# H201-T-UNIT-BL

# Temperature Control Unit

# Manual

IST1254-REV03
SV 4.0.9.4007

# Index

# 1 Preface

The **H201-T-UNIT-BL**, together with the H201-ENCLOSURE, is designed to maintain all the thermal conditions required around your microscope, thus enabling to carry out prolonged observations on biological specimens. The system controls the temperature in the range of 25-42°C.

The system is composed of the enclosure surrounding the microscope, H201-ENCLOSURE, which design depends on the user's microscope, the Temperature Control Unit, H201-T-UNIT-BL with the Heating Box, the HM-VF composed by a humidity module and a water trap (purchased separately)[1], a fine gauge thermocouple to monitor the temperature of a blank sample or Reference Well located in close proximity to the experimental one, a thermistor to monitor the cage temperature or the Room Temperature and the OKO-TOUCH touch screen control panel (to be ordered separately).

H201-T-UNIT-BL is compatible with any Bold Line Gas Controller Temperature and Gas controllers are stackable and connectable through a bus connector (see paragraph 7.1).

H201-T-UNIT-BL 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 DATA LOG is an optional software allowing logging temperature data or modification of selected parameters. DATA LOG can be installed on your PC; a mini USB connection to the Temperature Control Unit allows data download.

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

The H201-T-UNIT-BL can be equipped with the H201-T-FILTER-BOX (*optional*) that assembles with the Heating Box to ensure a dust and bacteria free environment inside the enclosure. In this case, H201-T-FILTER-BOX is assembled with the H201-FILTER KIT, a kit composed by a Prefilter and a HEPA filter (see Figure 21 in paragraph 8.2.1.3).

We recommend reading carefully this manual to familiarize yourself with the functions and the operation of H201-T-UNIT-BL before use.

[1] As Humidity Module you can purchase also HM-ACTIVE or HM-STANDALONE systems. In this case please refer to their own manual for humidity-related instructions.

# 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.

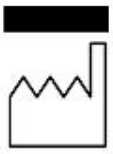
***Tip*** ► *Supplies you with helpful suggestions.*

***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 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.
- Avoid rapid changes in ambient temperature which may cause condensation, avoid direct air draft from air conditioner, exposure to direct sunlight and excessive heat accumulation.
- The products labels can be found on the bottom panel of the Main Unit.
- 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 tubing.
- Check tubing time to time for possible material usage.
- 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.
- Power cord of unit should be unplugged from electrical outlet when left unused for a long period of time.

---

- Do not start up the equipment if the supply cable is damaged.

- Connect the equipment only to grounded mains power socket.
- 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

**H201-T-UNIT-BL** includes:

1. **T-Unit** (pointer 1 in Figure 1)
2. **Heating Box** (pointer 2 in Figure 1)
3. **Fine Gauge Thermocouple** (pointer 3 in Figure 1). To measure specimen temperature
4. **NTC Thermistor** (pointer 4 in Figure 1). To measure ambient temperature
5. **#1 24V-DC Power Adapter** (pointer 5 in Figure 1)**.** To connect the Temperature Control Unit

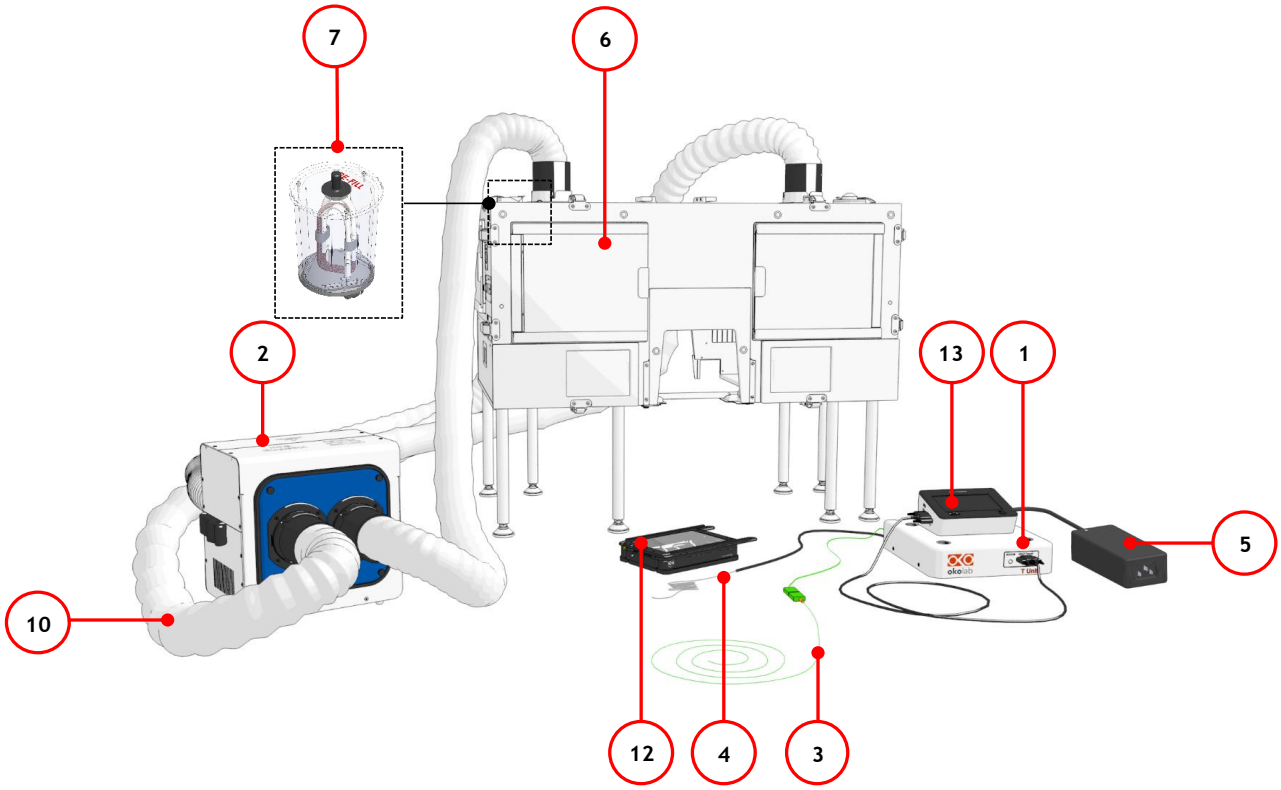



*Figure 1. H201-T-UNIT-BL equipment overview.*

## 5 NOT supplied equipment

H201-T-UNIT-BL can be equipped with:

1. **Microscope enclosure** (pointer 6 in Figure 1)
2. **HM-VF**, standard humidity control, that includes:
   - **Humidity Module** (pointer 7 in Figure 1)
   - **Water Trap** (see paragraph 9 Figure 60**)**
   - **TUBE G (x1)**. Silicon tube, 3 mm ID, connected by a plastic connector with a silicon tube 2 mm ID. The 3 mm ID silicone end must be connected to the Output Water Trap, while the 2 mm ID silicone tube to the Chamber Incubator. See Figure 70.
   - **TUBE H (x1).** Silicon tube, 3 mm ID. To connect the Humidity Module Output to the Water Trap Input. See Figure 70.

- **TUBE I (x1)**: Polyurethane tube, 4 mm OD, 45 mm long. To connect the Input of the gas coming from the Gas Mixer to the Humidity Module. See Figure 70.

