Insights into SETIS™ automation

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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

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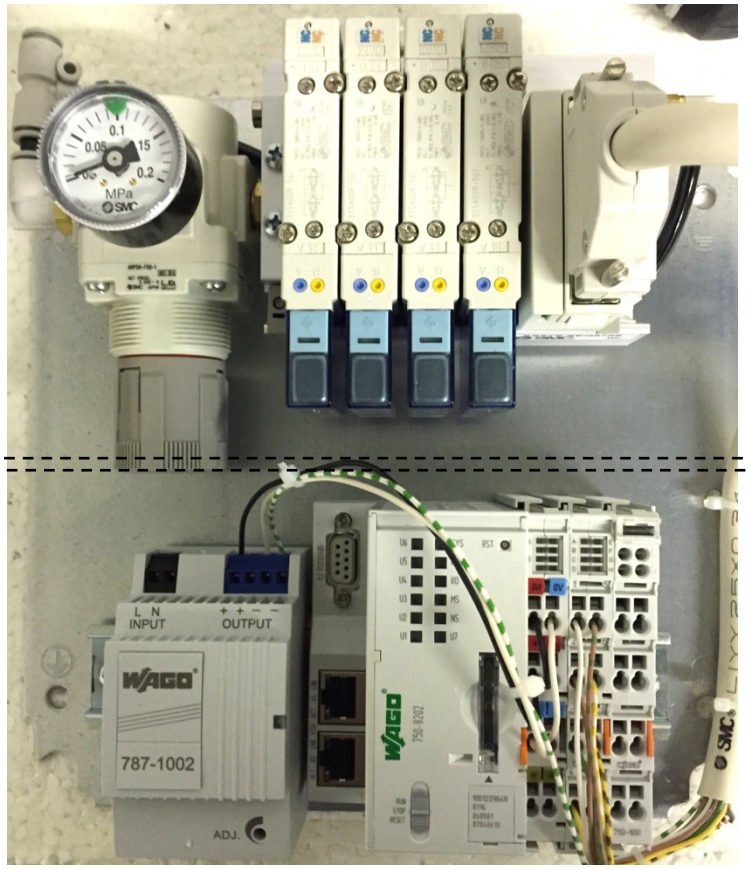
Our control unit is composed of three main elements:

- 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

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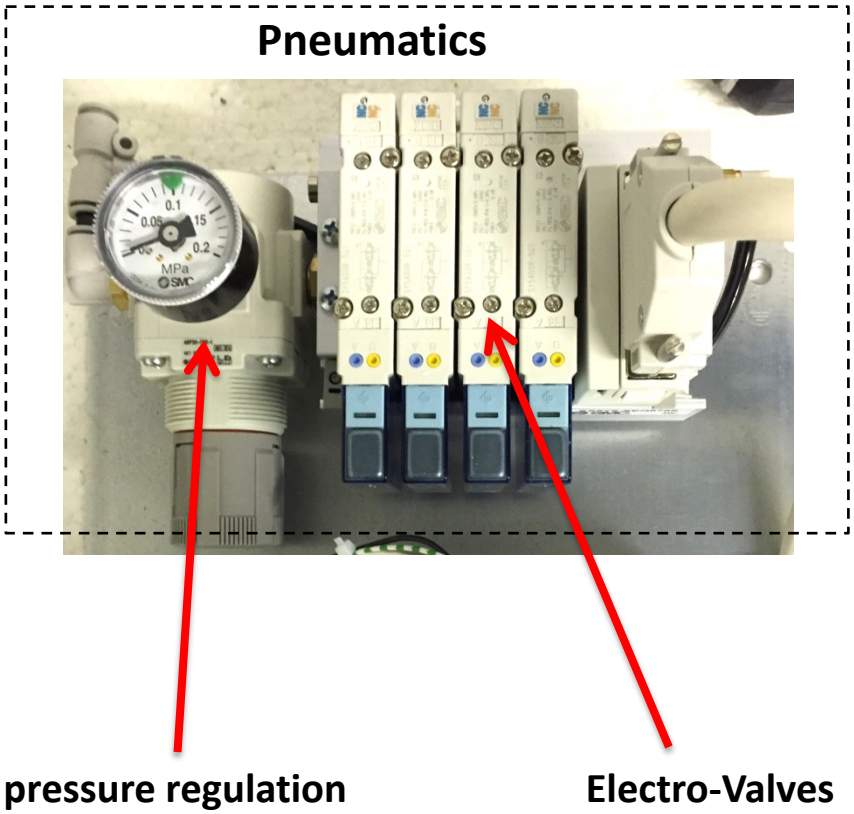
Pneumatics

The pneumatic side is composed of two main elements:

- Air pressure regulation
- Valves



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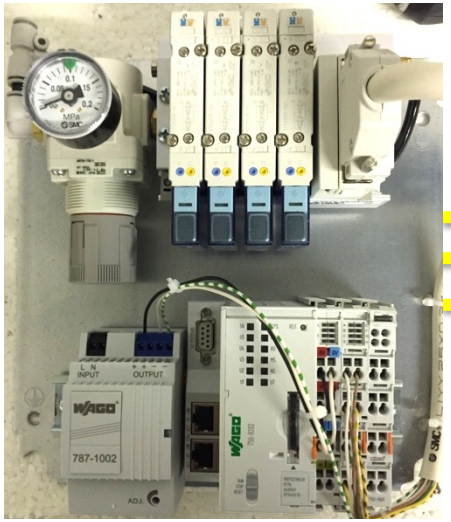
Compressed air is pressure-regulated before being distributed to all valves for later distribution to the bioreactors.

SETIS™ bioreactors

Compressed air



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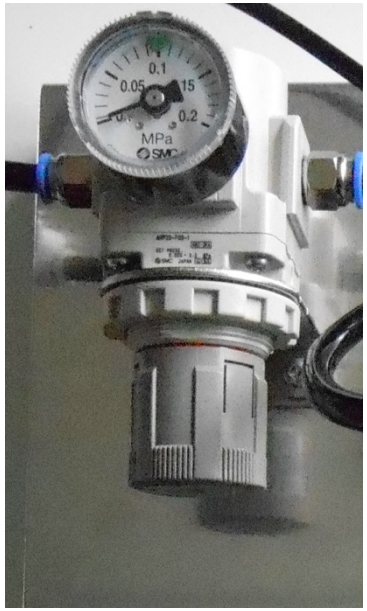
Air pressure regulation

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

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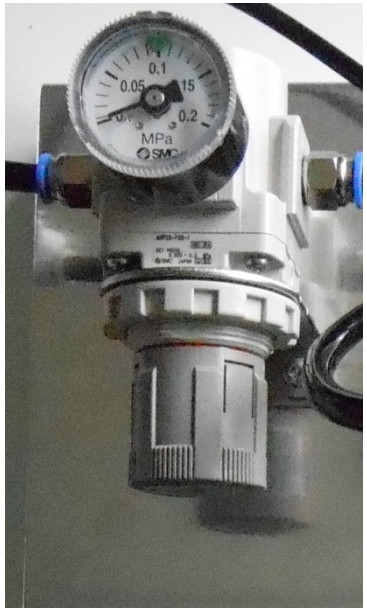
Air pressure regulation

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

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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.

