



**CO2-UNIT-3L**  
**Gas Blender**

**Manual**

Version 7.17

# Index

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## 1 Preface

CO2-UNIT-3L is a digital Air/CO<sub>2</sub> blender which delivers gas to the desired CO<sub>2</sub> concentration in the range 0-15%. Flow rate can be regulated in the range 0.1-2.5 l/min, up to 3.0 l/min is achieved when using Compressed Air.

CO2-UNIT-3L can be employed to control CO<sub>2</sub> concentration inside any semi-sealed container whose volume does not exceed 2 liters.

CO2-UNIT-3L must be connected to a source of 100%CO<sub>2</sub> at 1.5 bar (22 psi) and to a source of Air at 0.5 bar (7 psi).

The desired CO<sub>2</sub> concentration and total output flow rate is determined by controlling the flowrates of CO<sub>2</sub> and Air. CO2-UNIT-3L is equipped with a CO<sub>2</sub> Dual IR or NDIR sensor to measure and control the concentration of the output gas and provide feedback to the flow rate controllers.

If compressed Air is not available, CO2-UNIT-3L can be connected to the air pump. The air pump is powered and operated via CO2-UNIT-3L. The air pump is a plug and play solution for Air inlet and a convenient alternative to 100% Air tanks/compressed Air lines

CO2-UNIT-3L can be operated via the touch screen interface OKO-TOUCH-XL (not included), via OKOLAB Datalog Software (not included) or via any third party software.

We recommend reading carefully this manual to familiarize yourself with the installation of CO2-UNIT-3L.

## 2 Symbol description

This paragraph describes the symbols used in the manual and on the product label.

### 2.1 Symbols used in this manual

The following symbols identify important information to note:



CAUTION or WARNING: this symbol warns you about the risk of electrical shock.



CAUTION or WARNING or IMPORTANT: this symbol warns you of circumstances or practices that can affect the functionality of the instrument.

*Tip* ► Supplies you with helpful suggestions.

*Note* ► Supplies you with important information to successfully setup and use the instrument.

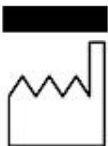
### 2.2 Symbols on the product label



CE MARKING: this symbol indicates product compliance with EU legislation.



PRODUCT DISPOSAL: this symbol indicates that this product must not be disposed as urban solid waste.



This symbol indicates the product production date.



This symbol indicates the manufacturer data.



This symbol indicates the protection degree against ingress of solids or liquids inside the product.



This symbol warns you to read the user manual before starting the device.

### 3 Safety Notes

In order to achieve maximum performance and to ensure proper operation of your new equipment, please read carefully the following safety notes and the instructions. If you have any question, please contact Okolab.

---

- The equipment must only be used as intended and as described in this Manual.
- Equipment should be operated only by technically qualified personnel.
- Do not start up the equipment if some of its parts are damaged.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Transport the equipment with care.
- Equipment and its internal parts can be damaged by dropping and by shock.
- Do not disassemble any part of the system.
- Do not disconnect cables while in operation.
- Do not use a volatile solvent such as paint thinner to clean the instrument because deformation or discoloration may occur.
- Use a soft, dry cloth to remove stains from the instrument.
- Do not exceed voltage indicated in this manual and on the product label.
- Avoid excessive induction noise, static electricity and magnetic fields.
- Do not expose this instrument to rain or moisture.
- Prevent throttling and kinking of cables.
- Do NOT go in close contact with or breathe any gas stream whose composition is different from that of ambient air.
- The product labels can be found on the bottom panel of the unit.
- Check tubing time to time for possible wear and tear.
- Check that all tubing is well inserted into the connectors so they cannot slip off.
- This device is not designed for use for medical applications.
- Install safety valves and adequate pressure regulators on gas lines before the Unit input connectors.
- Power feeder of unit should be unplugged from electrical outlet when left unused for long period of time.
- PRESSURIZED GAS, secure all connections with hose clamps. Never exceed pressure limits, 2.0 bar. Bleed all lines before disconnecting. Wear safety goggles if needed. If pressure regulators are not within easy sight and reach make sure at least one shut off valve within reach.
- LOW OXYGEN ATMOSPHERES and HIGH CO<sub>2</sub> ATMOSPHERES. Never enter a room or enclosure that has a low oxygen atmosphere or a high CO<sub>2</sub> atmosphere because of severe danger of suffocation. Only operate in well- ventilated room. A small amount of gas mixture (air and carbon dioxide) leaks continuously out of the instrument and should never be allowed to build up in the room.
- VENTILATION, unit should be situated so that its location or position does not interfere with proper ventilation. Either the gas blender or the stream destinations should not be placed in poorly ventilated areas.



- Unit should be situated away from heat sources such as open flames, radiators, heat registers, stoves, or other appliances or processes that produce heat.
- 



- Do not start up the equipment if the supply cable is damaged.
  - Connect the equipment only to grounded mains power socket.
  - Before starting, assemble the equipment while unplugged from an outlet.
  - Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- 



International caution symbol marks this device. **IMPORTANT:** read the “Safety Notes” before installing, using and commissioning this device, as the notes contain important information relating to safety and EMC. Not following these instructions can result in damage or breakdown of the device and its accessories.

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We reserve the right to make technical modifications.

IN NO EVENT OKOLAB S.R.L. SHALL BE LIABLE FOR ANY DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE, OR FINANCIAL LOSS RESULTING FROM IMPROPER USE OF THE PRODUCT.

## 4 Equipment supplied

Figure 1 shows a typical laboratory setup for CO<sub>2</sub>-UNIT-3L, with reference to the objects highlighted by the pointers we have:

- 1 **Gas Blender.** CO<sub>2</sub> blender.
- 2 **PTFE filter (x2).** One to be installed on the rear of the Controller and a spare replacement one.
- 3 **TUBE A (x3).** Rigid tubes, 3 m long 6 mm OD each. Use TUBE A to connect the output ports of Air and Carbon Dioxide tanks to the corresponding input ports (Air and CO<sub>2</sub>) on the rear panel of CO<sub>2</sub>-UNIT-3L and to connect the Gas Output connector on CO<sub>2</sub>-UNIT-3L rear panel to the Chamber Incubator. If the air pump is present, use the Air tank tube to connect it.

*Note ► Custom tubing available upon request.*

- 4 **Pressure Gauge for CO<sub>2</sub> + regulator (scale 0.0-2.0 bar)+ assembly stirrup (x1).** Install pressure gauge between the pure CO<sub>2</sub> tank pressure regulator and the CO<sub>2</sub> Controller CO<sub>2</sub> input port.
- 5 **Power feeder and power cord.** 24V DC -60 W power feeder.

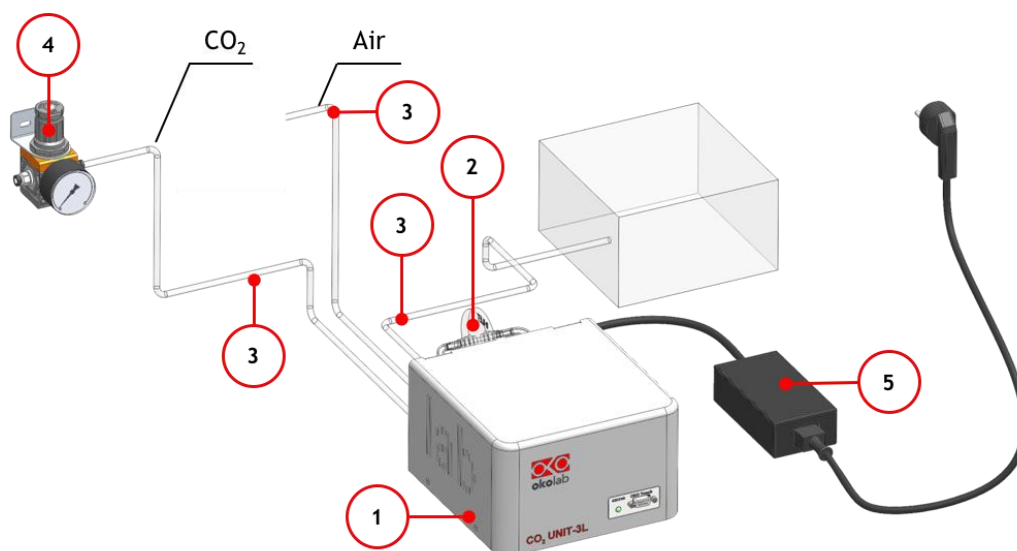


Figure 1. CO<sub>2</sub>-UNIT-3L - Components.

### 4.1 Optional Equipment - to be purchased separately

- 1 **ACC. 01.** Push in to fit connectors with ¼" NPT male thread with an O-ring for 6mm O.D. rigid tubing (x2). Screw a connector into the output port of each tank's regulator. Next, insert the 6mm O.D. tubing into the 'push in to fit' end of the connector. Use the ¼ NPT male connector with 6mm O.D. push-in adapter only if the regulator of pure gases tanks does not accept 6 mm O.D. tubing.
- 2 **DATA LOG.** Software to log composition data from any OKOLAB device via PC.
- 3 **OKO-AP-3L.** Air pump, plug and play solution for Air inlet and a convenient alternative to 100% Air tanks/compressed Air lines, includes:
- 4 **OKO-TOUCH-XL.** User friendly touch interface, includes:
  - **OKO-TOUCH-CABLE.** Use this cable to connect the OKO-TOUCH-XL to the RS232 port on CO<sub>2</sub>-UNIT-3L frontal panel.



## 5 Equipment NOT Supplied But Required

- CO<sub>2</sub> tank with safety valve/pressure gauge regulator to accept rigid tubes 6 mm OD exiting. Gas source must have a purity higher than N2.8, such as 99.8% or higher CO<sub>2</sub> and humidity-free gas.

**Note** ► Please note we also provide ¼ NPT male connector to 6mm OD push-in fitting connector adapters to this aim

- Air tank or compressed air line with safety valve/pressure gauge regulator (degree of filtration 20 µm and condensate drain) to accept rigid tubing 6 mm OD.

## 6 Equipment Description

CO<sub>2</sub>-UNIT-3L is a digital Air/CO<sub>2</sub> blender which delivers gas with an adjustable CO<sub>2</sub> concentration in the range 0-15% and an adjustable flow rate in the range 0.5-3.0 l/min (2.5 l/min max when using the OKO-AP-3L).

The desired CO<sub>2</sub> concentration and total output flow rate is determined by controlling the flowrates of CO<sub>2</sub> and Air. The device is equipped with a CO<sub>2</sub> sensor to measure the concentration of the output gas and provide feedback to the flow rate controllers.

A detailed description of the connectors on the rear panel of CO<sub>2</sub>-UNIT-3L is provided in the following list, which refers to Figure 2.

- 1 **Filter In.** To connect the PTFE filter.
- 2 **Filter Out.** To connect the PTFE filter.
- 3 **Mixed Gas Output.** Push to fit Input Connector for 6 mm O.D. rigid tubing.
- 4 **Pure CO<sub>2</sub> Input.** Push to fit Input Connector for 6 mm O.D. rigid tubing.
- 5 **Pure Air Input.** Push to fit Input Connector for 6 mm O.D. rigid tubing.
- 6 **Mini USB port.**
- 7 **Pump Output.** Useful only if AIR-PUMP-3L is present.
- 8 **24 VDC Power Input.**

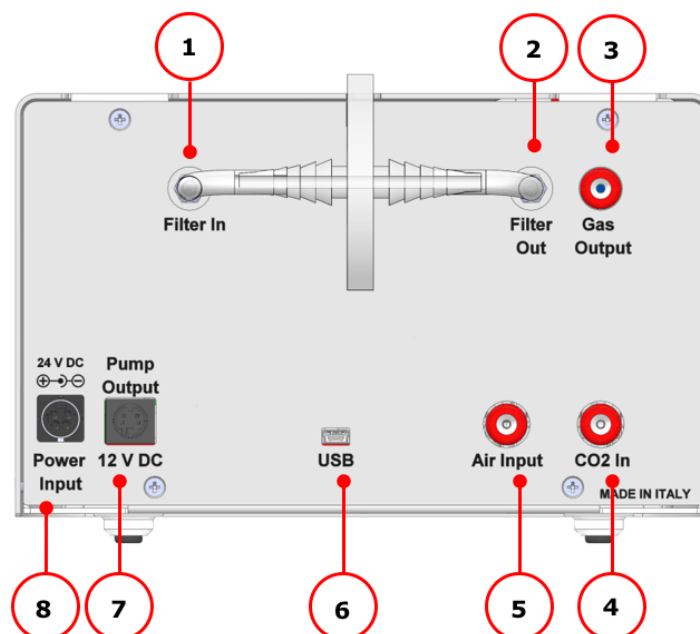


Figure 2. CO<sub>2</sub>-UNIT-3L - Equipment description.

## 7 Installation

The following steps will illustrate how to install CO<sub>2</sub>-UNIT-3L.

- 1 Install the pressure gauges (pointer 4 in Figure 1) for CO<sub>2</sub> and Air lines between the CO<sub>2</sub> and Air tanks and CO<sub>2</sub>-UNIT-3L. Follow the direction of the arrow on the rear of the pressure gauge for the correct Gas In-Out orientation (See Image b in Figure 3).

**Tip** ► To close the gauge, pull the knob up and rotate it counterclockwise. Push the knob down to lock it.

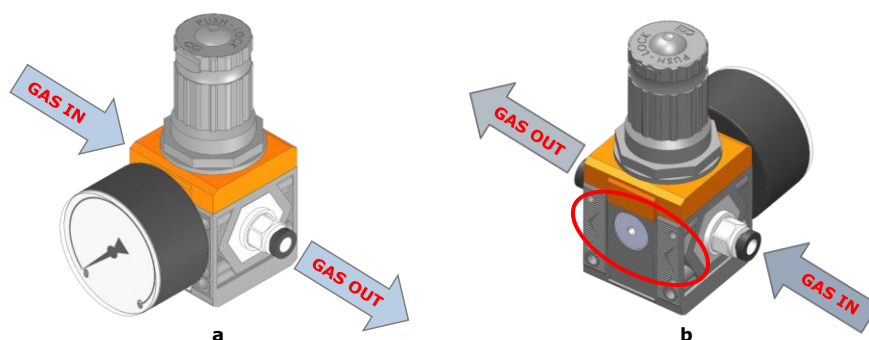


Figure 3. Input and Output gas ports on the pressure gauge (a) 3D, Frontal view; (b) 3D, Rear view.

- 2 Connect TUBE A (pointer 3 in Figure 1) between CO<sub>2</sub> and Air pressure gauges and CO<sub>2</sub>-UNIT-3L. See Figure 5

**Note** ► Make sure to push tubes securely all the way into connectors avoiding any gas leak.

**Tip** ► Make sure t

o push tubes securely all the way into connectors avoiding any gas leak. To remove tubing from push-in connectors push the black or red rubber ring while pulling the tubing. If tubing doesn't easily come out, do not force it; simply make sure the black ring is properly pushed.

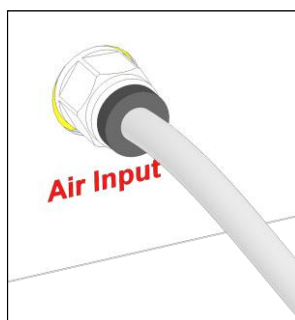


Figure 4. Avoid gas leak: strongly push the tube into the Push-in to-Fit connector.