3. **8-pins cable (x1).** To connect the connector labeled 'Control Unit' on the H201 T Heating Box with the connector labeled 'Heating Box' on the Temperature Control Unit (see paragraph7.1).
4. **3-pins – Flow Sensor Cable (x1).** To connect the flow sensor attached on the Blue Side of Heating Box to the connector labeled 'Air flow sensor' on the Temperature Control Unit (see paragraph 7.1).
5. **Calorflex tubes (x4)** (pointer 10 in Figure 1). To connect the Heating Box to the enclosure. Use two tubes labeled red (TUBE-DE) to attach the RED colored side of the Heating Box to the hoses of the enclosure labeled red. Use the two tubes labeled blue (TUBE-DF) to attach the BLUE colored side of the Heating Box to the hoses of the enclosure labeled blue (see paragraph 9 Figure 61 and Figure 62).
6. **Power supply cable.** To connect the Heating Box.
7. **Okolab incubating chamber** (see pointer 12 in Figure 1) with lid and base, chamber riser with one or more plate adapters.
8. **OKO-TOUCH** (see point 13 in Figure 1), including:

– Touch Screen Interface

– **#1 RS232 Serial cable**. To connect the Touch Screen to the T-Unit

– **MINI-USB-OTG cable**. To connect a USB pen to the OKO-TOUCH for data download.

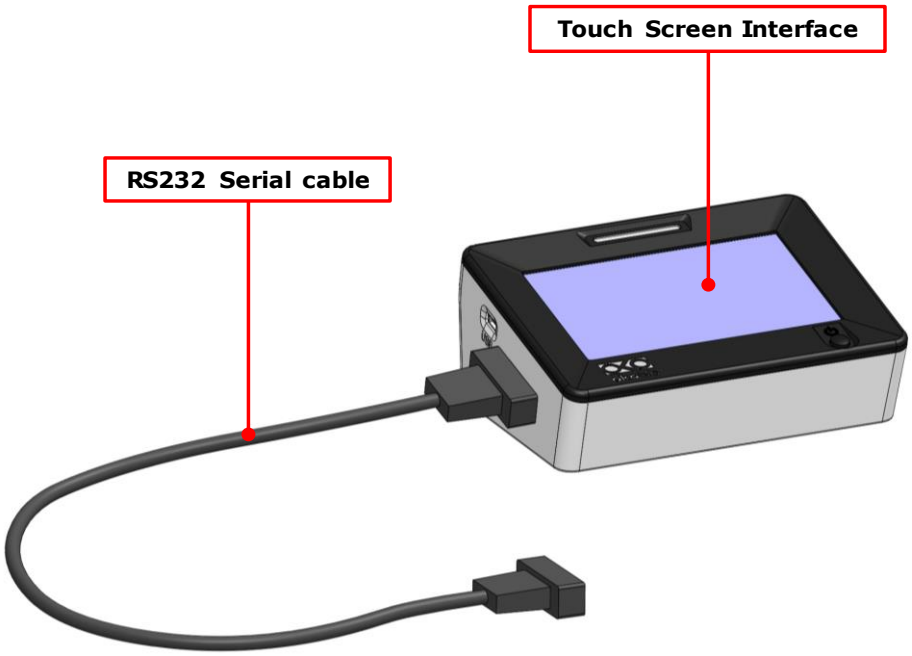



*Figure 2. Oko-touch components.*

## 5.1 Optional Equipment

- H201-T-FILTER-BOX , including:

1. H201-T-FILTER-KIT, Pre filter and HEPA filter

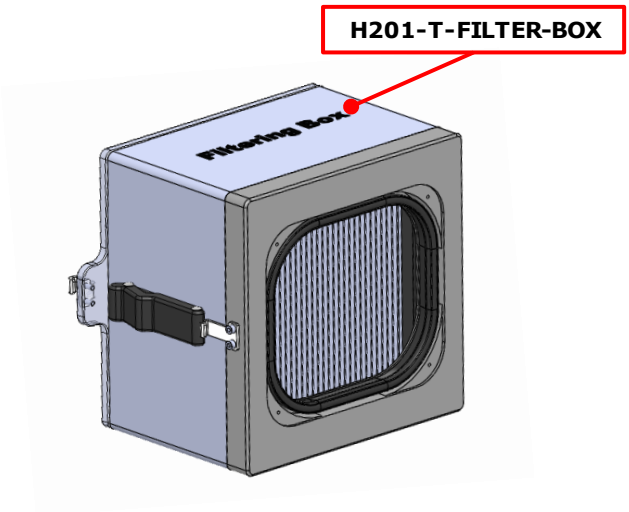



Figure 3. H201-T-FILTER-BOX.

- **DATA LOG (Optional-to be purchased separately).** 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.

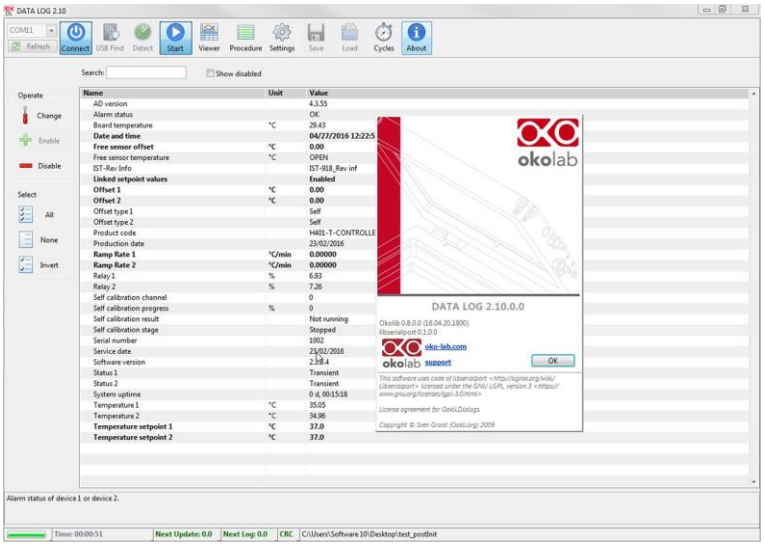



*Figure 4. DATA LOG software.*

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

## 6 Equipment Description

A detailed description of the H201-T-UNIT-BL rear is provided in the following list, which refers to the pointers in Figure 5:

1. OKO-TOUCH RS232 serial port.
2. Power Input.
3. Heating Box connector.
4. Air Flow Sensor connector.
5. USB port.
6. General Purpose Input Output (GPIO) port.
7. NTC Thermistor port.