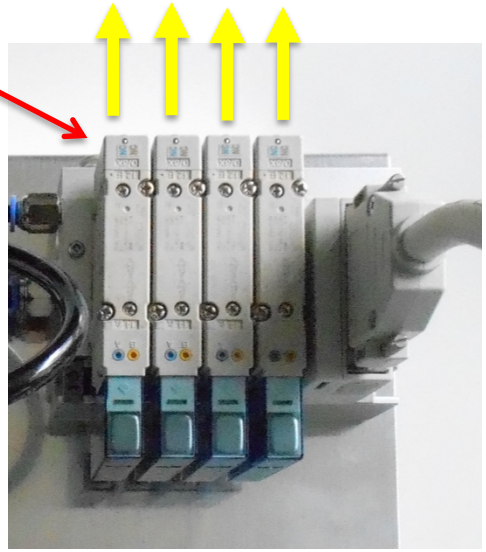
Manifolds are delivered with (minimum) 4 slides. Manifolds of 6, 8, 10 and 12 slides each, are possible as well.

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

Air out towards bioreactors



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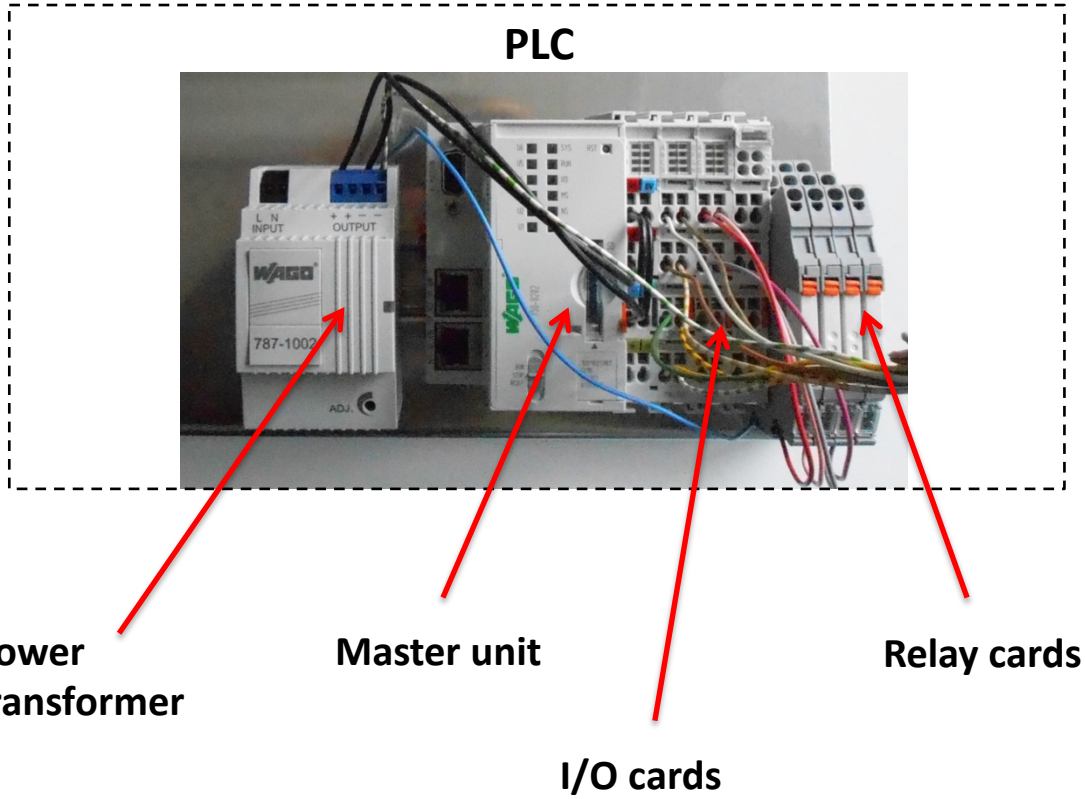
The PLC side

SETIS™ uses PLC to control all functions.
Main components:

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



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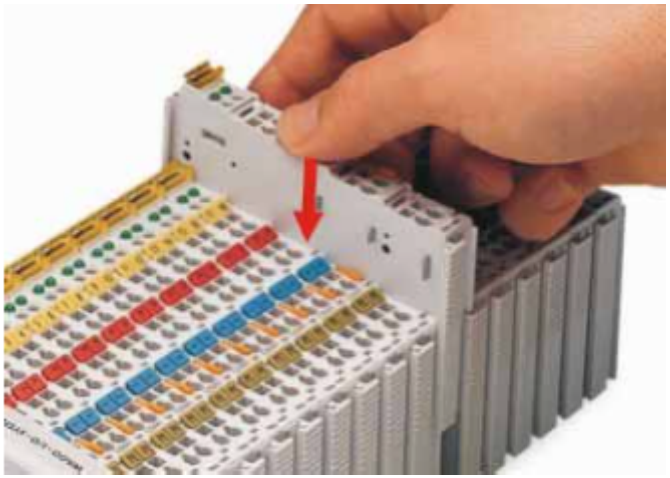
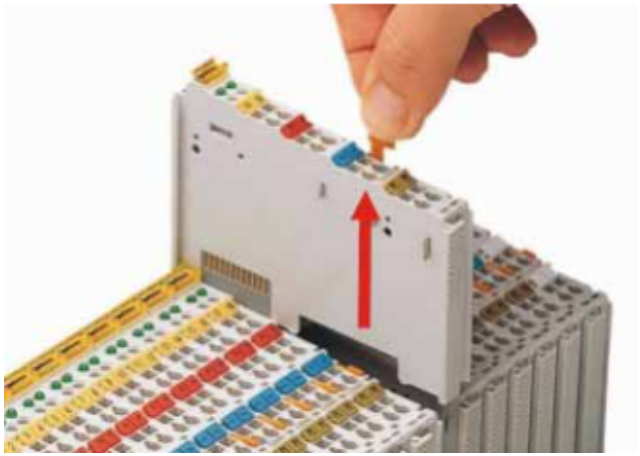
The PLC side

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.





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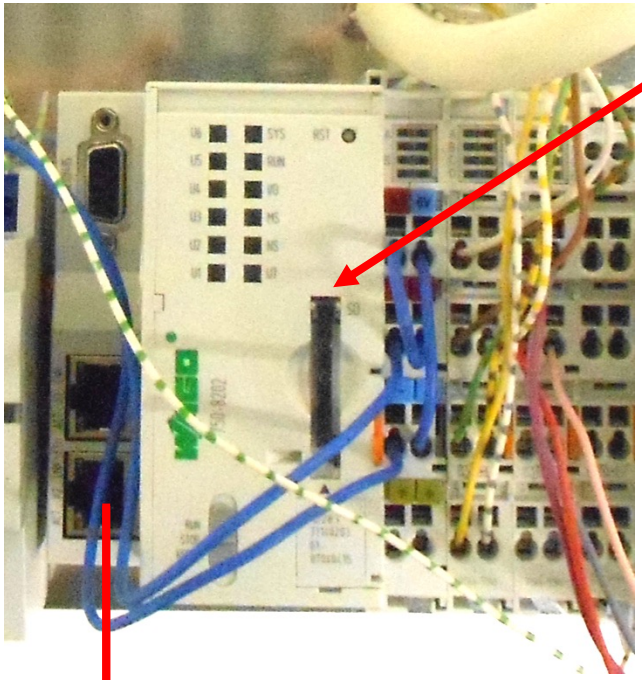
The PLC side

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.



