CO2-O2-UNIT-BL [0-10; 1-18]

Gas Controller

Manual

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1 Preface

CO2-O2-UNIT-BL [0-10; 1-18] is a Digital CO_2/O_2 Controller that mixes CO2, N2 and Air to the desired concentration in the CO2 range 0-10% and O2 range 1-18%.

It features a long life Non Dispersive Infrared (NDIR) dual wave length CO2 detector and a long life O2 optical sensor to ensure a high accuracy on the gas composition.

CO2-O2-UNIT-BL [0-10; 1-18] is operated via the OKO-TOUCH touch screen control panel (to be ordered separately). OKO-TOUCH features on-board memory for data logging and mini-USB port for data download.

In addition data logging is possible via SMART-BOX, via DATA-LOG Okolab software and via following third-party Imaging software: LASX 2.0, NIS-Elements, SlideBook, MetaMorph and MicroManager. Macro for ZEN Black software is available upon request.

Okolab Bold Line controllers are also capable to receive TTL input (requires to order separately TTL-CABLE).

CO2-O2-UNIT-BL [0-10; 1-18] allows easily operating without N2 by setting the maximum Oxygen % value from the Touch Screen.

CO2-O2-UNIT-BL [0-10; 1-18] connects to any Okolab Bold Line T controller. In this case, a single OKO-TOUCH operates both, the Bold Line T controller and CO2-O2-UNIT-BL [0-10; 1-18].

CO2-O2-UNIT-BL [0-10; 1-18] is also compatible with Okolab Active Humidity Controller to control output gas Relative Humidity and with Okolab air pump OKO-PUMP-BL, which enables to use background air as a convenient alternative to the compressed air.

2 Symbol description

This paragraph describes the symbols used in this 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.

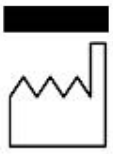
Tip ► *Supplies you with helpful suggestions.*

Note ► *Supplies you with important information to successfully 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 warns you to read the user manual before starting the device.

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

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.
- Not following these instructions can result in damage or breakdown of the device and its accessories.
- The products labels can be found on the bottom panel of the Main Box.
- Do not disassemble any part of the system.
- 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.

- Do NOT go in close contact with or breathe any gas stream whose composition is different from that of ambient air.
- Prevent throttling and kinking of tubing.
- Check tubing time to time for possible material usage.
- Check that all tubing are 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 CO2-O2-UNIT-BL [0-10; 1-18] input connectors.
- Power cord of unit should be unplugged from electrical outlet when left unused for a long period of time.
- PRESSURIZED GAS. Secure all connections with hose clamps. Never exceed the input pressure limit of 1.5 bar. Bleed all lines before disconnecting. Wear safety goggles if needed. If pressure regulators are not within sight and reach, make sure at least one shut off valve is within reach.
- LOW OXYGEN ATMOSPHERES. Never enter a room or enclosure which has a low oxygen atmosphere because of severe danger of suffocation. Only operate in well-ventilated room. A small amount for carbon dioxide gas 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. Neither the gas mixer nor stream destinations should be 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.
- Do not disconnect cables while in operation.
- Do not open the unit. Do not remove cover or back.
- Prevent metal fragments or lead wire scraps from falling inside instrument to avoid electric shock, fire or malfunction.
- No user serviceable parts inside.
- Unit should never be used where it can fall or be pushed into water.

International caution symbol marks this device. It is important to 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

We reserve the right to make technical variations.

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

4 Supplied equipment

1. **CO2-O2-UNIT-BL [0-10; 1-18]**, main box.
2. **PTFE filter (x2)**. One to be installed on the rear of CO2-O2-UNIT-BL [0-10; 1-18] and one as spare replacement.
3. **TUBE-C (x1).** Polyurethane 130cm long blue rigid tube 6mm OD with connected a 4mm ID Silicon transparent tube 150 cm long plus PTFE filter in the middle. Use TUBE C to connect the CO2/O2 Controller to your device or to the humidifier, if it is present.

   Note ► *If you purchased CO2-O2-UNIT-BL [0-10; 1-18] with H201-T-UNIT or H101-T-UNIT, you receive the **TUBE-Y**, Polyurethane 1m long blue rigid tube 6mm OD, connected to a Silicon 15cm long transparent tube 4mm ID plus PTFE filter in the middle, connected to a Polyurethane 1m long blue tube 6mm OD. Use TUBE-Y to connect CO2-O2-UNIT-BL [0-10; 1-18] to the cage incubator.*
4. **TUBE-A (x3).** Rigid tubes, Polyurethane 3m long 6mm OD each. Use TUBE A to connect N2, CO2 and Air supply to the corresponding input ports (N2, CO2, Air) on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18].
5. **Pressure Gauge for CO2 and N2+ regulator + assembly stirrup (x2)**. Install pressure gauges between the pure CO2 and N2 tank pressure regulator and CO2-O2-UNIT-BL [0-10; 1-18] input port.
6. **24V-DC Power Adapter (x1)**.

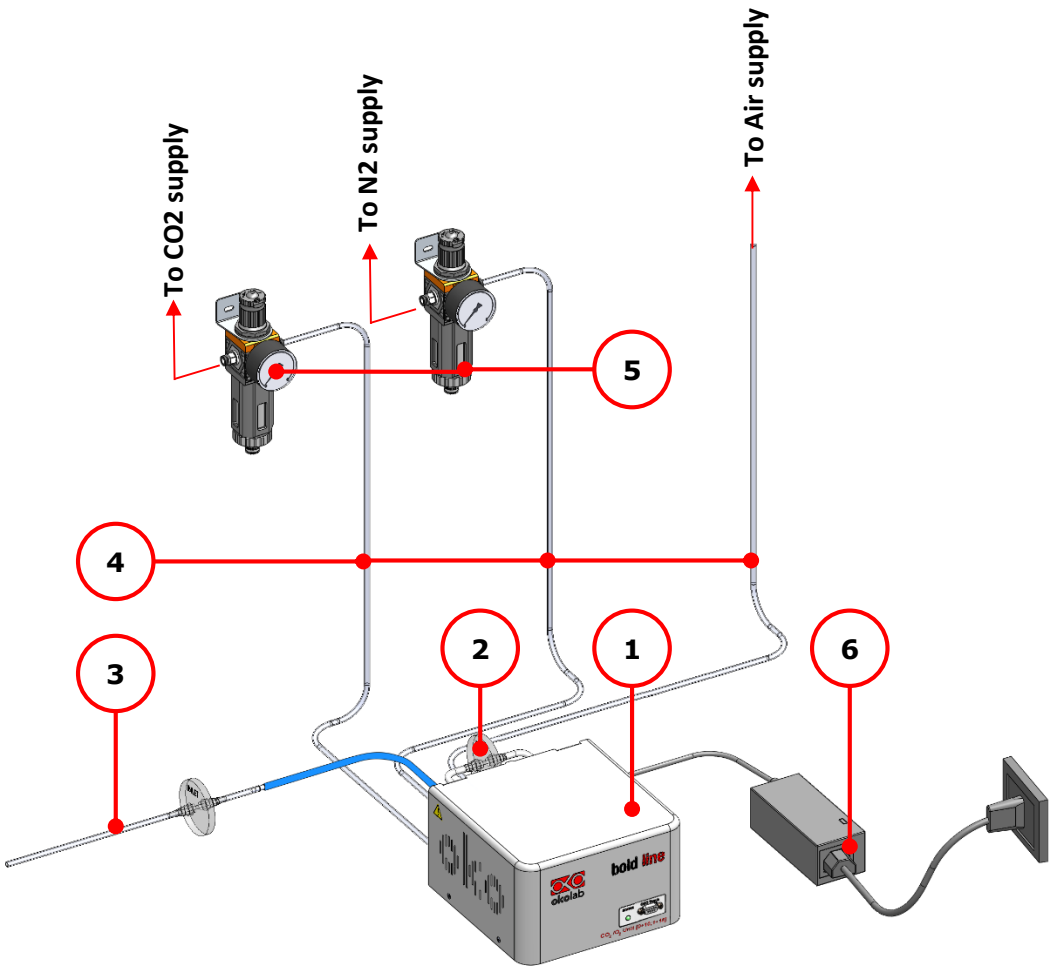


Figure 1. CO2-O2-UNIT-BL [0-10; 1-18] BL - components.

5 GAS supplied requirements

- **CO2.** CO2 must be available at **1.4 barg**, with a connector for 6mm OD rigid silicon tube. Gas source must be Standard Purity CO2 (coded as 4.5 that means 99.995 % of CO2) and humidity-free gas.
- **N2**. N2 must be available at **1.4 barg**, with a connector for 6mm OD rigid silicon tube. Gas source must be Standard Purity N2 (coded as 4.5 that means 99.995 % of N2) and humidity-free gas.
- **Air**. Air must be available at **1.4 barg**, with a connector for 6mm OD rigid silicon tube.

  Note ► *An alternative to the compressed air, OKO-AIR-PUMP-BL allows to use background Air.*

6 Compatibility

CO2-O2-UNIT-BL [0-10; 1-18] is compatible with:

- **OKO-TOUCH (required)**, including:
  - **Touch Screen Interface**
  - **#1 RS232 Serial cable**. To connect the Touch Screen to the unit.
  - **MINI-USB-OTG cable**. To connect a USB pen to the OKO-TOUCH for data download.
- **OKO-AIR-PUMP-BL**
- **H101-BASIC-BL**
- **H101-CRYO-BL**
- **H201-T-UNIT-BL**
- **H301-T-UNIIT-BL-PLUS**
- **HM-ACTIVE**
- **H101-HM**
- **HM-VF**

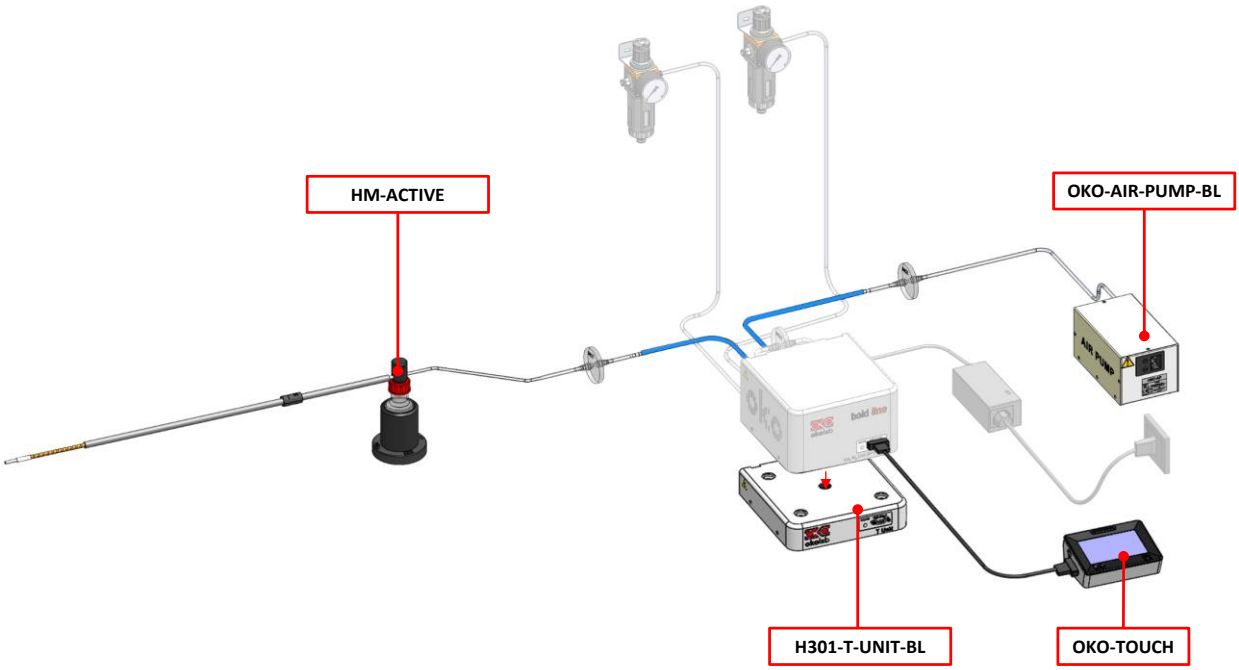


Figure 2. CO2-O2-UNIT BL [0-10; 1-18] within a typical H301 configuration.

- **DATA-LOG**. Software used to log, view, and store data from a PC. It may be used to change parameters of the controllers via PC. Data can be exported in .xlsx format.

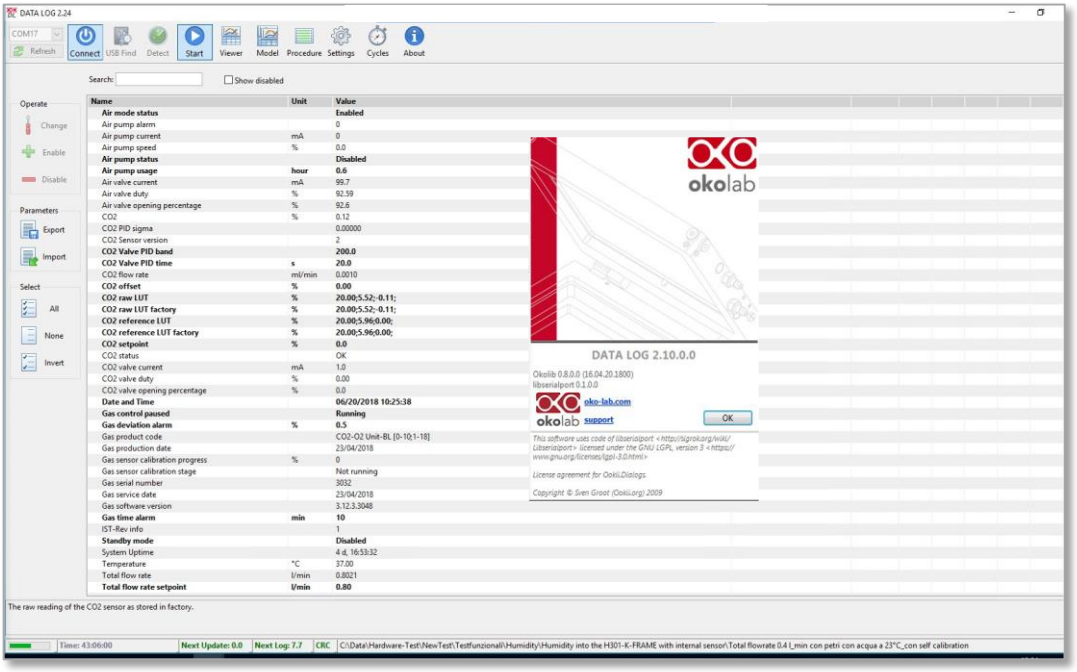


Figure 3. DATA LOG software.

- **SM-BL Smart Box**. To store data, to operate the controllers via web/smartphone/tablet and to allow remote assistance for service**.**

7 Equipment Description

Figure 4 illustrates CO2-O2-UNIT-BL [0-10; 1-18] front panel:

1. **Status Led**.
2. **RS232 connector**. Connector for OKO-TOUCH.

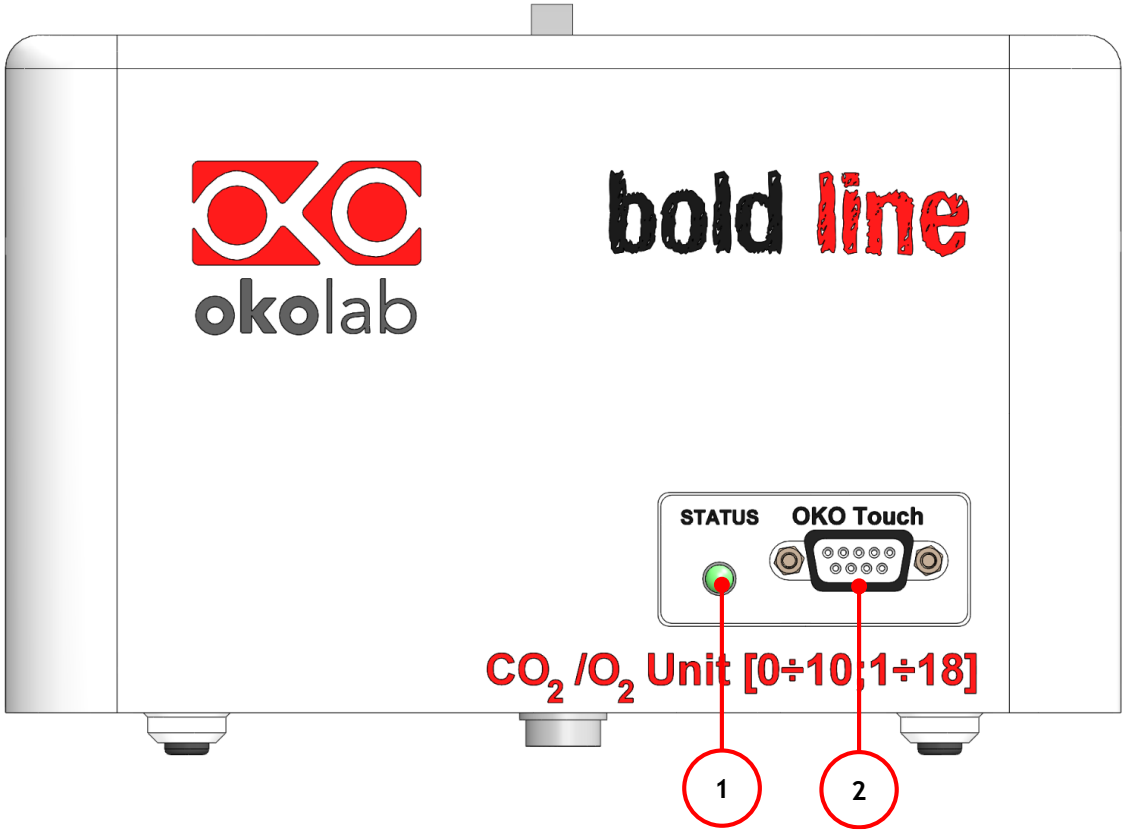


Figure 4. CO2-O2-UNIT-BL [0-10; 1-18] front panel.

A detailed description of CO2-O2-UNIT-BL [0-10; 1-18] rear is provided in the following list, which refers to the pointers in Figure 5:

1. **Filter Out.** To connect the PTFE filter.
2. **Filter In.** To connect the PTFE filter.
3. **Gas Output.**
4. **Power Input.**
5. **OKO-AIR-PUMP-BL connector**. Leave unplugged if the system is not equipped with OKO-AIR-PUMP-BL.
6. **HM-ACTIVE connector**. To connect the HM-ACTIVE active humidity controller.
7. **GPIO (General Purpose Input Output) connector.**
8. **USB connector.**
9. **Air.** Push to fit Input Connector for 6 mm O.D. rigid tubing carrying air from air source.
10. **Pure N2.** Push to fit Input Connector for 6 mm O.D. rigid tubing.
11. **Pure CO2.** Push to fit Input Connector for 6 mm O.D. rigid tubing.