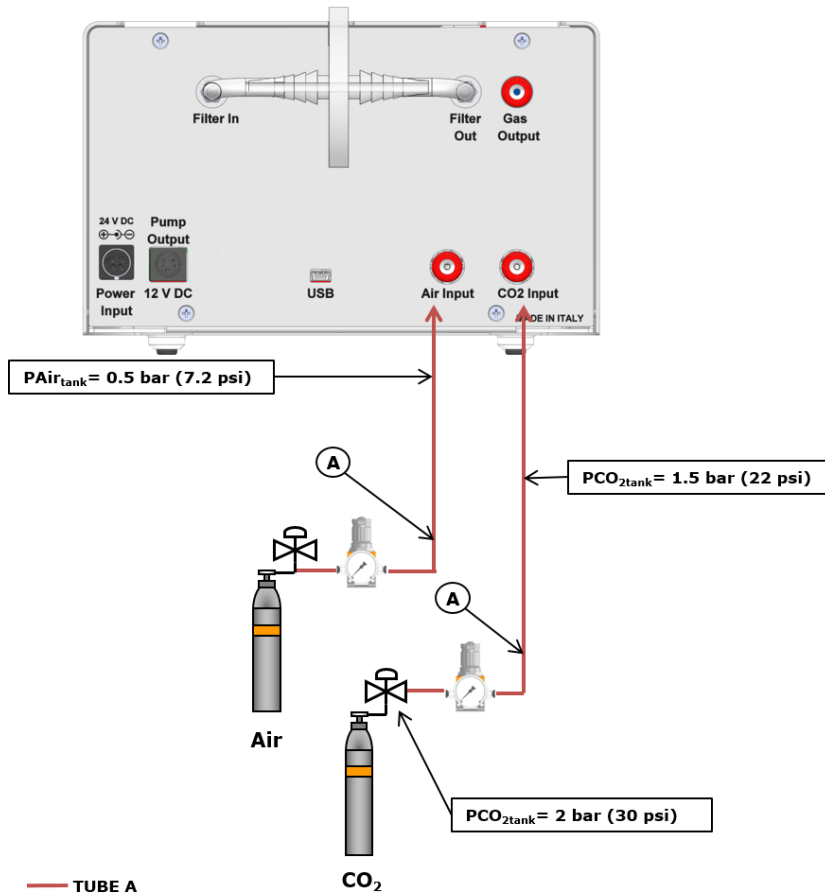


Figure 5. CO<sub>2</sub> and Air Tanks connections to the back panel of CO2-UNIT-3L.

**Note** ► When using OKO-AP-3L as air source, it is necessary to connect OKO-AP-3L to CO2-UNIT-3L as shown in Figure 6. Use the provided TUBE A to connect the OKO-AP-3L to the Air Input and connect the electrical cable of the air pump to the connector labeled 'Pump output' on the rear panel of the CO2-UNIT-3L.

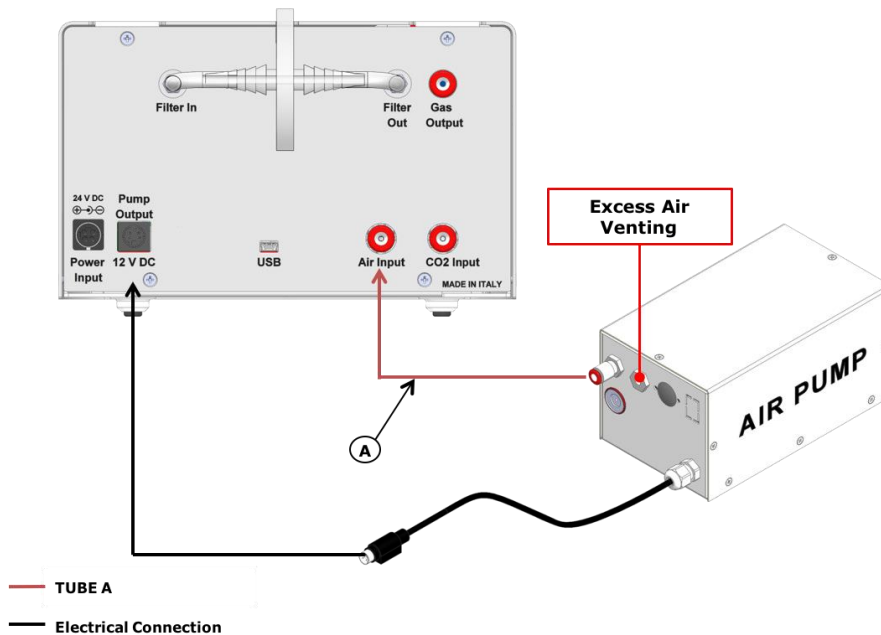


Figure 6. OKO-AP-3L Connections.



Before disconnecting any of the polyurethane tubing connected to the CO<sub>2</sub> Controller, be sure that there is no residual pressure by adjusting the pressure gauges upstream of the system and on the tanks manometer.

- Open valve on gas supply tanks and adjust the Pressure Gauge by pulling the knob up (A in Figure 7) and rotating it clockwise until the pressure reaches the desired value (B in Figure 7), then push the knob down to lock it (C in Figure 7). Set the CO<sub>2</sub> pressure value at 1,5 bar (22 psi) and the Air pressure value at 500 mbar (7,25 psi).

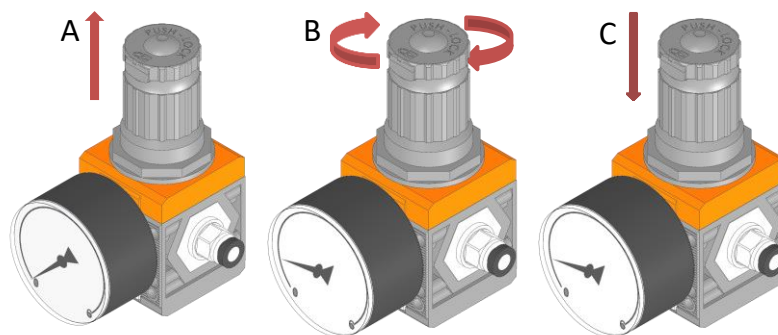


Figure 7. Pressure gauge using.

- Install the PTFE filter (pointer 2 in Figure 1) on the rear panel of CO<sub>2</sub>-UNIT-3L. The side of the filter on which 'INLET' is written must correspond to the connector labeled 'Filter In' on the rear panel, see pointer A in Figure 8. The PTFE filter allows filtering the Air/CO<sub>2</sub> flows coming from their tanks before entering in contact with gas sensors to prevent sample contamination from bacteria and gas sensors from damages caused by dirty gas streams.

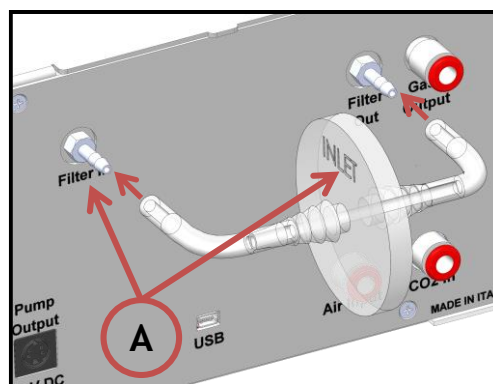


Figure 8. Filter tubing.

**Tip** ► Replace this filter each 6 months of continuous use to prevent sample contamination from bacteria and from gas sensors from damages caused by dirty gas streams.



Do not remove the filters. This may cause damages to the gas sensor and sample contaminations.

- 5 Connect the Gas Output to the Chamber Incubator using the provided TUBE A (pointer 3 in Figure 1), see Figure 9.

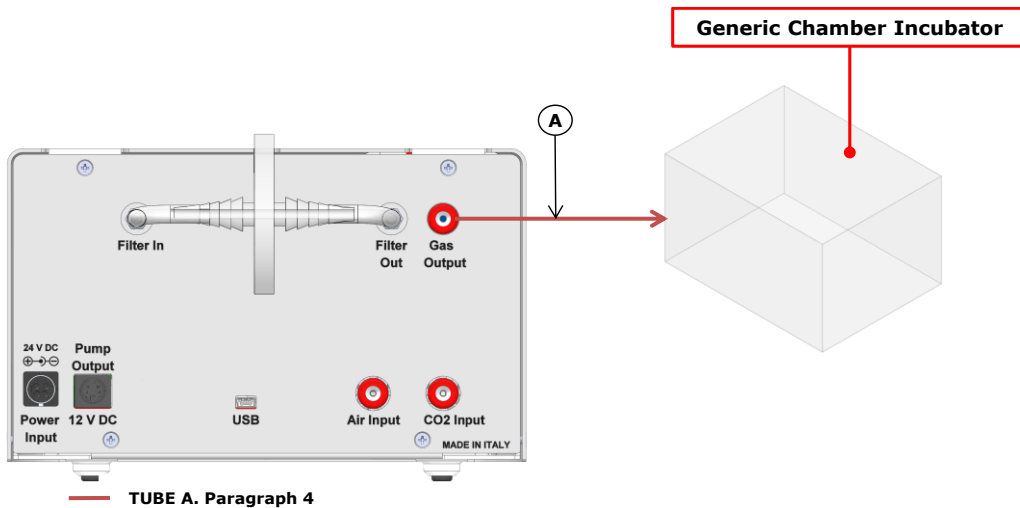


Figure 9. Generic Chamber Incubator Connection.

- 6 If CO<sub>2</sub>-UNIT-3L is equipped with OKO-TOUCH-XL, see Figure 10 for connection instructions.

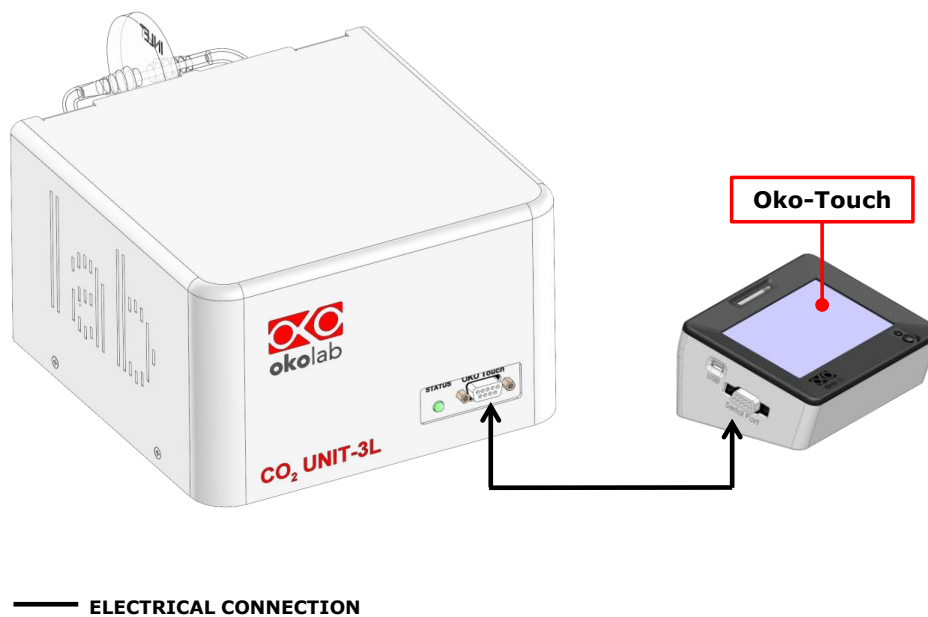


Figure 10. OKO-TOUCH-XL connection.

- 7 Connect the power feeder to the CO<sub>2</sub>-UNIT-3L (See Figure 11).

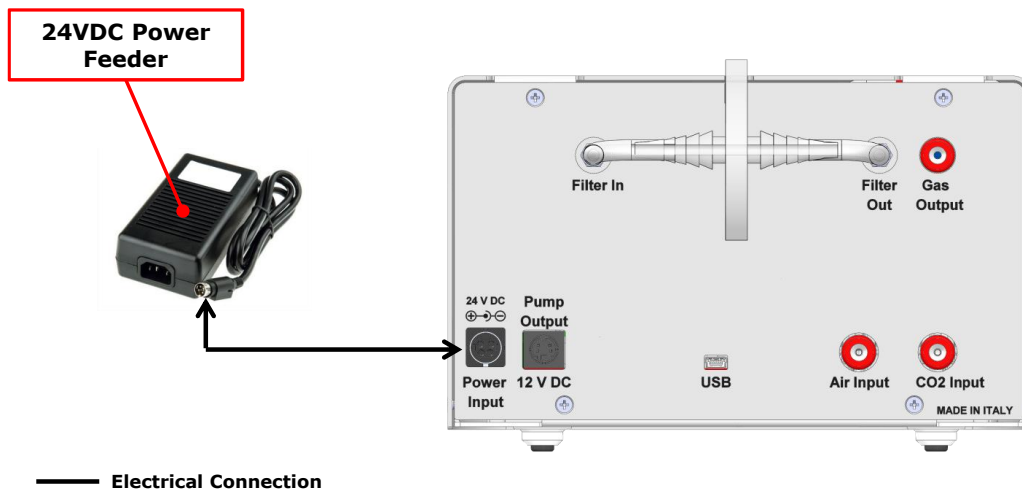


Figure 11. Power Feeder Connection.

### 7.1 PC Connection via USB

Use a standard MINI-USB cable to connect CO2-UNIT-3L to a PC, as shown in Figure 12. You can communicate with CO2-UNIT-3L via PC by using:

- DATA-LOG software. The software allows to log and to analyze the data provided by CO2-UNIT-3L via PC. Refer to DATA-LOG user manual for more info.
- SDK (OKOLAB API) for integration in third party software [http://www.oko-lab.com/support#soft\\_int\\_tools](http://www.oko-lab.com/support#soft_int_tools).

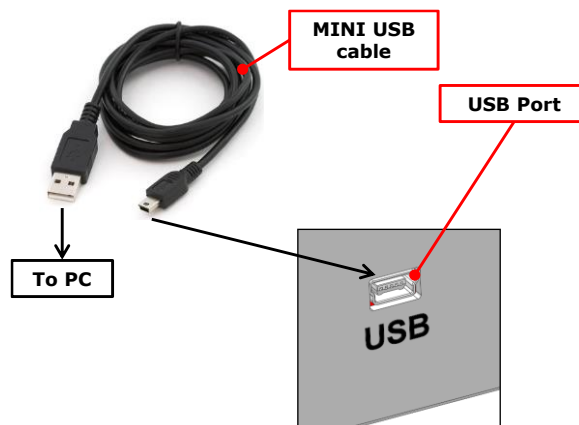


Figure 12. PC connection via USB.

### 7.2 CO2-UNIT-3L fixing

CO2-UNIT-3L is equipped with four supporting feet to be conveniently positioned on a table, shelf or working bench. The position of the supporting feet is indicated in Figure 13. CO2-UNIT-3L also features two threaded holes in the base panel, indicated with A in Figure 13, which can be used to fix the device with screws.

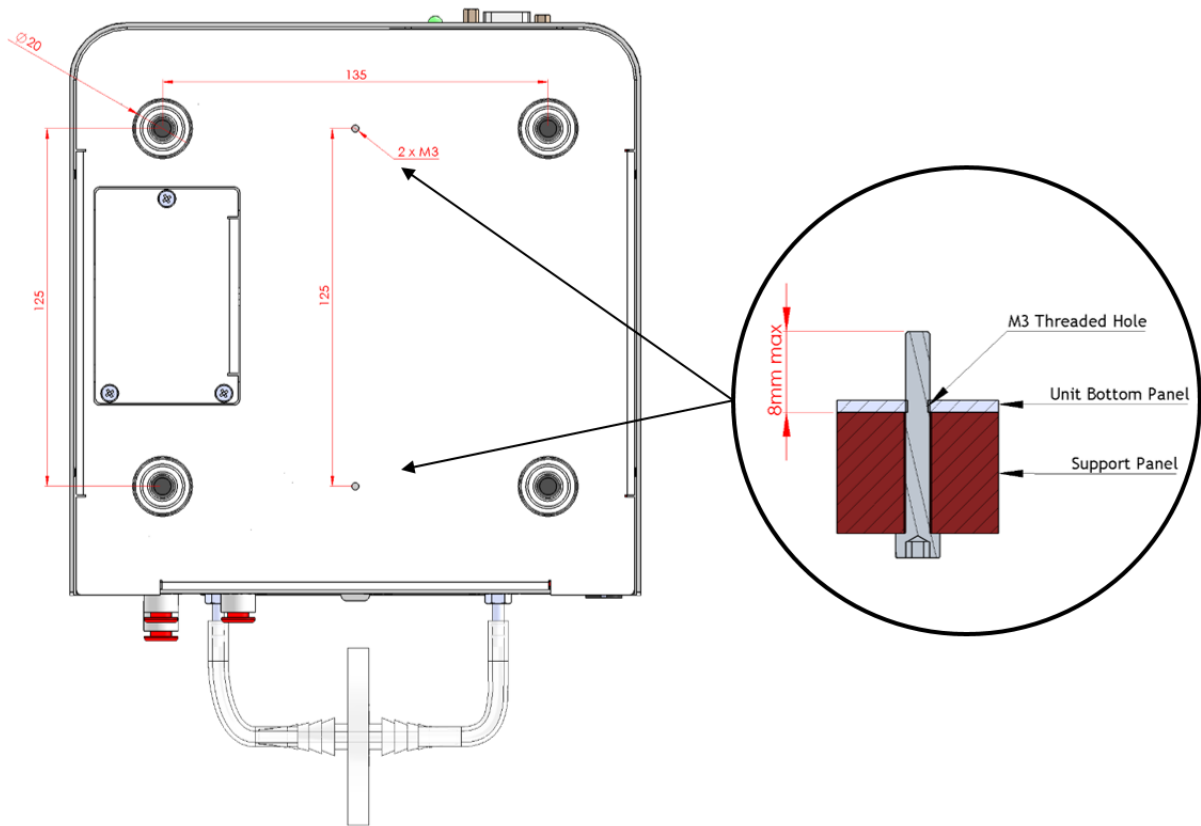


Figure 13. CO2-UNIT-3L, bottom panel with threaded holes and feet supporting position.