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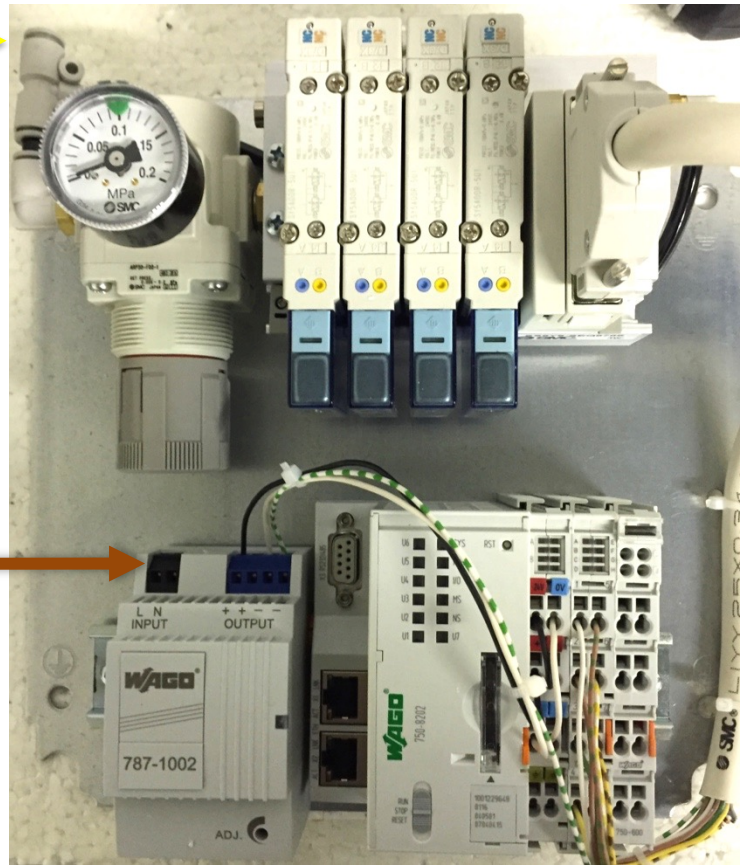
The SETIS™ Control unit is delivered ‘ready to use’. Only a source of compressed air and electricity are required to start using the unit.

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



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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

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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

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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.

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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)

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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.

Warm/cold
Dirty
Wet

Air Compressor

Air Dryer

Set of filters

Temp. OK
Clean
Dry

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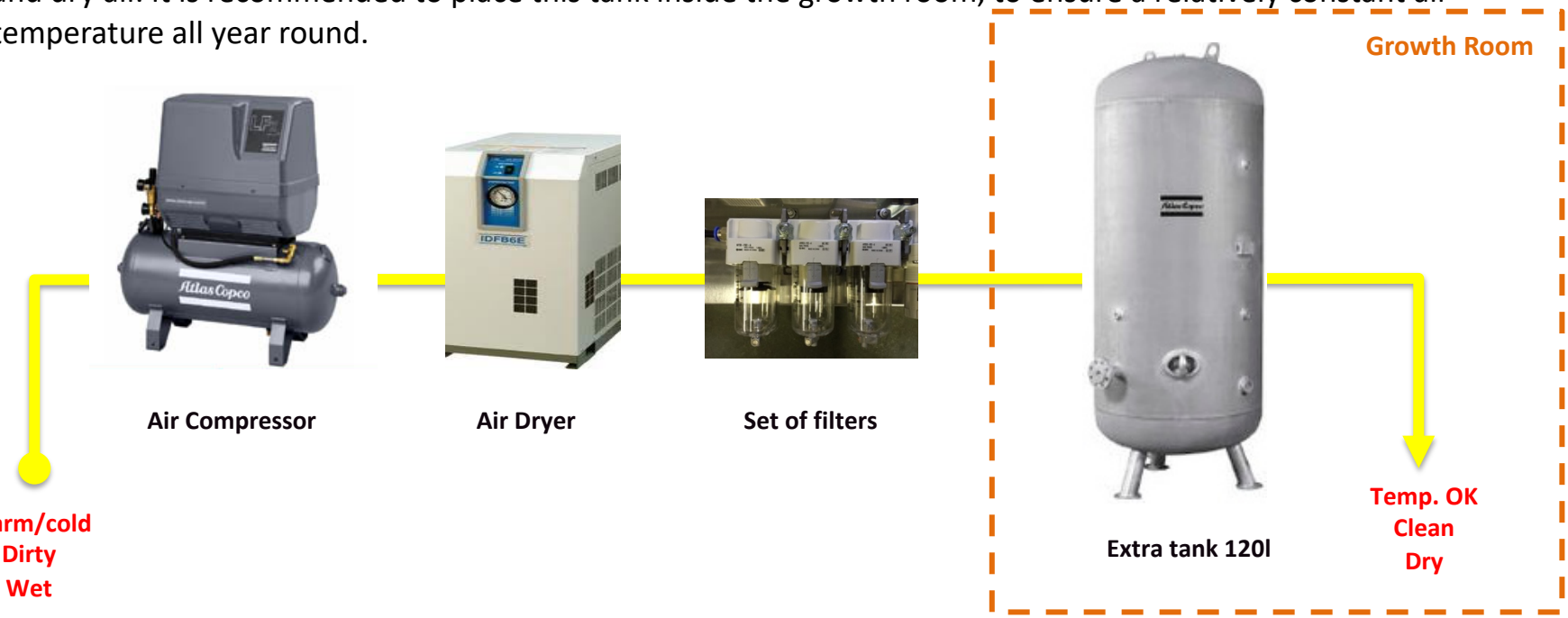
Generation and handling of compressed air

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.



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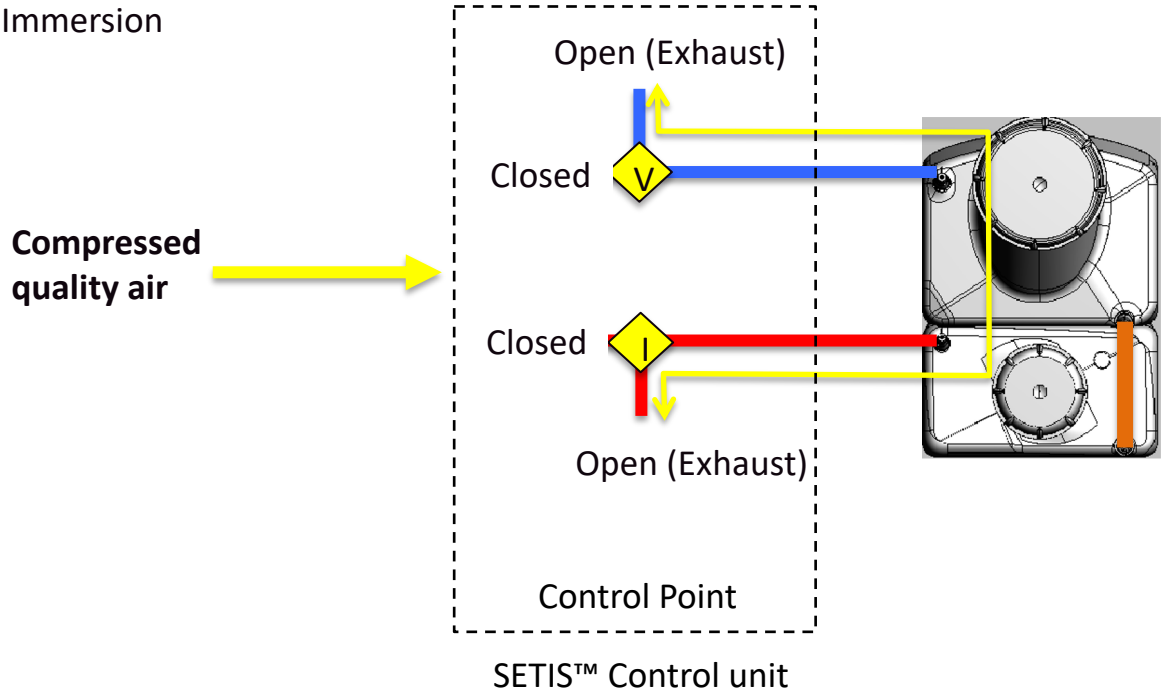
What is a Control Point?

