1,1kW
- Maximum pressure 10 BAR
- Two versions: 1x115V/60Hz
1x220V/50Hz
- Flow @ 7 BAR: 124-143 l/min
- Sound level 65 dB(A)
- Mounted in tank of 50 liters
- Tank internally epoxy-coated
- Electronic timer drain



Air compressor

Where to place the compressor?

In order to produce high quality oil-free compressed air, this compressor should be placed inside.

Place the compressor in a clean, dust free room close to the lab, with a relatively constant temperature all year round. Preferably around 22-28 °C.

Compressed air will be stored in the tank until further use directly into the bioreactors. If tank temperature is very low, the air supplied to the bioreactors / plants will be very cold as well. This could affect plant growth.



When air capacity is not sufficient, an external tank of 120 liters can be coupled to the compressor.

More info on p. 18.

Air dryer and air filters

Compressed air, generated by the compressor, is humid and still contains many particles (contaminants). The air needs to be dried out and all particles need to be removed.

As part of our SETIS™ platform, Vervit offers dryers and sets for microfiltration.

Dryer

- Brand: SMC
- Two models: 1x115V/60Hz
1x220V/50Hz
- Flow capacity 400 l/min

Set of filters

- Brand: SMC
- Sequence of filtration (5µm/0,3µm/0,01µm)



Generation and handling of compressed air

With these elements, clients can profit from high quality compressed air, ideal for all bioreactor operations. Elements should be installed according to this diagram.

It is HIGHLY recommended to request the services of a local technician to set up the installation. Guaranty of the air handling equipment can be **deemed** if the installation is not certified by an expert.