8. Gauge Thermocouple port.

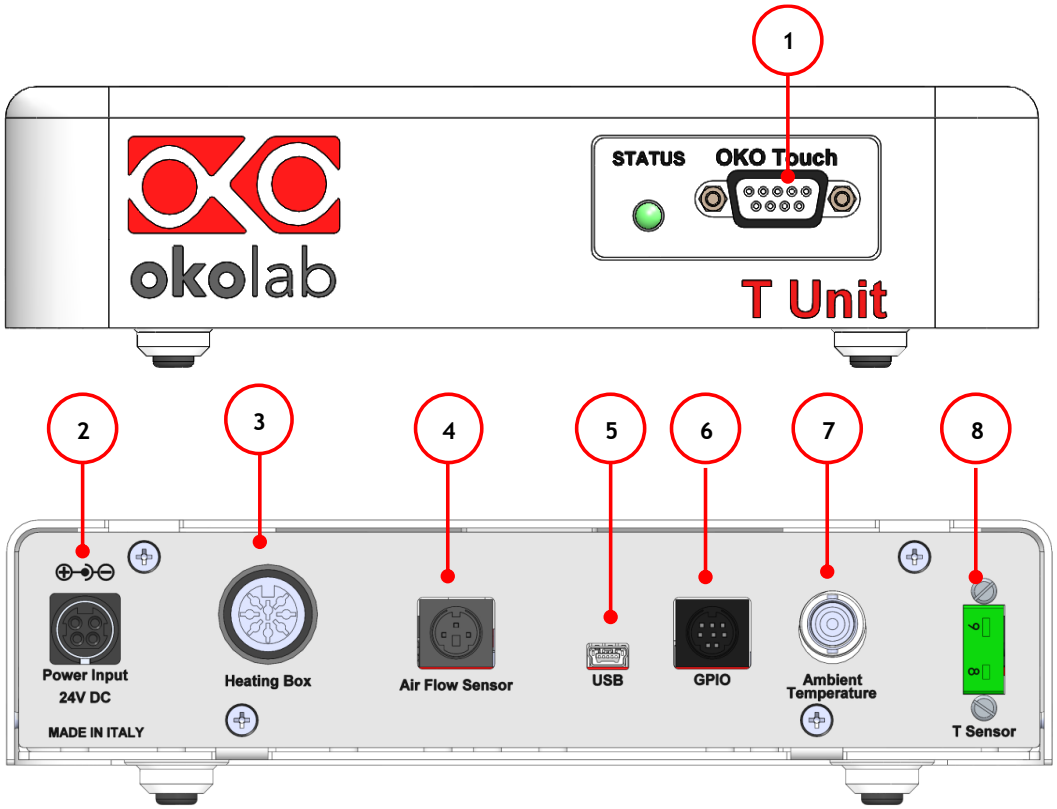



*Figure 5. Control Unit Overview*

# 7 Installation

The following paragraphs will illustrate how to install and to use the Temperature Control Unit.

## 7.1 H201-T-UNIT-BL. Installation guide

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.

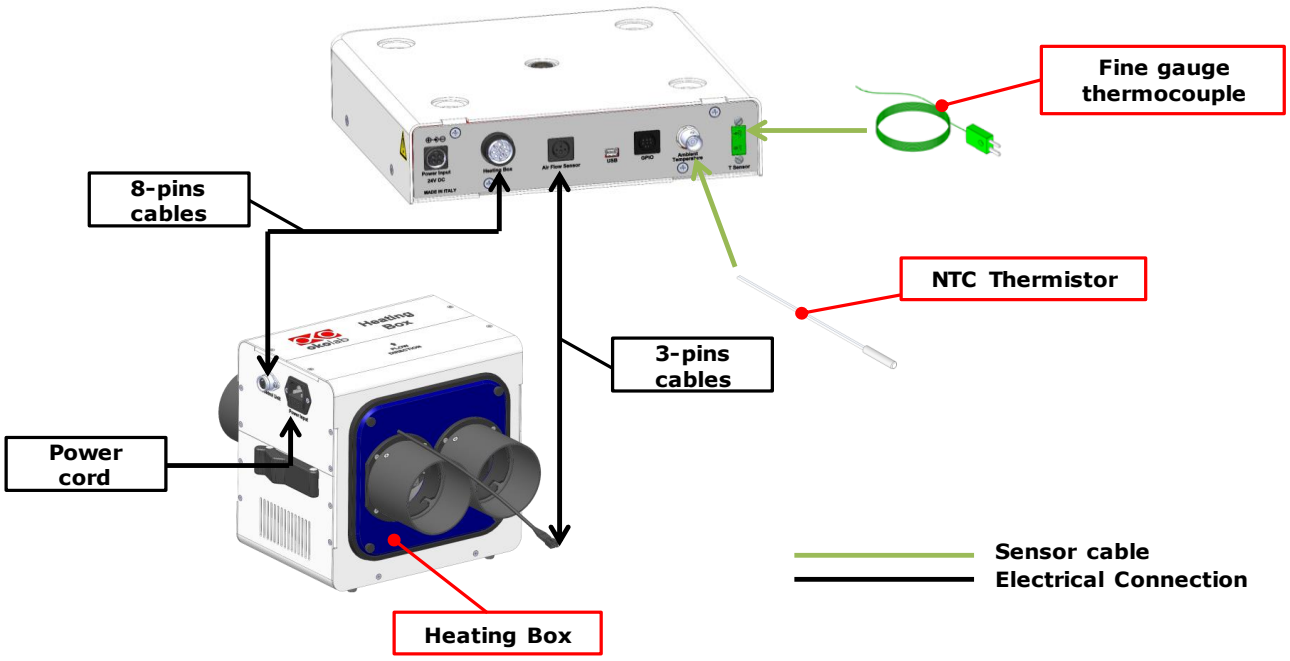



*Figure 6. H201-T-UNIT-BL. Standard Connection*

1. Connect the Heating Box to the port labeled 'Heating Box' on the rear panel of the Temperature Control Unit (see Figure 6).
2. Plug the NTC Connector on the port labeled 'Ambient Temperature' located on the rear panel of the Temperature Control Unit (see Figure 6). This temperature sensor must be placed in air close to the illumination pillar in proximity to the microscope stage. This thermistor monitors the air temperature inside the cage. The NTC thermistor can be also used to monitor the room temperature when working in Sample Feedback Mode. In this case, you have to place it outside the cage.
3. The Fine Gauge Thermocouple (green) plugs into the green port labeled 'Reference Temperature' located on the rear panel of the Temperature Control Unit (see Figure 6). When operating the device in 'Sample Feedback Mode' place this thermocouple in a Reference Well filled with water. Make sure that the end of the Fine Gauge Thermocouple is fully immersed.

   ***Tip*** ► *The Fine Gauge Thermocouple may be placed into a Reference Well if running the "Sample Feedback Mode" (see paragraph 8.2.1.1). The Fine Gauge Thermocouple may also be used to calibrate the Microscope Incubator temperature if running the "Cage Feedback Mode" (see paragraph Control Mode). The Fine Gauge Thermocouple may be left in air if the system is operated in 'Cage feedback mode' (see paragraph 8.2.1.1)*

4. Install the microscope enclosure (purchased separately) following the instructions of its dedicated booklet and reading the paragraph 9 for the positioning of some its components.
5. Connect the touch screen interface OKO-TOUCH to the Temperature Control Unit using the serial cable provided (see Figure 7).