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



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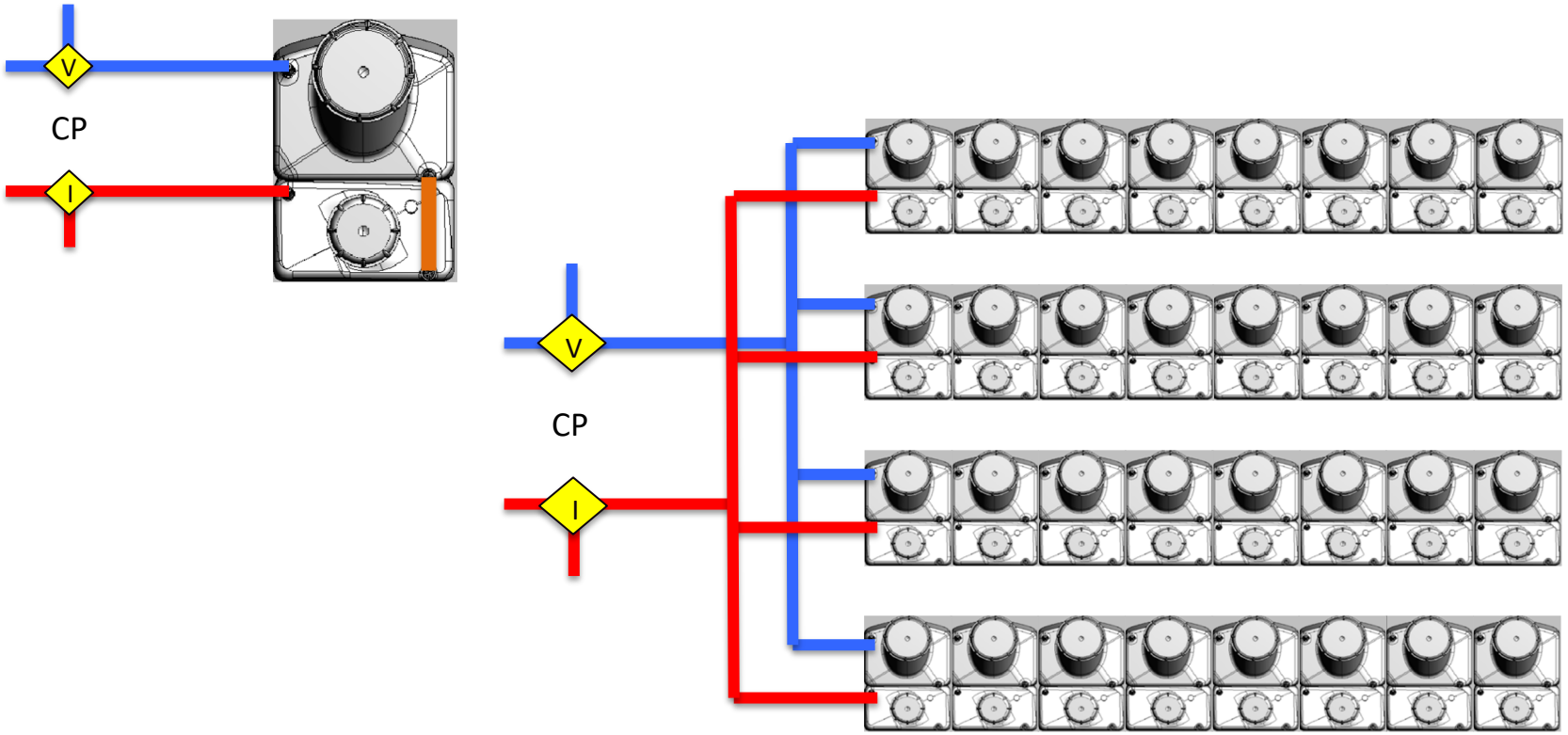
What is a Control Point?

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



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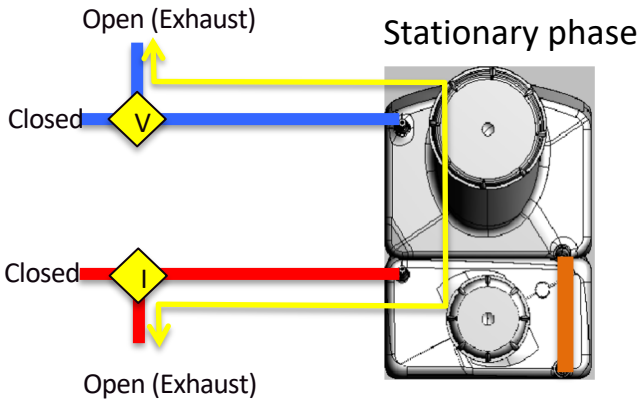
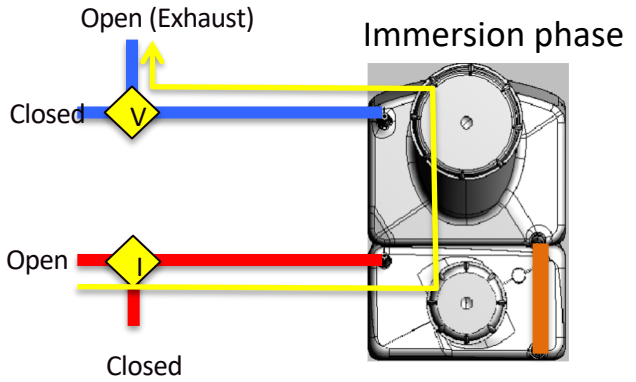
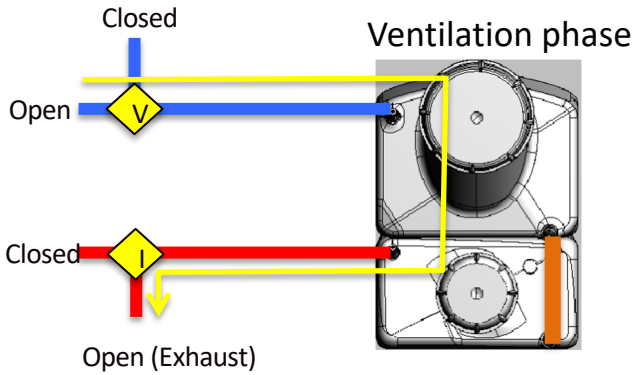
How does a Control Point operate the bioreactor?