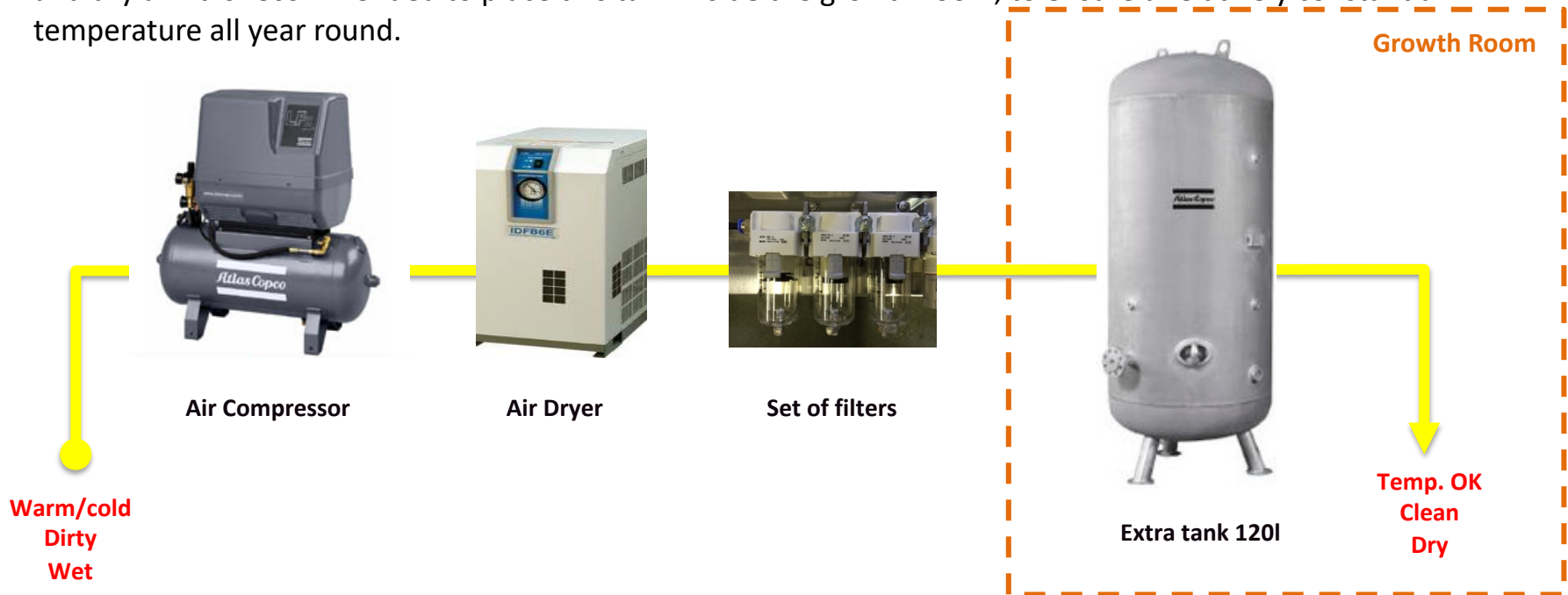


Generation and handling of compressed air

If your installation requires more air capacity, it is recommended to add an extra tank to store more compressed air.

A tank of 120 liters will be sufficient.

As shown in the scheme, the new tank should be connected at the end of the installation, storing only clean and dry air. It is recommended to place this tank inside the growth room, to ensure a relatively constant air temperature all year round.



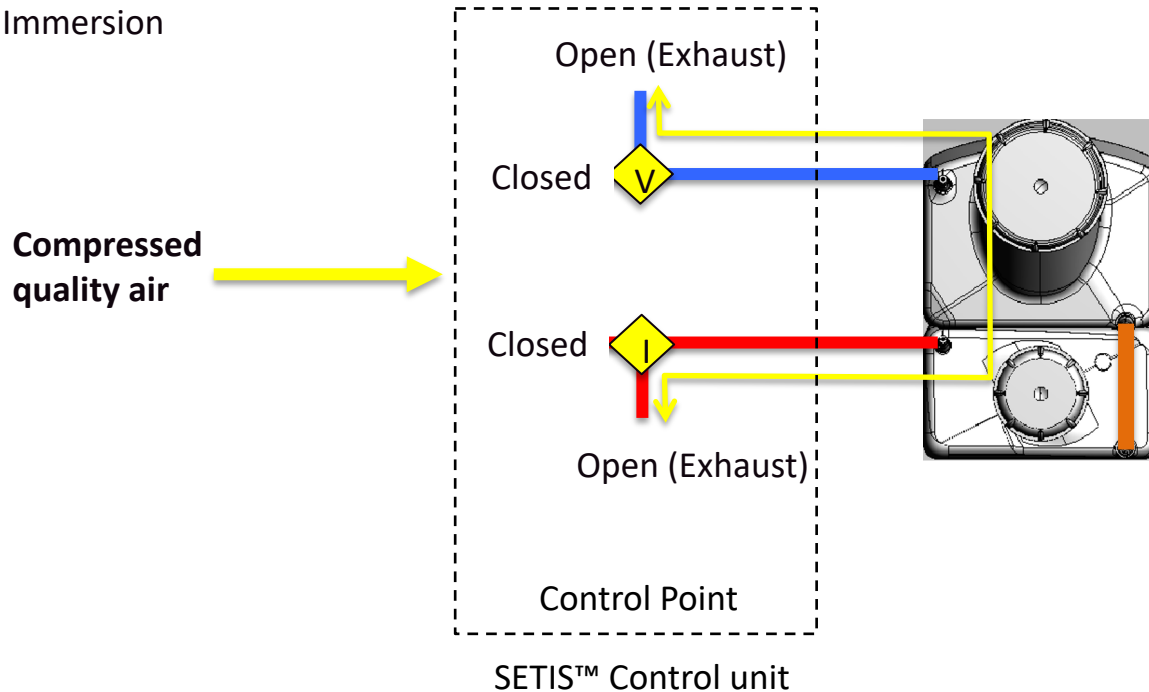
What is a Control Point?

A Control Point (CP) is a compressed air output from the SETIS™ Control unit, which independently controls one or several bioreactors via the SETIS™ Software.