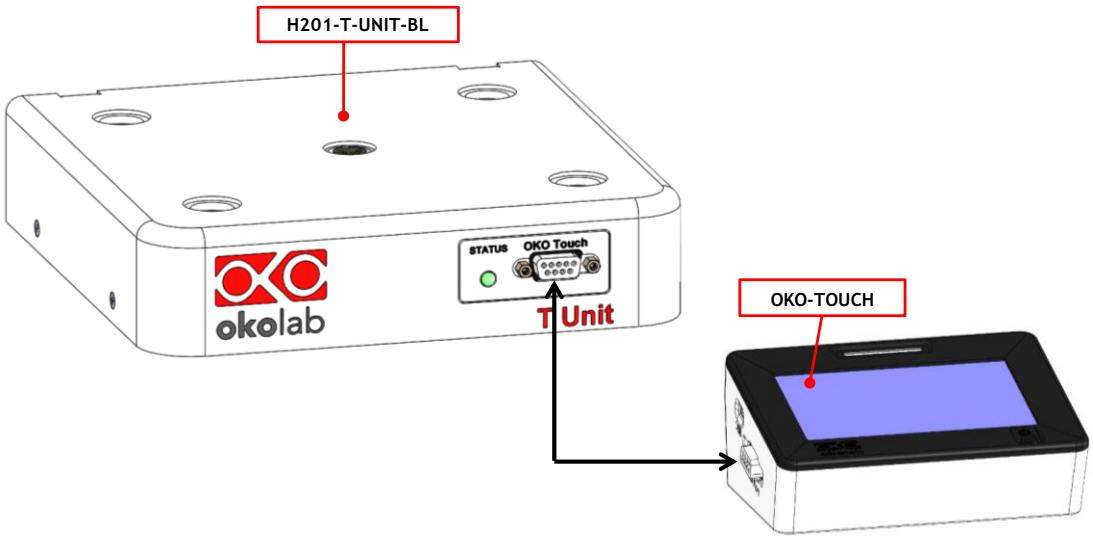


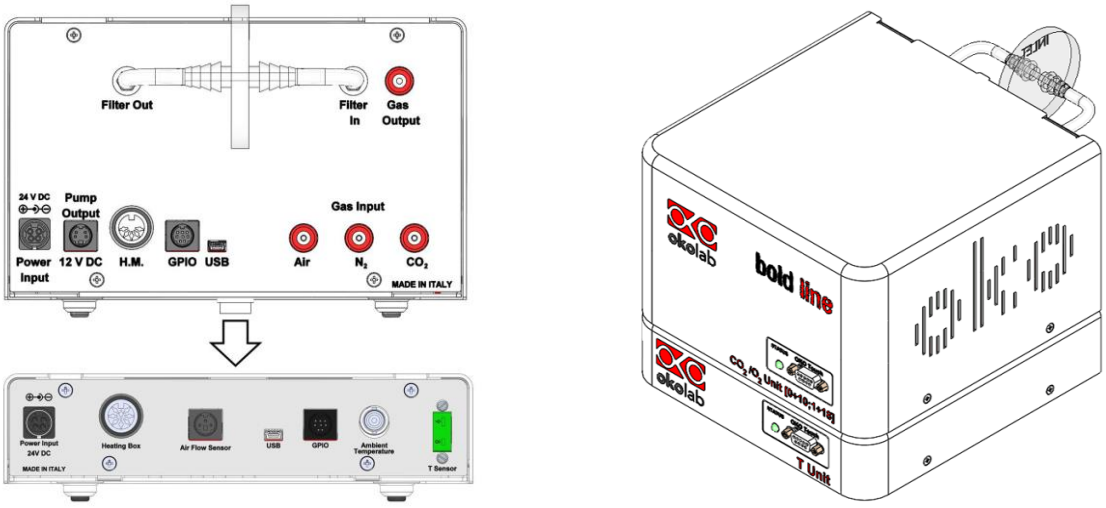

*Figure 7.OKO-TOUCH Connection*

6. Connect the 24V-DC Power adapter to the Temperature Control Unit.
7. To switch H201-T-UNIT-BL on use the power button on OKO-TOUCH (see Figure 11). A small green LED light will blink on the front of the Temperature Control Unit. This means that the system is initializing.

***Tip*** ► *Wait until system has reached the steady state before loading your samples.*

## 7.2 How to connect H201-T-UNIT-BL to a BOLD LINE Digital Gas Controller

H201-T-UNIT-BL can be used as a stand-alone device or in combination with any one of the Bold Line Gas Controllers. Figure 8 shows how to assemble H201-T UNIT-BL, for example, with a CO2-O2 Unit BL [0-10; 1-18].




a. CO2-O2 UNIT-BL [0-10; 1-18] and H201-T-UNIT-BL. Units rear panels.

b. CO2-O2 UNIT-BL [0-10; 1-18] and H201-T-UNIT-BL. 3D view.

*Figure 8. CO2-O2 UNIT-BL [0-10; 1-18] and H201-T-UNIT-BL*

The Gas Controller must stack on top of the Temperature Control Unit by lining up the bus ports located on the top and bottom surface of each. When the units are properly connected the Temperature, CO2 and O2 parameters will appear on the Touch Screen interface Home page. 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 with each other.

---

If you have the CO2 Controller and a Temperature Control Unit, it is essential to read both this manual and the Temperature Control Unit Manual to familiarize yourself with the functions and the operation of the devices before use.

---

# 8 User Interface

This chapter describes the user interface of the H201-T-UNIT-BL.

## 8.1 Home page

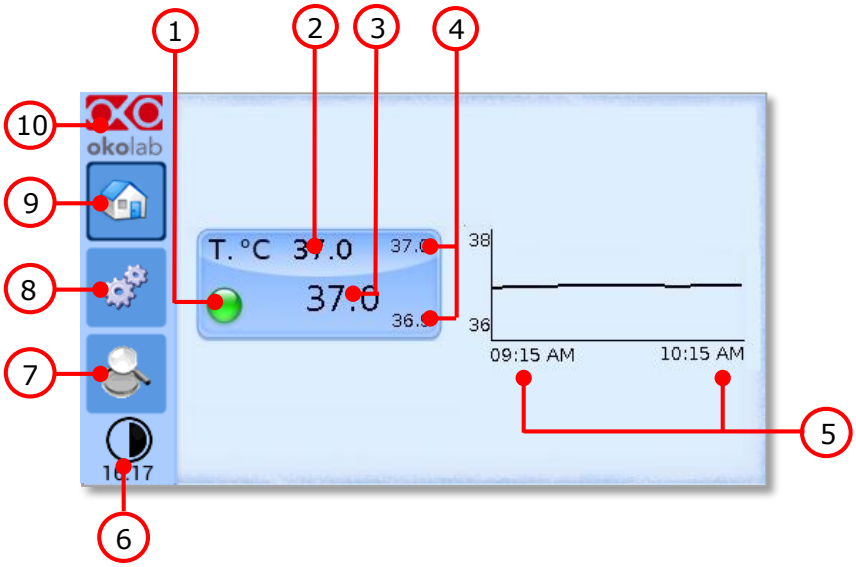



*Figure 9. Homepage of the H201-T-UNIT-BL Controller Touch Screen Display*

1. Status LED
2. Temperature set point (see paragraph 8.1.1 to learn how to change the set point value)
3. Temperature current value
4. Minimun and Maximum Temperature reached within the time frame set in the *Options subpage* (see paragraph 8.2.2.1)
5. Chart history length set at 1 hour
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 OKO TOUCH and H201-T-UNIT-BL and running time

***Tip*** ► *The Touch Screen is pre-set at the following temperature: 37°C. Once turning the Touch Screen on it will start operating to reach this set-point value.*

### 8.1.1 How to enter the set point temperature

To input a new set-point temperature, touch the corresponding tab, as indicated in Figure 10 a.

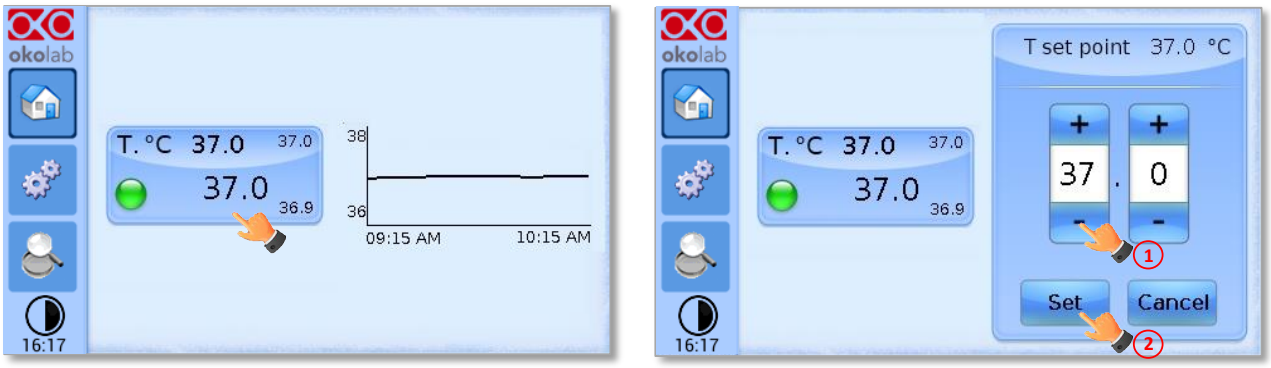



*Figure 10. How to change the Temperature set point (a – b)*

The set point regulation page will appear as in Figure 10 b. You can modify the set point by clicking on + and -. Once you have input the new set point temperature, press "*Set*" to save or "*Cancel*" to undo.