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.







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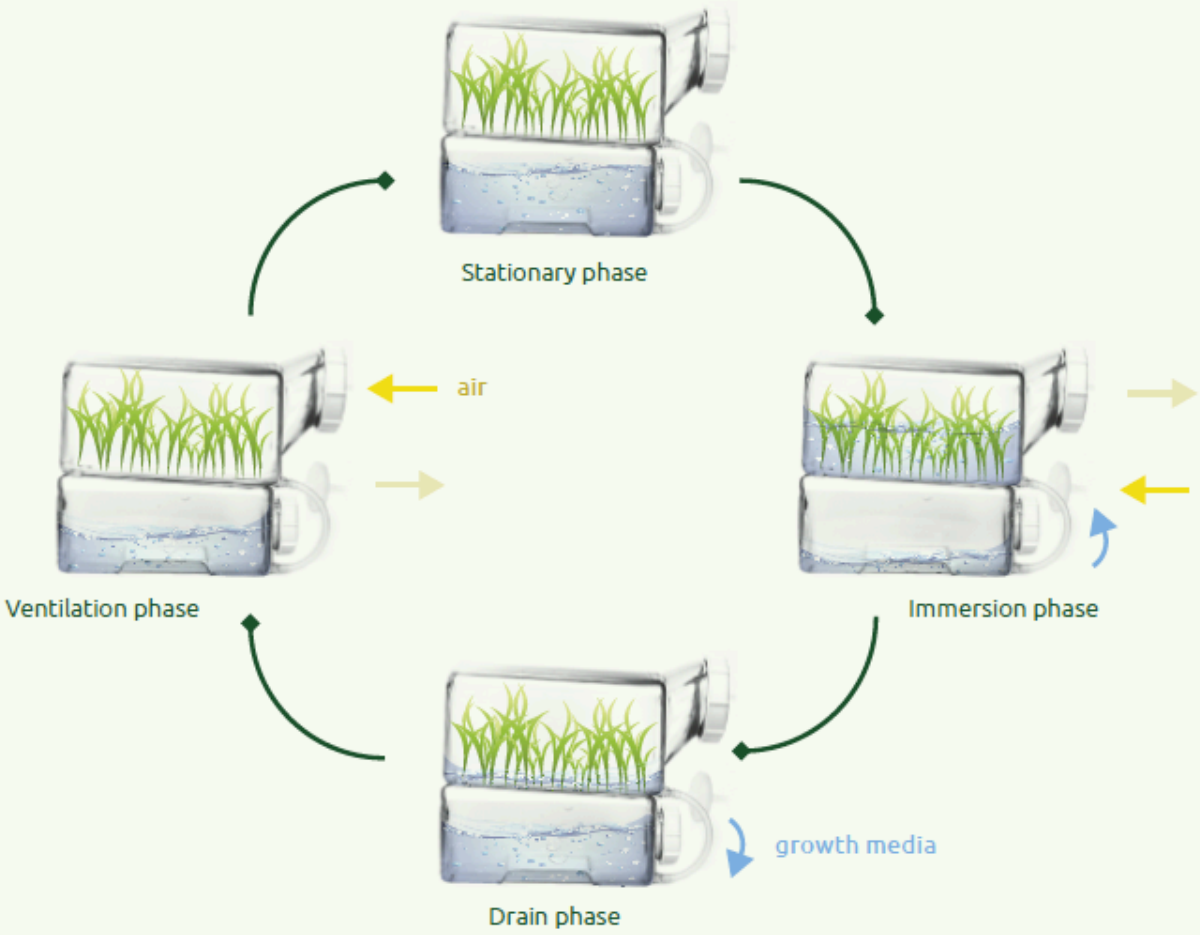

SETIS™ Bioreactor working cycles

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.

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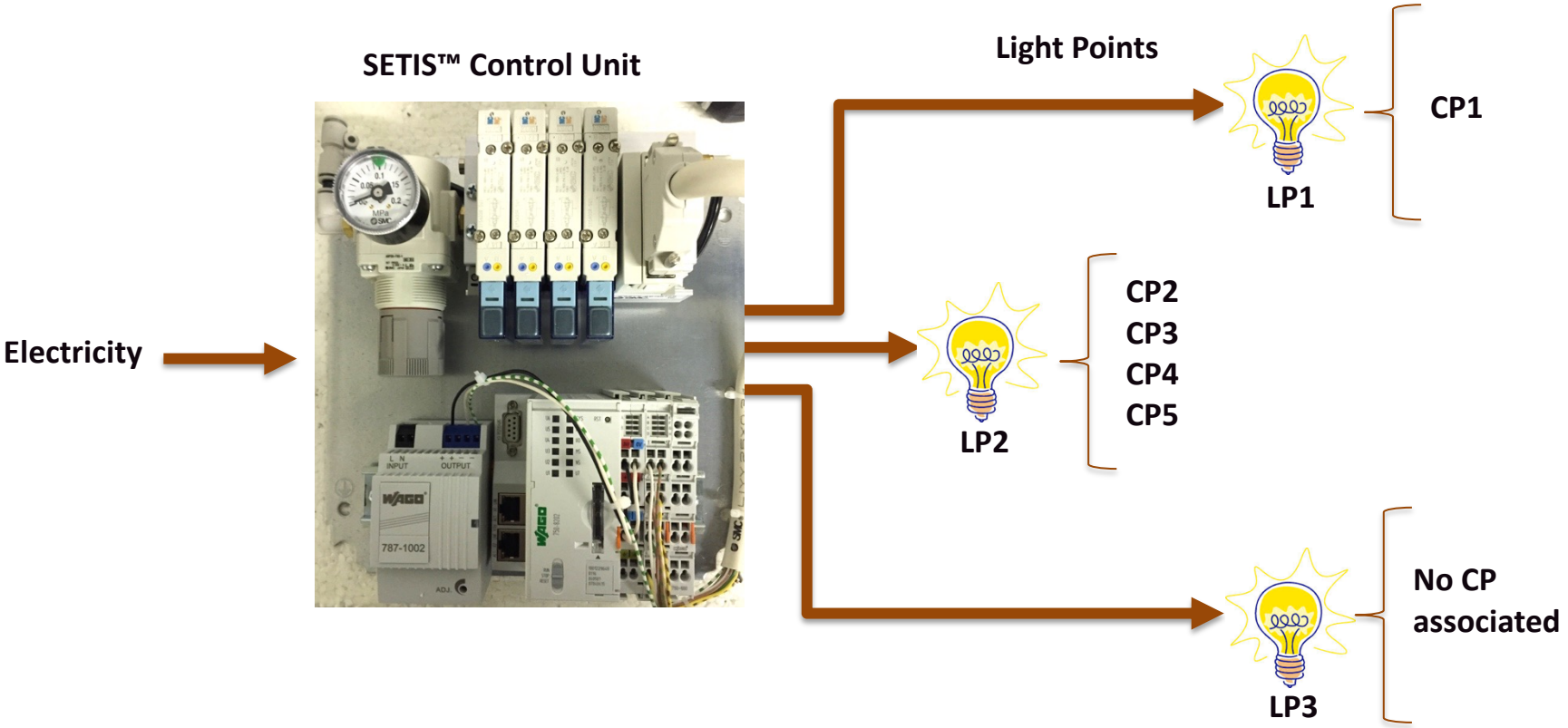
What is a Light Point?