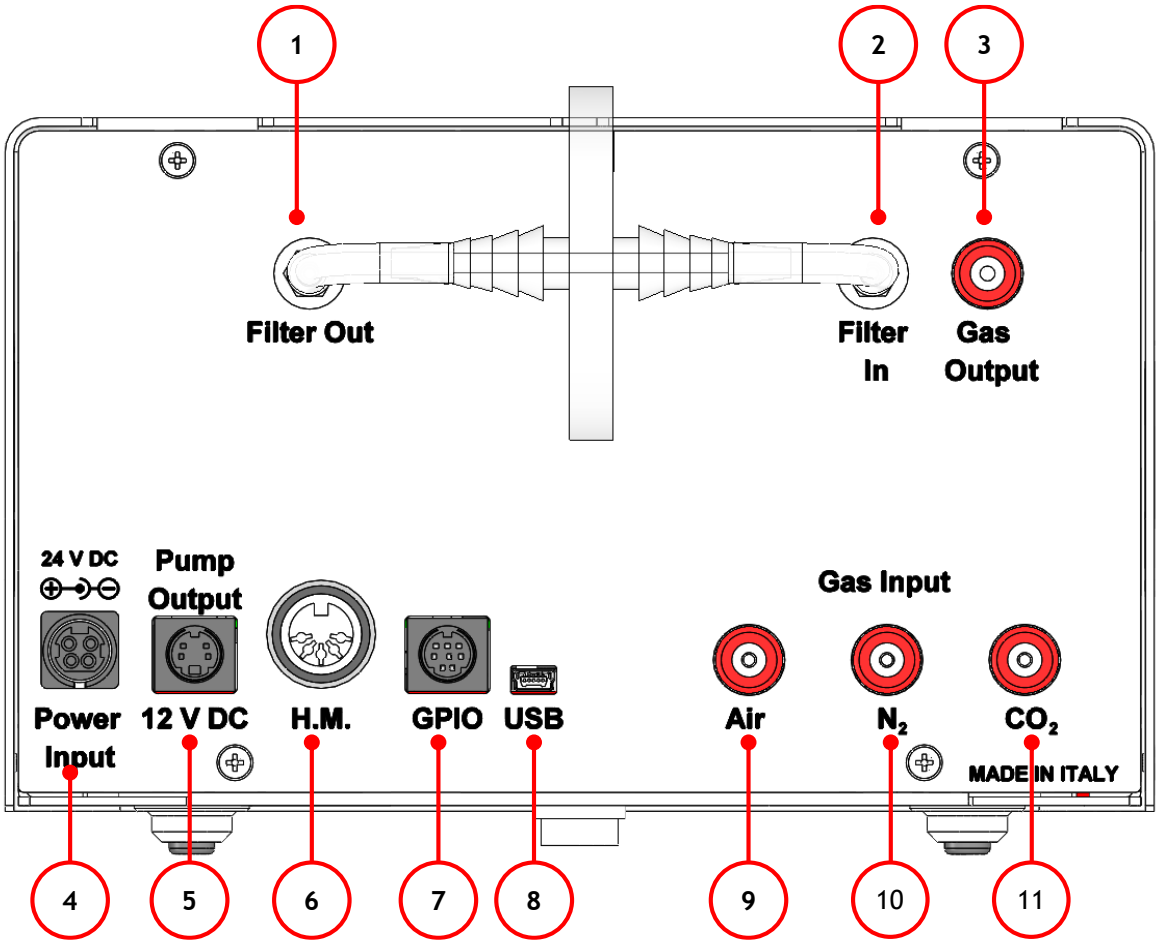


Figure 5. CO2-O2-UNIT-BL [0-10; 1-18] rear panel.

8 Installation

The following paragraphs will illustrate how to install and to use CO2-O2-UNIT-BL [0-10; 1-18].

8.1 Setting up CO2-O2-UNIT-BL [0-10; 1-18].

The following instructions shall give you the possibility to install the unit quickly. For safe operation of the unit it is absolutely necessary to read carefully all the instructions and safety notes.

1. Install the **pressure Gauge for the CO2 and N2 lines** between the CO2/N2 tanks and CO2-O2-UNIT-BL [0-10; 1-18]. Follow the arrow on the rear of the Pressure Gauge for the correct Gas In-Out (see Figure 6).

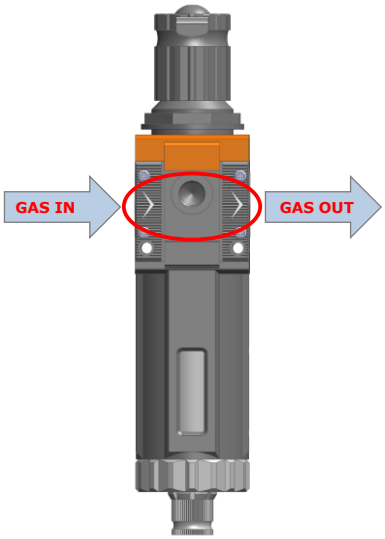


Figure 6. Input and Output gas ports. See symbol on the rear of Pressure Gauge

On the bottom of the Pressure Gauge there is an automatic purging valve. Close it before operating the Pressure Gauge. To close the purging valve, looking at the regulator vertically from the top knob, pull it down and rotate it counterclockwise (see A and B in Figure 7). Now you can operate the Pressure Gauge.

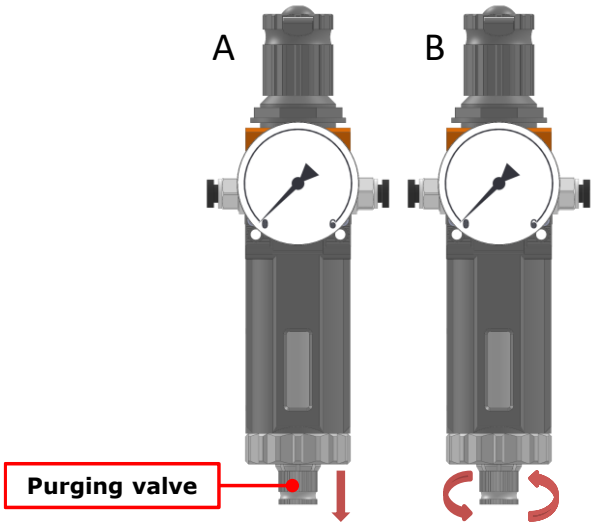


Figure 7. How to close the purging valve of the Pressure Gauge

To close the Pressure Gauge, pull the knob up and rotate it counterclockwise. Push the knob down to lock it. Open valve on the gas supply tank. Adjust Pressure Gauge by pulling the top knob up and rotating it clockwise until the pressure reaches the desired value (see Figure 8), then push the top knob down to lock it.

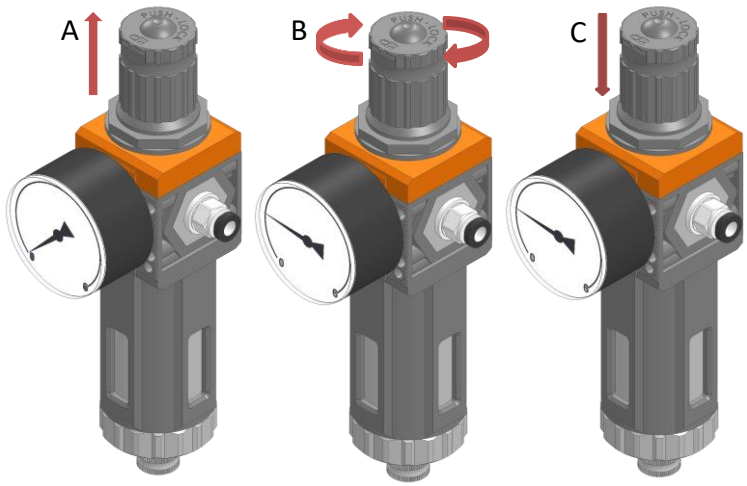


Figure 8. Pressure gauge using

2. Install the **PTFE filter** on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18]. It filters the mixed gas before it enters in contact with CO2-O2-UNIT-BL [0-10; 1-18] gas sensors. Connect the PTFE filter with the *Filter In* and *Filter Out* connectors on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18] (see Figure 9 and pointer 1 and 2 in Figure 5).

Note ► *CO2-O2-UNIT-BL [0-10; 1-18] cannot operate if the PTFE filter is not connected.*

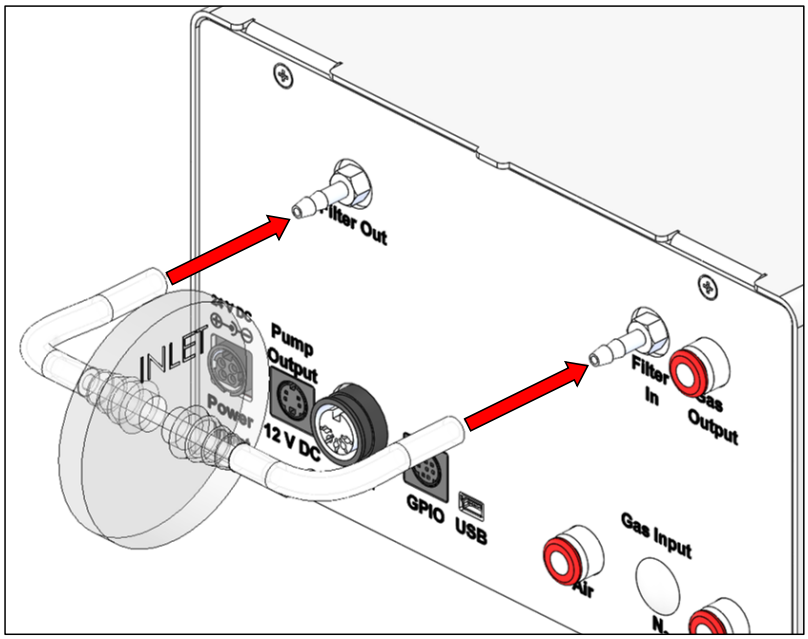


Figure 9. Filter tubing

Tip ► *Replace this filter each 2-3 months of continuous use or when it is present water in the inner part of the filter.*

Do not remove the filters. This may cause damages the gas sensors.

---

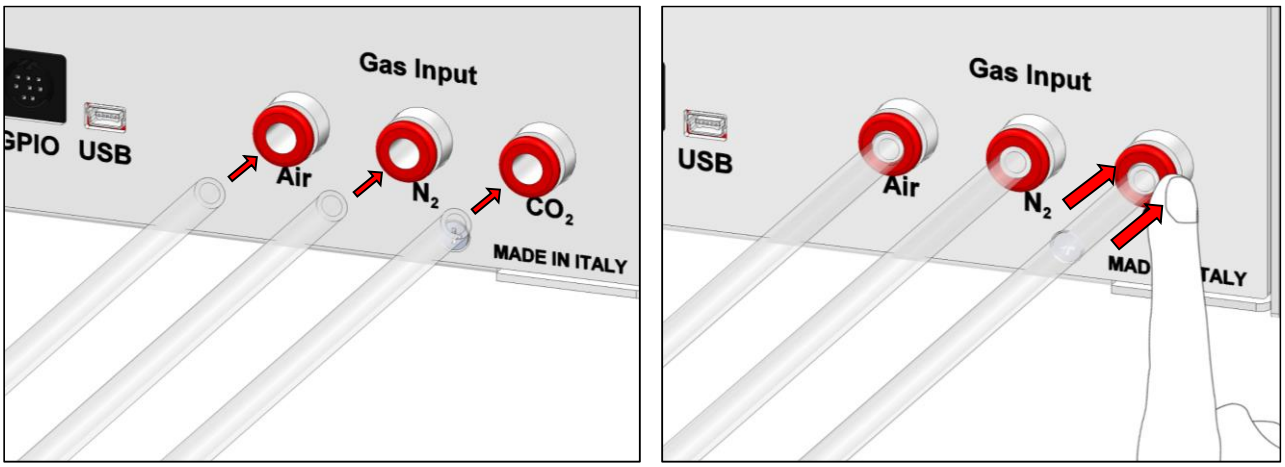
3. Connect CO2 and N2 supply to the corresponding push to fit connectors on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18] by using TUBE-A (see Figure 10 a).

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

Note ►*Do not exceed 1.5 barg (20 psig) for CO2, N2 and Air pressure.*

To remove tubing from the connectors, push the red rubber ring while pulling the tubing (see Figure 10 b).

Tip ► *If the tubing does not come out easily, do not force it, simply make sure the red ring is properly pushed.*



a b

Figure 10. How to connect (a) and disconnect (b) tubings from push to fit connectors.

Before disconnecting any of tubing connected to CO2-O2-UNIT-BL [0-10; 1-18], make sure there is no residual pressure by adjusting the pressure gauges upstream of the system and the tanks.

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3. Figure 11 shows the connections between the CO_2, N_2 and Air tanks and the respective connectors on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18] (see pointer 3 in Figure 1).

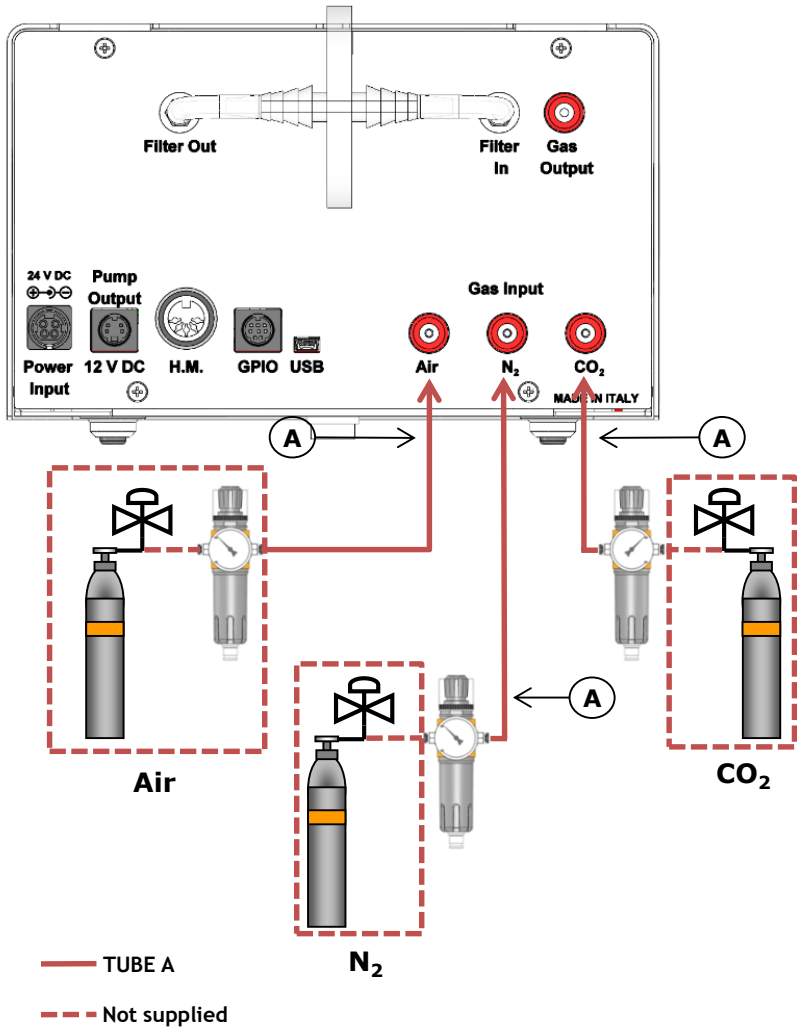


Figure 11. CO_2, N_2 and Air Tanks connections to the back panel of the CO2/O2 Controller

Tip ► *If you have ordered OKO-AIR-PUMP-BL, you have to connect TUBE-B between the Air Pump and the connector labeled "Air" on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18] (see Figure 12).*

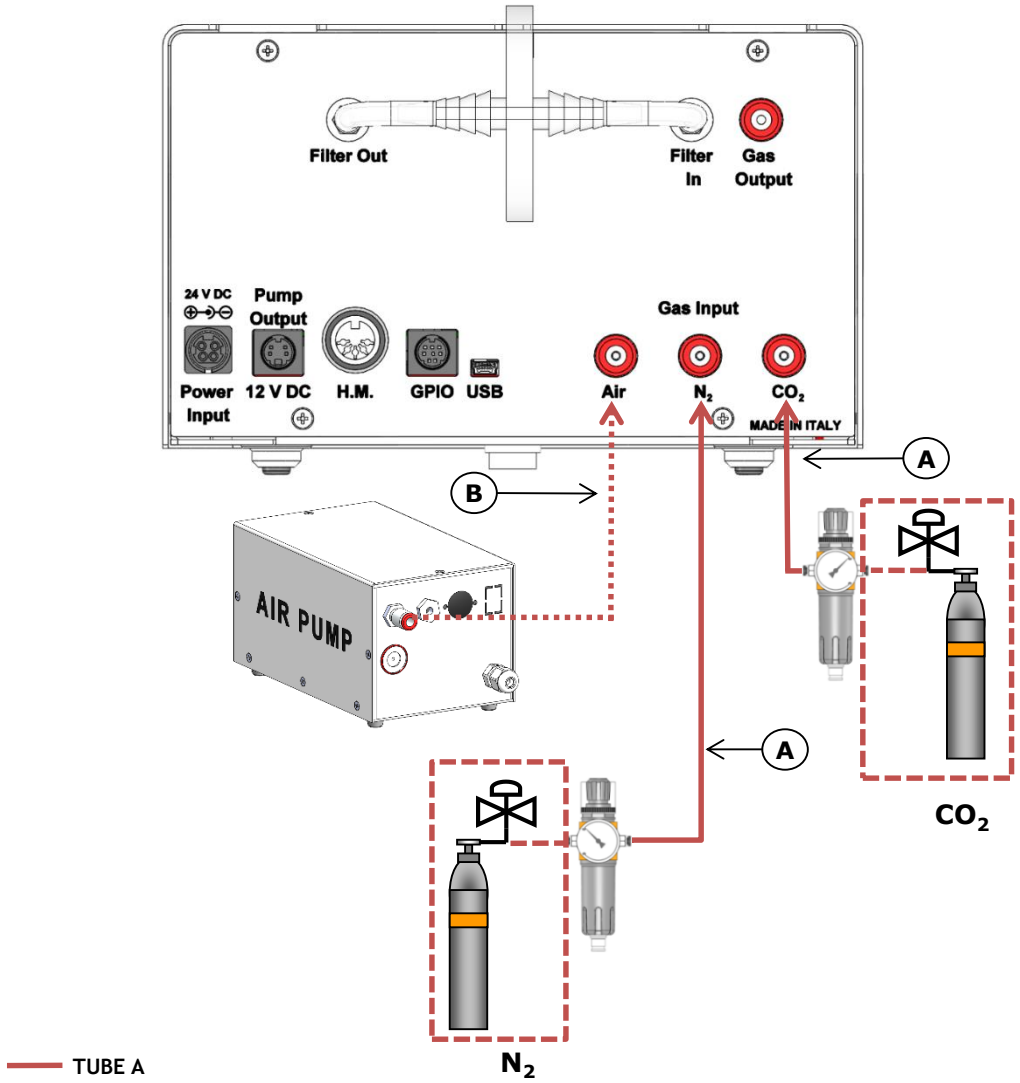


Figure 12. CO_2, N_2 Tanks and Air Pump connections to the back panel of the CO2/O2 Controller

4. Connect the TUBE-C to the gas port labeled "*Gas output*" on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18] and the other side of the TUBE-C to your device, as shown in Figure 13.

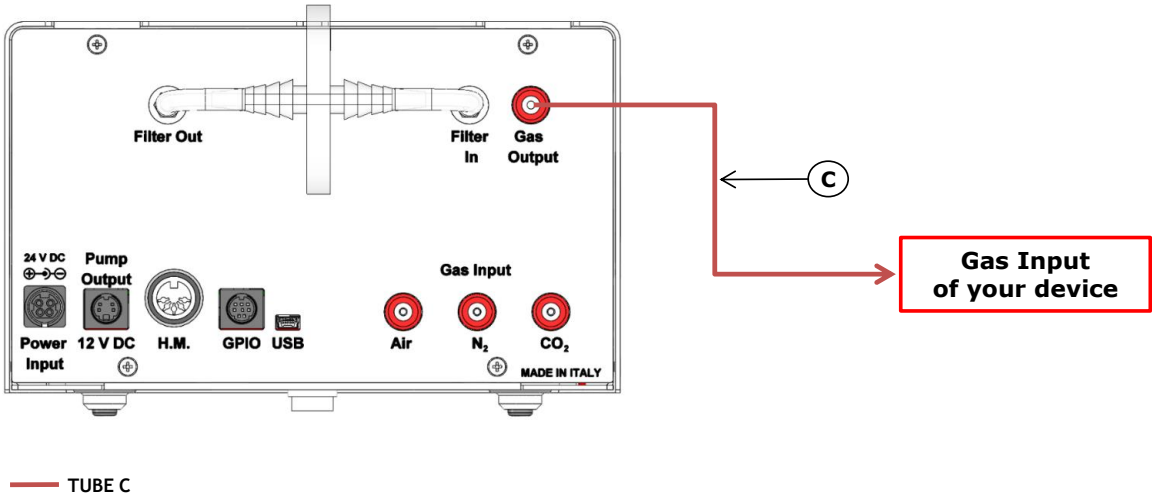


Figure 13. Gas Output connections.