Each CP is composed of two 3/2 electro valves (NC):

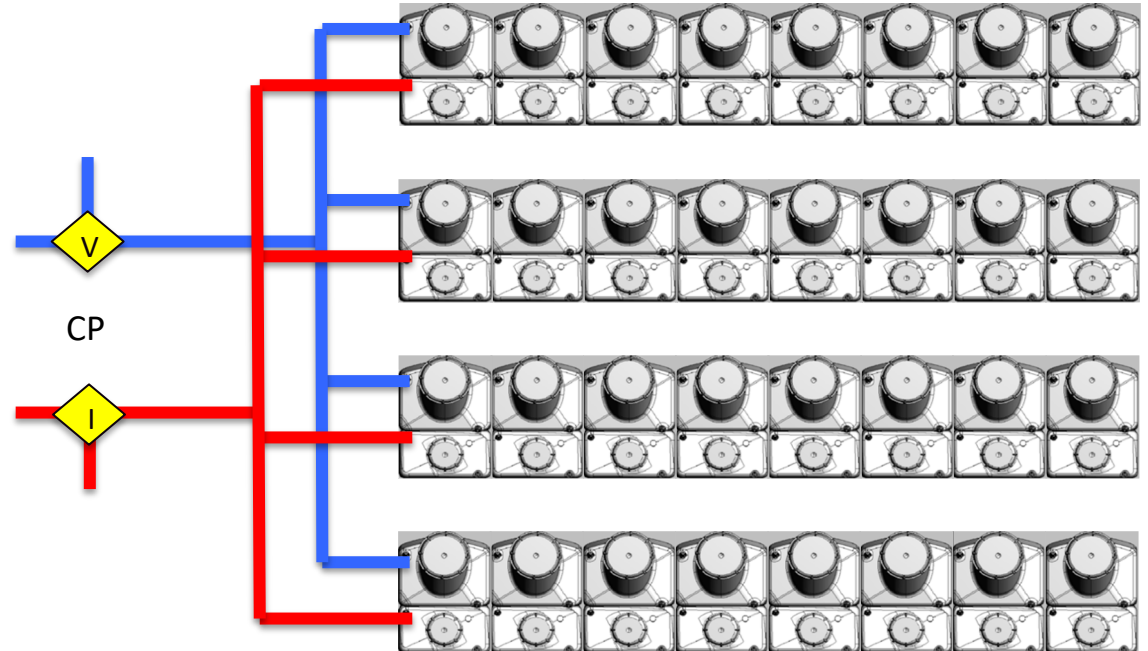
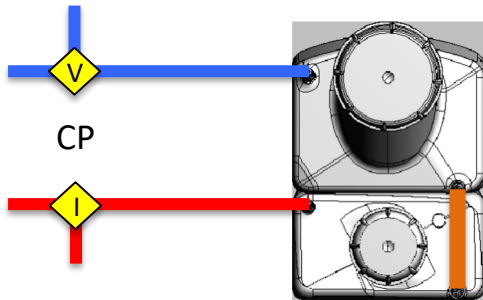
V – one for Ventilation