## 8 USER INTERFACE

This chapter describes the user interface of CO2-UNIT-3L.

### 8.1 Homepage

Figure 14 shows the main control panel, in particular it highlights 19 pointers detailed below.

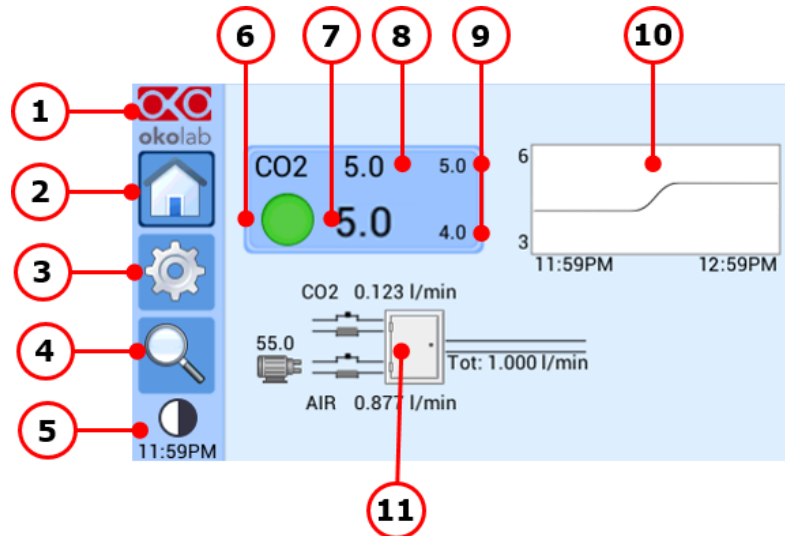


Figure 14. Home page.

1. **System Information.** Press here to know generic info about CO2-UNIT-3L and its running time. See paragraph 8.2.
2. **Home.** Press here to return to the home page.
3. **Settings.** Press here to access system options and settings. See paragraph 8.3.
4. **Status.** Press here to see the status of your system (you will need this page in case of assistance). See paragraph 8.4.
5. **Glance mode.** Press here to switch the display to glance mode. See paragraph 8.3.1.5 and 8.5.
6. **Status led.** See paragraph 8.1.1 for the color mapping.
7. **Current CO2 %**
8. **CO2 % set point**
9. **Minimum and Maximum CO2 % values** in the actual time window.
10. **CO2 % evolution graph.** Press here to enlarge the plot.
11. **Valves opening status**



### 8.1.1 Colors meaning



The **GREEN** indicator indicates that the set-point value has been reached (within the tolerance you have set in the alarm subpage, see paragraph 8.3.2) and that the system is working properly.



The **YELLOW** indicator means that the system is working towards reaching the set-points (transient state). No actions on your part are required. Please note the Yellow light will also appear every time you change concentration set point.



The **ORANGE** indicator means that the current concentration is out of the tolerance you have set (see paragraph 8.3.2). Verify that all cables are properly connected. Check all the enclosures to verify that they are properly closed.



The **RED** indicator means that there is a problem with the unit itself. Turn the system off, wait 5 minutes, and turn it back on. If the problem continues, contact Okolab at [www.oko-lab.com](http://www.oko-lab.com)

### 8.1.2 Changing the concentration set point

To input a new CO<sub>2</sub> concentration set point, touch the corresponding tab, indicated as Pointer 1 in Figure 15(a).

The set point regulation page will appear as in the Figure 15(b). You can modify the set point by clicking on +/-, see Pointer 2. Once you have input the new set point concentration, press *Set* to save (or *Cancel* to undo), see Pointer 3.

*Tip* ► After any change in the set point value the controller enters into a transient regime, the Status Indicator and the Top LED turn yellow (see paragraph 8.1.1). During the transient regime, the controller will not trigger on alarm. The maximum length of the transient regime is set by the operator as indicated in paragraph 8.3.2.

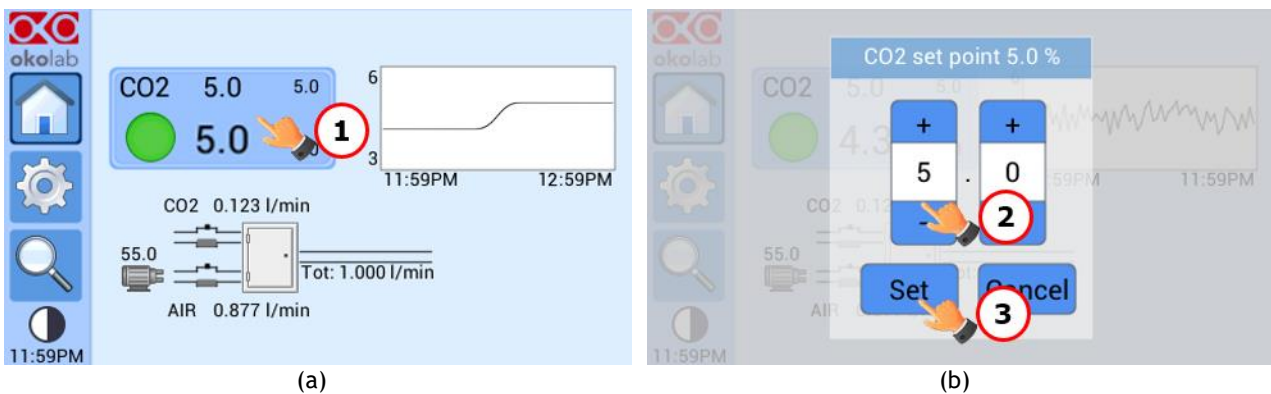


Figure 15. Changing the concentration set point.

### 8.1.3 Graph view

By pressing on the Concentration evolution chart (pointer 1 in Figure 16(a)), the Graph view page will open.

By checking or unchecking the checkbox Grid (pointer 2 in Figure 16(b)), it is possible to see or to remove, respectively, the grid behind the graph.

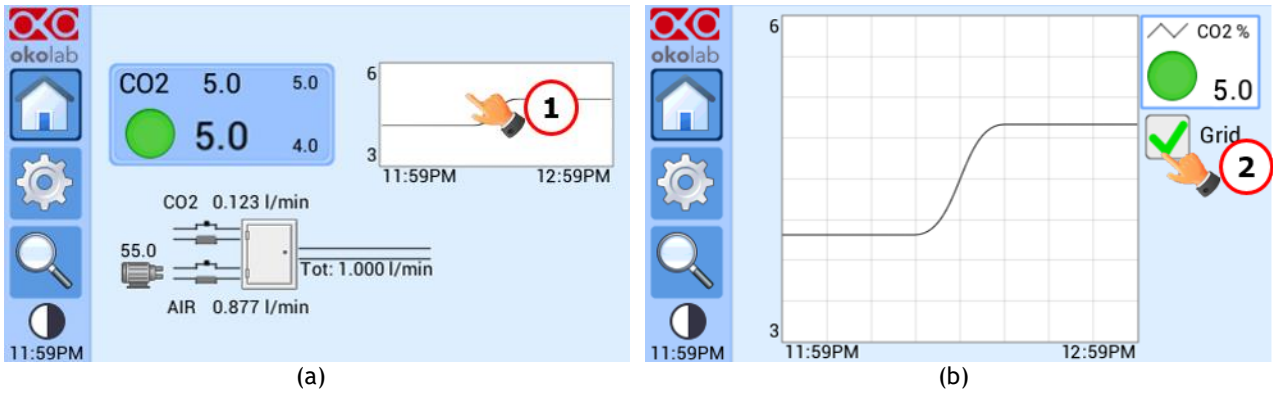



Figure 16. Graph view.

## 8.2 System Information

Press the icon  to access the *Info Page*, as shown in Figure 17. This page contains the information related to CO2-UNIT-3L version.

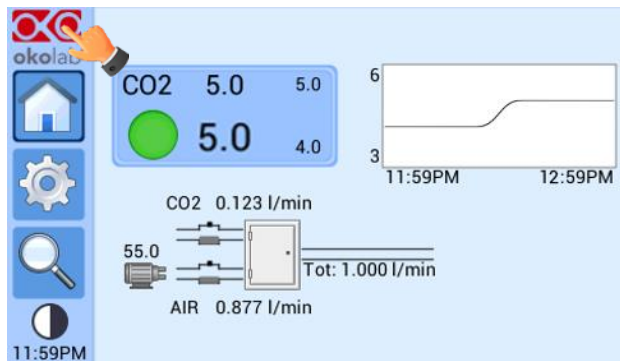


Figure 17. Info page selection

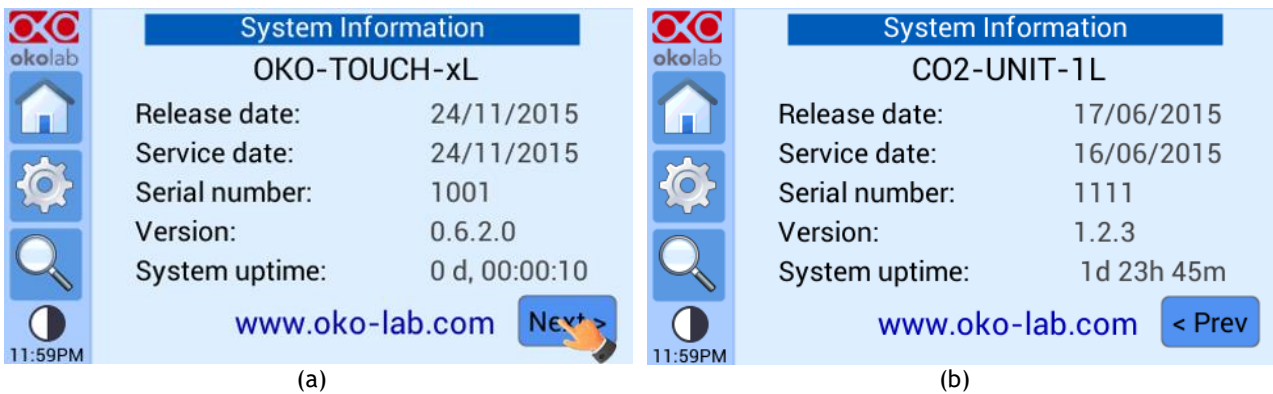



Figure 18. Info pages

**Tip** ► Please have this information handy when contacting Okolab for support.

## 8.3 Settings

Press on *Settings* icon  to enter the *Settings* menu, as shown in Figure 19.

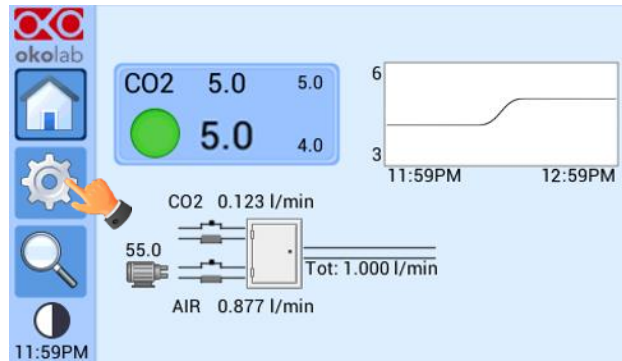


Figure 19. How to access the Settings page.

The settings menu has 6 items, as Figure 20 shows:

1. **Display.** See paragraph 8.3.1
2. **Alarms.** See paragraph 8.3.2
3. **Calibrations.** See paragraph 8.3.1
4. **Flow Rates.** See paragraph 0
5. **Air Source.** See paragraph 8.3.5
6. **Pump Usage.** See paragraph 8.3.6

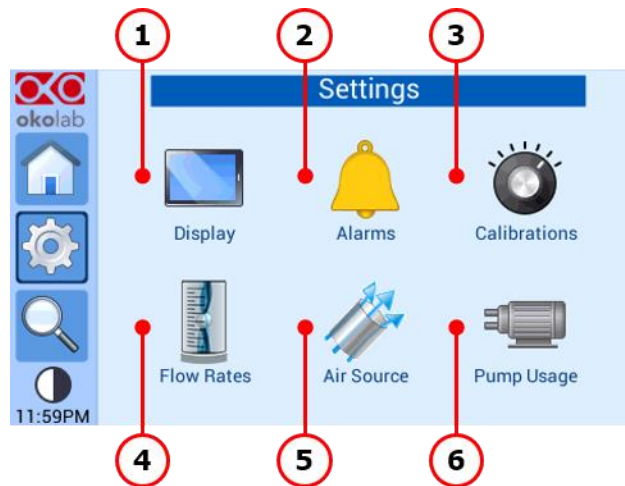



Figure 20. Settings.

Each of the aforementioned item will be detailed in the following.

### 8.3.1 Display

To enter the Display configuration menu, press on the icon , as shown in Figure 21(a) and the Display page shown in Figure 21(b) will appear.

1. **Options.** See paragraph 8.3.1.1.
2. **Brightness.** See paragraph 8.3.1.2.
3. **Calibration.** See paragraph 8.3.1.3.
4. **Date & Time.** See paragraph 8.3.1.4.
5. **Visual Effects.** See paragraph 8.3.1.5.
6. **Factory Reset.** See paragraph 8.3.1.6.

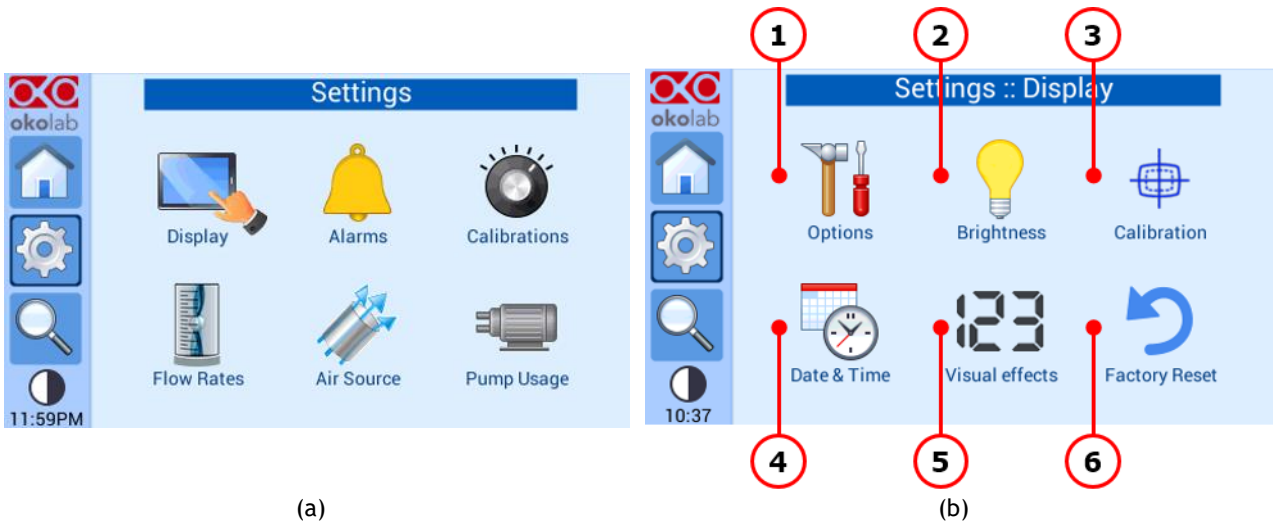


Figure 21. Display settings page. (a) How to enter the Display menu. (b) Display menu.