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.



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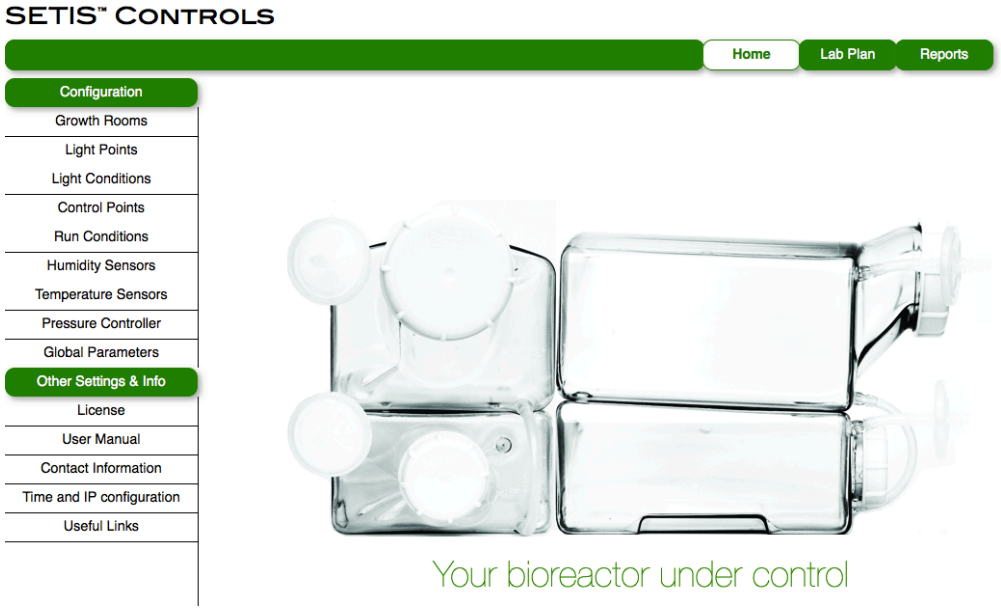
General view on the SETIS™ Software

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.



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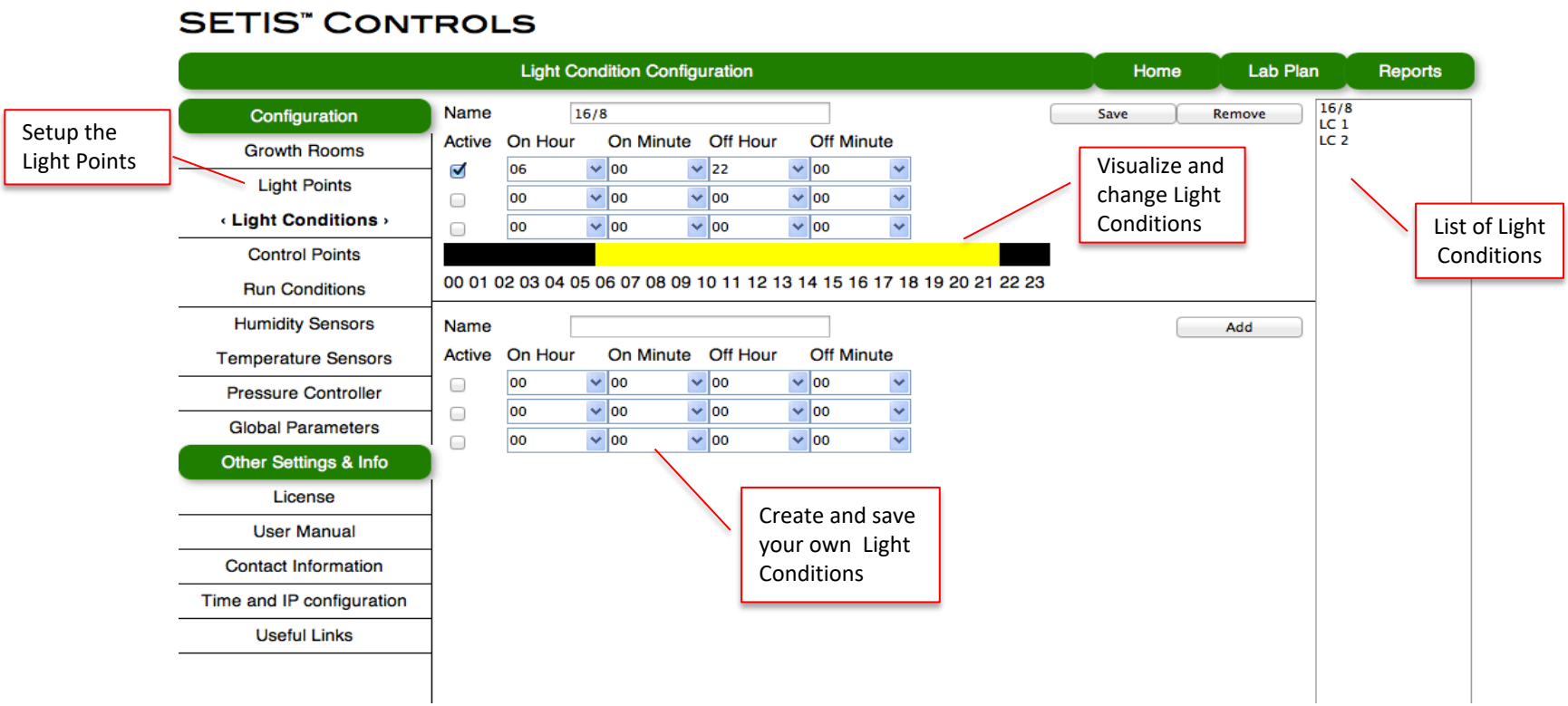
General view on the SETIS™ Software