Note ► *If you purchased CO2-O2-UNIT-BL [0-10; 1-18] with H201-T-UNIT-BL or H101-T-UNIT-BL, use the TUBE-Y supplied to connect CO2-O2-UNIT-BL [0-10; 1-18] gas output to the cage incubator (see Figure 14).*

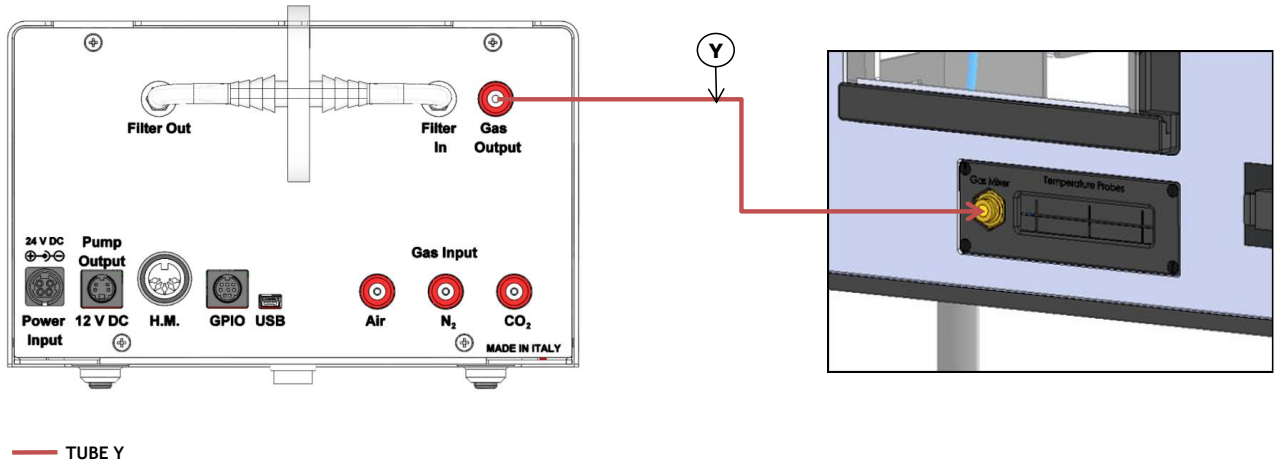


Figure 14. Gas Output connections with a Cage Incubator.

5. Connect the touch screen interface OKO-TOUCH to CO2-O2-UNIT-BL [0-10; 1-18] with the RS232 serial cable as illustrated in Figure 15.

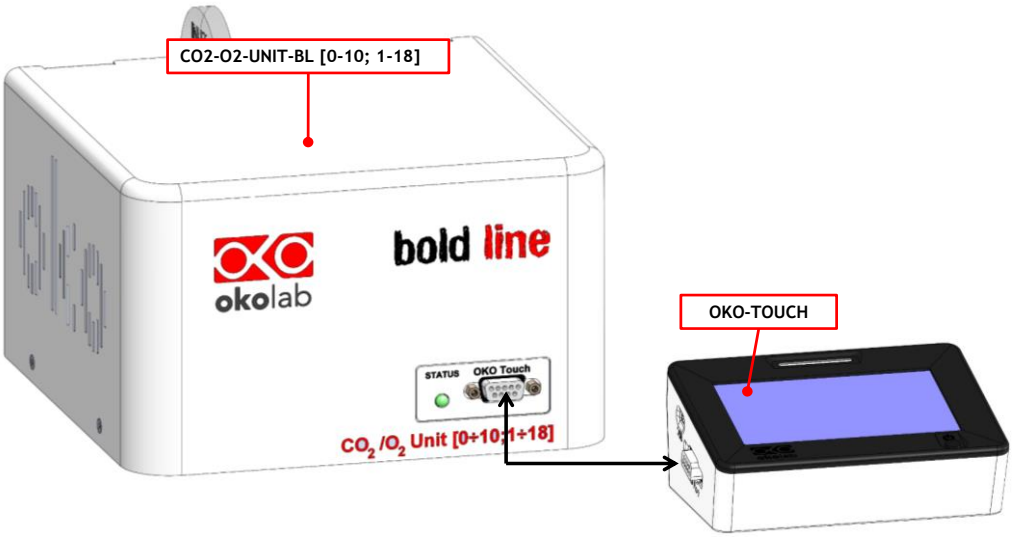


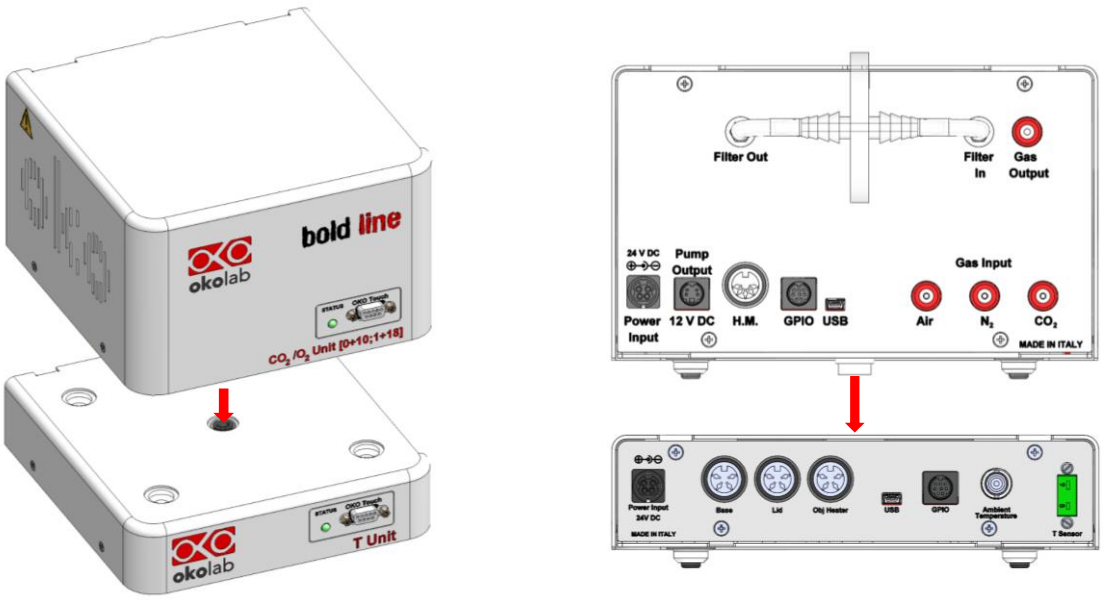
Figure 15. Oko Touch Connection

6. Connect the power adapter to CO2-O2-UNIT-BL [0-10; 1-18] (see pointer 8 in Figure 1).
7. To switch CO2-O2-UNIT-BL [0-10; 1-18] on use the power button on OKO-TOUCH. The Status LED (1 in Figure 4) on the front of CO2-O2-UNIT-BL [0-10; 1-18] will turn green.
8. Once the system has been initialized the Status LED on the front of CO2-O2-UNIT-BL [0-10; 1-18] will stop blinking and will turn steadily on. The Homepage will appear on the touch screen, the color of the Status Indicator (see 1 in Figure 18 and Figure 23) on the gas tab will be yellow at the start.
9. Select the Setpoint gas composition from the touch screen Home page (see paragraph 9.1.1).
10. The light indicator on the Home page becomes green when the Setpoint compositions are reached and are stable.

8.2 How to assemble CO2-O2-UNIT-BL [0-10; 1-18] with a Bold Line T controller

CO2-O2-UNIT-BL [0-10; 1-18] can be used as a stand-alone device or in combination with any one of the Bold Line T controller.

Figure 16 shows how to assemble CO2-O2-UNIT-BL [0-10; 1-18], for example, with a H301-T UNIT-BL-PLUS.



a b.

Figure 16. CO2-O2-UNIT-BL [0-10; 1-18] and H301-T-UNIT-BL PLUS (a – b).

CO2-O2-UNIT-BL [0-10; 1-18] must stack on top of the Bold Line T controller by lining up the bus ports located on the top and bottom surface of each unit. When the units are properly connected the Temperature and CO_2/O_2 parameters will appear on the OKO-TOUCH Touch Screen interface Home page.

Tip ► *If not all the parameters appear on OKO-TOUCH Home Page then the Control Units are not properly connected. Please check that the bus ports are properly aligned (see Figure 17).*

Figure 17. CO2-O2-UNIT-BL [0-10; 1-18] and H301-T-UNIT-BL PLUS on stock.

If you have CO2-O2-UNIT-BL [0-10; 1-18] and a Bold Line T controller, it is essential to read both this manual and the Bold Line T controller User Manual to familiarize yourself with the functions and the operation of the devices before use.

9 User Interface

This chapter describes the user interface of CO2-O2-UNIT-BL [0-10; 1-18].

9.1 Home page

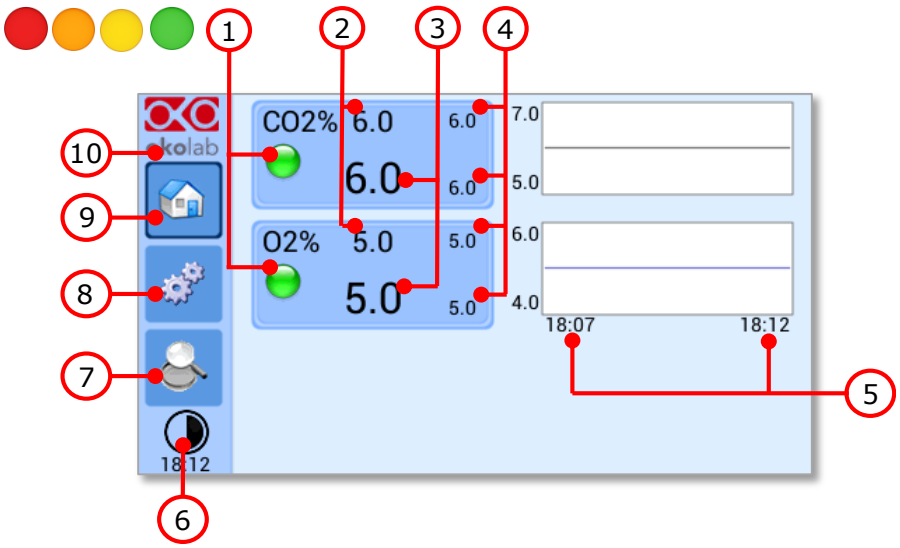


Figure 18. Homepage of the CO2/O2 Controller Touch Screen Display.

1. Status Indicator.
2. CO_2 and O_2 set point (see 9.1.1 to learn how to change the set point value).
3. CO_2 and O_2 current value.
4. Min/max CO_2 and O_2 values within the time-frame set in the *Options* subpage (see paragraph 9.3.2.1).
5. Chart history length set at 5 minutes.
6. Display mode. Touch here to switch display mode.
7. Overview page.
8. Settings. Press here to access system options and settings.
9. Home. To open the homepage.
10. Product info. Press here to know generic info about CO2-O2-UNIT-BL [0-10; 1-18] and running time.

Tip ► *The OKO-TOUCH is pre-set at a 6% CO_2 and 5% O_2.*

9.1.1 How to enter the set point

To input a new CO_2 or O_2 set point, touch the corresponding tab, as indicated in Figure 19 a and Figure 20 a.

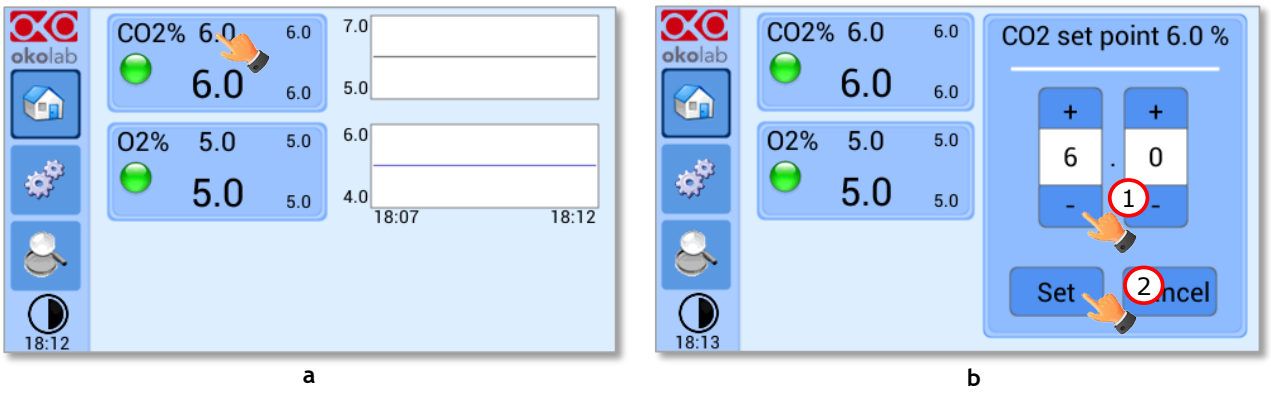


Figure 19. How to change the CO_2 set point (a – b)

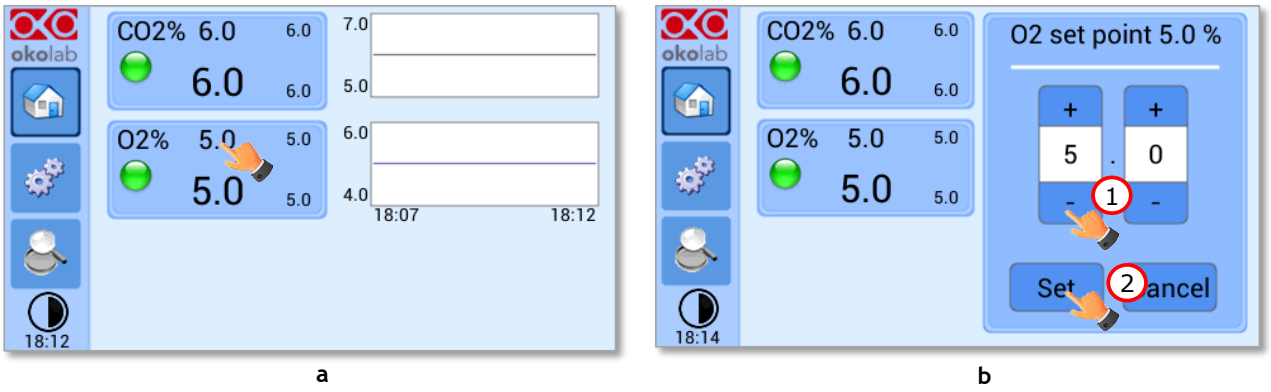


Figure 20. How to change the O_2 set point (a – b)

The Setpoint regulation page will appear as in the Figure 19 b and Figure 20 b. You can modify the Setpoint by clicking on *+ and* –. Once you have input the new CO_2 or O_2 Setpoint, press *Set* (2 in Figure 19 b and 2 Figure 20 b) to save or *Cancel* to undo.

> ***Tip*** ►*After any change in the Setpoint value, CO2-O2-UNIT-BL [0-10; 1-18] enters into a transient regime, the Status Indicator and the TOP LED (see Figure 23) turn yellow (see paragraph 9.2). During the transient regime, CO2-O2-UNIT-BL [0-10; 1-18] will not trigger on alarm.*

9.1.1.1 How to operate without N_2

When you need to have Air/CO_2 mixtures (therefore in case you don't need to regulate Oxygen too), press the O2 tab (as shown in Figure 21 a) and click on *"+"* (see Figure 21 b) until *"Air"* appears as shown in Figure 22 a. Then press *Set* to save, as shown in Figure 22 a. The Homepage will appear as in Figure 22 b.

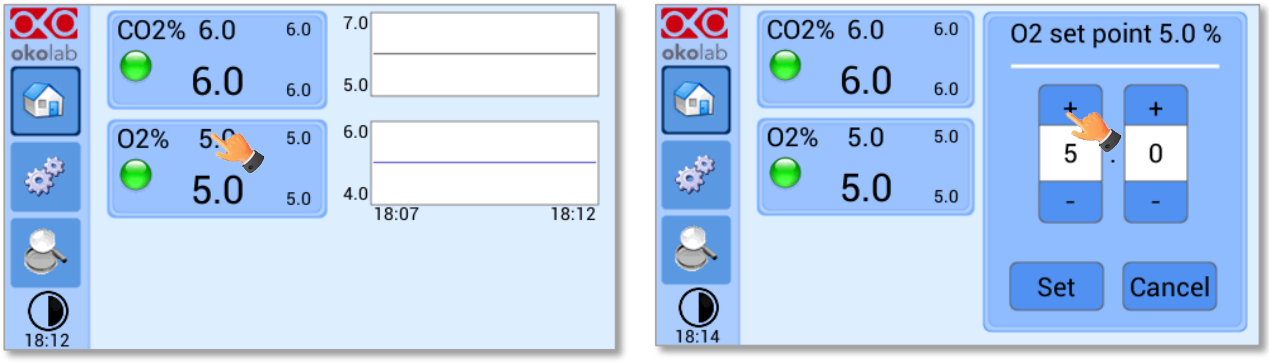


Figure 21. How to change the O_2 set point as AIR (a – b)

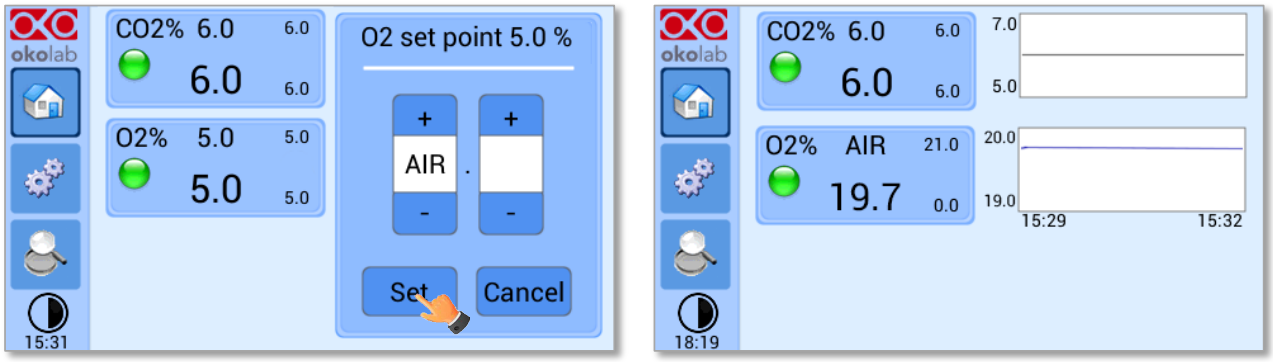


Figure 22. How to set AIR (a). CO2-O2-UNIT-BL [0-10; 1-18] Homepage operated without N_2 (b)

Note ► *When running the system without N2, keep in mind that in this operation mode Oxygen is obviously NO more a parameter that you can regulate, that's why you will see displayed AIR in place of the Setpoint on the Oxygen tab. The Oxygen % value displayed is the current Oxygen % resulting from the fact that Air is composed for c.a. 21% by Oxygen, and from the CO2 % that you have set in Air*

Note ►*When you work with Air and CO2, the N2 supply valve is automatically closed.*

Note ►*Please keep in mind that only when you run the system without N2, total gas flowrate can be set to 0.1 l/min. If you were using this setting and change mode to AIR/N2/CO2 mode, the flowrate set point will be forced to the new minimum which is 0.2 Liters for minute.*

9.2 Controller Status: colours led and meaning

CO2-O2-UNIT-BL [0-10; 1-18] can assume four different status, which are represented by the colors assumed by the Status Indicator and by the TOP LED (see Figure 23):

	The GREEN color indicates that the Setpoint value has been reached (within the tolerance defined in the alarm subpage, see paragraph 9.3.2.5) and that the system is working properly. **Controller Status: NORMAL**
	The YELLOW color indicates that the controller is in transient regime. The Yellow light will appear after the controller is turned on and after any Setpoint change. The system is working properly, it is not in alarm and no action is needed. As soon as CO2-O2-UNIT-BL [0-10; 1-18] reaches the CO_2 and/or O_2 composition, CO2-O2-UNIT-BL [0-10; 1-18]. Status changes to NORMAL and the color turns GREEN. If CO2-O2-UNIT-BL [0-10; 1-18] cannot reach the set composition values within the maximum time defined by the operator (see paragraph 9.3.2.5), the Gas Controller Status changes to ALARM and the color turns ORANGE. **Controller Status: TRANSIENT**
	The ORANGE color indicates that the current gas concentration is not correct and its value is out of the set tolerance (see section *ALARMS* in paragraph 9.3.2.5). Most commonly this is related to gas leaks or gas source(s) running low. Verify that all cables are correctly connected. Check all tubing for gas leaks and pressure in gas supply tanks. **Controller Status: ALARM**
	The RED color indicates that there is a problem with the unit itself (for example the sensor is broken). The system is on alarm. Turn the system off, wait for 5 minutes, and turn it back on. If the color is still red, contact Okolab at www.oko-lab.com for support. **Controller Status: ALARM**

Tip ► *The TOP LED follows the same color code as the Status Indicator (see Figure 23). To enable/disable the TOP LED follow the instruction reported in paragraph 9.3.2.3.*

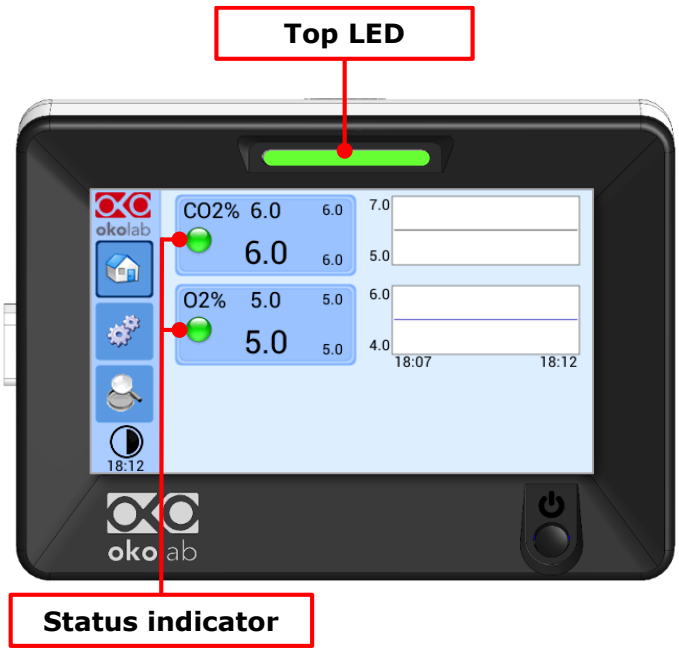


Figure 23. Status Indicator and TOP LED.