> ***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 8.1.2). During the transient regime, the controller will not trigger on alarm.*

### 8.1.2 Controller Status: colours led and meaning

The H201-T-UNIT-BL can assume four different status, which are represented by the colors assumed by the Status Indicator (pointer 1 in Figure 9) and by the TOP LED (if enabled, as indicated in paragraph 8.2.2.3):

The GREEN color indicates that the set-point value has been reached (within the tolerance defined in the alarm subpage, see paragraph 8.2.2.5) 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 set point chance. The system is working properly, it is not in alarm and no action is needed. As soon as the H201-T-UNIT-BL stabilizes the temperature, the Controller Status changes to NORMAL and the color turn GREEN. If the H201-T-UNIT-BL cannot stabilize the temperature of one or both heating devices within the maximum time defined by the operator (see paragraph 8.2.2.5), the Controller Status changes to ALARM and the color turn ORANGE.

**Controller Status: TRANSIENT**

The ORANGE colour indicates that the current Temperature value is out of the tolerance defined in the alarm subpage (see paragraph 8.2.2.5). The controller triggers in Alarm.

**Controller Status: ALARM**

The RED color indicates that there is a problem with the unit itself (for example a Temperature sensor is broken). The system is in 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 (see Figure 11) follows the same color code as the status LED.*

To activate the Top LED, follow the instructions reported in paragraph 8.2.2.3.

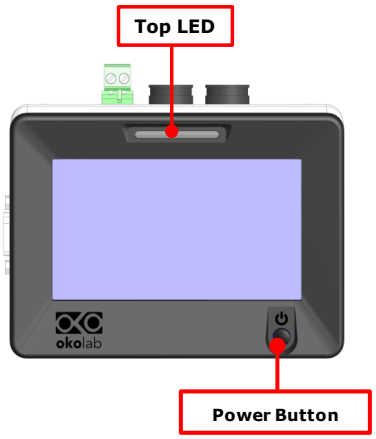



*Figure 11. Top LED and Power Button.*

## 8.2 Settings

### 8.2.1 Temperature

To choose and insert the proper operation parameters, follow the instruction below:

1. Press on the *Settings* icon (see Figure 12 a) to enter the *Settings* menu.

2. Press on the *Temperature* icon to enter the temperature settings menu, as shown in the Figure 12 b.

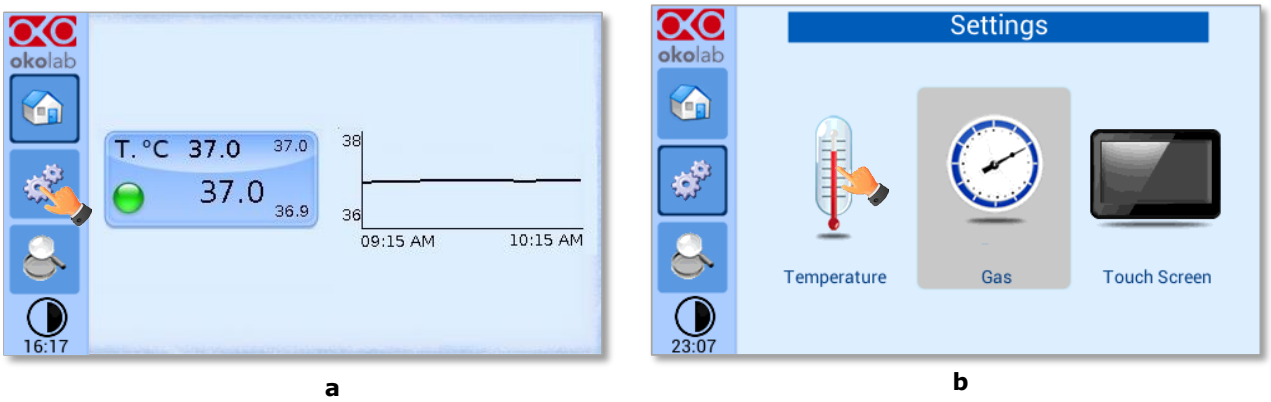



*Figure 12. Temperature Settings (a – b)*

The Temperature settings menu has 5 items, as shown in Figure 13.

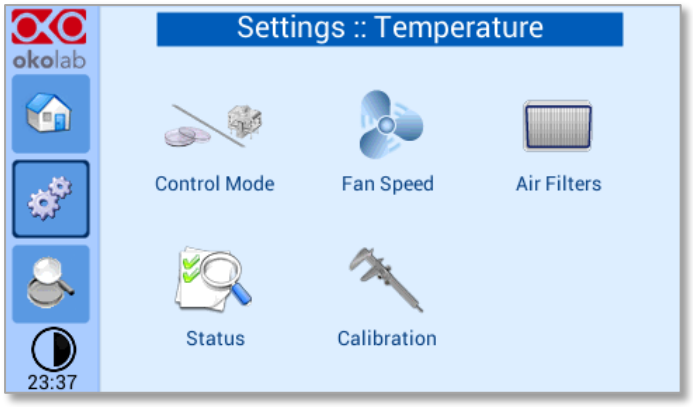



*Figure 13. Temperature Settings submenu*

#### *8.2.1.1 Control Mode*

The Temperature Control can run in two different modes: Sample or Cage Feedback Mode. Press on Control Mode icon  (see Figure 14 a) to choose which one you want to use, Sample or Cage Feedback Mode. Figure 14 b shows how to select the Cage Feedback Mode.

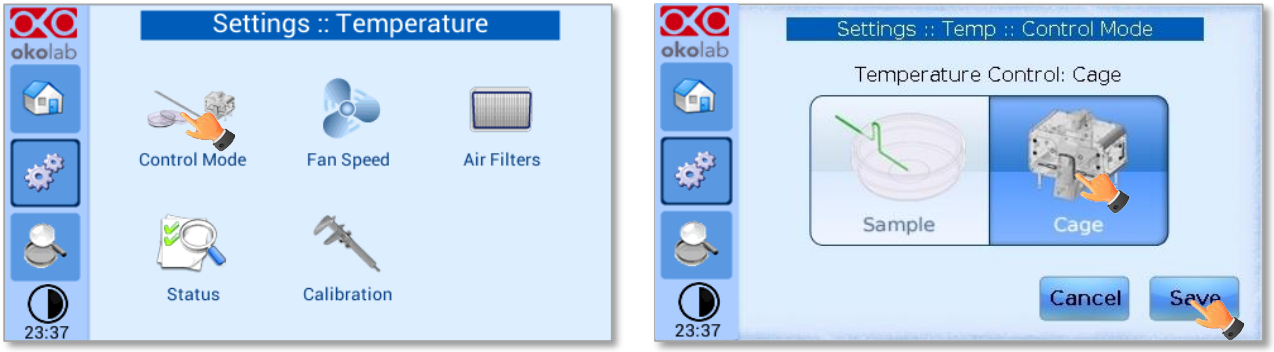



*Figure 14. Cage Mode Settings (a - b)*

In this configuration the temperature of the air inside the cage is controlled, precisely in the position where you have placed the NTC thermistor. It is strongly recommended to attach the NTC thermistor close to the sample chamber, right above the stage or on the top condenser as illustrated in (use a standard adhesive tape to fix the sensor on those parts).