### 8.3.1.1 Options


The Display Options menu allows to set the time frame in which the minimum and maximum CO2 concentration values are collected. To insert the time frame, press on the icon  and slide your finger along the *Displayed time frame* bar or click the +/- icons, then press *Save*, see Figure 22.



Figure 22. Options subpage configuration. (a) Select options; (b) Setting display options


To change the touch sound frequency press and slide your finger along the setting bar indicated with *Sound frequency*, then press *Save*, see Figure 22(b)

**Note** ► The max and minimum concentration values will be displayed in the top left box in the Homepage (see pointer 9 in Figure 14).

**Note** ► The collected points are 60, regardless the time frame, hence, changing on the Displayed time frame will change the time interval between two collected points as well.

**Note** ► To activate a sound at each touch, flag the tab labeled *Touch Sound*

### 8.3.1.2 Brightness

To modify display *Brightness* press the icon  and scroll the bar or press the +/- icons in the page that opens, as shown in Figure 23.

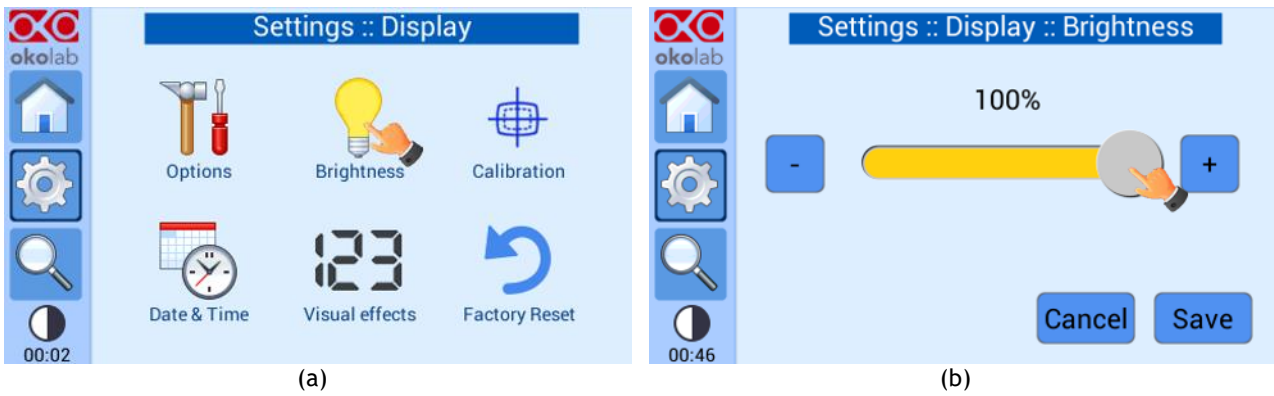



Figure 23. Brightness display page

Set the required configuration and then press on *Save* to obtain the right configuration of *Brightness*, see Figure 23(b).

### 8.3.1.3 Calibration

When pressing the calibration icon , the procedure for the calibration of the touch screen will start.

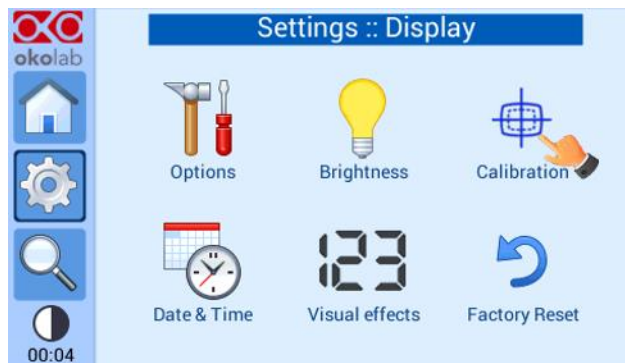



Figure 24. Touch screen calibration.

**Tip** ► The calibration procedure will start also by pressing the power button for 10 seconds. This feature is useful specially when a previous touch calibration went wrong, making the interface not responsive.

### 8.3.1.4 Date & Time

To set Date & Time, follow the instructions below:

1. Press the *Date & Time* icon , see Figure 25(a)
2. Set the values, as shown in Figure 25(b)
3. Click on *Save* to save or *Cancel* to undo

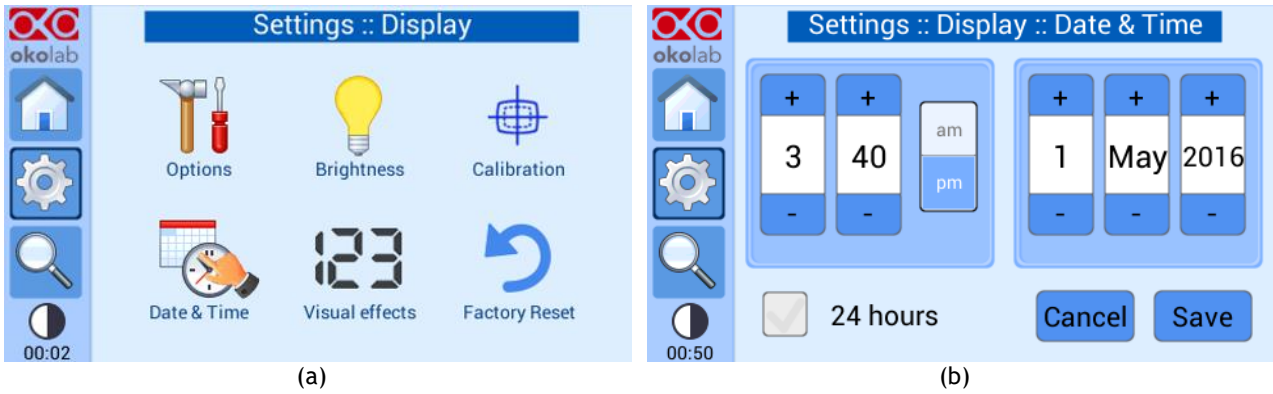


Figure 25. Select Date&Time configuration.

**Tip** ► Flag the 24 hours box, if you want to use the hour format based on 24 hours.

### 8.3.1.5 Visual Effects

To enter in the Display visual effects menu, press on the icon , see Figure 26 (a).

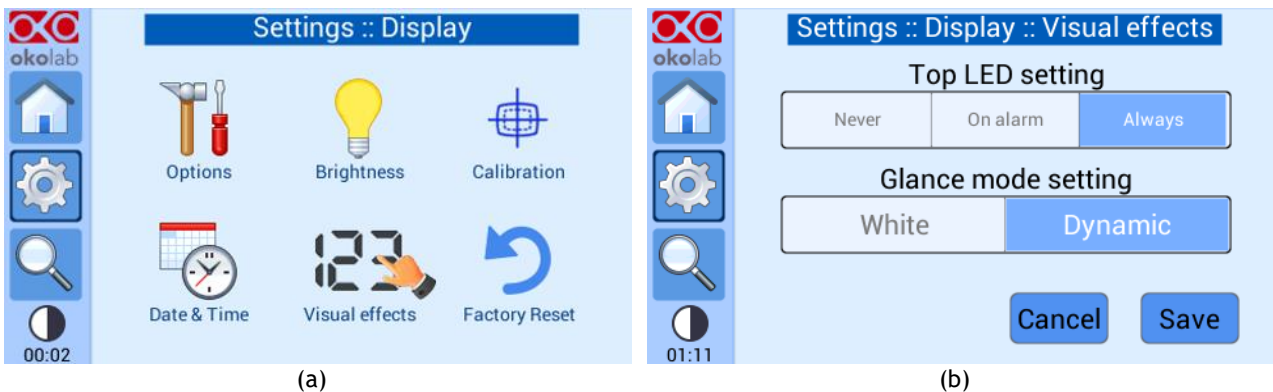


Figure 26. Display Visual Effects. (a) How to enter in Visual Effects menu; (b) Visual Effects menu.

The Top LED settings allows you to when the Top LED should be illuminated: if you select *Never*, the Top LED will never illuminate, if you select *On Alarm*, the Top LED will illuminate only when CO2-UNIT-3L is in Alarm Status (see paragraph 8.1.1), if you select *Always*, the Top LED will always illuminate.

Glance Mode Setting (see also paragraph 8.5)

The Glance mode setting defines the color of the Top LED and of the digits displayed in Glance Mode. If you select *White*, the Top LED illuminates in white color (according to the criterion selected in Top LED setting) and the digits displayed in Glance Mode are white. If you select *Dynamic* the color of the Top LED and the color of the digits in Glance Mode follow the color coding reported in paragraph 8.1.1.

**Tip** ► To swap between Icon and Glance mode press on the icon

### 8.3.1.6 Factory Reset

To reset the display settings, press on the icon , see Figure 27(a). At this point Figure 27(b) will appear, asking to confirm the Factory Reset of the display.

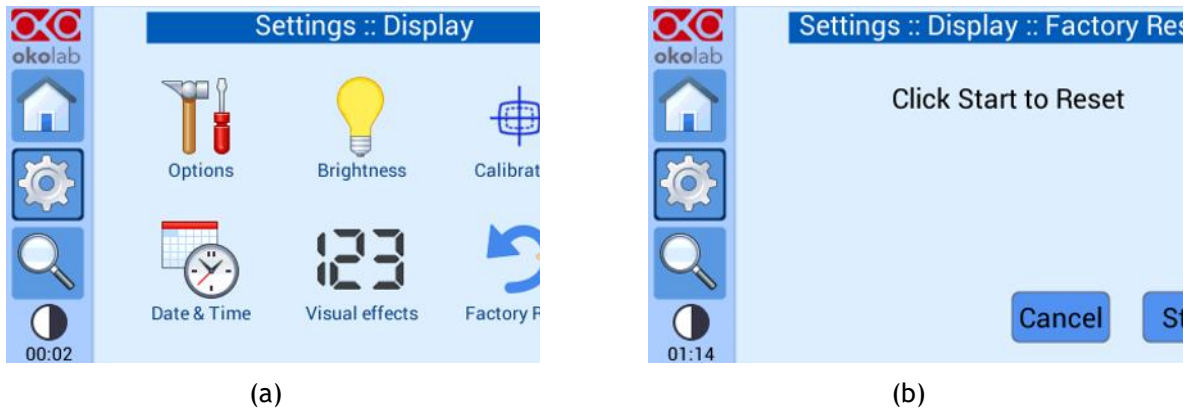



Figure 27. Factory reset.

### 8.3.2 Alarms

When CO2-UNIT-3L triggers on alarm, it may activate both visual and audible alarms.

To set the alarms specifications, press on the Alarms icon ; see Figure 28(a) then follow the indications below:

1. Insert the alarm time; i.e. the time for which the CO2 concentration may remain outside the allowed tolerance before the controller triggers in alarm, see 1 in Figure 28(b)

**Note** ► The alarm time range is 5-20 minutes.

2. Insert the *Tolerance* value, see 2 in Figure 28(b). This value defines the allowed tolerance form the set point.

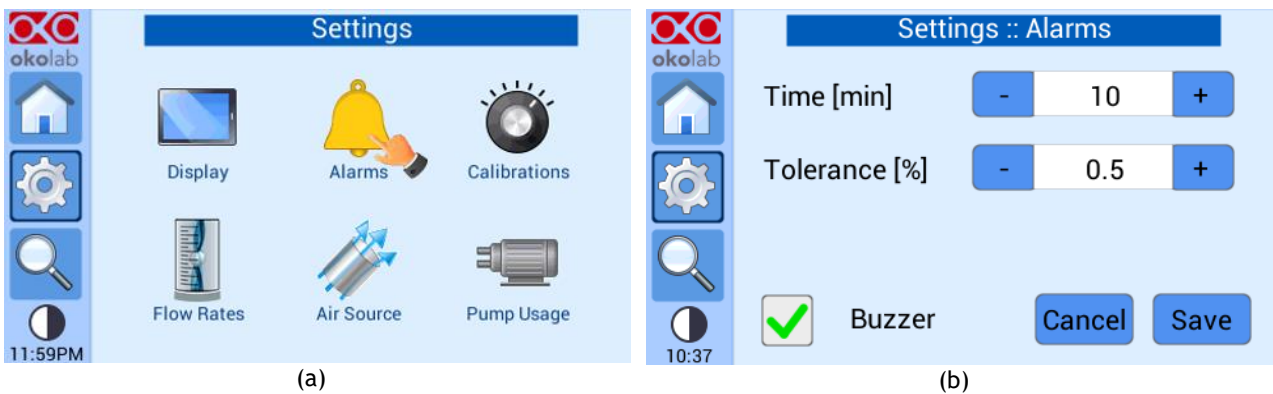


Figure 28. Alarms settings. (a) How to enter the Alarm setting menu; (b) Alarm configuration

3. Flag the tab labeled *Buzzer* if you want the alarm to be acoustical, additionally to being visual, see Figure 28(b)

### 8.3.3 Calibrations


Press on *Calibration* icon  to enter the *Settings* menu, as shown in Figure 29.




Figure 29. How to access Calibration menu.

Once you are in the *Control Mode* submenu it is possible to choose:

1. *Sensors*. Here you can perform the calibration of the sensors, see paragraph 8.3.3.1.
2. *Offset*. Here you can adjust manually the reading offset, see paragraph 8.3.3.2.

### 8.3.3.1 Sensors

Press on *Sensors* icon , as Figure 30 shows, to enter the Chamber Calibration submenu in Figure 30.

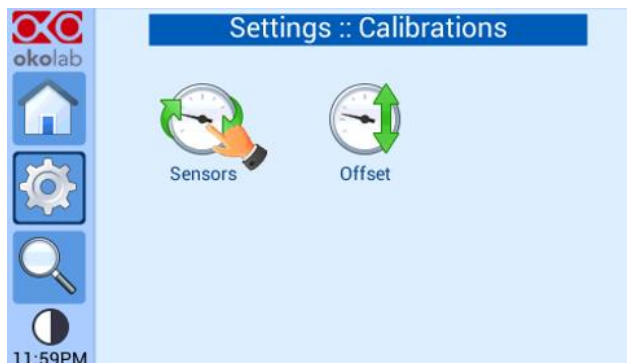


Figure 30. Sensors calibration.

Five options are available to the Chamber Calibration, see Figure 31:

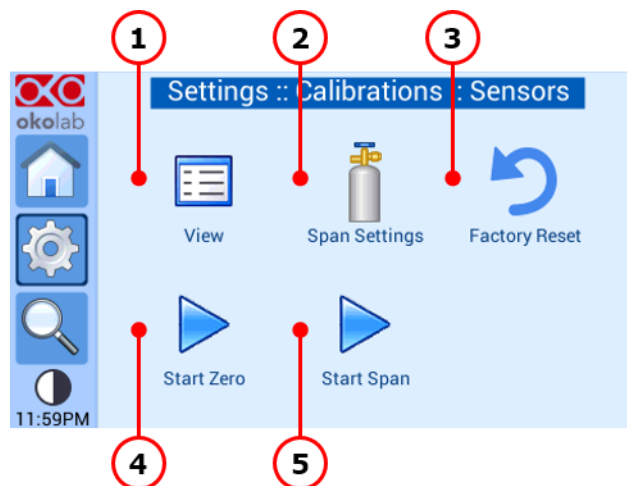



Figure 31. Sensors calibration Menu.