9.3 Settings

9.3.1 Gas

Press on *Settings* icon to enter the *Settings* menu, as shown in the Figure 24 a.

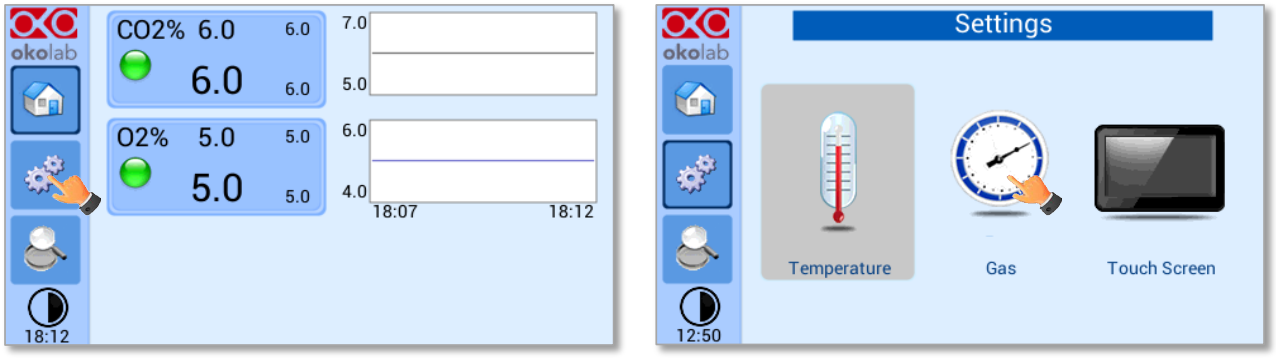


Figure 24. Gas Settings (a – b).

To enter the Gas Settings Submenu, press the Gas Icon (see Figure 24 b). Then the page shown in Figure 25 appears.

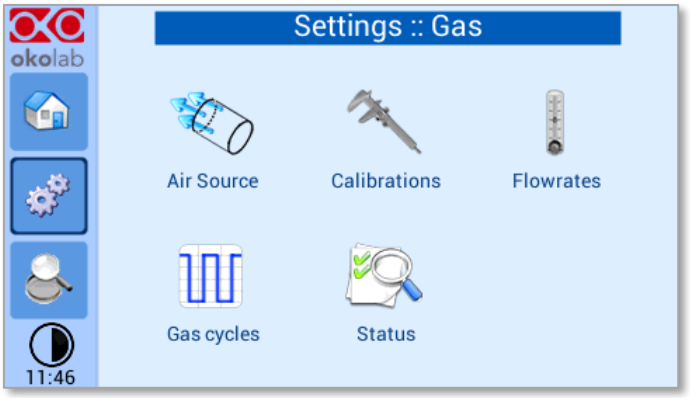
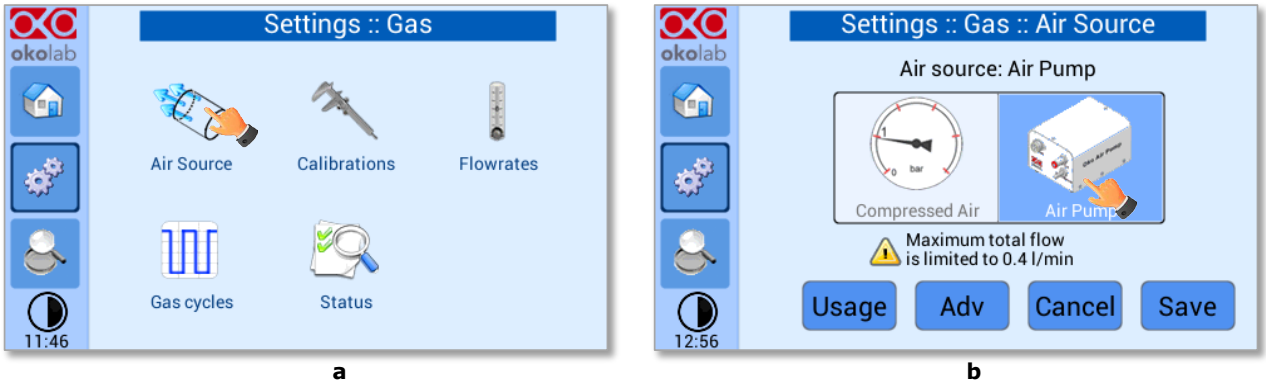


Figure 25. Gas Settings submenu

9.3.1.1 Air Source

Press the icon to set which *Air Source* you are using (see Figure 26 a). If this is an external Air tank or compressed Air line (*Compressed Air*) or if you are instead using OKO-AIR-PUMP-BL (*Air Pump*) (See Figure 26 b).

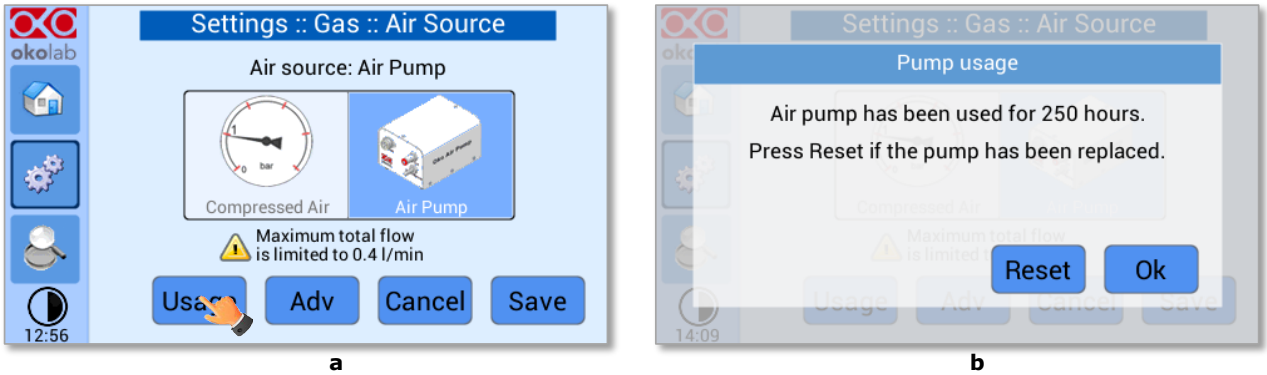


a b

Figure 26. Air Source page (a - b)

To connect the air pump (OKO-AIR-PUMP-BL) to CO2-O2-UNIT-BL [0-10; 1-18], see Figure 12. In the case you are using OKO-AIR-PUMP-BL please note that it can be turned on/off only via the Touch Screen interface (OKO-TOUCH). Thus, it is essential that you hereby set the correct Air source.

By pressing on "*Usage*" button (see Figure 27 a), it is possible to check/reset the usage time of the air pump:

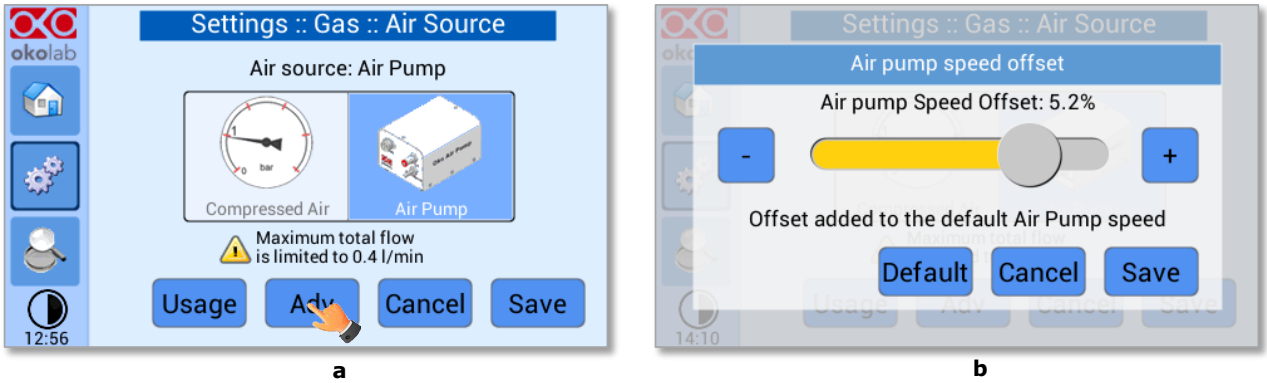


a b

Figure 27. Air pump usage (a – b)

Tip ► *Do not forget to reset the time counter after replacing the air pump.*

Press on "*Adv*" button (see Figure 28 a) to change the air pump speed in a range [-10; +10] % (see Figure 28 b).



a b

Figure 28. Air pump advanced settings (a – b)

Tip ► *Reducing the air pump speed will lead to a lower emitted noise from the air pump, while rising the air pump speed will help if you cannot reach your desired flow rate set-point.*

9.3.1.2 Calibrations

Press on Calibration icon to enter in the Calibration Menu, as shown in Figure 29.

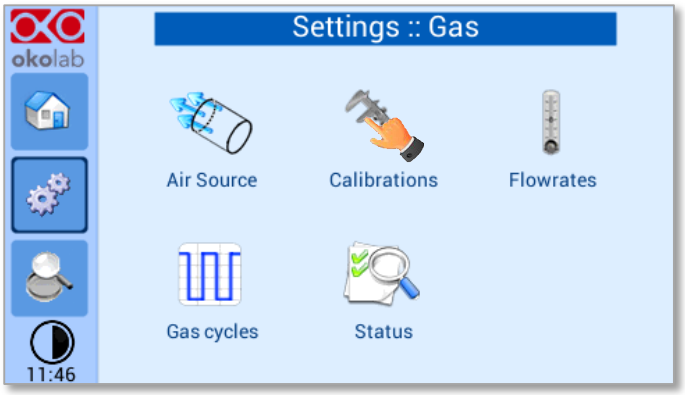


Figure 29. How to reach the Sensor Calibration Submenu

9.3.1.2.1 Offset (with exthernal meter)

Press on *Offset* icon to calibrate the instrument by using LEO as external meter (NOT provided).

Note ► *You can use any external gas meter to make an accurate calibration.*

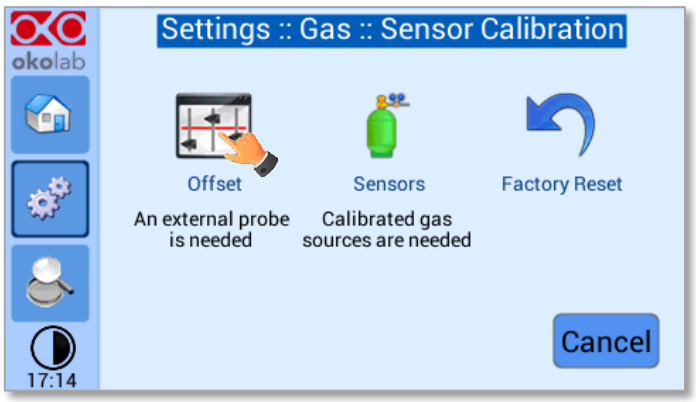


Figure 30. How to enter a gas offset calibration.

Please make sure that the external Gas meter used is accurate and calibrated.

To run the gas sensor calibration using LEO as external gas meter, follow the indications below:

1. Connect the TUBE-C to the TUBE-A (supplied with LEO, Figure 31), using the Fitting tube (3 in Figure 32) supplied with LEO.

Figure 31. TUBE-A supplied with LEO.

2. Connect the TUBE-A to LEO Gas Inlet port labeled with icon IN (1 in Figure 32).

3. Put the cap on LEO Gas Input port labeled with icon IN (2 in Figure 32).

4. Start a *Gas Single Point* measurement in *Diffusion Mode* on LEO (*please refer to LEO User Manual*).

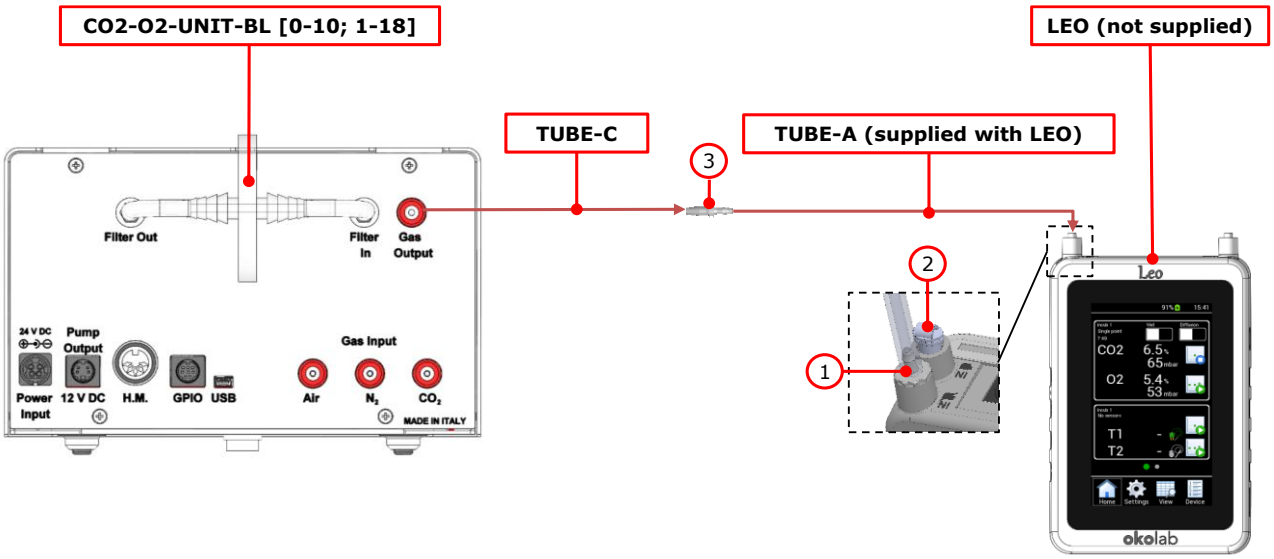


Figure 32. External Gas Meter Connection.

5. Wait until LEO stabilizes the CO2 and O2 readings; this may take 10-15 minutes.

6. Press on the *External Probe* Tab (as shown in Figure 33 a) in *Offset* page on the OKO-TOUCH display. The Figure 33 b appears.

7. Press on +/- icons to input the CO2 (1 in Figure 33 b) and O2 (2 in Figure 33 b) levels read by LEO (i.e. 6.5% for CO2 and 5.4% for O2), then press *Save* (3 in Figure 33 b).

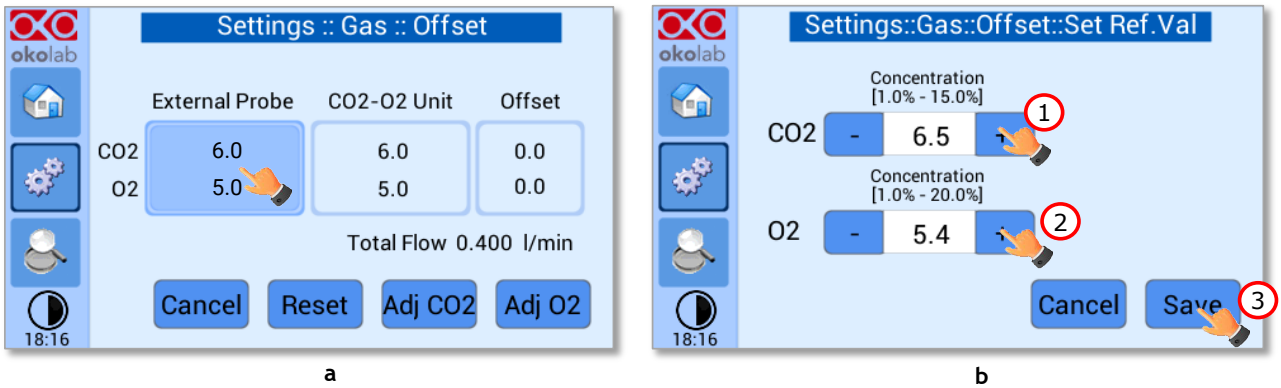


Figure 33. Manual Calibration (a – b).

Note ► *The Touch Screen will go back to the previous screen. It will display on the left (External Probe tab) the CO_2 and O_2 levels read by the external Gas meter, as just input. The value in CO2-O2 Unit tab is the value read by CO2-O2-UNITL-BL [0-10; 1-18] (see Figure 34).*

8. Press *Adj CO2* (see Figure 34) and/or *Adj O2* to make a calibration using the input value from LEO as a reference.

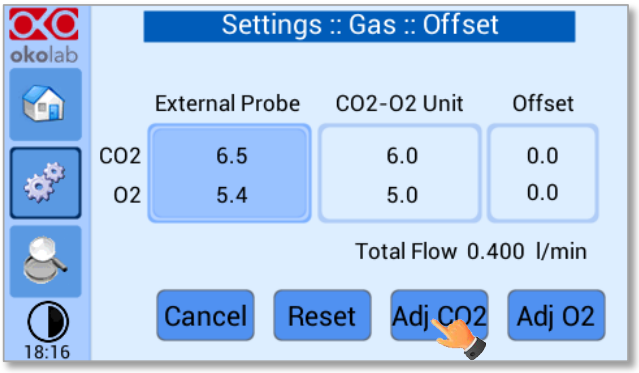


Figure 34. Manual Calibration Correction.