*Figure 15. Cage Mode Settings (a - b)*

The advantage of this solution is that you don't have to manually stick the fine gauge thermocouple into a reference well. Once the CAGE feedback mode has been selected, the operator should calibrate the difference of the temperature between the air inside the enclosure (where the NTC thermistor has been placed) and the specimen temperature (by sticking the fine gauge thermocouple into a reference well inside the Chamber Incubator). Usually the air temperature within the cage is slightly higher than that of the sample, this difference between the temperature of air within the enclosure and that of the sample, referred to as Offset from here on, is the value that the system subtracts from the cage temperature to reach the necessary sample temperature set-point. So, for example, to keep the specimen temperature at a set-point of 37°C, the cage temperature will need to be at a higher value depending on the offset determined during the cage calibration (see paragraphs 8.2.1.5). This control mode is well suited for multi-user tasks where users prefer not to position the fine gauge thermocouple into a reference well precisely, inside the chamber incubator. It must be noted that since this control mode is based on a calibration between cage and specimen, therefore isn't an active thermal control on the sample.

> ***Tip*** ► *Advantages of this Control Mode are: fast experiment starts up and no specific action required in multi user applications. The disadvantage is that it needs calibration between cage and specimen. The temperature difference between the cage and the sample sensors depends on many factors like: the ambient temperature, the enclosure design, the sensors position, but if these ones don't change, the temperature difference doesn't change.*

Figure 16 b shows how to select Sample Feedback Mode.

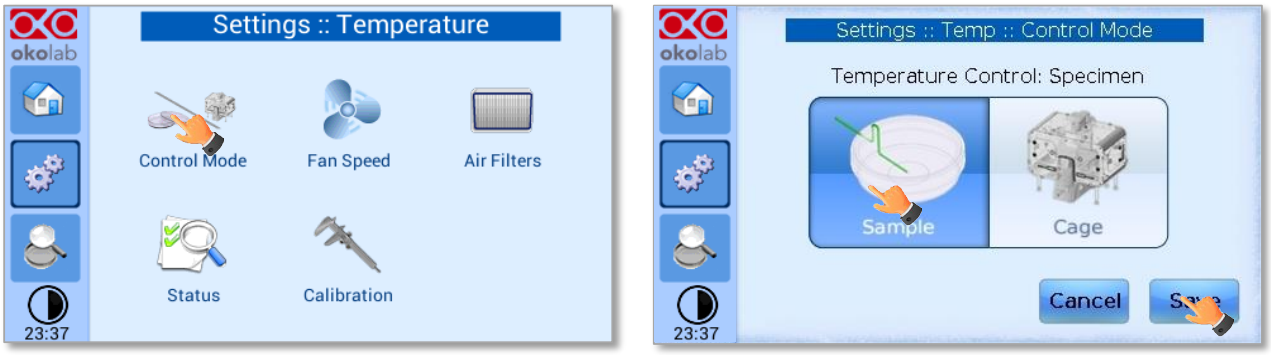



*Figure 16. Sample Mode Settings (a - b)*

In this configuration, every time you run an experiment, you must place the Fine Gauge Thermocouple (thin green wire) into a Petri dish or a well adjacent to your sample (from here on this will be referred to as Reference Well). Fill the Reference Well with distilled water to a level allowing a full immersion of the fine gauge thermocouple (see Figure 17). When possible close the petri with its own plastic lid (or with SENSOR LID, see ***Tip*** below) and place it in the appropriate holder. Using a Reference Well in close proximity to your Experimental Well provides active Sample Feedback Temperature Control. This ensures that your sample will be within 0.1°C from the temperature set point regardless from room temperature variations.

*Figure 17. Free Sensor attached on the internal base of the Petri Dish*

***Tip*** ► *Using an Okolab SENSOR LID (available for purchase) is recommended to secure the Fine Gauge Thermocouple in place in the Reference Well during calibration or operation in Sample Feedback Mode (see Figure 18).*

Sensor lids are available for the following: 35 mm, 60 mm Petri-dish, chamber slide and chambered cover glass. Sensor Lids are ordered separately using the codes in following table.

| SENSOR LID CODES | |
|---|---|
| SENSOR LID-35 | Temperature sensor lid. To be used in specimen feedback in a 35 mm Petri Dish |
| SENSOR LID-60 | Temperature sensor lid. To be used in specimen feedback in a 60 mm Petri Dish |
| SENSOR LID-GS | Temperature sensor lid. To be used in specimen feedback in chamber slides and chambered cover glass |

*Table 1. Sensors lid codes*

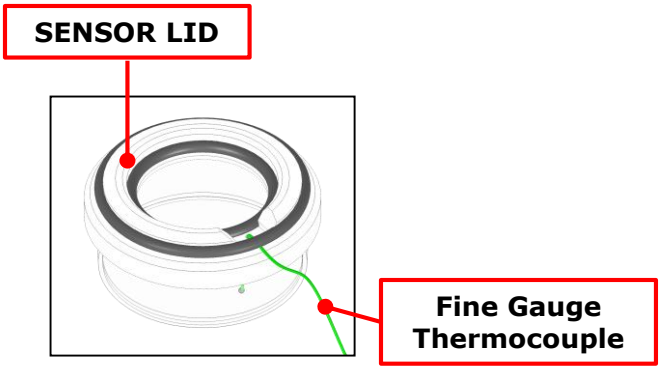



*Figure 18. SENSOR LID-35. For 35 mm Petri-dish*

***Tip*** ► *Advantages of Sample Feedback Control Mode are: direct monitoring and active control of sample temperature and independence from room temperature variations. The disadvantage is that it requires manual operation for correct placement of the fine gauge thermocouple in a Reference Well.*

#### *8.2.1.2 Fan Speed*

The Heating Box has an internal flow sensor that allows regulating the speed of the Air being blown inside the enclosure. An increased speed allows a quicker start-up and a more uniform thermal distribution inside the enclosure, a low speed allows instead a smooth operation in applications particularly sensitive to vibrations.

You can set the Air Flow value by pressing on Fan Speed icon  (see Figure 19 a). Then you can change the value in the range 35-100 $m^3/h$ (see Figure 19 b). Only when you use the H201-FILTER-BOX, the working range of the Air Flow becomes 35-70 $m^3/h$, see paragraph 8.2.1.3.


*Figure 19. Fan speed setting (a – b).*

You can also activate the 'Fast Heating' button (see Figure 20), which enables a quick start-up every time you turn on the system. The 'Fast Heating' accelerates the transient time.

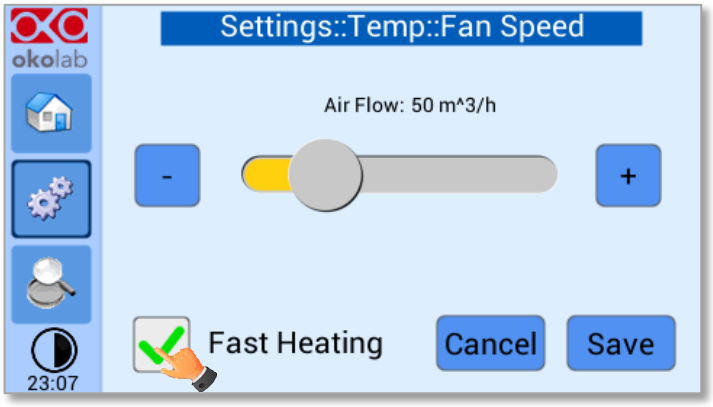



*Figure 20. Fast Heating Activation.*

#### *8.2.1.3 Air filters*

If you have purchased also H201-T-FILTER-BOX, a module containing a filters kit composed by a prefilter and a HEPA filter (High Efficiency Particulate Air Filter) has been added to the Heating Box, see Figure 21. In this case, Okolab recommends activating the 'Filter Monitoring' in the Air Filters subpage.