1. **View.**



2. Span Settings.
3. Factory Reset.
4. Start Zero.
5. Start Span.

### 8.3.3.1.1 View

Press on View icon  , as Figure 32(a) shows, to view the latest calibration outcome as in Figure 32(b).

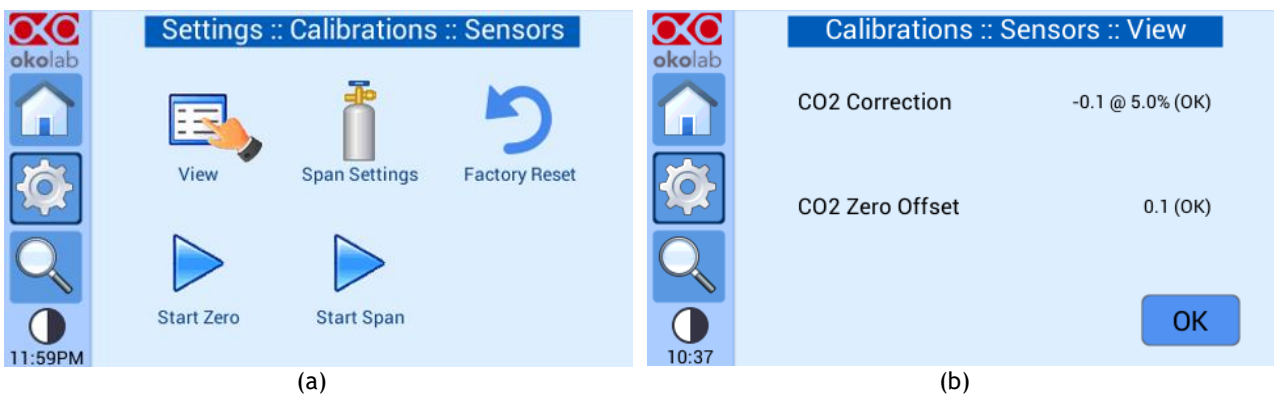



Figure 32. View Sensor calibration status.

### 8.3.3.1.2 Span settings

Press on Span Settings icon  , as Figure 33(a) shows, to set your span gas settings as Figure 33(b) shows.

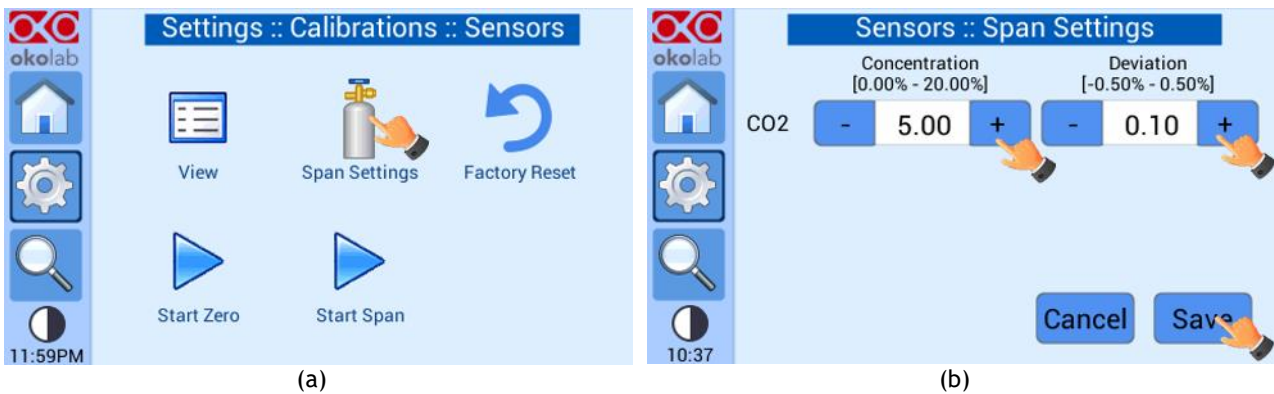



Figure 33. Span Settings Menu.

**Note** ► The Concentration and the Deviation can be easily retrieved on the span gas tank label. The Concentration is the mean gas concentration in the tank while the Deviation, also known as blending tolerance, is the concentration range that includes minor component also present in the gas mixture.

### 8.3.3.1.3 Factory Reset

Press on Factory reset icon  , as Figure 34(a) shows, to reset your Gas Calibration to factory settings by clicking on Reset button as Figure 34(b) shows.

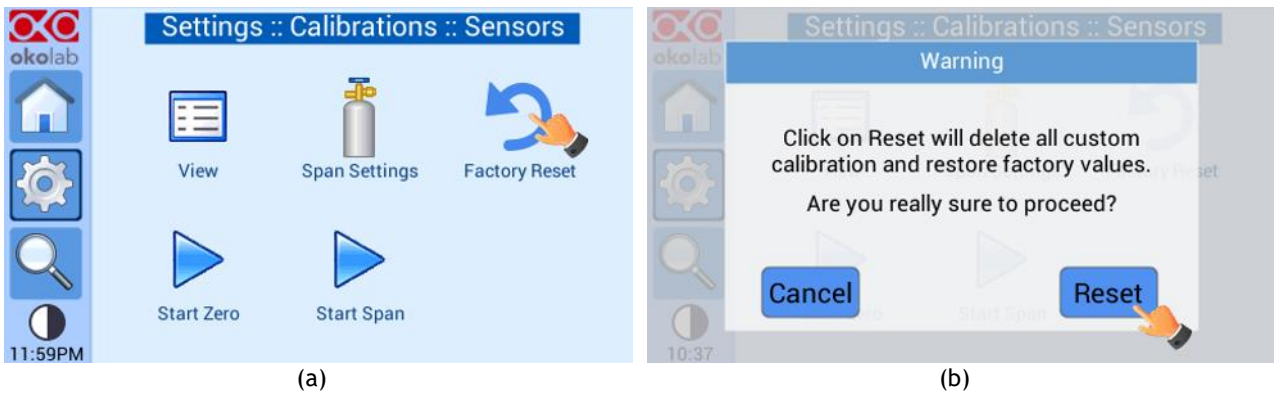



Figure 34. Span Settings Menu.

### 8.3.3.1.4 Start Zero

Press on *Start Zero* icon , as Figure 35(a) shows, to perform a new Gas Calibration for the CO<sub>2</sub> at 0% concentration (using N<sub>2</sub> only).

After clicking a pop-out message, see Figure 35(b), will appear, warning about the pause of the control during the calibration routine.

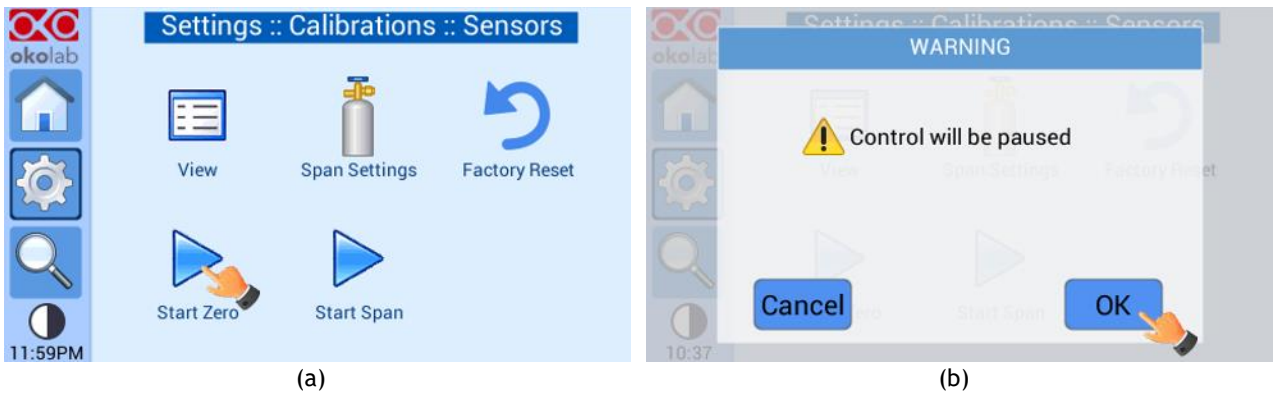


Figure 35. Start Zero calibration.

After clicking “OK”, as Figure 35(b) shows, the page in Figure 36(a) will appear; at this point connect N<sub>2</sub> at 0.5 bar to the Air Input, located on the rear panel of CO<sub>2</sub>-UNIT-3L, and press “OK”: the Zero Calibration will start and the progress bar in Figure 36(b) will appear.

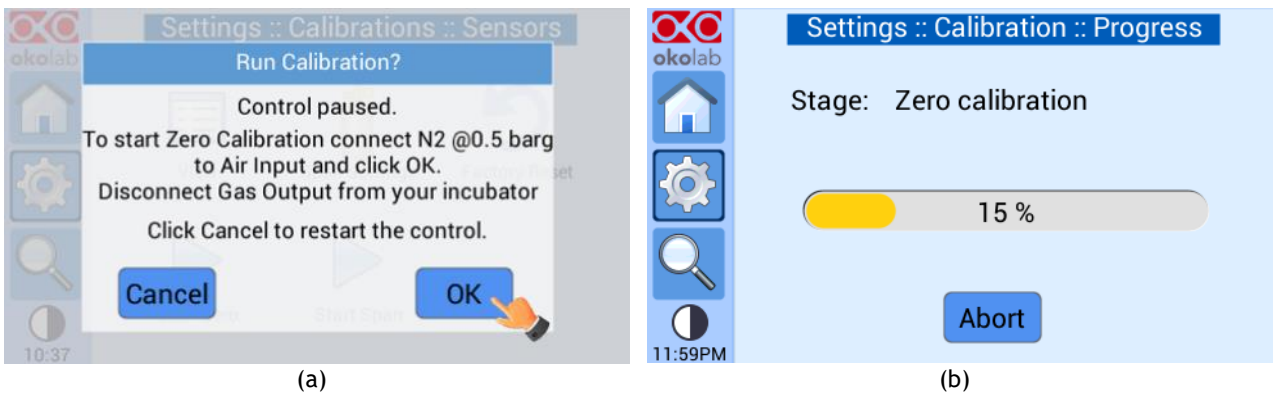



Figure 36. Zero Calibration running.

### 8.3.3.1.5 Start Span

Press on *Start Span* icon , as Figure 37(a) shows, to perform a new Gas Calibration using a Span gas.

After clicking a pop-out message, see Figure 37(b), will appear, warning about the pause of the control during the calibration routine.

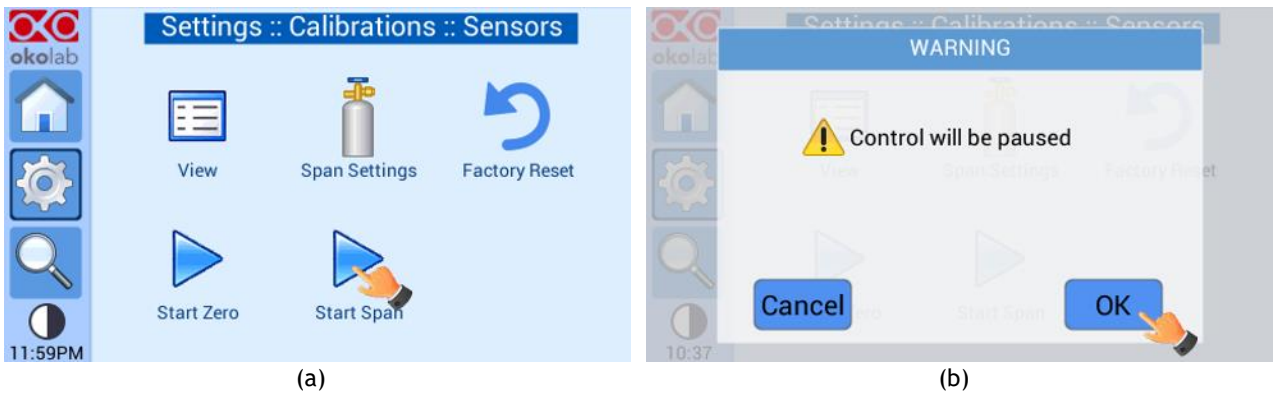


Figure 37. Start Span calibration.

After clicking “OK”, as Figure 37 (b) shows, the page in Figure 38 (a) will appear; at this point connect the span tank at 0.5 bar to the Air Input, located on the rear panel of CO2-UNIT-3L, and press “OK”: the Span Calibration will start and the progress bar in Figure 38(b) will appear.

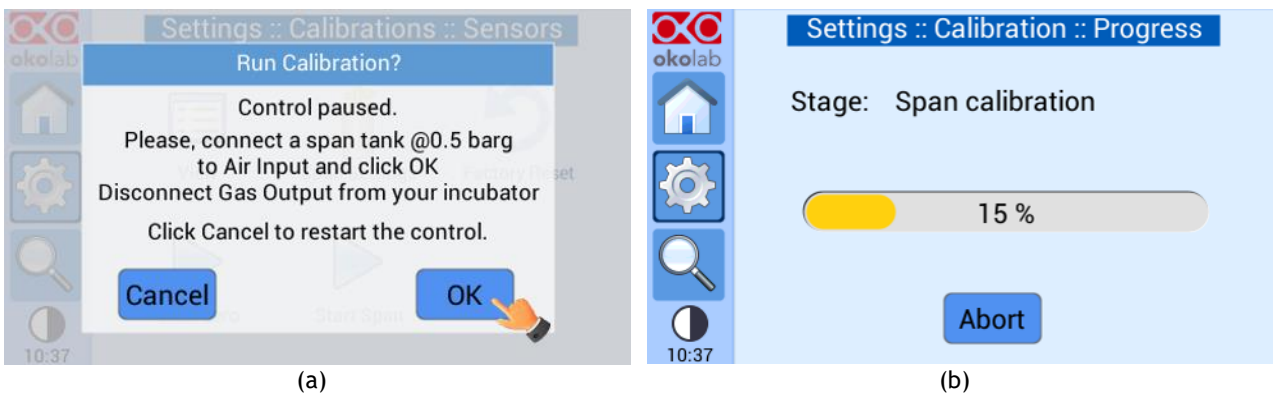


Figure 38. Span Calibration running.

Once the calibration finishes, the pop-up page in Figure 39 will appear. Press “OK” to return to normal operations.

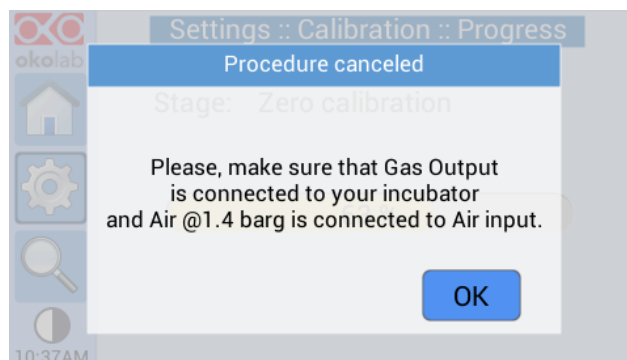



Figure 39. Calibration end.

### 8.3.3.2 Offset

If you are using an external Gas Reader, it is possible to manually calibrate CO2-UNIT-3L. It is possible to adjust the CO2 sensor reading by inserting the offset by pressing on the *Offset* icon  as Figure 40 shows.

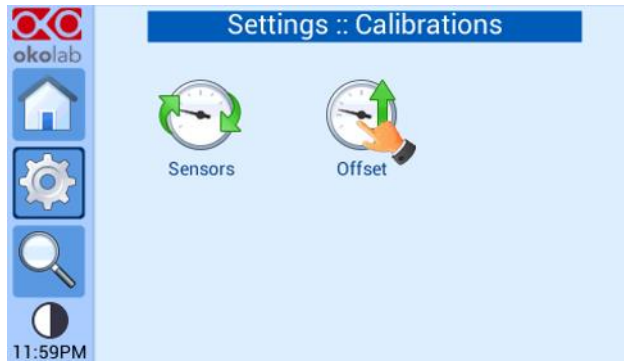


Figure 40. Offset menu.