Configuration



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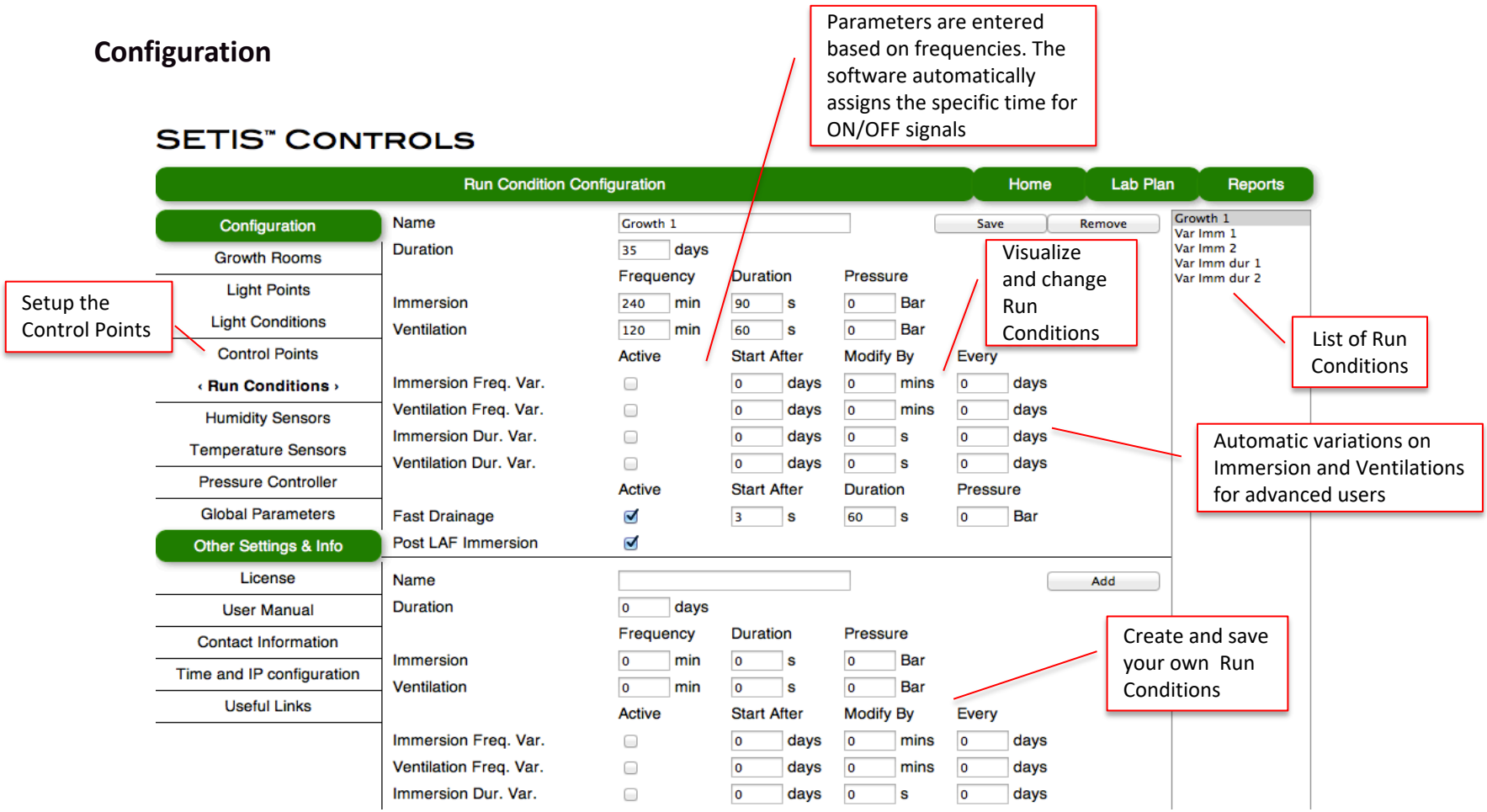
General view on the SETIS™ Software

Configuration



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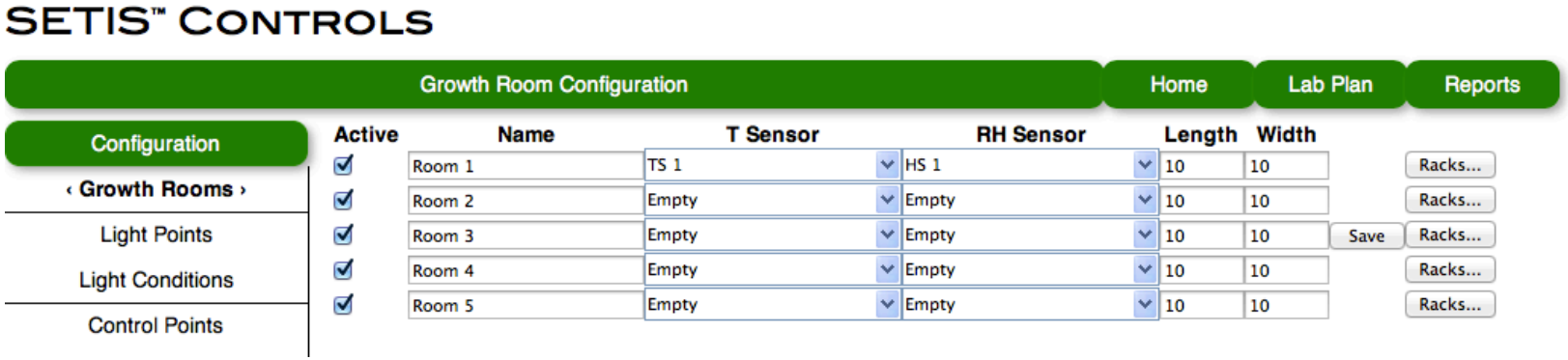
General view on the SETIS™ Software

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.



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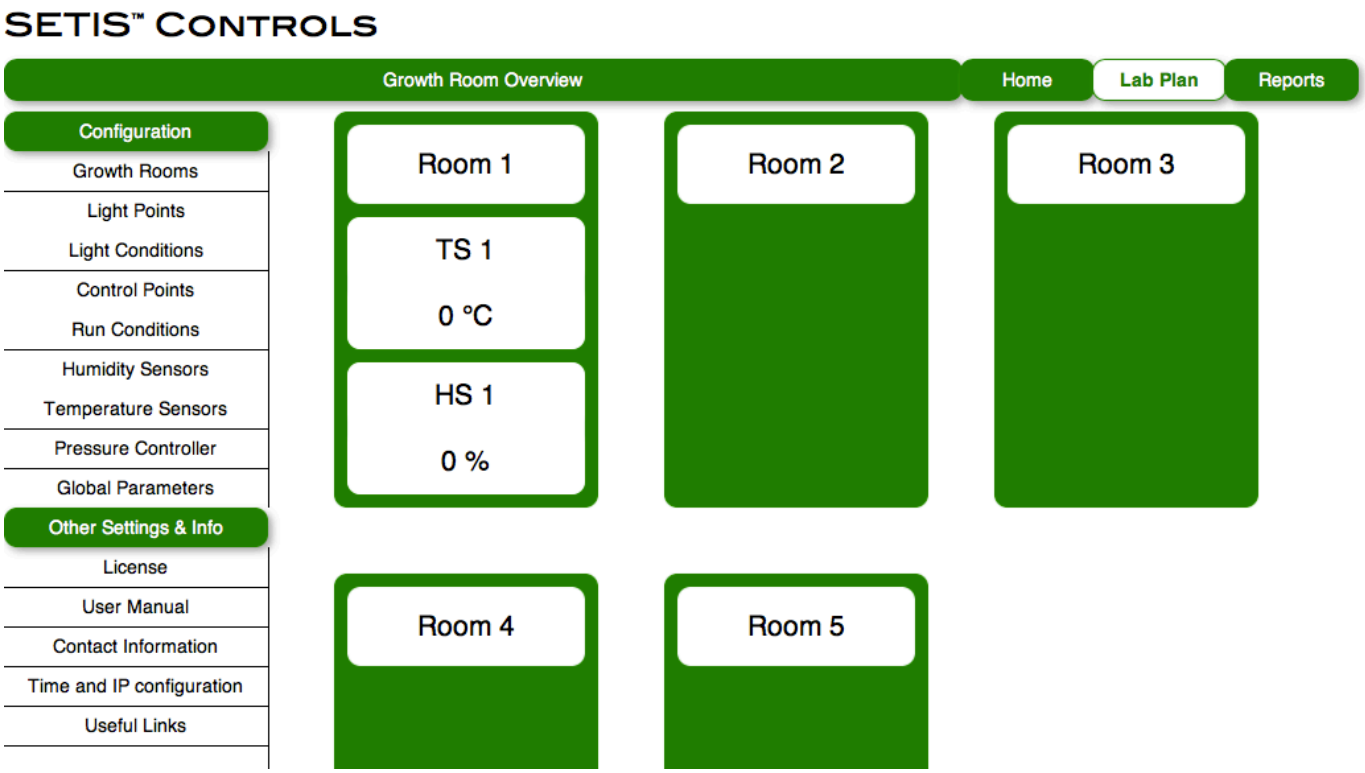
General view on the SETIS™ Software