Press on *Air Filters* icon  (see Figure 22 a), then active "*Filter Monitoring*" (see Figure 22 b).

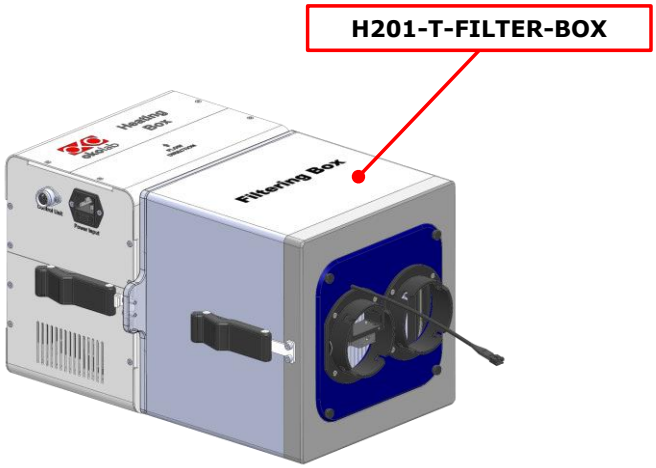



*Figure 21. Heating Box with H201-T-FILTER-BOX*

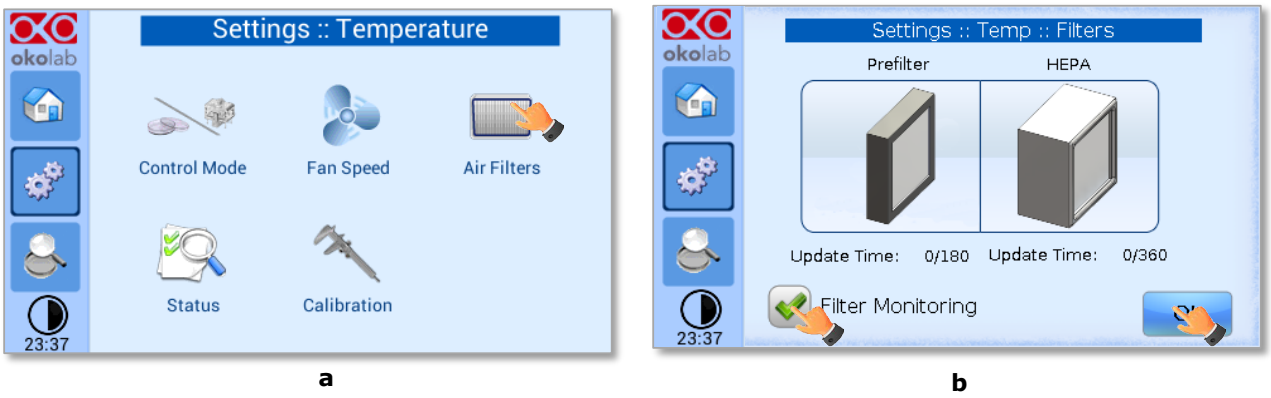



*Figure 22. Filter Monitoring activation (a – b).*

When you active the 'Filter Monitoring', the counting of the usage days (indicated with 'Update Time') starts. The maximum usage time for the Prefilter is 180 days, while for the Hepa Filter is 360 days.

When the usage time exceeds these values, the warning icons appear in the 'Homepage' and in the 'Overview': icon A in Figure 23 for HEPA filter, icon B in Figure 24 for Prefilter.

If you press on the Prefilter or the HEPA icon (see Figure 25 a and Figure 26 a), the warning shown in Figure 25 b and Figure 26 b will appear. These warning messages and icons allow you to remember that you should replace one or both the filters in order to avoid contaminations of the samples. See paragraph 10.3 for the Filters Replacement.

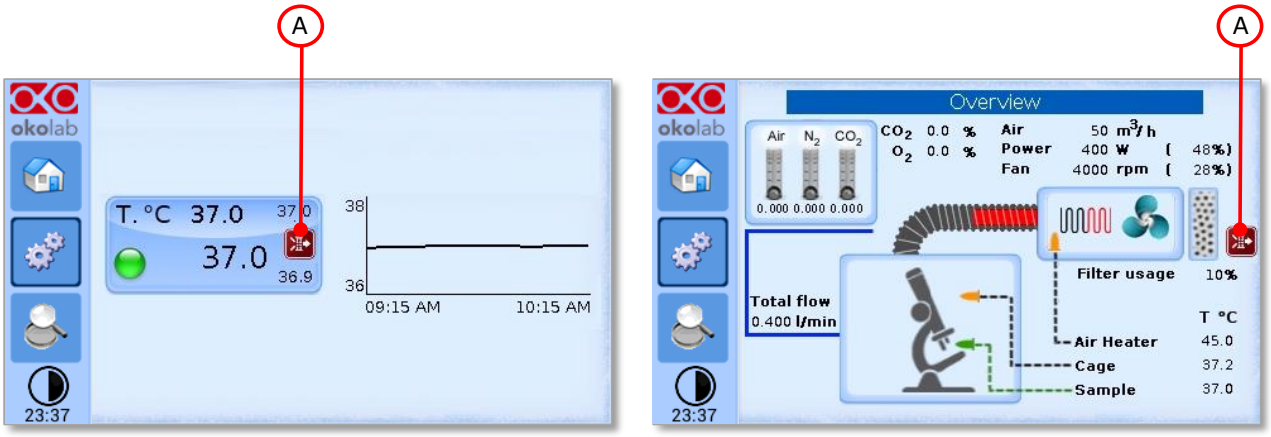



*Figure 23. Home Page and Status Page when the usage time of the HEPA filter exceeds the maximum time of 360 days*