**Tip** ► Okolab recommends using a certified gas meter as external reference.

It is necessary to connect the external gas meter to the port “Gas Output” on the rear of the CO2-UNIT-3L (see Figure 41). First disconnect the blue tubing inserted into the “Gas Output” port. Remove it by keeping the black ring of this connector pushed in; you should feel no resistance in pulling this tubing out. If you do make sure you are properly pushing in the black ring.

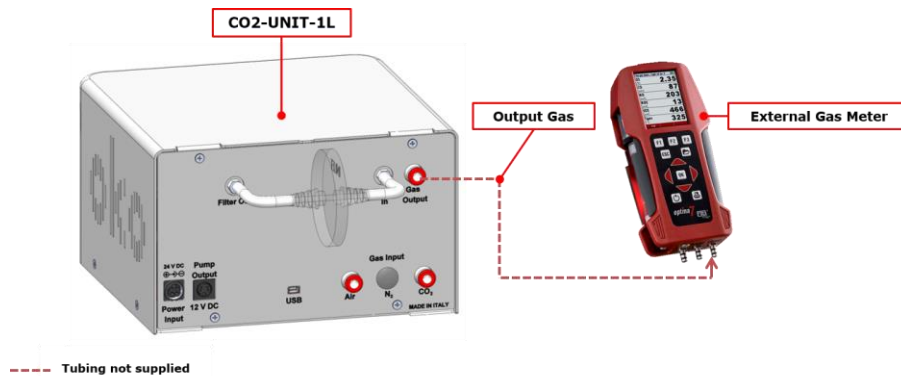


Figure 41. External Gas Meter Connection.

Connect the external Gas meter as described above (see Figure 41). The Gas Meter will read same gas levels that are going into the Top Stage Incubator. Wait until the external Gas meter steadily reads CO<sub>2</sub> value; this may take 10-15 minutes. When you are sure that the value being read is at steady state press on the “External Probe” Tab. The screenshot shown on the right of Figure 42 appears. Press on “+/-” to input the CO<sub>2</sub> level read by the external Gas meter (i.e. 5.5% for CO<sub>2</sub>), then press “Save”.



Figure 42. Manual Calibration.

The Touch Screen will go back to the previous screen. It will display on the left (“External Probe” tab) CO<sub>2</sub> level read by the external Gas meter as you have just input. The value in the “CO<sub>2</sub> Unit” tab is the

value that the device (CO2-UNITL-3L) was reading before connecting it to the external Gas meter. Now press “Adj CO2”

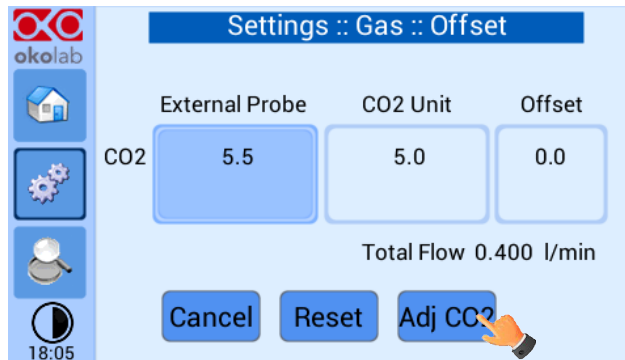


Figure 43. Manual Calibration Correction

Once you have pressed “Adj CO2”, the system will perform a self-calibration using the input value from the external meter as a reference. After pressing “Adj CO2” an offset resulting from the calibration will be displayed on the “Offset” tab (last tab on the right). Now you can press the “Home” icon to go back to the Main page.

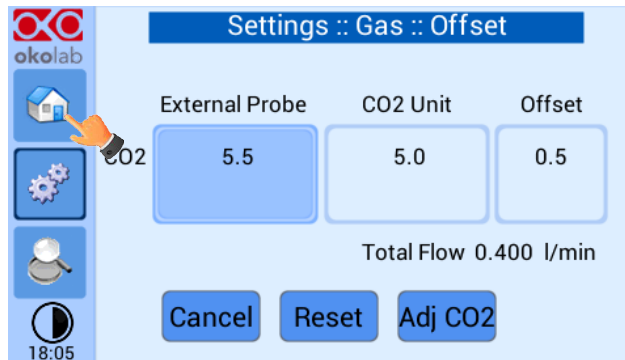



Figure 44. Manual Calibration End



Please make sure that the external Gas meter you use has been recently calibrated and that it has sufficient accuracy. It often happens that external Gas meters are less accurate than Okolab CO2-UNIT-3L, and are not suitable to perform the calibration described above.

Finally, if you are unsure on the calibration you have just performed or if for any reason you want to reset to the factory calibration go “Factory Reset” (paragraph 8.3.3.1.3).

#### 8.3.4 Flow Rates

Press on *Flow Rates* icon , as Figure 45 shows, to enter the Flow Rates menu.

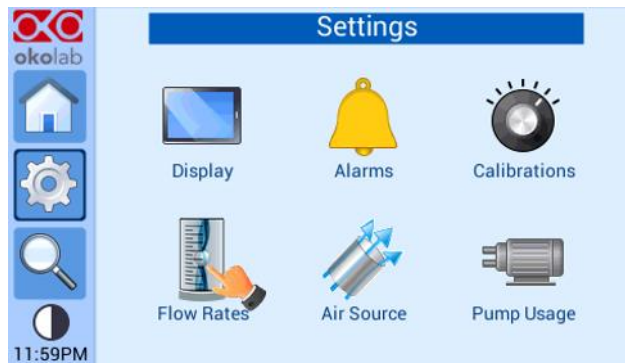


Figure 45. Flow Rates.

### 8.3.4.1 Changing the Total Flow set point

To change the *Total Flow set point*:

1. Press on the Total Flow indicator, on the right in Figure 46(a);
2. Select the desired set point value, see Figure 46(b);
3. Press on “Save” button Figure 46(a).

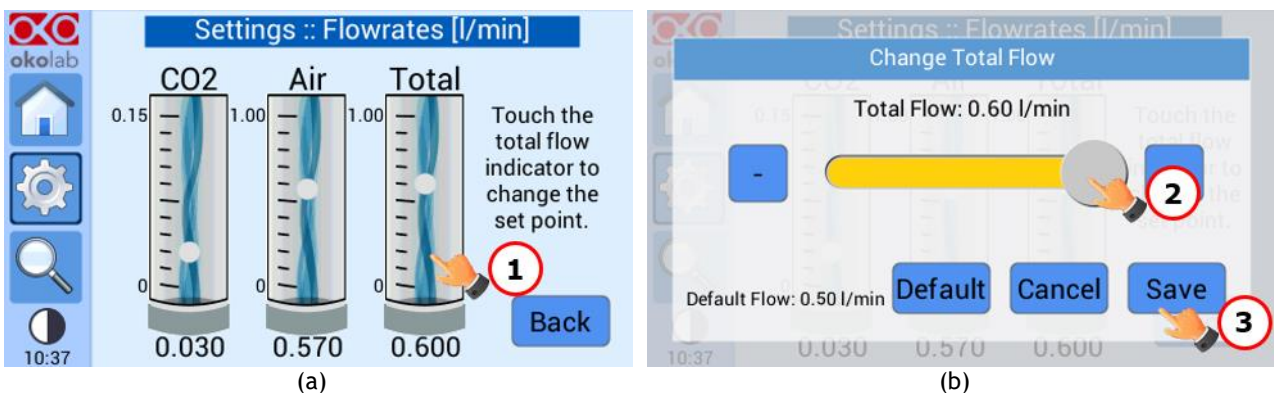



Figure 46. How to change the Total Flow set point.

**Note** ► To reset the Total Flow set point to the default value (0.5 l/min) press on the “Default” button.

**Note** ► A Total Flow higher than 2.5 l/min can be achieved by using Compressed Air as Air Source.

### 8.3.5 Air Source

Press on *Air Source* icon , as Figure 47(a) shows, to enter the Air source menu in Figure 47(b). Here it is possible to select as Air Source:

1. Compressed Air. Flow rate up to 3 l/min.
2. Air Pump. Flow rate up to 2.5 l/min

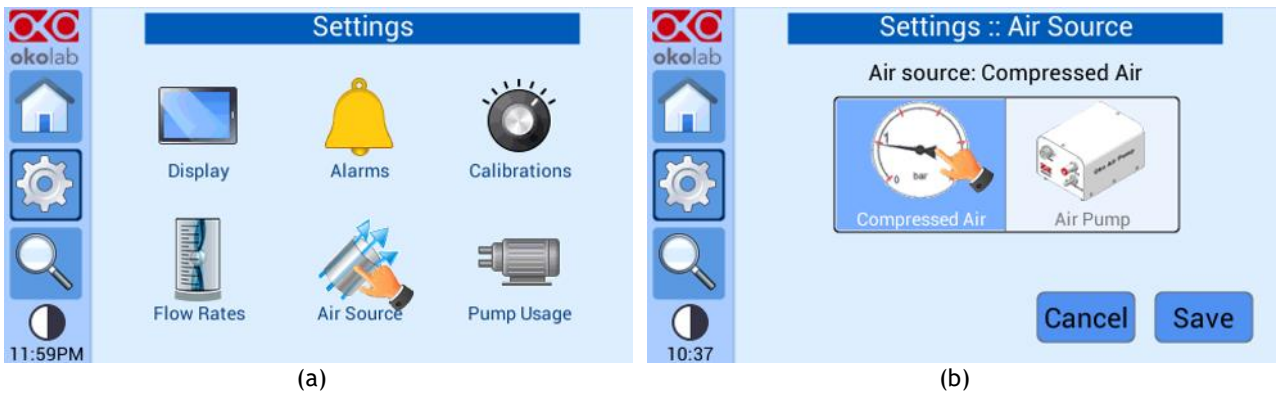


Figure 47. Air Source.

When Air Pump is selected, by pressing “Adv” button as in Figure 48(a), it is possible to access to the Air Pump advanced menu where it is possible to change the Air Pump speed offset. The Air Pump Speed Offset permits to adjust the flow amount of air in the range [-10; +10] %, the default value is 0%.

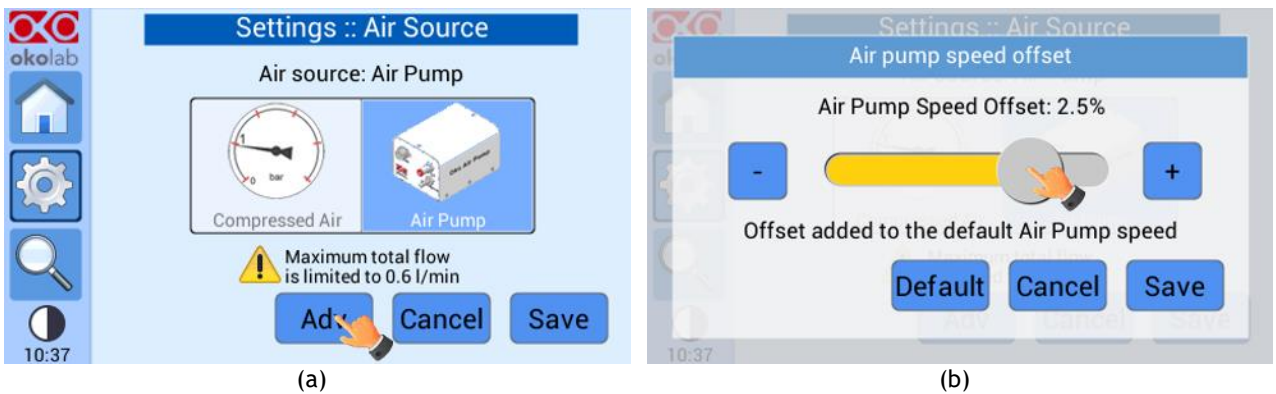



Figure 48. Air Pump Advanced menu.

### 8.3.6 Pump Usage

Press on Pump Usage icon , as Figure 49(a) shows, to enter the Pump Usage Info page in Figure 49 (b). Here it is shown the lifetime of the Air Pump.

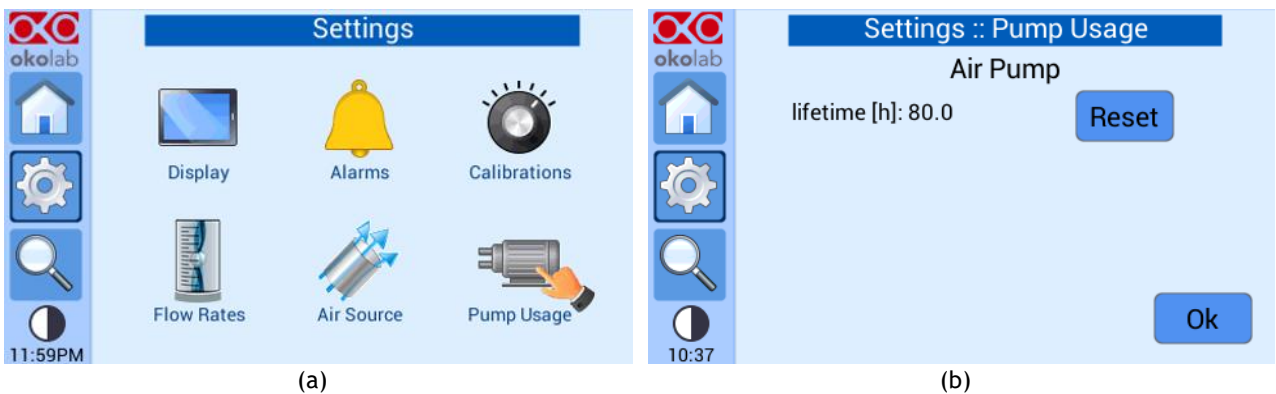


Figure 49. Pump Usage.

**Tip** ► Press on “Reset” button to reset the air pump lifetime counter. To be used only after the air pump has been replaced, to have a good expectation of the residual lifetime of the air pump.





## 8.4 Status

On this page you can read the Status of the Gas Blender; this is useful to check that the system is working properly. Most of the parameters displayed are technical/control parameters that you may be asked to access in case you have requested for Okolab support.

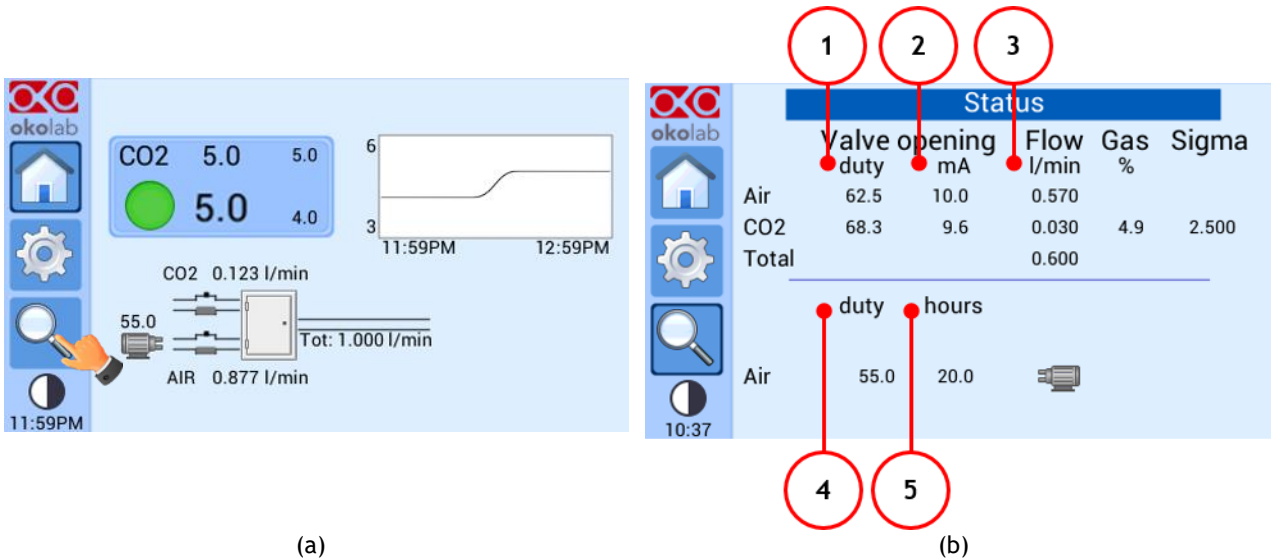


Figure 50. Status page.