I – one for Immersion



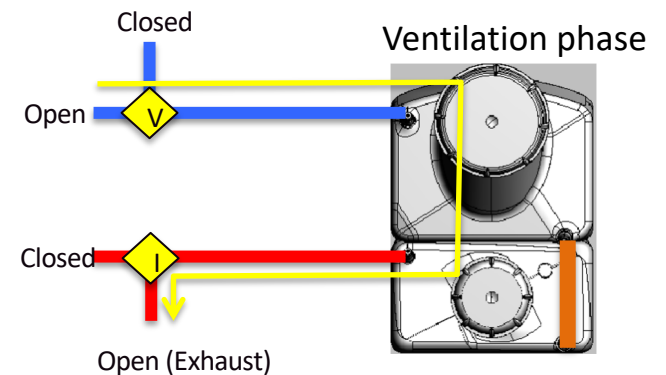
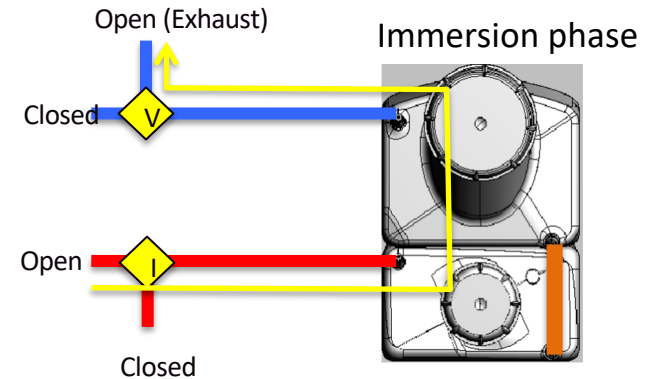
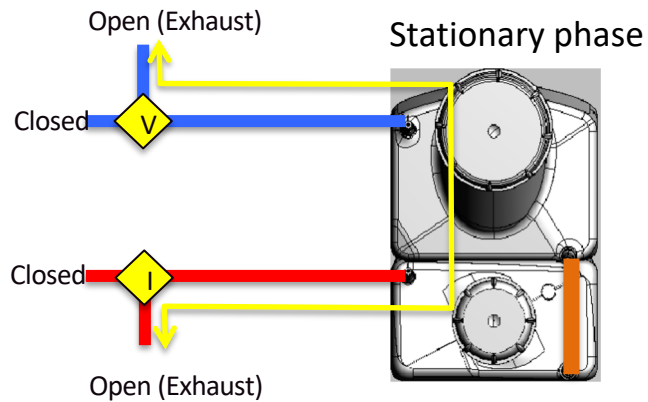
What is a Control Point?

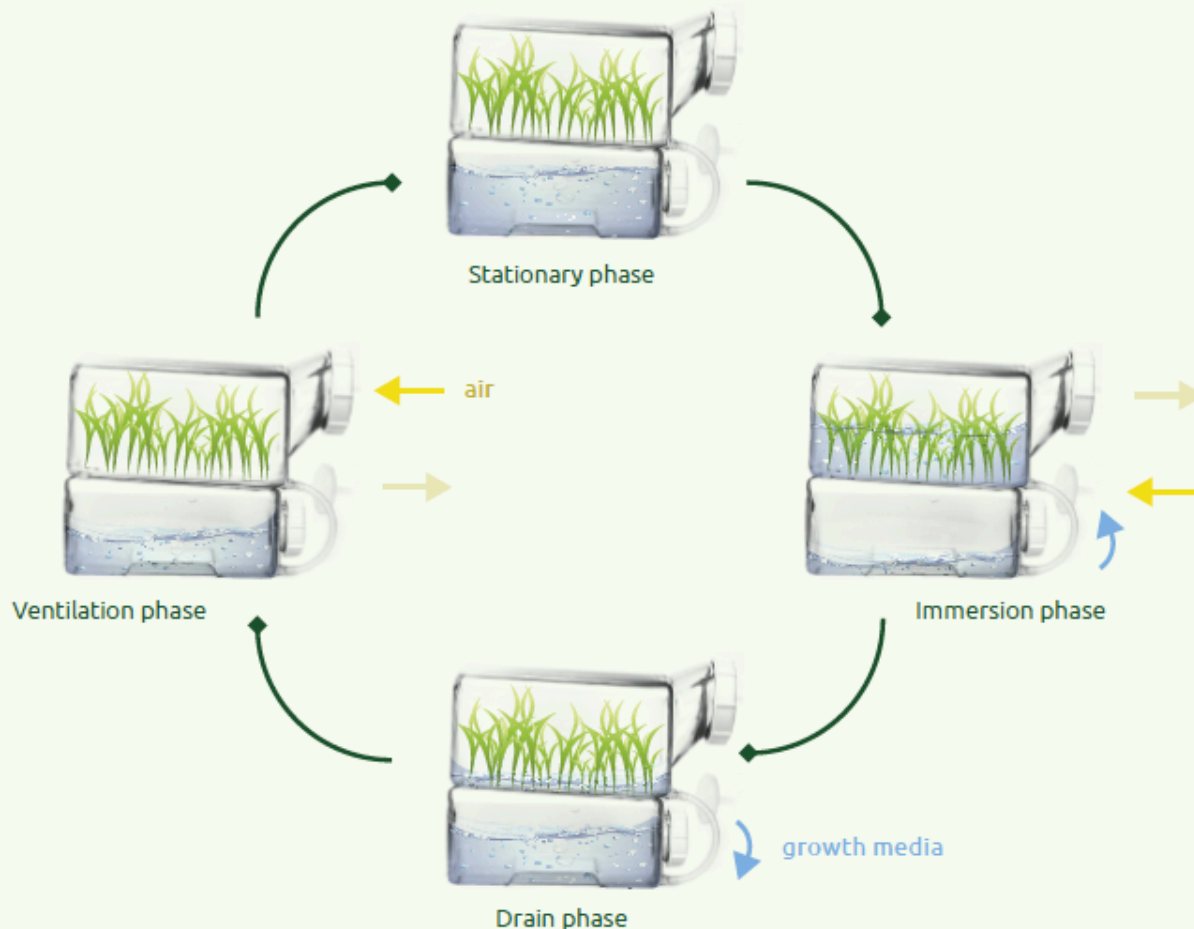
Each CP can control a minimum of 1 and a maximum of 32 SETIS™ bioreactors.