Note ► *By pressing Adj CO2 / Adj O2, the system will perform a calibration using the External Probe as a reference. The offset resulting from the calibration will be displayed in the Offset tab (see Figure 35).*

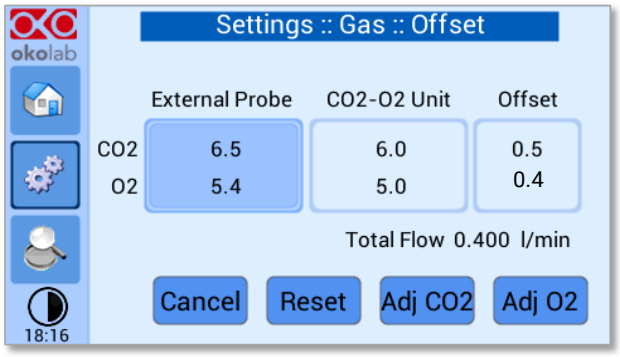


Figure 35. Manual Calibration End.

9.3.1.2.2 Sensors (with calibration gas)

This function allows performing a calibration using a Span Gas or Air or pure N2 Tank. Before starting the instrument calibration, make sure you have the Gas Tank connected to the port labeled "*Air Input*" on the rear panel of CO2-O2-UNIT-BL [0-10; 1-18], then press the *Sensors* icon , as shown in Figure 36 a. At this point several options are available (see Figure 36 b).

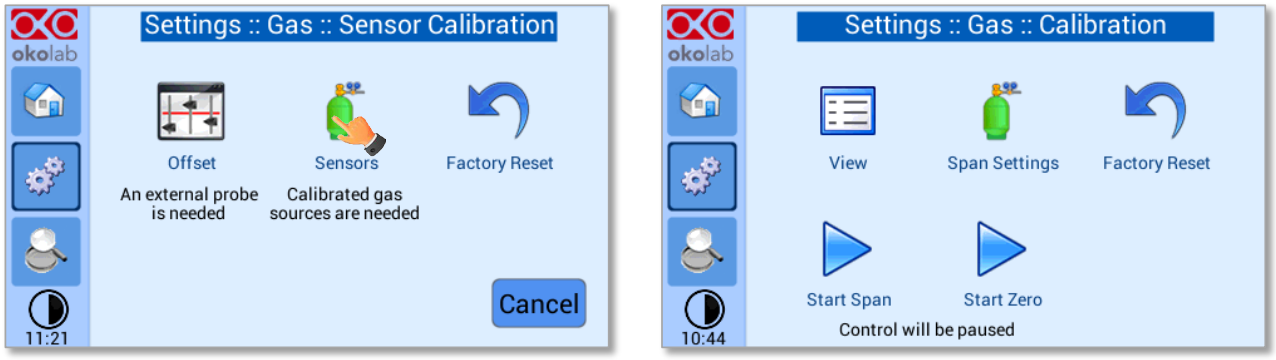
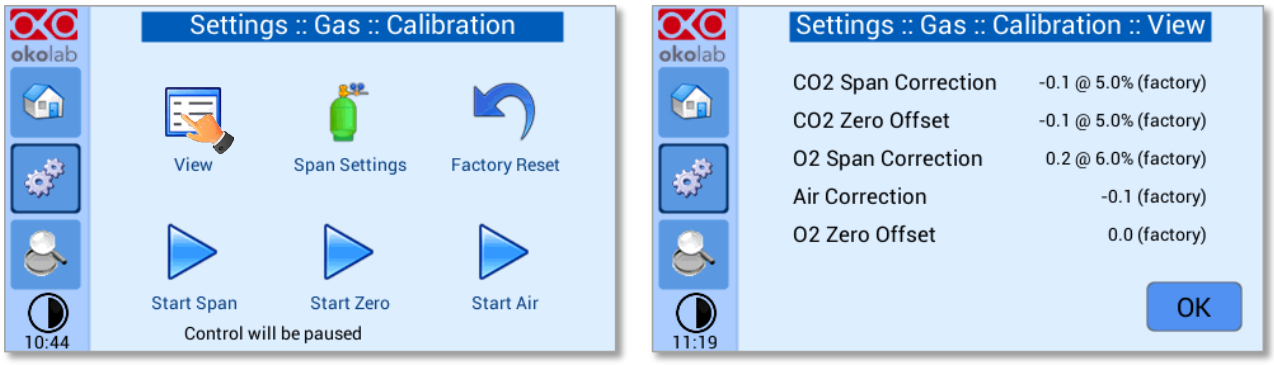


Figure 36. How to insert the Span Gas Calibration parameters (a – b).

9.3.1.2.2.1 View

Press on *View* icon to visualize the latest calibration.

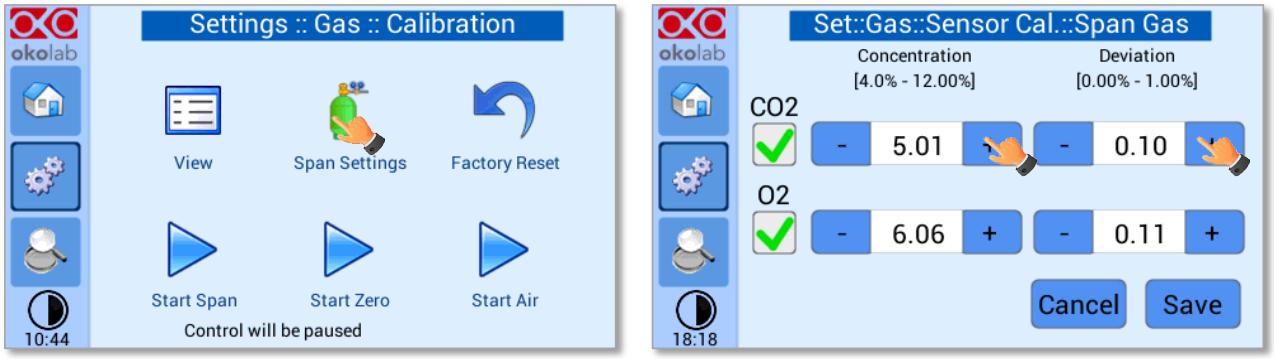


a b

Figure 37.View Sensor calibration status (a – b).

9.3.1.2.2.2 Span Settings

Press on *Span Settings* icon to access to the span gas settings (see Figure 38 a) and insert the exact gas composition of your span gas tank (see Figure 38 b).

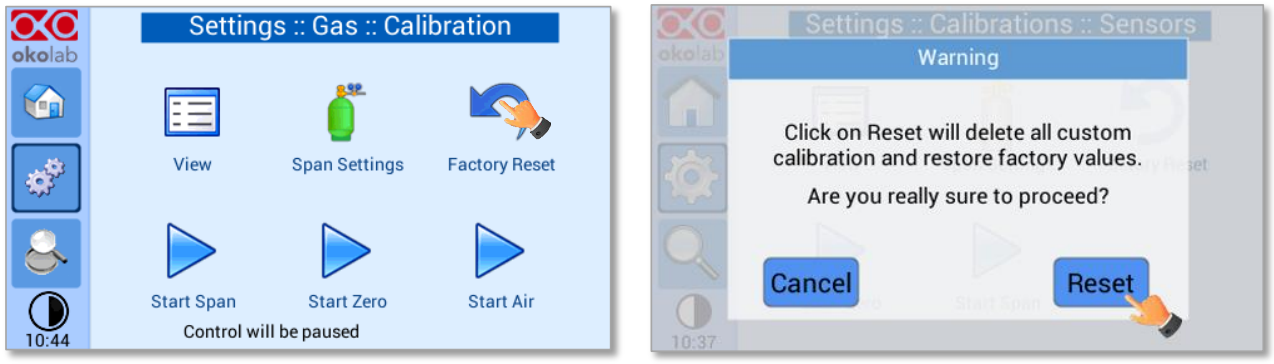


a b

Figure 38. Span Settings Menu (a – b).

9.3.1.2.2.3 Factory Reset

Press on *Factory Reset* icon (see Figure 39 a) to reset the Gas Calibration to the factory calibration. After clicking, a pop-up message will appear. If you are sure to proceed and restore factory values, press "*Reset*", as shown in the Figure 39 b.



a b

Figure 39. Factory Reset Menu (a – b)

9.3.1.2.2.4 Start Span

Press the *Start Span* icon and the controller will perform a new Gas Calibration for the CO2 and O2 using a span gas (see Figure 40 a).

After clicking, a pop-up message will appear warning about the pause of the control during the calibration routine (see Figure 40 b).

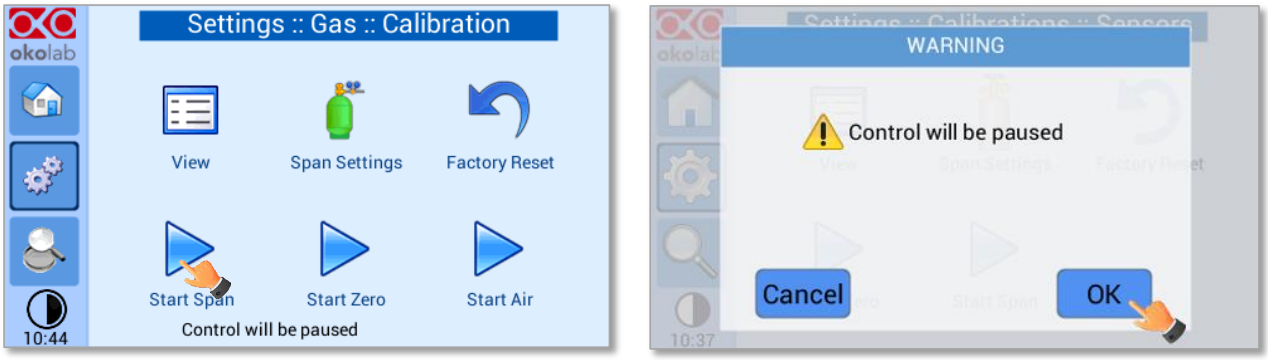


Figure 40. Start Span calibration (a – b)

Click "*OK*" and the controller will ask for connecting the span tank at 0.5 barg to the Air Input, located on the rear panel of the Unit, the Span Gas Calibration will start after pressing "*OK*" (see Figure 41 a) and the progress bar will appear, as shown in Figure 41 b.

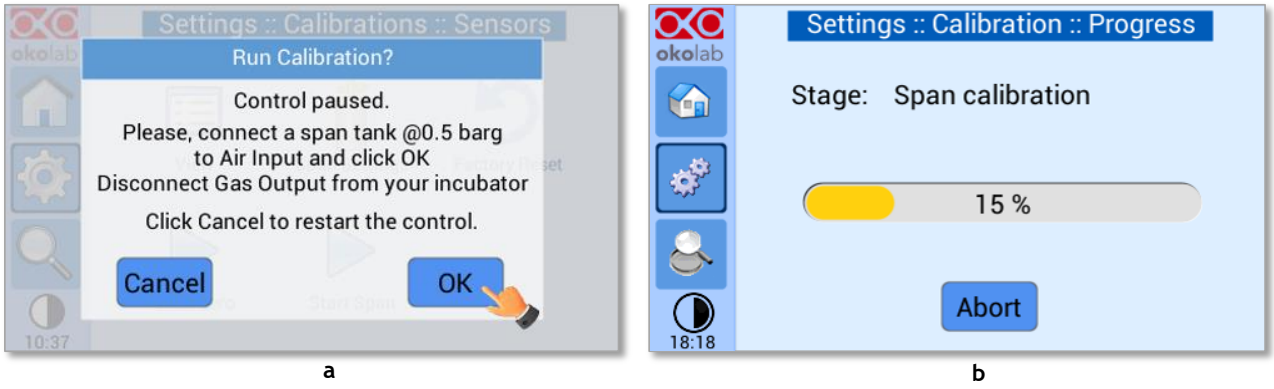
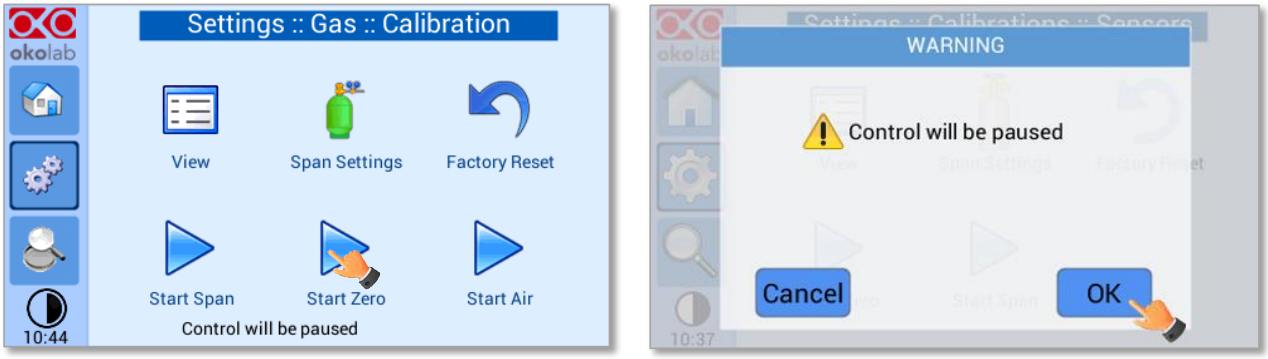


Figure 41. Span calibration running (a – b)

9.3.1.2.2.5 Start Zero

Press the *Start Zero* icon to perform a new Zero Calibration (see Figure 42 a).

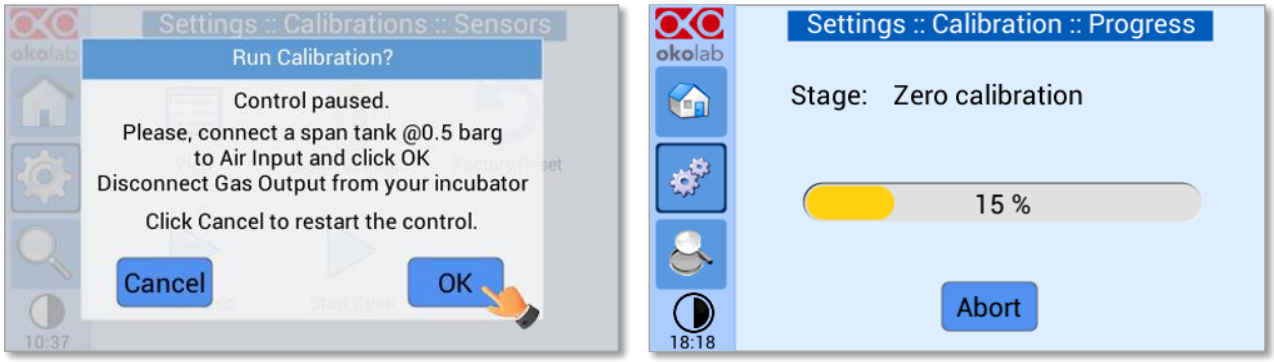
After clicking a pop-up message will appear warning about the pause of the control during the calibration routine (see Figure 42 b).



a b

Figure 42. Start Zero calibration (a – b)

After clicking "*OK*", the controller will ask for connecting N2 at 0.5 barg to the Air Input, located on the rear panel of the CO2/O2 Controller (see Figure 43 a). The Zero Calibration will start after pressing "*OK*" and the progress bar will appear (see Figure 43 b).



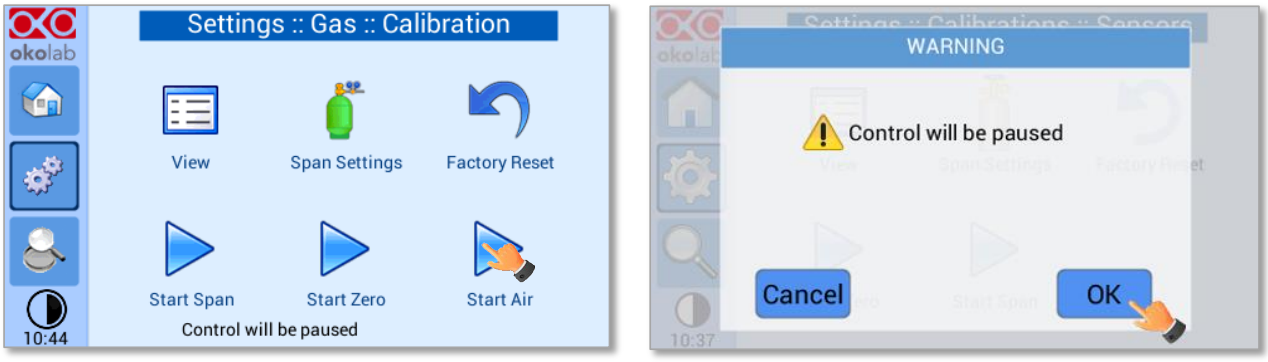
a b

Figure 43. Zero calibration running (a – b)

9.3.1.2.2.6 Start Air

Press the *Start Air* icon to perform a new Air Calibration (see Figure 44 a).

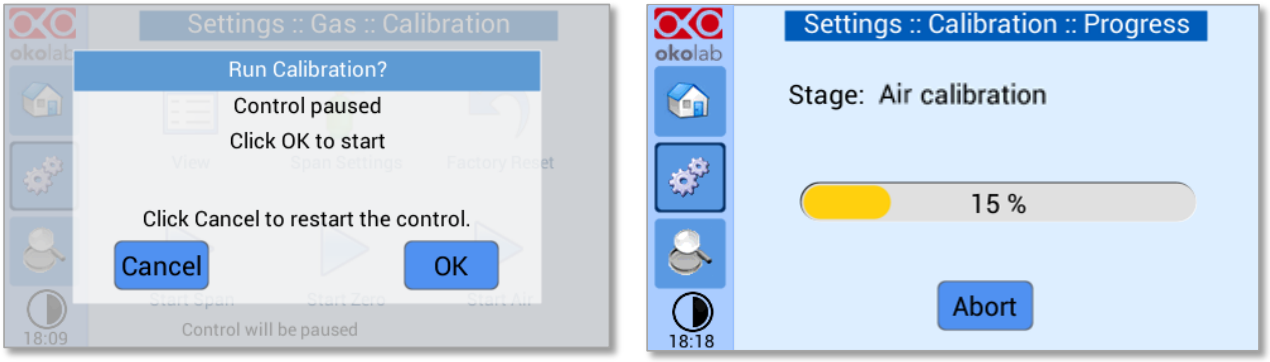
After clicking a pop-up message will appear warning about the pause of the control during the calibration routine (see Figure 44 b).



a b

Figure 44. Start Air calibration (a – b)

After clicking "*OK*", the controller will ask for confirmation, as shown in Figure 45 a. Press "*OK*" to start Air Calibration and the process bar will appear (see Figure 45 b).



a b

Figure 45.Air calibration running (a – b)

9.3.1.2.3 Factory Reset

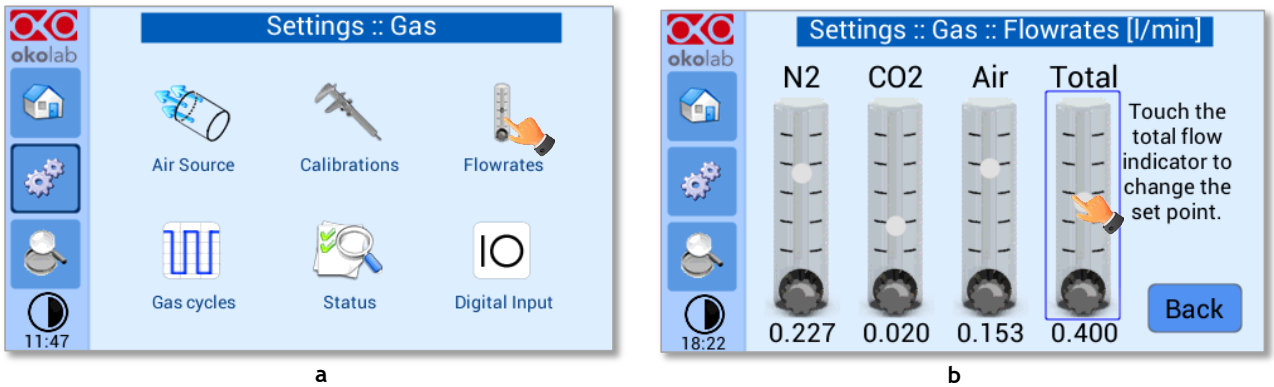
If you are unsure about the calibration you have just performed or if for any reason you want to reset to the factory calibration, press on *Factory Reset* icon (see Figure 46 a). A pop-up message appears (see Figure 46 b). Press *Reset* to proceed or *Cancel* to undo.

a b

Figure 46. Sensor calibration factory reset (a – b).