## 8.5 Glance Mode

Pressing on 'Glance Mode' (see Figure 51(a)), you can change the data visualization format on the Homepage that turns into a brief information about the state of the atmosphere inside the incubator, as Figure 51(b) shows.

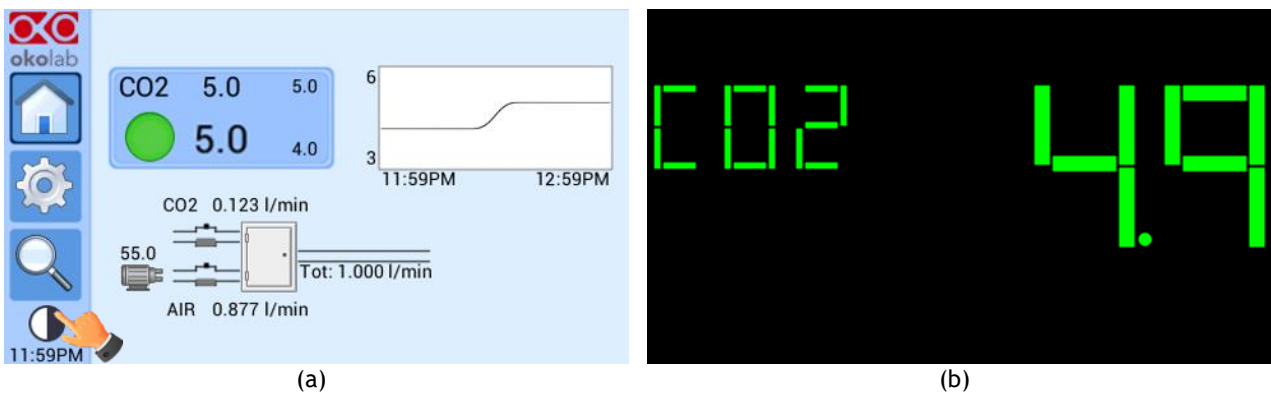


Figure 51. Glance Mode view.

This visualization type allows you to have a quick overview of the device from far away. See paragraph 8.3.1.5 for Glance Mode settings.

## 9 Maintenance

In this section is described how to replace the spare parts in order to keep the CO2-UNIT-3L efficient during time.

The following list is related to the components that could be subjected to damage, but can be replaced easily:

1. **The fuses:** with reference to this operation, please see subsection 9.1.
2. **The valves:** the CO2-UNIT-3L is supplied with two valves for controlling CO<sub>2</sub> and air injection, respectively. The spare parts code are: CO2-UNIT-3L-2-SP-CO2-VALVE for the CO<sub>2</sub> valve and CO2-UNIT-3L-2-SP-AIR-VALVE for the air valve, see Table 1. Contact Okolab for this operation.

The following components need to be changed due to the aging caused by the moving parts:

3. **CO2-UNIT-3L-2-SP-PUMP:** this part is the pump inside the CO2-UNIT-3L and needs to be changed after 9000 hours of operation. With reference to this operation, please see subsection 9.2.
4. **OKO-AP-3L-SP:** this part is the pump inside the optional air pump OKO-AP-3L and needs to be changed after 9000 hours of operation. With reference to this operation, please see subsection 9.3.



- Verify periodically the status of all cables. If some cable is damaged, contact Okolab to receive assistance.
- Verify periodically the status of all tubes. If the tubes are damaged, contact Okolab to receive assistance.
- Calibrate the CO<sub>2</sub> Sensor once a year.

---

### 9.1 Replacement of the fuses

In order to replace one or both the fuses follow the steps shown below:

- 1 Loosen the screws (M3x6, A in Figure 52, a) on the sides of the metal cover and the screws (M3x6, B in Figure 52, b) on the rear panel of CO2-UNIT-3L.
- 2 Lift the cover as shown in Figure 52, c to access the inside of CO2-UNIT-3L and to the fuses (see C in Figure 52, c) to replace them.

**Note** ► Near each fuse there is a LED, orange for FS2, 1.5 A FF, and red for FS1, 2.5 A FF. If one LED is off, then the corresponding fuse is blown. In this case, you have to replace the fuse. Once you have replaced one or both the fuses reassemble the cover on CO2-UNIT-3L.



Switch off the unit and disconnect the power cord before opening the box.

---

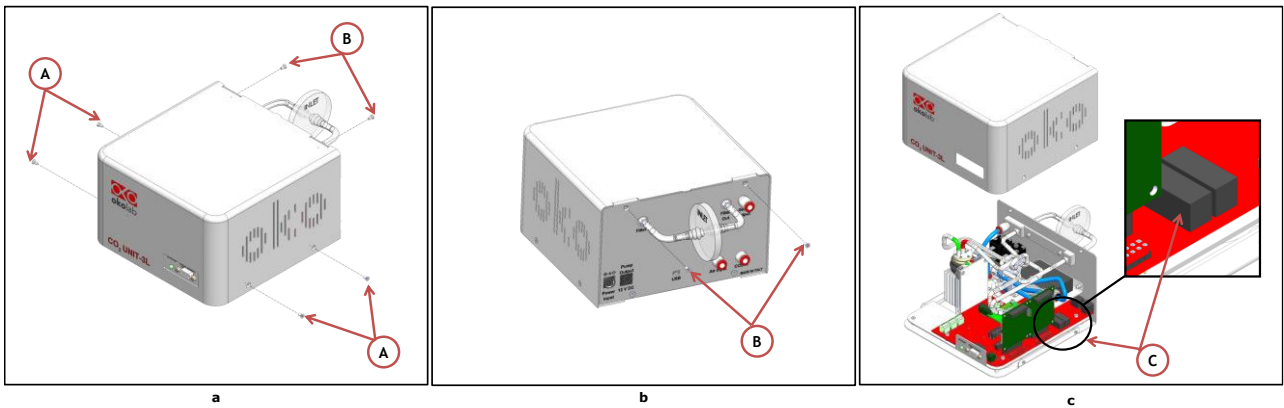


Figure 52. (a) and (b) How to disassemble the chassis of CO2-UNIT-3L; (c) Fuses position inside CO2-UNIT-3L.

Figure 53 shows a real image of the position of the two fuses on the internal board of CO2-UNIT-3L.

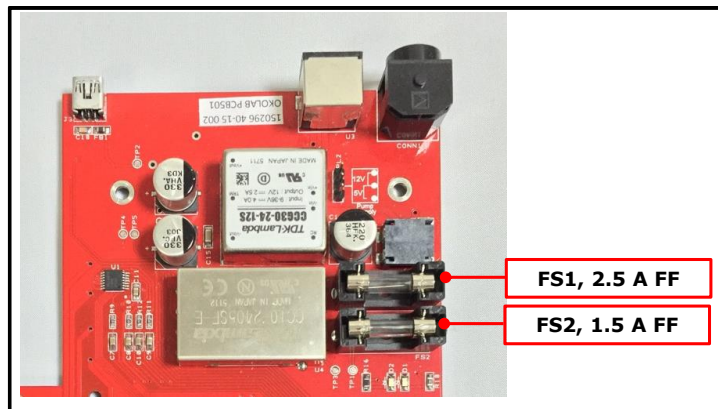


Figure 53. Fuses on the Internal Board.

## 9.2 Replacement of the pump inside the CO2-UNIT-3L

The pump inside CO2 UNIT-3L should be replaced periodically. The time life is 9,000 hours of operation which corresponds ca. 1 year of use. It is possible to check pump operation hours via touch screen, by Okolab software DATALOG or via any third party software.

The Air pump replacement part code is CO2-UNIT-3L-2-SP-PUMP and is delivered as shown in Figure 54.

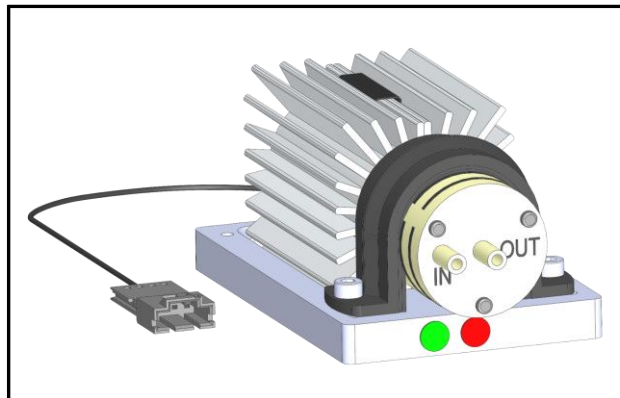


Figure 54. Pump to replace.

To replace the pump, follow the steps below:

- 1 Use a screwdriver for loosening the socket head cap screws (M3x6, A in Figure 55, a and b) on CO2-UNIT-3L bottom panel.
- 2 Remove the pump from its housing paying attention not to damage the other components of the unit, see Figure 56, a.
- 3 Disconnect from the pump the tubing marked with green and red tape (B in Figure 56, a) and the connector indicated with C in Figure 56, a. Figure 56, b shows the tubing labeled with green and red tape and the connector, once disconnected.
- 4 Connect the new pump to the tubings, paying attention to match the colors (B in Figure 56, a) and to the connector (C in Figure 56, a).

**Tip** ► Follow the tubing color code, a wrong tubing connections will cause improper functioning of the device.

- 5 Insert the pump careful in the CO2-UNIT-3L chassis and use an Allen wrench to tighten the socket head cap screws.

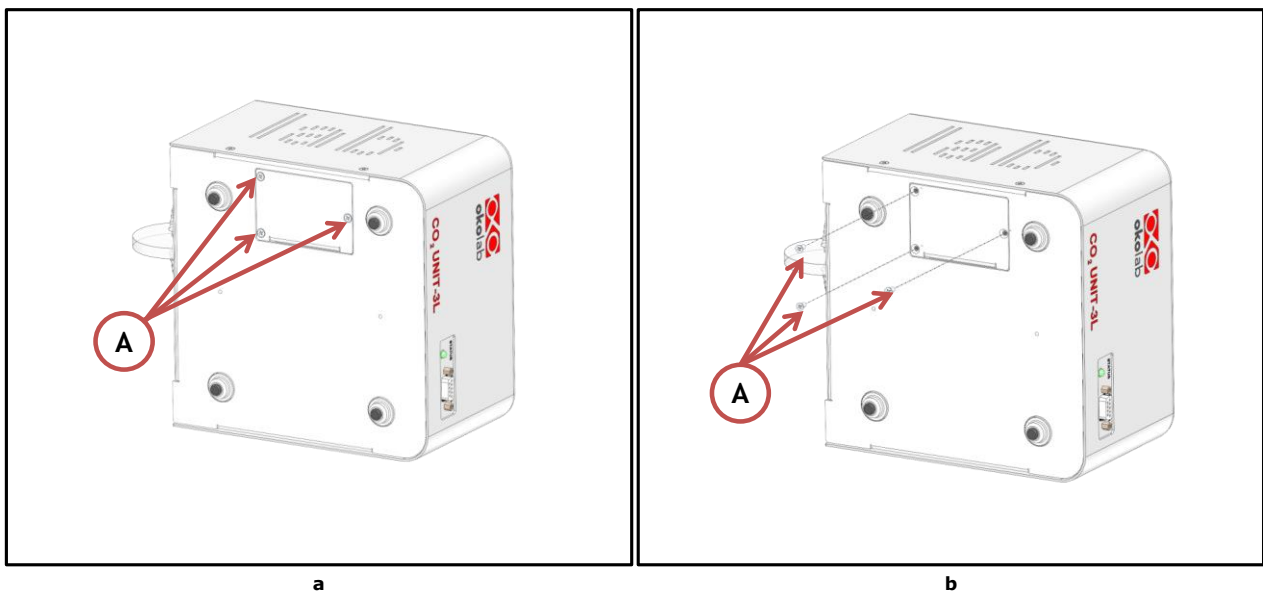


Figure 55. CO2-UNIT-3L Pump disassembly.

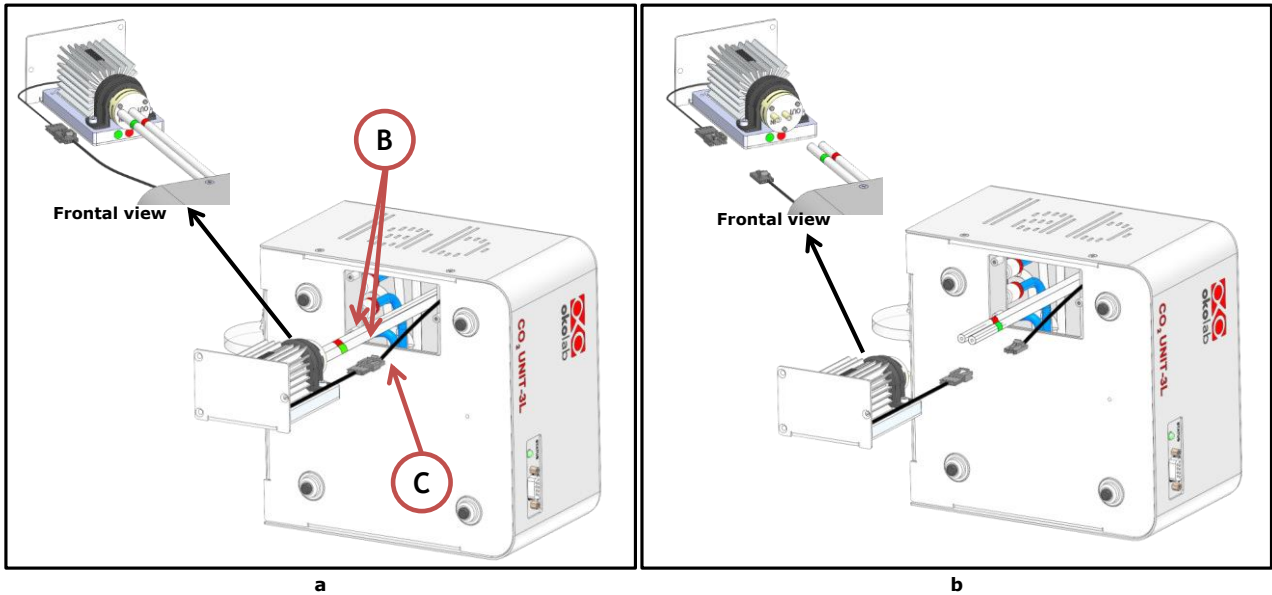


Figure 56. Pump tubing and connector disconnection.

### 9.3 Replacement of the pump inside OKO-AP-3L

The pump inside OKO-AP-3L should be replaced periodically. The lifetime of the pump is 9,000 hours which corresponds to ca. 1 year of use. It is possible to check pump operation hours via touch screen, by Okolab Software DATALOG or via any third party software. The internal OKO-AP-3L pump replacement part code is OKO-AP-3L-SP. and is delivered as shown in Figure 57.

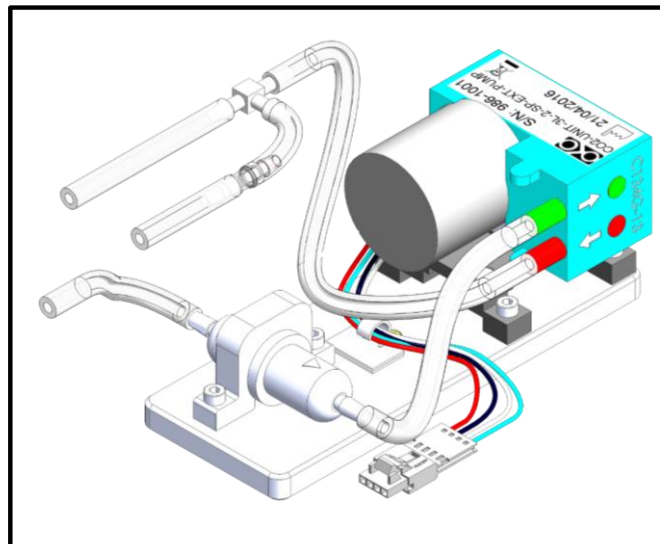


Figure 57. Pump to replace.