How does a Control Point operate the bioreactor?

By Opening/Closing the V and I electro valves, the immersion and ventilation phases are created.
Compare the images below to the diagram from p. 22.





SETIS™ Bioreactor working cycles

Stationary phase

No compressed air is supplied. Growth medium remains in the media vessel and plant material within a gas environment.

Immersion phase

Compressed air is supplied into the media vessel in order to transfer growth media to the upper culture vessel. Plant material remains under a liquid environment and nutrients uptake takes place.

Drain phase

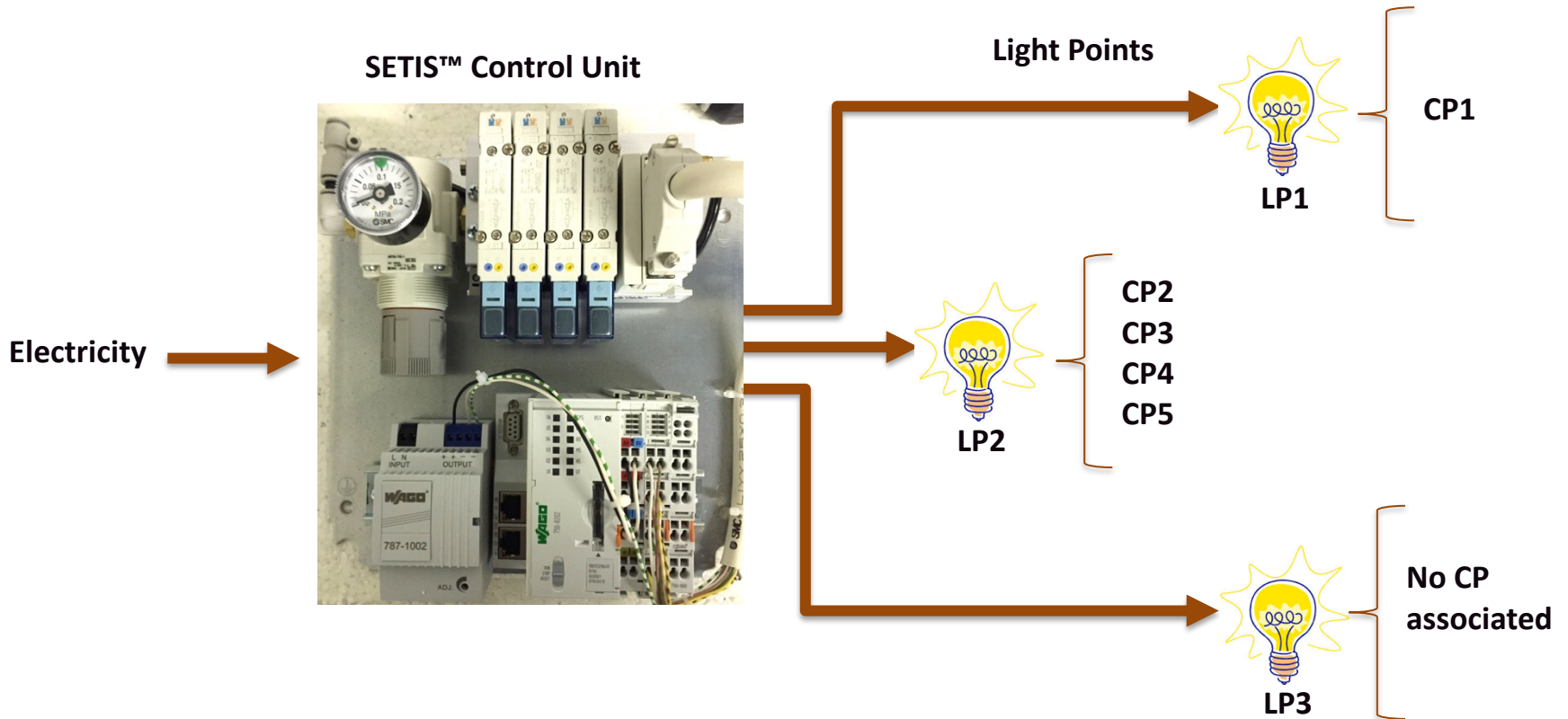
Gravity forces the growth medium back into the media vessel.