9.3.1.3 Flowrates

Press the Flowrates icon to check how many liters per minute of N2, CO2 and Air the system is consuming (see Figure 47 a). Additionally, this panel allows you to select the flowrate of the gas mixture you want to send to your incubator/device. Press the *Total* flowmeter to set the gas flowrate in the range 0.2÷1.0 l/min using the slider, as shown in Figure 48.



a b

Figure 47. Flowrates View (a – b)

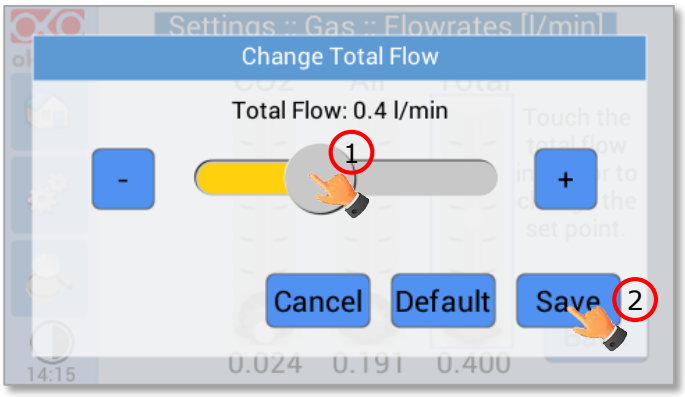


Figure 48. How to change the total flow rate.

When setting the flowrate for values below 0.2 l/min, the warning message "*Total Flow not allowed*" appears (see Figure 49).

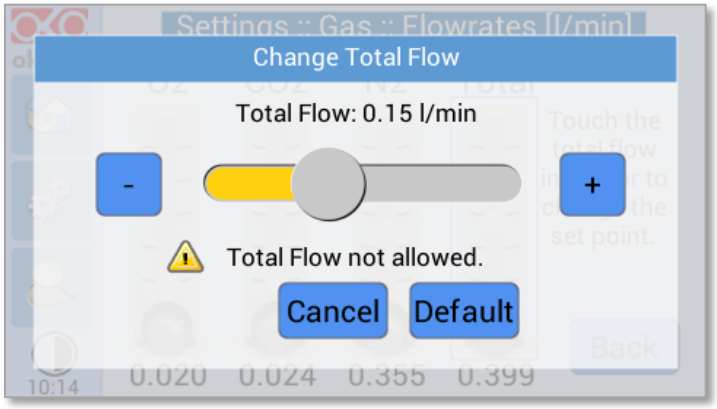


Figure 49. Flowrates for values below 0.2 l/min.

Note ► *You can set the flowrate at 0.0 l/min, in this case the gas flowrate will be paused and output flow will be interrupted (see Figure 50). In this working mode three dots will appear in Homepage instead of CO_2% and O_2% current value and the indicator will turn yellow.*

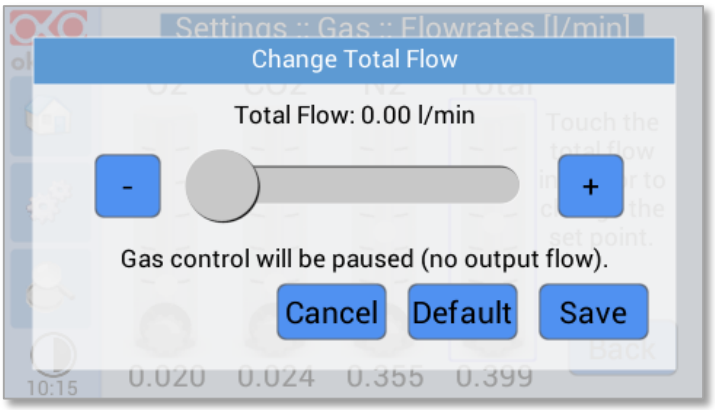


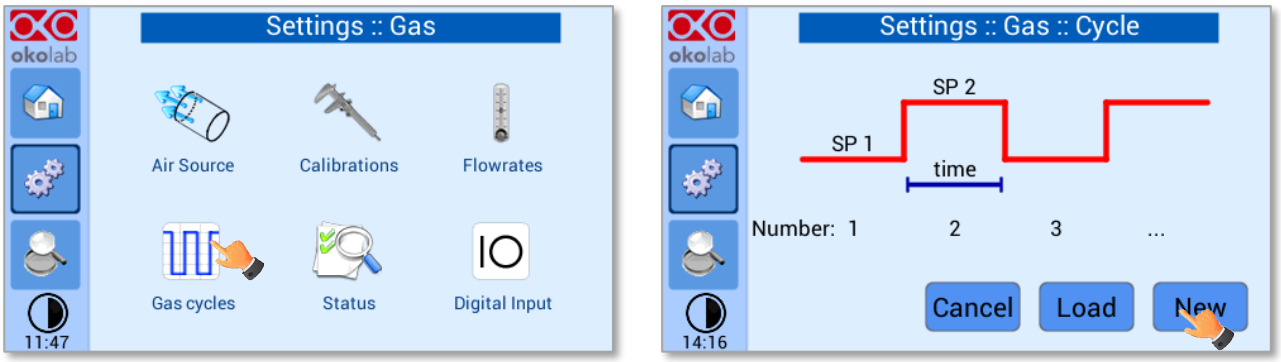
Figure 50. Setting the flowrate at 0.0 l/min.

Note ► *When using the Air Pump, the gas flowrate is available in the range 0.2÷0.4 l/min.*

Note ► *When operating CO2-O2-UNIT-BL [0-10; 1-18] without N_2, the gas flowrate is available in the range 0.1÷1.0 L/min. When using the Air Pump, the gas flowrates available in the range 0.2÷0.4 l/min.*

9.3.1.4 Gas cycles

This function allows switching between two different CO_2/O_2 concentrations. Press the *Gas cycle* icon to set a gas concentration cycle (see Figure 51 a).

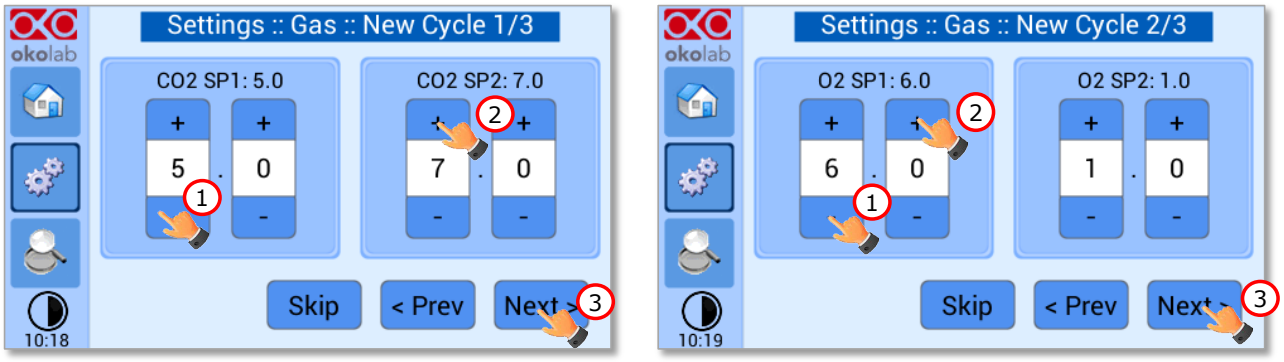


a b

Figure 51. CO_2 % Cycles Subpage (a – b)

You can decide whether setting a new gas cycle (*New*, as shown in Figure 51 b) or load a previously saved one (*Load*). To set a new CO_2 and O_2 concentrations cycle, follow the indications below:

1. Choose the two CO_2 and O_2 concentrations between which you want to switch (*SP1*: Setpoint 1 and *SP2*: Setpoint 2, as shown in Figure 52).
2. Set the duration in hours and minutes you want the system to dwell on each concentration (1 in Figure 53).
3. Set the number of cycles (*Number*) you want the system performs (2 in Figure 53). Finally press *Next>* (3 Figure 53).



a b

Figure 52. CO_2 and O_2 Concentrations cycles settings (a – b).

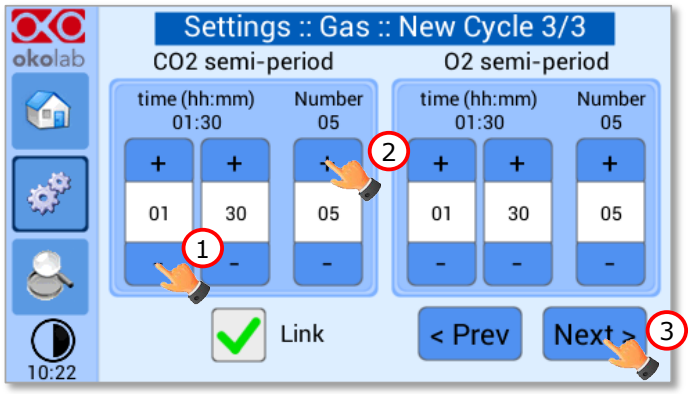


Figure 53. Set the duration of the Gas Cycle.

4. Once you have adjusted the settings, the *Cycle Summary* page will be displayed (see Figure 54 a). Press *Save As* if you want to save the CO_2/O_2 Cycle program to be recalled for future experiments.

   Note ► You can save up to 4 different CO_2/O_2 Cycles programs. Saving a 5th one will overwrite the first one.

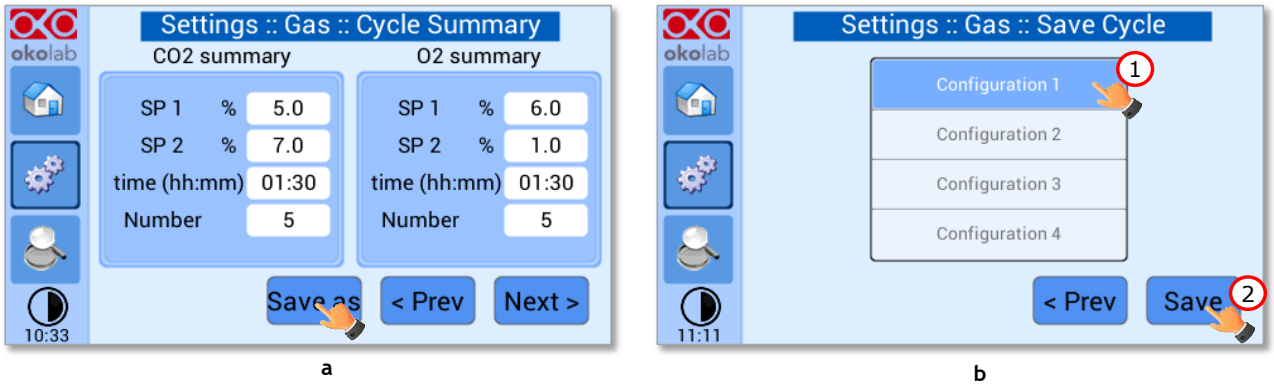


Figure 54. Cycle Summary and Configuration Saving (a – b).

5. Schedule the time for the concentration cycle to start (see Figure 55).

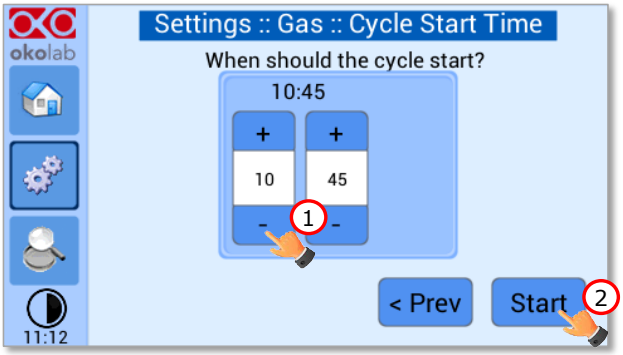


Figure 55. Cycle Start.

The cycle will start at the time set. A concentration cycling icon will be displayed on the Homepage as a reminder (see Figure 56).

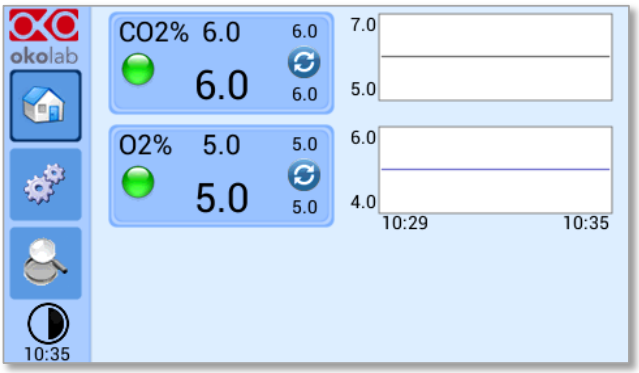


Figure 56. Icon in Homepage during a CO_2/O_2% cycle.

Note ► *Trying to change Setpoint or starting a new cycle while a cycle is still running will open the window in Figure 57. You can press Abort to abort the cycle. Pressing "View" will open the current cycle settings. Press Home to undo.*

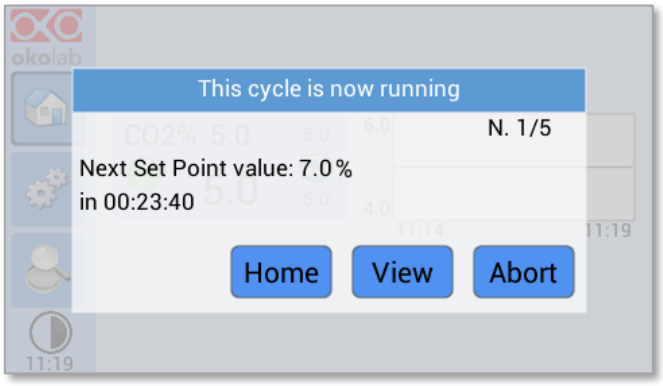
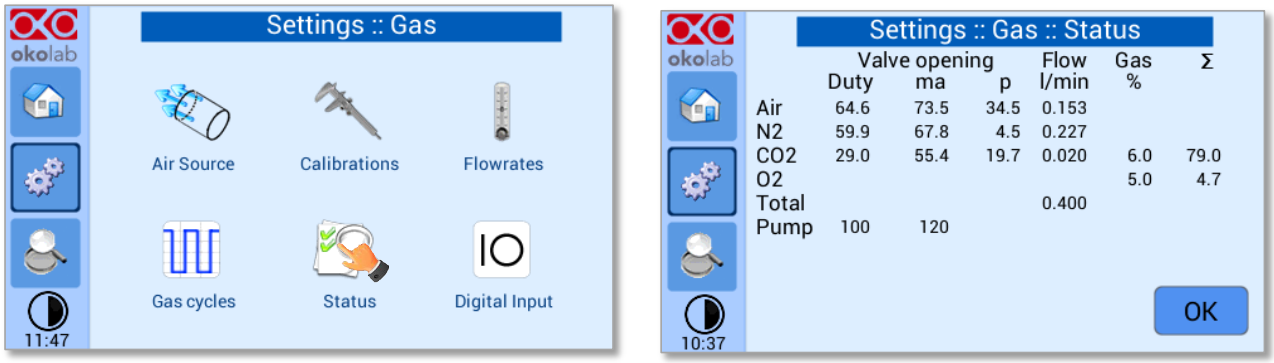


Figure 57. Warning shown if you try to change Setpoint during a gas cycle.

9.3.1.5 Status

Press the Status icon to check CO2-O2-UNIT-BL [0-10; 1-18] performance (see Figure 58 a).



a b

Figure 58. Status page (a – b).

Note ► *The Status page contains advanced technical data. You may be asked to read these data in case of technical assistance with Okolab engineers.*

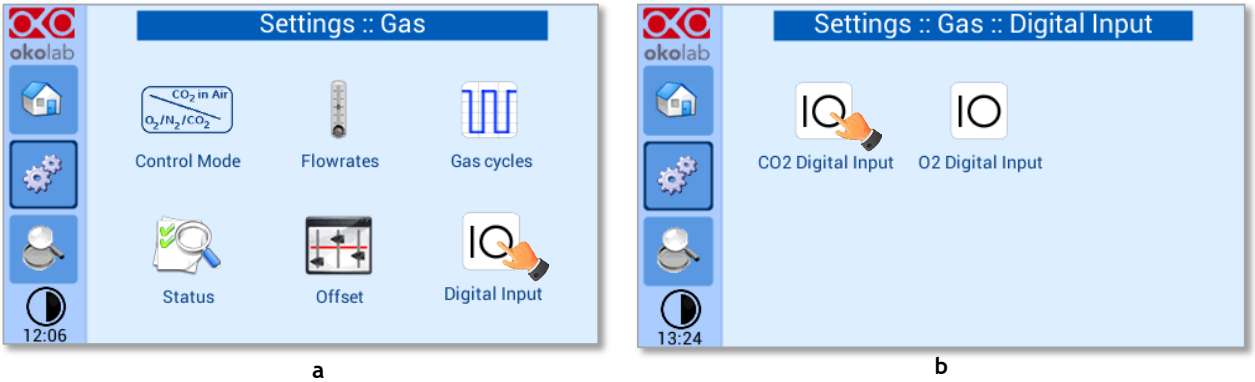
9.3.1.6 Digital Input

Digital Input feature is available only for TTL ready (optional) controller.

TTL feature allows to change Setpoint between two specified values using a TTL signal (see Figure 60). The TTL is a digital input for our Units and has only two values: High and Low. The Setpoint values for High TTL value and for Low TTL value can be set using OKO-TOUCH, via GPIO connector.

When TTL Control is enabled, the user cannot change the Setpoint using the dialog in the main page. In this case, the Setpoint value is read by the external TTL signal.

Press the *Digital Input* icon to access to Digital Input page (see Figure 59 a). Press the *CO2 Digital Input* icon (see Figure 59 b) and / or *O2 Digital Input* icon to activate the Digital Input on CO2 and/or O2 Setpoint.



a b

Figure 59. Digital input.

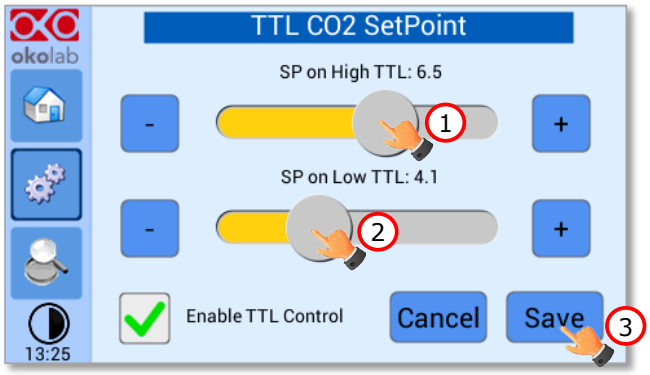
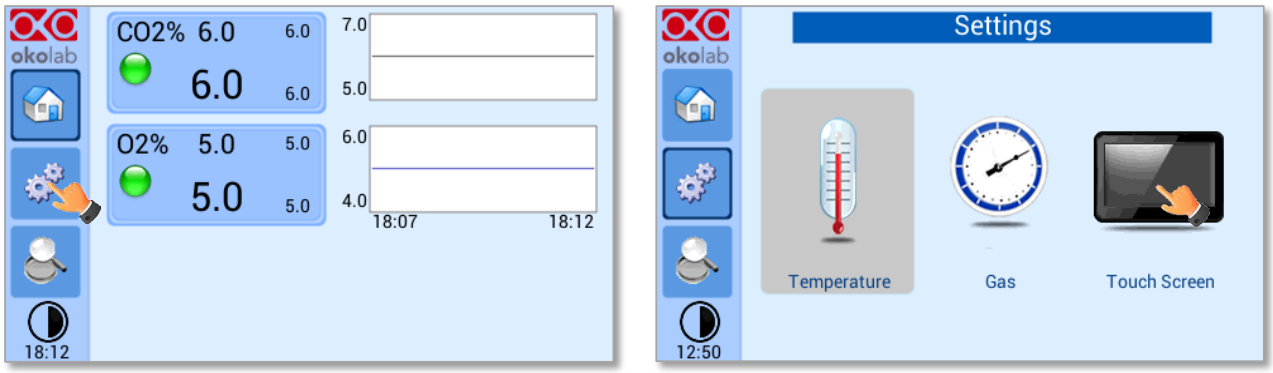


Figure 60. CO2 Setpoint with Digital input.