To replace the pump, follow the steps below:

1. Use a screwdriver for loosening the socket head cap screws (M3x6, see Figure 58, a) on the OKO-AP-3L cover panel and lift it paying attention not to damage the other components of the unit (See Figure 58, b).

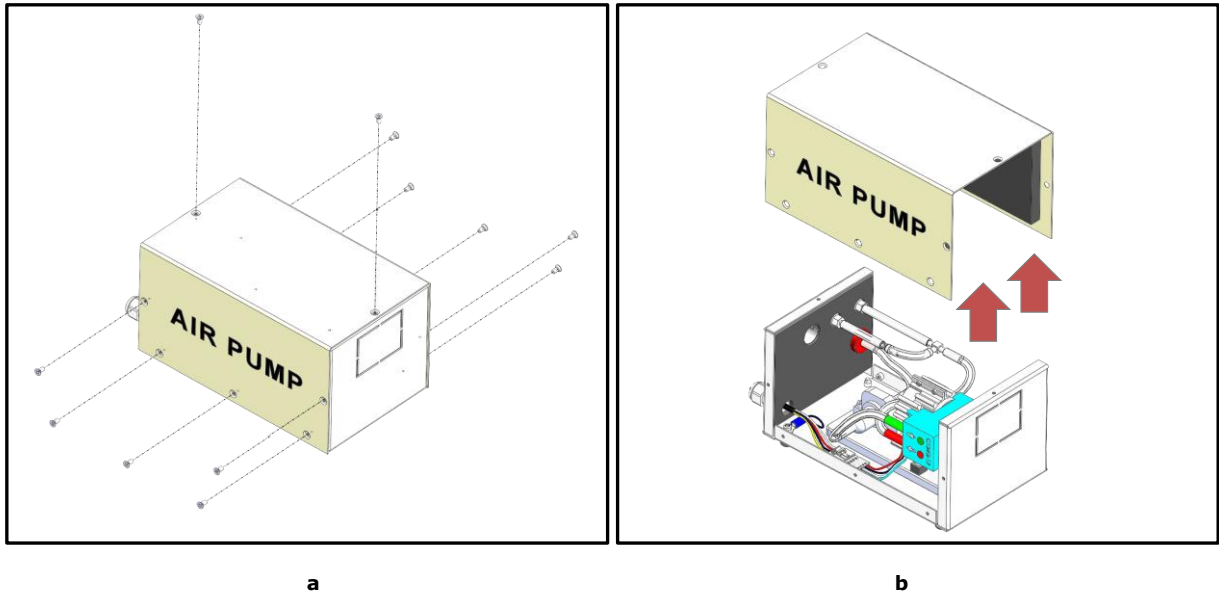


Figure 58. OKO-AP-3L cover disassembly. (a) Screws removal. (b) Cover lifting.

2. Disconnect the silicone tubing inside the OKO-AP-3L from the frontal panel (B in Figure 59) and the connector indicated with C in Figure 59, a and b.

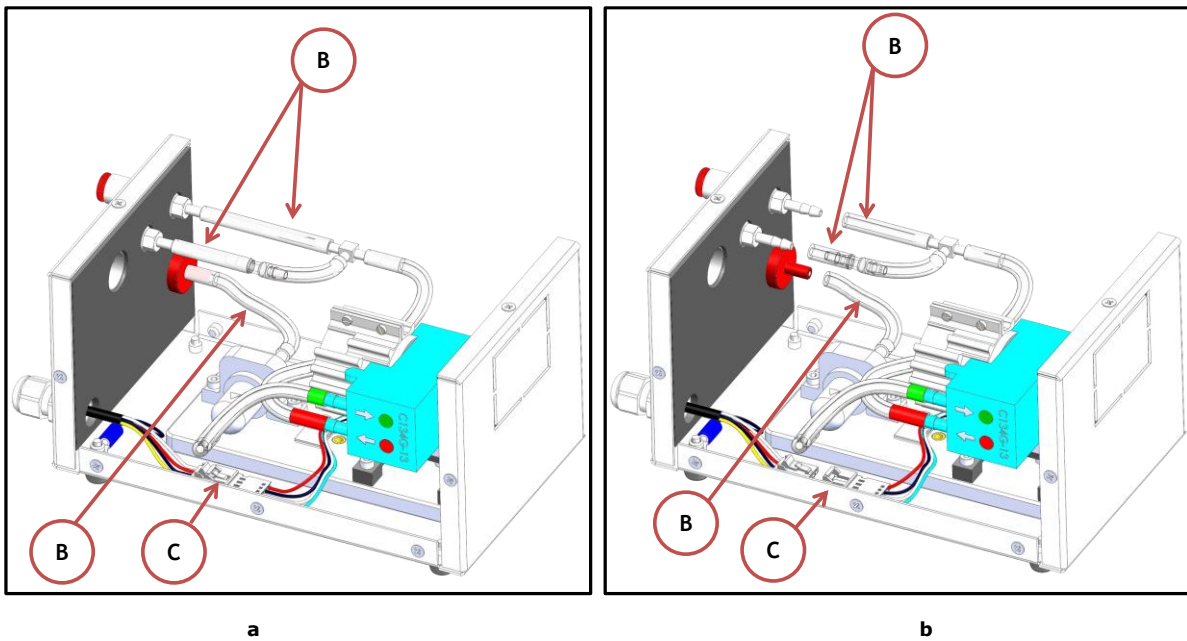


Figure 59. Tubing disconnections inside the OKO-AP-3L.

3. Use a screwdriver for loosening the slotted head screws (M4x5, A in Figure 60) on the OKO-AP-3L bottom panel.

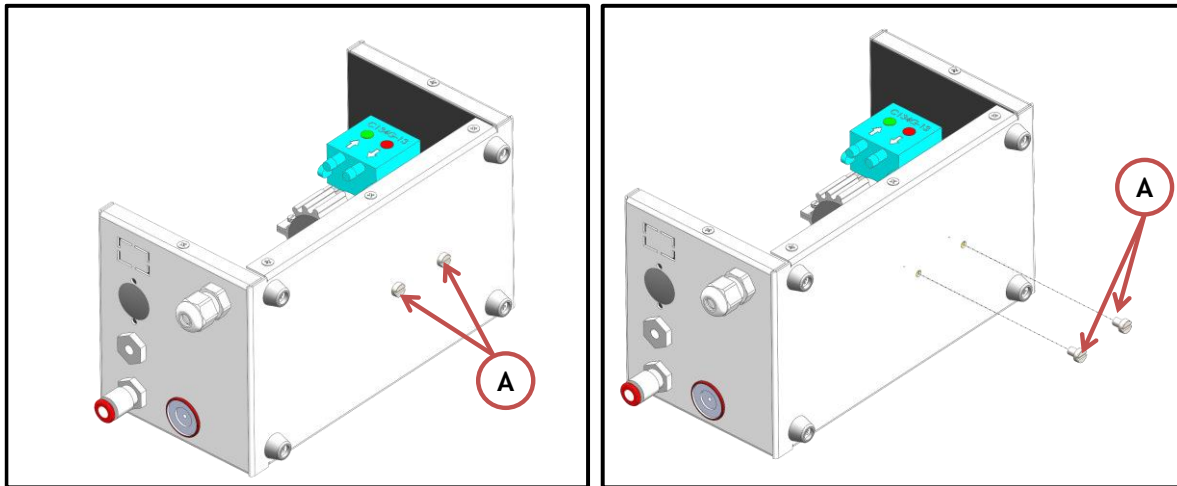


Figure 60. Screws on the bottom panel.

4. Lift the pump with its support. (see Figure 61, a).
5. Loosen the screws to remove the heat sink from the pump (see Figure 61, b).
6. Insert the heat sink on the new pump and insert the pump careful in OKO-AP-3L chassis.
7. Reconnect the silicon tubes indicated with B in Figure 59 and the connector indicated with C in Figure 59 and reassemble the cover on OKO-AP-3L.

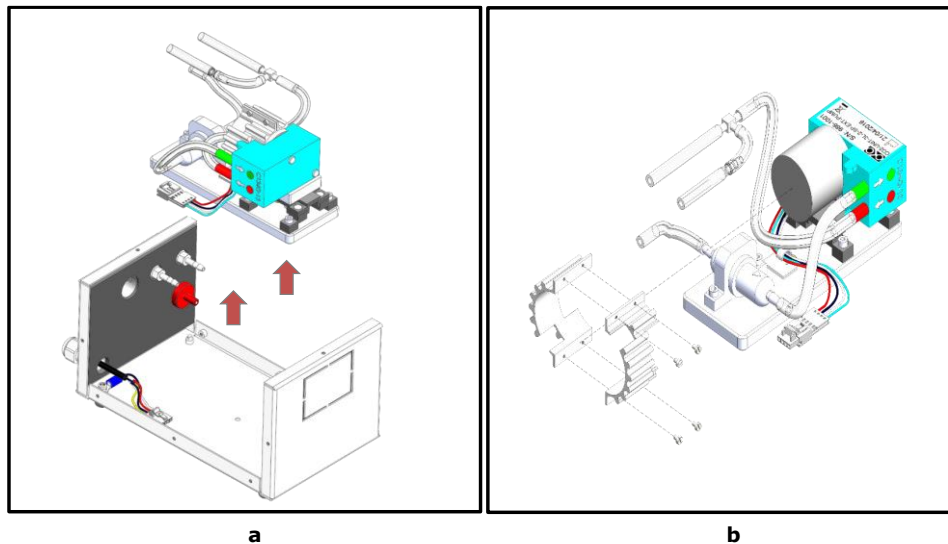


Figure 61. Pump replacement. (a) Pump lifting; (b) Heat sink removal.

#### 9.4 Cleaning

In order to prevent damages to CO2-UNIT-3L, please, when performing the cleaning routine follow the instruction below:

- Use a polishing cloth or dry cloth to wipe off dust and dirt.
- Before cleaning the unit, pull out the main plug.
- Liquids should not be entered inside CO2-UNIT-3L.

## 9.5 Spare part codes

Product	Spare part type	Spare part code	Frequency of replacement
CO2-UNIT-3L	Pump	CO2-UNIT-3L-2-SP-PUMP	Every 9,000 hours (~ 1year) of usage
CO2-UNIT-3L	0.2 micron filter	MPF	Every 6 months of usage
CO2-UNIT-3L	Fuses	FS1 2.5A FF FS2 1.5A FF	In case of malfunction
CO2-UNIT-3L	CO <sub>2</sub> valve	CO2-UNIT-3L-2-SP-CO2-VALVE	In case of malfunction
CO2-UNIT-3L	Air valve	CO2-UNIT-3L-2-SP-AIR-VALVE	In case of malfunction
OKO-AP-3L (optional)	Pump	OKO-AP-3L-SP	Every 9,000 hours (~ 1year) of usage

*Table 1. CO2-UNIT-3L Spare part codes.*



## 10 Support

To contact one of our engineers please see below, write to [support@oko-lab.com](mailto:support@oko-lab.com) or contact us through the live chat on [www.oko-lab.com](http://www.oko-lab.com). You can request a remote support session anytime, also via video chat.

- Contact our technical support ([sibillo@oko-lab.com](mailto:sibillo@oko-lab.com)) by e-mail to take an appointment for the web assistance.

Technical Support.

Please, do not hesitate to contact Okolab should you need any further commercial information or technical support.

For COMMERCIAL SUPPORT WORLDWIDE: [lanzaro@oko-lab.com](mailto:lanzaro@oko-lab.com)

Phone +39 081 806 2624

Fax: +39 081 876 4410

Mobile: +39 348 96807 17

For COMMERCIAL SUPPORT US&CANADA: [foppiano@oko-lab.com](mailto:foppiano@oko-lab.com)

Mobile: 415 722 1490

For HARDWARE SUPPORT: [sibillo@oko-lab.com](mailto:sibillo@oko-lab.com)

Phone +39 081 806 3470

Fax: +39 081 876 4410

Mobile: +39 348 96807 18

**Tip ►** By using the following QR codes, you can send directly an email to receive commercial (Figure 62) or technical info (Figure 63).



Figure 62. QR code for commercial info contact



Figure 63. QR code for technical info contact

## 11 Technical Specifications

CO2-UNIT-3L TECHNICAL SPECIFICATIONS	
CO <sub>2</sub>	Range: 0-15% Step size: 0.1% Recommended Calibration Interval: 1 year
Input Gas	CO <sub>2</sub> , Air
Operating Temperature	0° C -. +55° C (23° C suggested)
Storage Temperature	5° C - +60° C
Operating Humidity	0-70%
Power Consumption	115/230V AC 50/60 Hz; FS1 2.5A FF FS2: 1.5A FF 250V 5x20; 37 W max
Weight	3,4 Kg

Table 2. Technical specifications

## 12 Troubleshooting

We have collected in the table below some frequently asked questions, please contact Okolab if you need support.

Symptom	Probable cause	Remedy
The little led on the front of CO2-UNIT-3L is off	Power plug is disconnected from outlet	Insert plug securely into outlet
CO2-UNIT-3L does not turn on	Blown fuse FS2 1.5A FF	If the orange LED is off, replace the fuse FS2 1.5 A FF. See paragraph 9.1
No Air, CO <sub>2</sub> flow rate stability	Pressure drop	Check reservoirs and/or compressed line. Check CO <sub>2</sub> /Air tanks; make sure they're not close to finish
No Air and/or CO <sub>2</sub> flow streams	Regulators closed	Open regulators
	Blown fuse FS1 2.5A FF	If the red LED on the fuse is off, replace the fuse FS2 1.5 A FF. See paragraph 9.1
No CO <sub>2</sub> composition	Missing connection	Make sure you've attached the PTFE filter on the back of CO2-UNIT-3L. Connectors 1 e 2 in paragraph 6.
	Blown fuse FS1 2.5A FF	If the red LED light is off, replace the fuse FS2 1.5 A FF. See paragraph 9.1
Gas leak on the rear of the control box	Not properly inserted tubes	Strongly push the tube into the Swift-Fit connector
Gas composition instability	Pump is not working properly anymore because close to its end of life.	Replace the pump. Ask to Okolab for a new pump and see paragraph 9.3
Gas composition instability and one of the gas flows is zero	Valve is damaged	Ask to Okolab for a new valve
The screen does not respond properly or not at all	The display is not calibrated	Press and hold the power button for more than 10 seconds and the touch calibration will start
I checked the previous troubleshooting but I cannot solve the problem		Refer to Okolab assistance

Table 3. Troubleshooting.

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## 15 Manual Revision Table

Revision Number	Addition of changes	Date
01	Redaction	May 2015
02	Revision after product update	November 2015
03	New redaction	April 2016
04	Major revision	April 2016
05	Addition of the User Interface. Major Revision.	August 2016
06	Revision	March 2017
07	Revision	March 2017

## WARRANTY

Okolab S.r.l. warrants the CO2-UNIT-3L to be free of defects in materials and workmanship for a period of one year starting from invoice date. If the unit malfunctions, it must be returned to the factory for evaluation. If the equipment has to be returned to the factory, please ensure that is carefully and properly packed. Okolab S.r.l. accepts no responsibility for damage due to unsatisfactory packing. Upon examination of Okolab S.r.l., if the unit is found to be defective, it will be repaired or replaced at no charge. This warranty does not apply to defects resulting from any actions of the purchaser. Components which wear are not warranted. Okolab S.r.l. neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by Okolab S.r.l. Okolab S.r.l. warrants only the parts manufactured by it will as specified and free of defects. Okolab S.r.l. makes no other warranties or representations of any kind whatsoever, express or implied, except that of title, and all implied warranties including any warranty of merchantability and fitness for a particular purpose are hereby disclaimed. **LIMITATION OF LIABILITY:** the total liability of Okolab S.r.l. shall not exceed the purchase price of the component upon which liability is based. In NO event shall Okolab S.r.l. be liable for consequential, incidental or special damage.

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