Ventilation phase

Compressed air is supplied into the culture vessel in order to renew its internal gas environment.

What is a Light Point?

A Light Point (LP) is a switch output from the SETIS™ Control Unit, which independently controls a group of lamps (associated or not to a defined CP) via the SETIS™ Software.

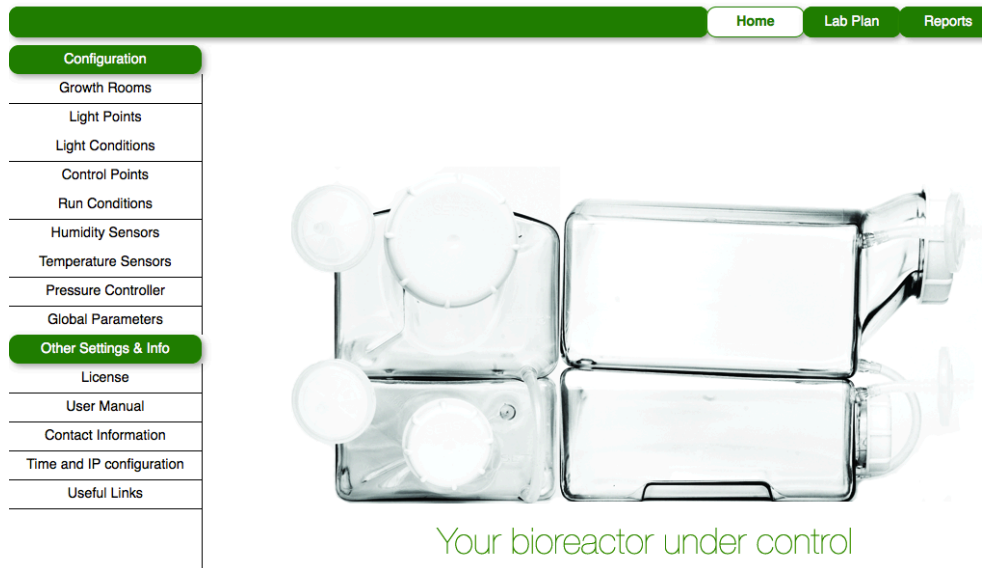


General view on the SETIS™ Software

Main Menu groups:

- Configuration: The setup of all parameters related to Control Points, Light Points, sensors, and Lab configuration.
- Lab Plan: A dynamic and user-friendly visualization and operation of your lab setup.
- Reports: Live visualization of completed operations and operations taking place, to check the correct functioning of the system.
- Other Settings and Info: Additional relevant information for the end user.