9.3.2 Touch Screen configuration

Press on *Settings* icon to enter the *Settings* menu, as shown in the Figure 61 a. To enter the Touch Screen configuration menu, press on the icon , as shown in Figure 61 b.



a b

Figure 61.Touch screen settings (a – b).

9.3.2.1 Touch Screen Options

Press the *Options* icon (see Figure 62 a) to enter the Touch Screen Options page. The Display Options menu allows to set the time frame in which the minimum and maximum CO_2/O_2 values are collected.

To insert the time frame, press the + / - icons or scroll the *Chart history length* bar (1 in Figure 62 b).

Note ► *The chart history value length is pre-set at 5 minutes.*

Note ► *Recommended value for the chart history length is 60 or 120 minutes.*

To change the sound frequency, press the + / - icons or scroll the *Buzzer frequency* bar *(2 in* Figure 62 b), then press *Save* (4 in Figure 62 b) to confirm.

Note ► *To activate a sound at each touch, flag the Touch Buzzer checkbox (3 in Figure 62 b).*

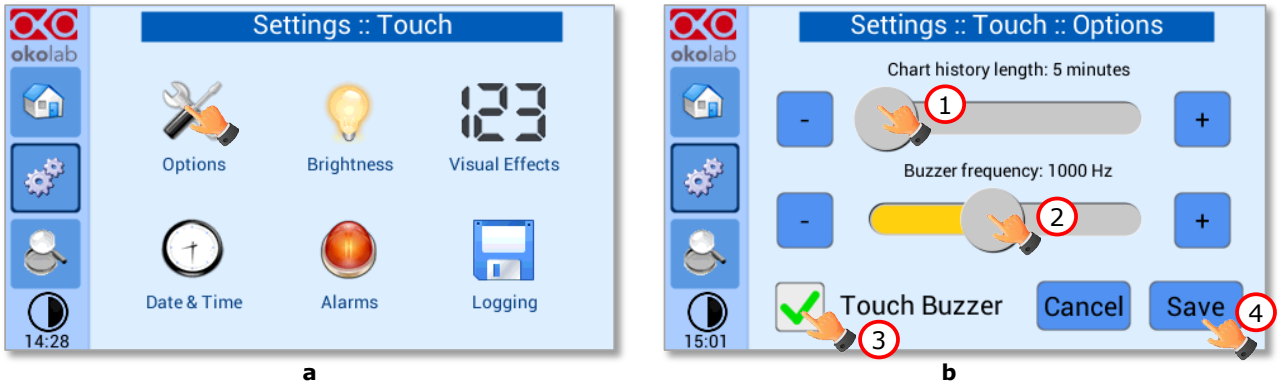


Figure 62. Touch Options (a – b).

9.3.2.2 Touch Screen Brightness

Press the icon (see Figure 63 a) and scroll the bar (1 in Figure 63 b) or press the + / - icons in the page that opens to modify display *Brightness*. Set the required configuration and press *Save* (2 in Figure 63 b) to confirm.

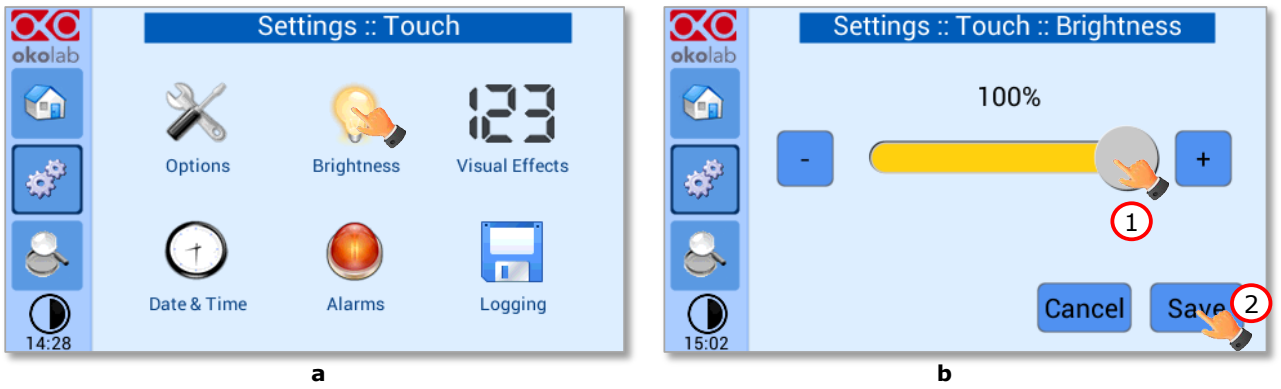


Figure 63. Brightness display page (a – b).

9.3.2.3 Touch Screen Visual Effects – icon and glance mode.

Press on the icon to enter the Display visual effects menu, see Figure 64 a.

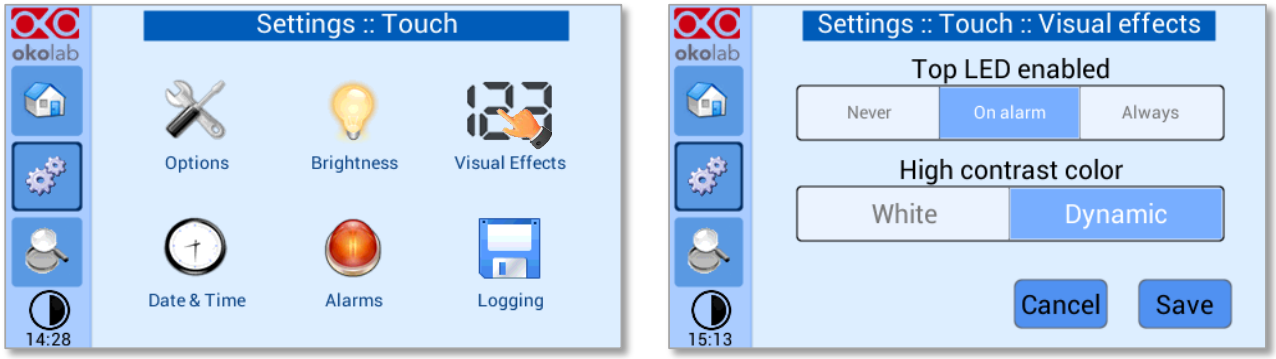


Figure 64. Visual Effects (a – b).

- **TOP LED Settings.** The TOP LED settings allows you to establish 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-O2-UNIT-BL [0-10; 1-18] is in Alarm Status (see paragraph 9.2), if you select *Always*, the TOP LED will always illuminate.
- **Glance Mode Setting** (see also paragraph 9.5). The Glance mode setting defines the colour of the TOP LED and of the digits displayed in Glance Mode. If you select *White*, the TOP LED illuminates in white colour (according to the criterion selected in TOP LED setting) and the digits displayed in Glance Mode are white. If you select *Dynamic* the colour of the TOP LED and the colour of the digits in Glance Mode follow the colour coding reported in 9.2.

Tip ► *To swap between Icon and Glance mode press on the icon* , *see paragraph 9.5.*

9.3.2.4 Date & Time

To set Date & Time, follow the instructions below:

1. Press the *Date & Time* icon (see Figure 65 a).
2. Set the values by using the *+/-* icons (1 and 2 in Figure 65 b).

   Tip ► *Flag the 24 hours box, if you want to use the hour format based on 24 hours (3 in Figure 65 b).*
3. Click on *Save* to confirm (4 in Figure 65 b) or *Cancel* to undo.

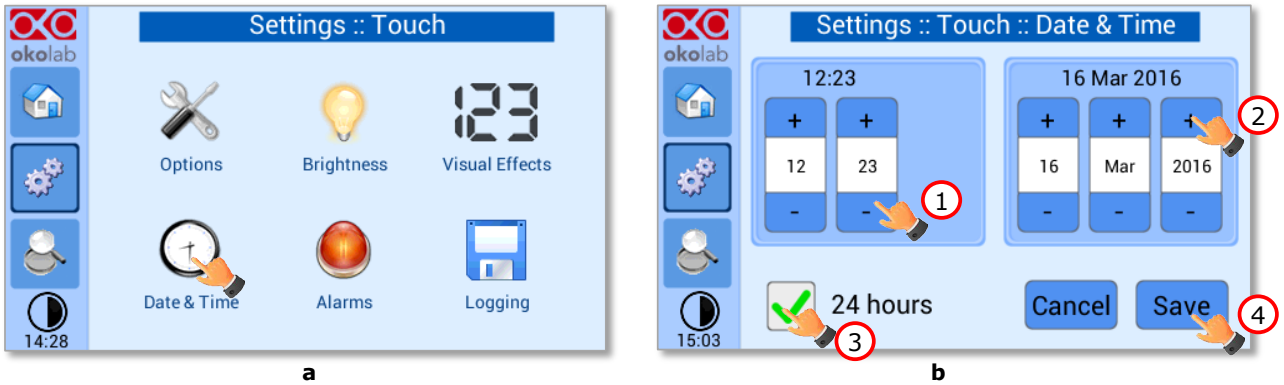


Figure 65. Touch screen settings. Date and Time (a – b).

9.3.2.5 Alarms

CO2-O2-UNIT-BL [0-10; 1-18] also allows activating visual and audible alarms.

To set the alarms specifications, press the *Alarms* icon (see Figure 66 a), then follow the indications below:

1. Click on the Gas icon to set the gas deviation for a period of time then the system triggers on Alarms, as shown in the Figure 66 b.

   Tip ►*Flag the Buzzer checkbox if you want the Alarm to be acoustical as well rather than just being displayed.*

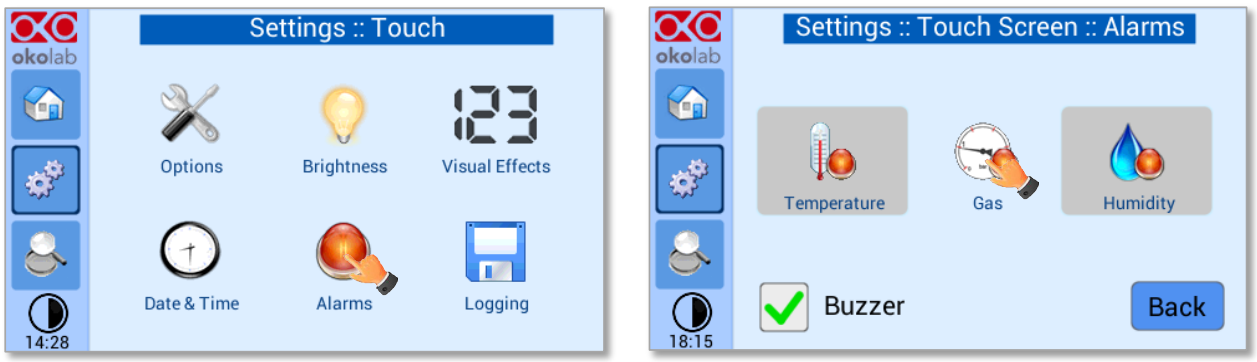


Figure 66. How to enter in Alarms page (a -b).

2. Insert the Gas Deviation by scrolling the bar (1 in Figure 67) or pressing the *+/-* icons.

   Note ►*The Gas Deviation value defines the tolerance from the Setpoint.*

   Note ►*The gas deviation value range is 0.1-2.0 %.*

3. Insert the *Gas Time* by scrolling the bar (2 in Figure 67) or pressing the *+/-* icons.

   Note ►*The Gas Time value defines the time for which the CO2 / O2 composition may remain outside the allowed tolerance before CO2-O2-UNIT-BL [0-10; 1-18] triggers in alarm.*

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

4. Press *Save* (3 in Figure 67) to confirm.

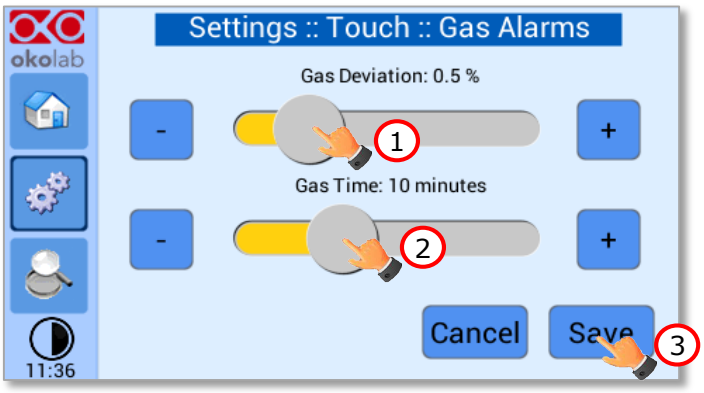


Figure 67. How to set the Deviation and Time Alarm.

Figure 67. In this example the following settings are displayed (valid only after the system has reached its stationary state): if the *Gas Deviation* from Setpoint is 0.5% or greater (i.e. if Setpoint gas is 5.0% and the composition reaches a value equal or less than 4.5% or equal or more than 5.5%) for a period of time equal or longer than 10 minutes (*Gas Time* set in this example) then the system triggers an Alarm.

Tip ► *After any change in the Setpoint value the device enters into a transient regime.*

9.3.2.6 Data Logging

CO2-O2-UNIT-BL [0-10; 1-18] touch screen interface, OKO-TOUCH (see Figure 2), is equipped with on-board memory for data logging and storage. A simple routine allows downloading data to USB drive or to PC.

In order to log and then download the logged data, connect a USB drive (not supplied) to OKO-TOUCH, using MINI-USB-OTG cable (provided), as shown in Figure 68.

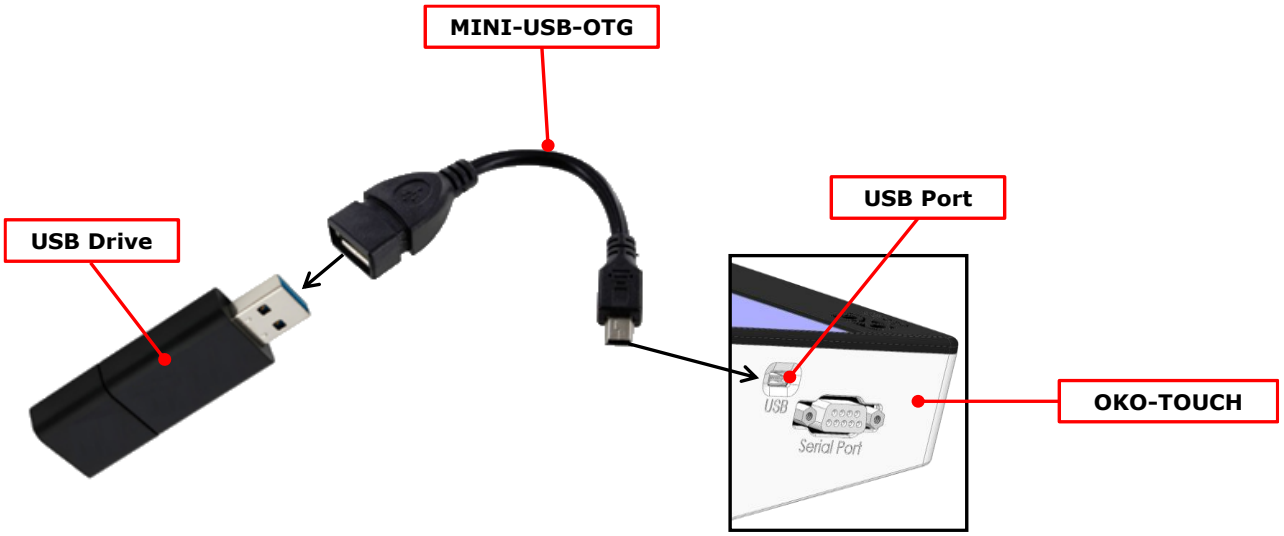


Figure 68. USB drive connection.

To activate the logging, follow the steps indicated below:

1. Press on *Settings* icon (see Figure 69 a) and press on *Touch screen* icon on the window that opens next (see Figure 69 b).

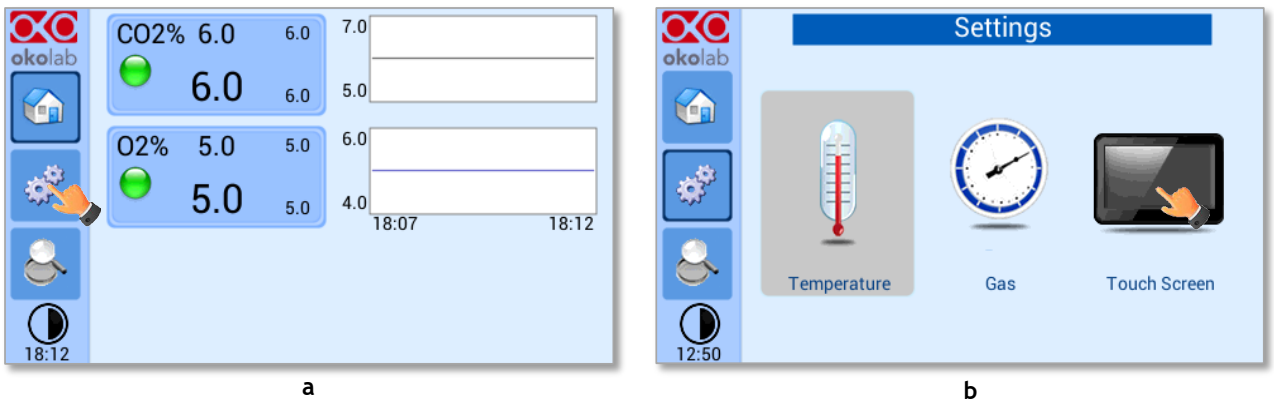
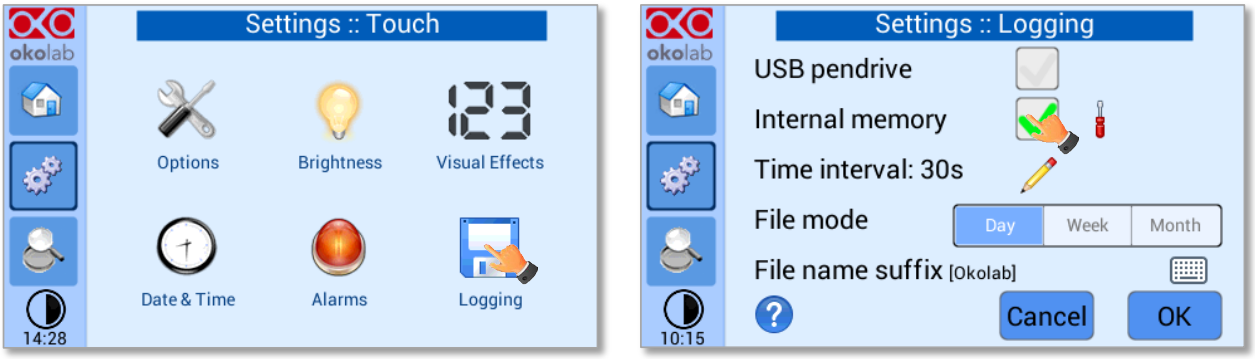


Figure 69 (a) How to enter the setting menu; (b) how to enter the Touch Screen menu.

2. Press on *Logging* icon (see Figure 70 a) and flag *Internal memory* in the page that appears (see Figure 70 b).

Tip ► *When activating the logging on the internal memory, you can access the Logging page also by pressing the activated logging icon on the Homepage, as shown in Figure 71*



a b

Figure 70. Logging. (a) How to enter in the logging menu; (b) logging in internal memory.