Lab Plan

Growth rooms visualization



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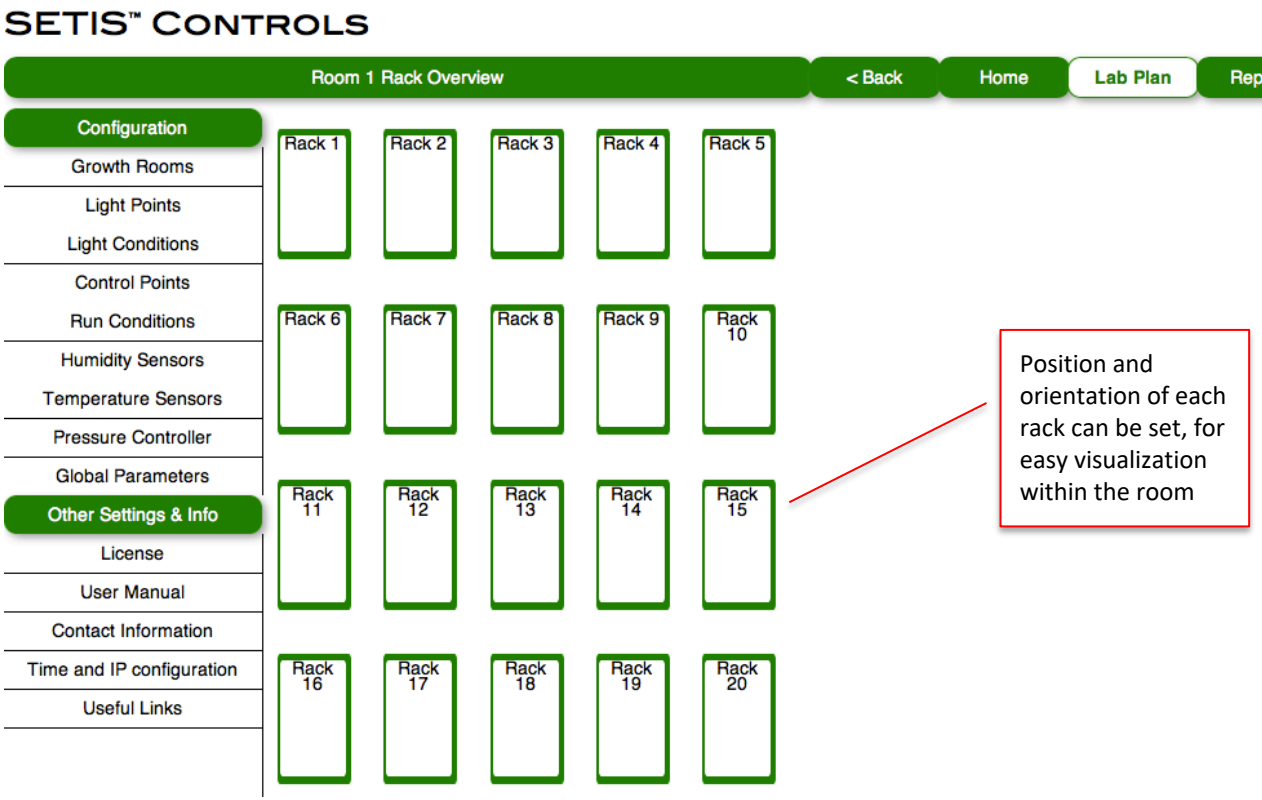
General view on the SETIS™ Software

Lab Plan

Racks visualization



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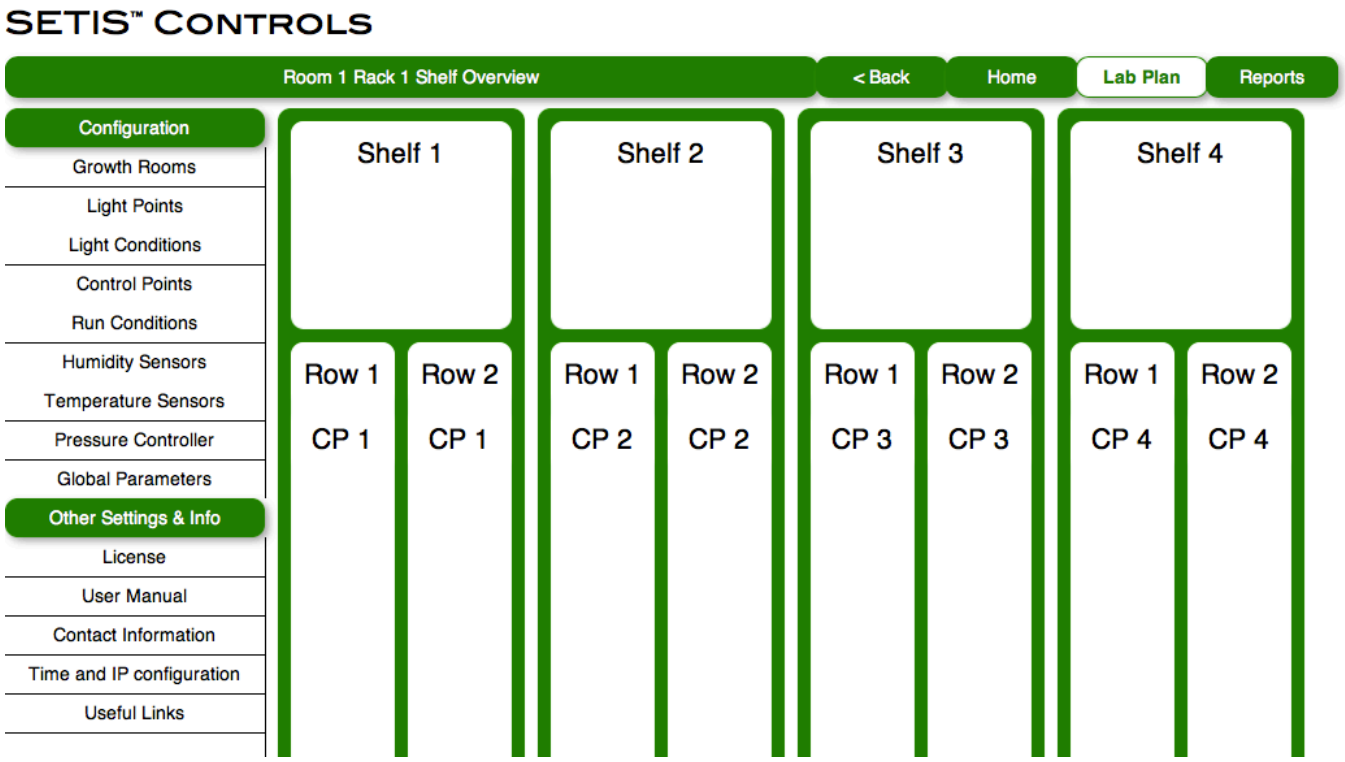
General view on the SETIS™ Software

Lab Plan

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



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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…

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