SETIS™ CONTROLS



General view on the SETIS™ Software

Configuration

SETIS™ CONTROLS

Light Condition Configuration | Home | Lab Plan | Reports

Configuration

- Growth Rooms
- Light Points
- Light Conditions
- Control Points
- Run Conditions
- Humidity Sensors
- Temperature Sensors
- Pressure Controller
- Global Parameters
- Other Settings & Info
 - License
 - User Manual
 - Contact Information
 - Time and IP configuration
 - Useful Links

Light Condition Configuration

Name: 16/8 [Save] [Remove]

Active	On Hour	On Minute	Off Hour	Off Minute
<input checked="" type="checkbox"/>	06	00	22	00
<input type="checkbox"/>	00	00	00	00
<input type="checkbox"/>	00	00	00	00

00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Other Settings & Info

Name: [Add]

Active	On Hour	On Minute	Off Hour	Off Minute
<input type="checkbox"/>	00	00	00	00
<input type="checkbox"/>	00	00	00	00
<input type="checkbox"/>	00	00	00	00

16/8
LC 1
LC 2

List of Light Conditions

Setup the Light Points

Visualize and change Light Conditions

Create and save your own Light Conditions

General view on the SETIS™ Software

Configuration

SETIS™ CONTROLS

Run Condition Configuration

Home Lab Plan Reports

Configuration

Growth Rooms

Light Points

Light Conditions

Control Points

Run Conditions

Humidity Sensors

Temperature Sensors

Pressure Controller

Global Parameters

Other Settings & Info

License

User Manual

Contact Information

Time and IP configuration

Useful Links

Name: Growth 1

Duration: 35 days

Frequency: 240 min

Duration: 90 s

Pressure: 0 Bar

Immersion: 120 min

Duration: 60 s

Pressure: 0 Bar

Active:

Start After: 0 days

Modify By: 0 mins

Every: 0 days

Immersion Freq. Var.:

Ventilation Freq. Var.:

Immersion Dur. Var.:

Ventilation Dur. Var.:

Fast Drainage:

Post LAF Immersion:

Name: []

Duration: 0 days

Frequency: 0 min

Duration: 0 s

Pressure: 0 Bar

Immersion: 0 min

Duration: 0 s

Pressure: 0 Bar

Active:

Start After: 0 days

Modify By: 0 mins

Every: 0 days

Immersion Freq. Var.:

Ventilation Freq. Var.:

Immersion Dur. Var.:

Save Remove

Visualize and change Run Conditions

List of Run Conditions

Automatic variations on Immersion and Ventilations for advanced users

Create and save your own Run Conditions

Parameters are entered based on frequencies. The software automatically assigns the specific time for ON/OFF signals

Setup the Control Points

Visualize and change Run Conditions

List of Run Conditions

Automatic variations on Immersion and Ventilations for advanced users

Create and save your own Run Conditions

General view on the SETIS™ Software

Configuration

The whole lab configuration is defined and modified via this menu.

- up to 5 growth rooms
- up to 20 racks per growth room
- 4 shelves per rack

Visualization capacity: 6400 SETIS™ bioreactors in operation.

SETIS™ CONTROLS

Growth Room Configuration
Home
Lab Plan
Reports

Configuration

Active	Name	T Sensor	RH Sensor	Length	Width	
<input checked="" type="checkbox"/>	Room 1	TS 1	HS 1	10	10	Racks...
<input checked="" type="checkbox"/>	Room 2	Empty	Empty	10	10	Racks...
<input checked="" type="checkbox"/>	Room 3	Empty	Empty	10	10	Save Racks...
<input checked="" type="checkbox"/>	Room 4	Empty	Empty	10	10	Racks...
<input checked="" type="checkbox"/>	Room 5	Empty	Empty	10	10	Racks...