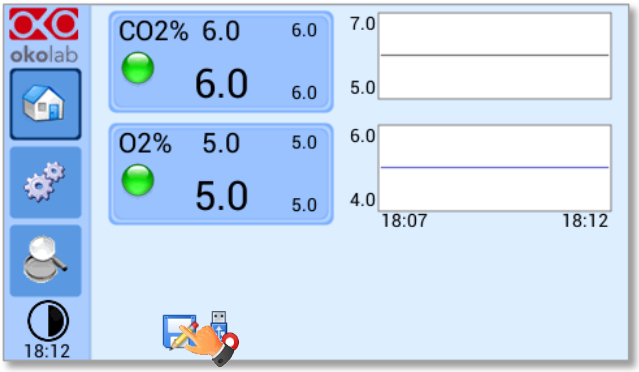
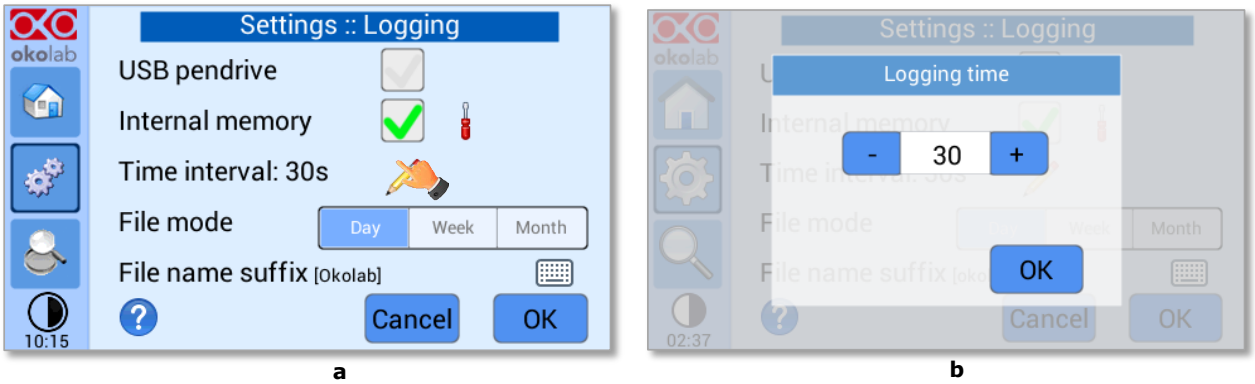


Figure 71. How to access the Logging page from the Homepage.

3. Press on the icon to insert the *Time Interval* i.e. the frequency with which you want to record a data point, as shown in Figure 72. In this example a data point is logged every 30 seconds, you can change *Time Interval* in the range 1-60 seconds.



a b

Figure 72. How to set the logging time (a – b).

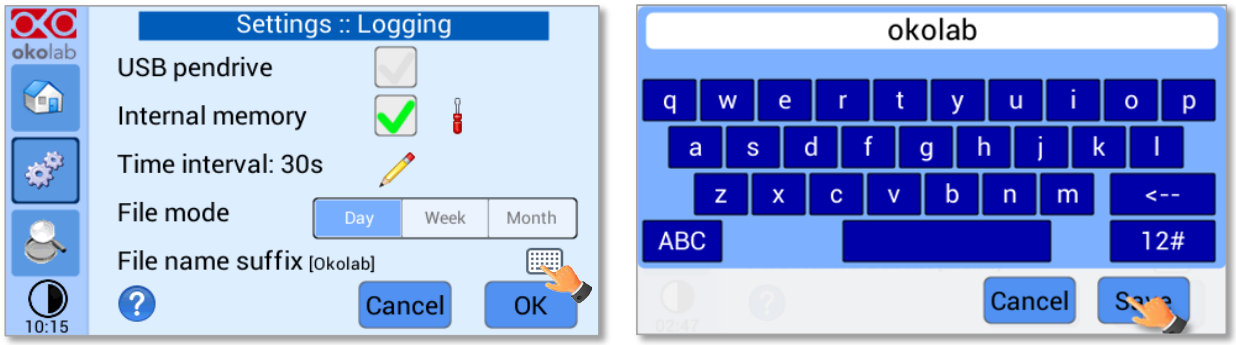
4. Choose how you want to organize the data when downloaded, by pressing on Day, Week or Month, see Figure 72 a.

> ***Tip*** ►*If you select Day, the data will be split in files, each one containing the data of one day. If you select Week, the data will be split in files, each one containing the data of one week.*

5. Write the file name suffix to be reported in the downloaded files by pressing on the keyboard icon , see Figure 73 a.

6. Press *Save*, see Figure 73 b.

Tip ► *With the selections as in Figure 72 and in Figure 73, the data will be downloaded on the USB drive as shown in Figure 74.*



a b

Figure 73. Data Logging. How to define the suffix for the downloaded files (a – b).

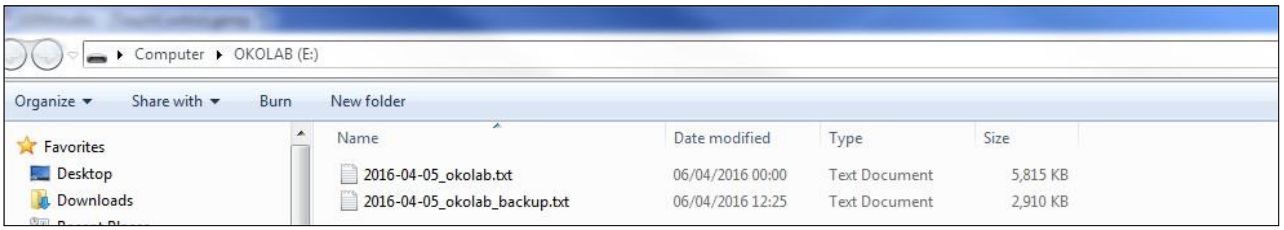


Figure 74. Downloaded files on the pen drive.

Note ► *If you press on the screwdriver icon (see Figure 75 a) you can view the logging starting date, the available memory and the latest download, see Figure 75 b.*

Note ► *The available memory depends on the time interval you have inserted in the Logging page. The default logging Time Interval is 30 seconds.*

a b

Figure 75. Internal memory status. (a) Logging page settings; (b) Internal log page settings.

To download the data, press on *To USB* or on *Erase* if you want to delete the data, see Figure 75 b.

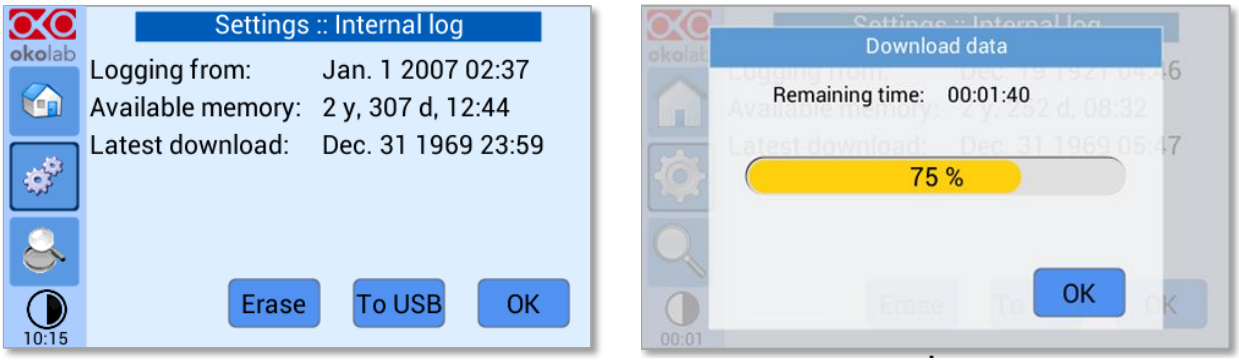


Figure 76. Download to USB.

You can activate the logging also on the *USB drive*, by flagging on *USB drive*, see Figure 77 a.

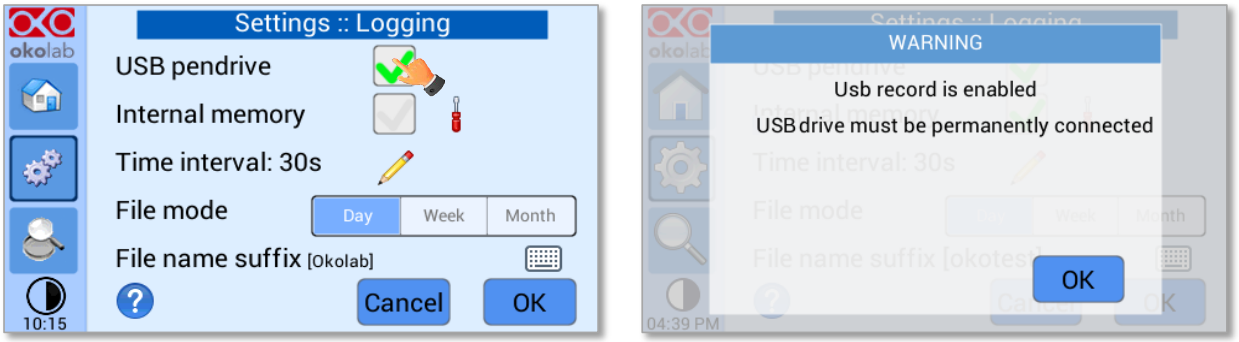


Figure 77. Logging on USB flash drive. (a) USB drive selection; (b) Reminder to connect the USB drive.

In this case, OKO-TOUCH warns you that a USB drive must be connected to the USB port, see Figure 77 b, and will store the data on the USB drive.

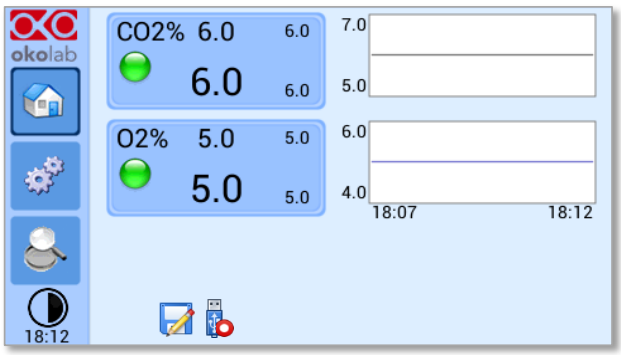


Figure 78. Logging to USB drive.

Note ► *When connecting the USB drive to OKO-TOUCH, a USB drive icon* *appears on the Homepage. If you activate the logging on USB drive, a red dot appears on the USB drive, to remind that the USB drive should not be disconnected while data logging is ongoing see Figure 78.*

9.4 Overview

Press on the icon to open the status page as show in Figure 79 a.

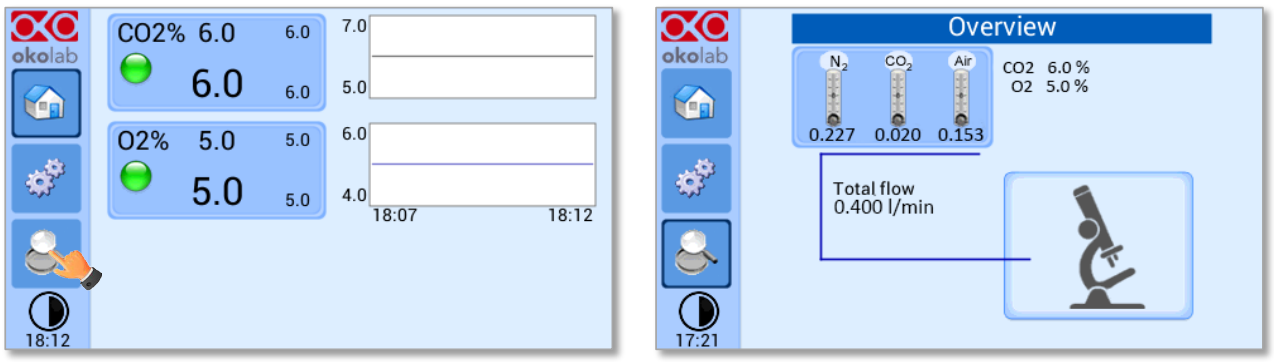


Figure 79. Overview Status page. (a) How to enter in the Overview Page (b) Overview Status Page

Note ► *This page contains data useful for technical/control reasons. In case you requested support from one of Okolab engineers you may be asked for some of these data*

9.5 Icon and Glance Mode View

CO2-O2-UNIT-BL [0-10; 1-18] features two display modalities: Icon mode and Glance Mode, as shown in Figure 80(a) and (b). You can swap between the two display modalities by pressing on icon .

Figure 80. Display modalities. (a) Icon Mode; (b) Glance Mode

9.6 Info page

Press the icon to access the Info Page, as shown in Figure 81. This page contains the information related to the OKO-TOUCH (as shown in Figure 82 a) and to CO2-O2-UNIT-BL [0-10; 1-18] version (as shown in Figure 82 b).

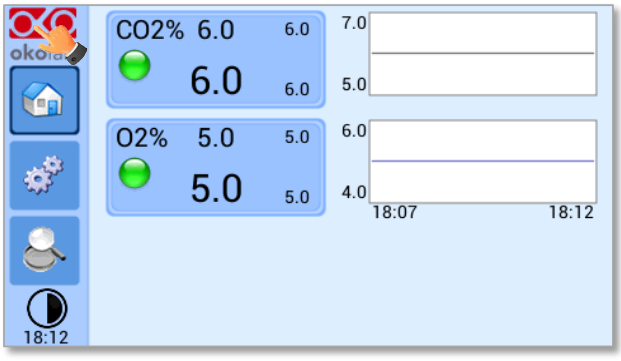


Figure 81. Info page selection

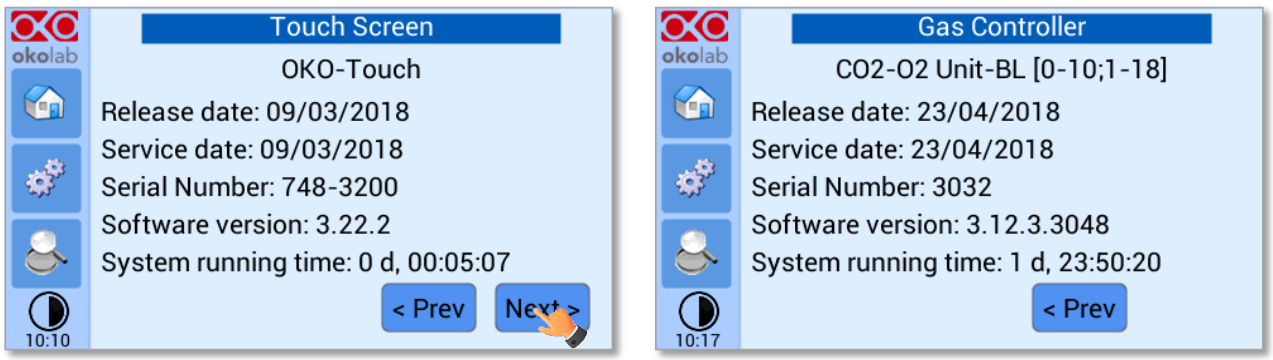


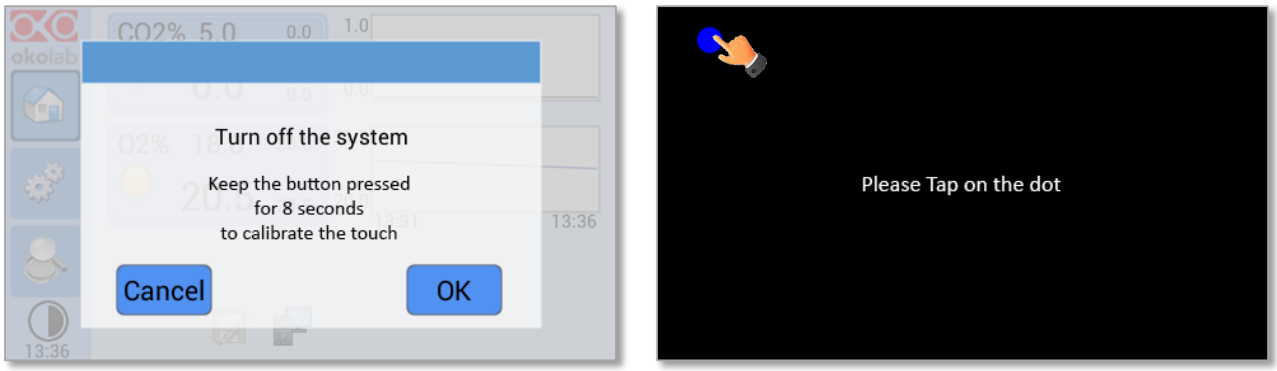
Figure 82. Info page OKO-Touch (a) and CO2-O2-UNIT-BL [0-10; 1-18] (b).

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

10 Touch Screen Calibration

Keep pressed the *ON/OFF* button on OKO TOUCH for 7 seconds to start the Touch Screen Calibration (see Figure 83). While holding the button, the pop-up message shown in Figure 84 a appears. Then tap blue calibration dots until the calibration is complete (see Figure 84 b).

Figure 83. How to enter in Touch Screen Calibration.



a b

Figure 84. Start Touch Screen Calibration (a – b).

11 Cleaning & Maintenance

Cleaning

Please, follow the instructions below to clean CO2-O2-UNIT-BL [0-10; 1-18]:

- 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-O2-UNIT-BL [0-10; 1-18].

Maintenance

- Verify periodically the status of all hoses/tubing. If some hoses/tubing is damaged, contact Okolab to receive assistance.
- After 2 years, disconnect all polyurethane tubing, cut the last 1 cm of the tubing and reconnect them.
- Replace the PTFE filters (on the rear panel of the unit and along the tubes) each 2-3 months of continuous use or when it is present water in the inner part of the filter.
- Okolab Air pumps have to be replaced every 18-24 months.

12 Support

To contact one of our engineers please write to support@oko-lab.com or contact us through the live chat in www.oko-lab.com. You can request a remote support session anytime.

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

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Phone +39 081 806 3470
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Mobile: +39 348 96807 18

For COMMERCIAL SUPPORT WORLDWIDE: lanzaro@oko-lab.com
Phone +39 081 806 2624
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13 Technical Specifications

CO2-O2-UNIT-BL [0-10; 1-18] – Technical Specifications	
CO_2	Range: 0-10% Step size: 0.1% Accuracy:± 0.1%@ 5.0% Sensor: 10 year-life, Non Dispersive InfraRed (NDIR) dual wave length detector Recommended Calibration Interval: 1 year
O_2	Range: 1-18% Step size: 0.1% Accuracy:± 0.1%@ 5.0% Sensor: 5 year-life, optical sensor Recommended Calibration Interval: 1 year
Input Gas	CO_2, N_2 and Air
Total Flow rate	0.0-1.0 L/min (0.4 L/min max with OKO-AIR-PUMP-BL)
Operating Temperature	0°C ~ +55°C (23°C suggested)
Storage Temperature	-5°C ~ +60°C
Operating Humidity	0-70%
Power Consumption	Input 24 V DC 35 W max (85 W max if used together with HM-ACTIVE)
Weight	3.4 Kg

Table 1. Technical specifications.

14 Troubleshooting

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

Symptom	Probable cause	Remedy
No power supplied to Unit	Power plug is disconnected	Connect plug securely
No Gas flow rate stability	Pressure drop	Check gas tanks and/or compressed lines
		Change the PTFE filter with degree of filtration 0.2 micron
No CO_2 or O_2 read	The Unit is off	Switch the Touch Screen on
	The PTFE filter with degree of filtration 0.2 micron is dirty	Change the PTFE filter with degree of filtration 0.2 micron
Gas leak on the rear of the control box	Not properly inserted tubes	Strongly push the tube into the Push to fit connector
No Gas arrives to the incubating chamber	Missing connection	Make sure you've attached the PTFE filter on the back of CO2-O2-UNIT-BL [0-10; 1-18]
	Gas source closed	Open gas tanks regulators (set to 1-2 bar)
Fast sample drying	No Gas arrives to the incubating chamber	See above
	Humidifying Module empty	Fill it with distilled water until 50 mm below the top of glass column.
	Humidifying Module not heated	Correctly connect the heater of the Humidifying Module

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16 Manual Revision Table

Revision Number	Additions or changes	Date
01	Edited new form factor User Manual	January 2019
02	Equipment Correction	May 2019
03	Cleaning & Maintenance	January 2020

WARRANTY

Okolab S.r.l. warrants “CO2-O2-UNIT-BL [0-10; 1-18]” 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. 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 damage that may results from improper use of its products in accordance with information provided by Okolab S.r.l. Okolab S.r.l. warrants only the parts manufactured by Okolab S.r.l to be 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.