- Configuration
- ◀ Growth Rooms ▶
- Light Points
- Light Conditions
- Control Points

General view on the SETIS™ Software

Lab Plan

Growth rooms visualization

SETIS™ CONTROLS

The screenshot displays the SETIS™ Controls software interface. At the top, there is a navigation bar with three tabs: 'Home', 'Lab Plan' (which is currently selected), and 'Reports'. Below the navigation bar is a main header 'Growth Room Overview'. On the left side, there is a vertical menu with two main sections: 'Configuration' and 'Other Settings & Info'. The 'Configuration' section includes: Growth Rooms, Light Points, Light Conditions, Control Points, Run Conditions, Humidity Sensors, Temperature Sensors, Pressure Controller, and Global Parameters. The 'Other Settings & Info' section includes: License, User Manual, Contact Information, Time and IP configuration, and Useful Links. The main area of the dashboard contains five room cards arranged in two rows. The top row has three cards: 'Room 1', 'Room 2', and 'Room 3'. The bottom row has two cards: 'Room 4' and 'Room 5'. Room 1 is the only card that displays sensor data: 'TS 1' with a value of '0 °C' and 'HS 1' with a value of '0 %'. The other rooms (2, 3, 4, and 5) are currently empty.

General view on the SETIS™ Software

Lab Plan

Racks visualization

SETIS™ CONTROLS

Room 1 Rack Overview

< Back Home Lab Plan Reports

Configuration

- Growth Rooms
- Light Points
- Light Conditions
- Control Points
- Run Conditions
- Humidity Sensors
- Temperature Sensors
- Pressure Controller
- Global Parameters

Other Settings & Info

- License
- User Manual
- Contact Information
- Time and IP configuration
- Useful Links

Rack 1 Rack 2 Rack 3 Rack 4 Rack 5

Rack 6 Rack 7 Rack 8 Rack 9 Rack 10

Rack 11 Rack 12 Rack 13 Rack 14 Rack 15

Rack 16 Rack 17 Rack 18 Rack 19 Rack 20

Position and orientation of each rack can be set, for easy visualization within the room

General view on the SETIS™ Software

Lab Plan

Visualization goes up to the shelf level, displaying each activated Control Point or associated Light Point.

SETIS™ CONTROLS

Room 1 Rack 1 Shelf Overview
< Back
Home
Lab Plan
Reports

Configuration								
Growth Rooms								
Light Points								
Light Conditions								
Control Points								
Run Conditions								
Humidity Sensors								
Temperature Sensors								
Pressure Controller								
Global Parameters								
Other Settings & Info								
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Contact Information								
Time and IP configuration								
Useful Links								

Shelf 1

Row 1	Row 2
CP 1	CP 1

Shelf 2

Row 1	Row 2
CP 2	CP 2

Shelf 3

Row 1	Row 2
CP 3	CP 3

Shelf 4

Row 1	Row 2
CP 4	CP 4

General view on the SETIS™ Software

Overview of features and advantages:

- A secure 'ready-to-use' installation
- Pneumatics optimized for SETIS™ bioreactors
- Compact and dynamic installation/software, based on a modular system
- No software installation required
- Web-based access to software, controlling your installation from any location worldwide
- Software designed for an optimal and simple operation of SETIS™ bioreactors, for both research and production applications
- Parameters are entered as frequencies, the software automatically sets the precise hour for ON/OFF actions
- Software automatically avoids valves overlapping, reducing compressed air requirements and saving energy
- Dynamic Lab visualization with measuring of temperature and RH
- Option of manual or automatic compressed air pressure regulation
- Integrated Lighting controls
- Live reports on any operation that takes place
- Unlimited number of Control Points and Light Points
- Easy and user-friendly software and interface
- And much more...