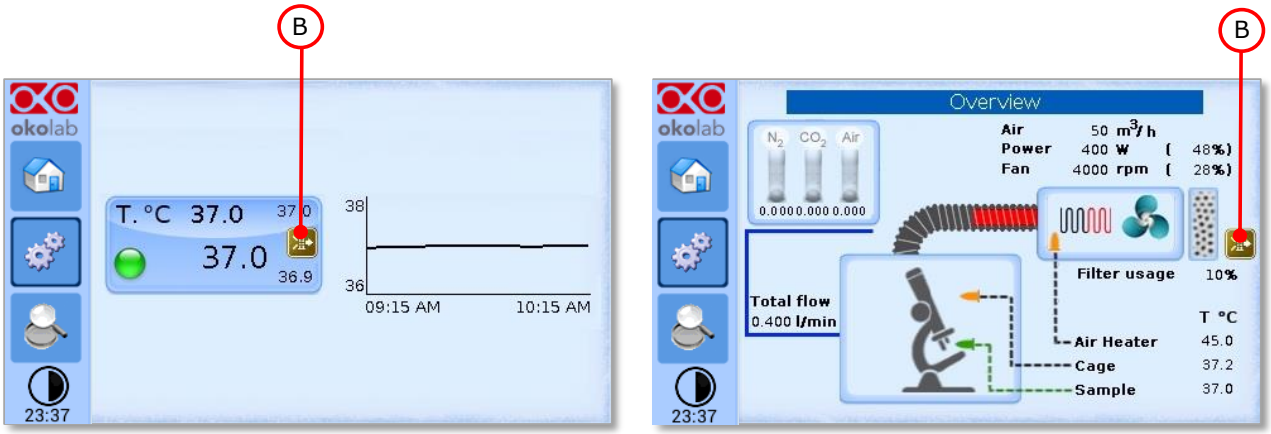
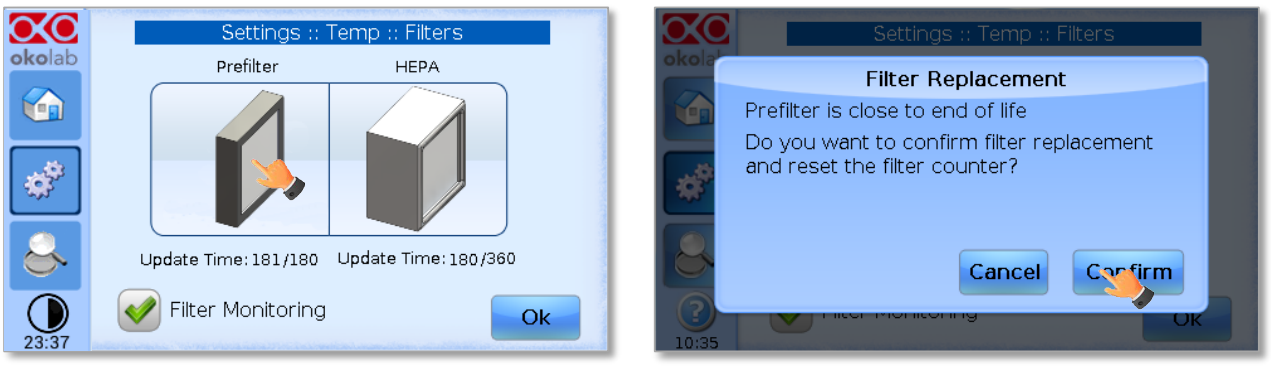
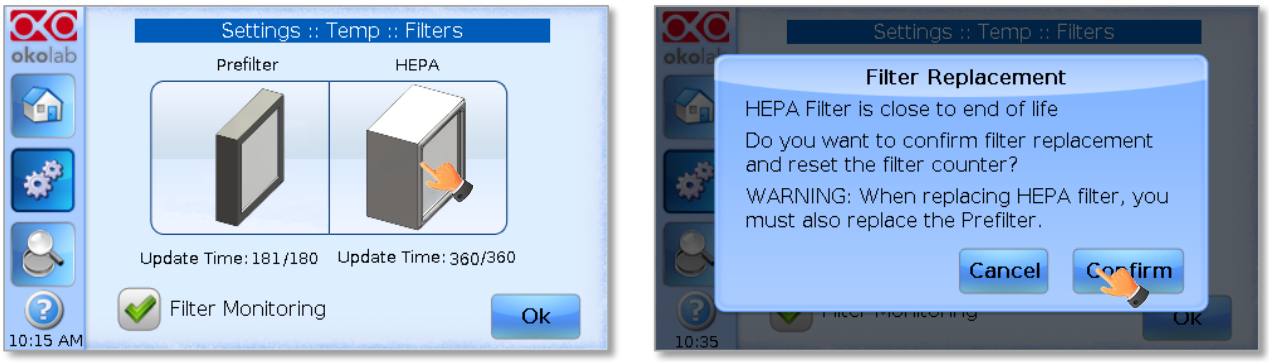



*Figure 24. Home Page and Status Page when the usage time of the Prefilter exceeds the maximum time of 180 days*




a b

*Figure 25.Warning for Prefilter replacement.*




a b

*Figure 26. Warning for HEPA replacement*

**IMPORTANT:** when you use the H201-FILTER-BOX, the working range of the Air Flow becomes 35-70 $m^3/h$, if you set the Air Flow set point at a value more than 70 $m^3/h$ the message shown in Figure 27 will appear

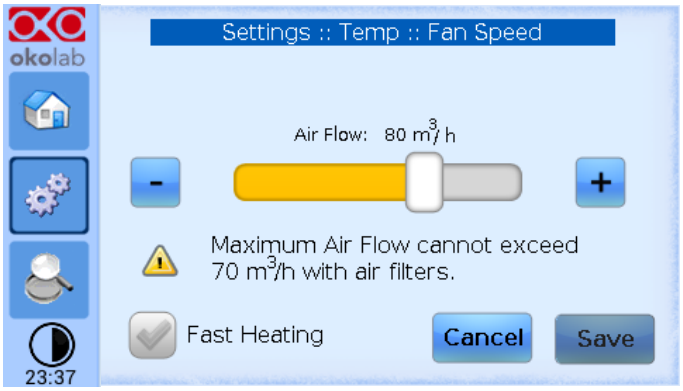
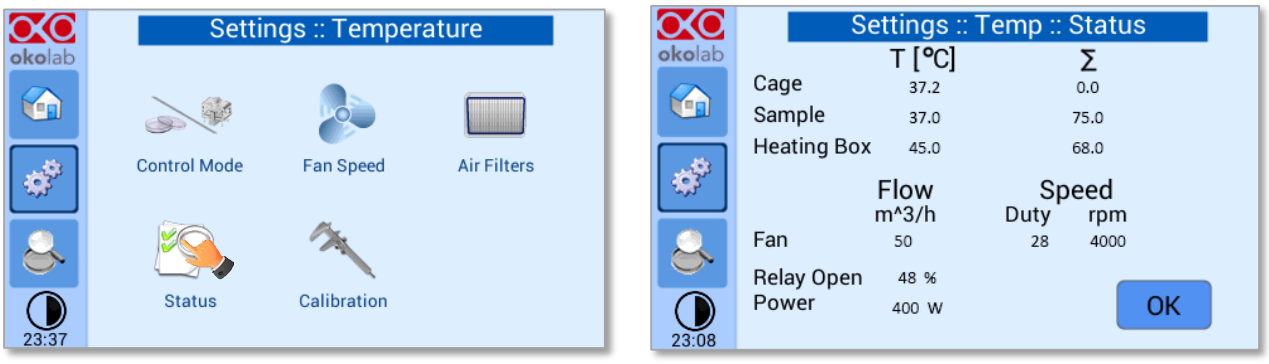



*Figure 27. Air Flow Warning message when using Air Filters*

### *8.2.1.4 Status*

Press on the *Status* icon  to open the Status page (see Figure 28 a). The Status Temperature page will open (see Figure 28 b). On this page you can see the status of the Temperature Control Unit, with a summary of all parameters allowing you to check that all is working properly. You may have to refer to this window when asking for Okolab technical support.




a b

*Figure 28. Status page (a – b)*

#### *8.2.1.5 Calibration*

##### *8.2.1.5.1 Cage Calibration*

Carefully read the instructions given in this paragraph before starting the Cage Calibration.

***Note*** ► *It is important to monitor the room temperature during the calibration, as well as reducing air drafts and forced convection. If possible, divert any draft coming from the air conditioning system in the room, away from the microscope incubation system.*

For maximum of accuracy when using "Cage Feedback Mode", H201-T-UNIT-BL allows to calibrate the system in your lab at your Room Temperature. The goal of this procedure is to adjust the temperature offset of the Cage temperature hence maintaining the sample at the desired temperature (e.g., 37°C) during imaging. For performing the Cage -Calibration:

1. Plug the green Fine Gauge Thermocouple in the port labeled "T sensor" (see Figure 29) located in the rear panel of the Temperature Control Unit

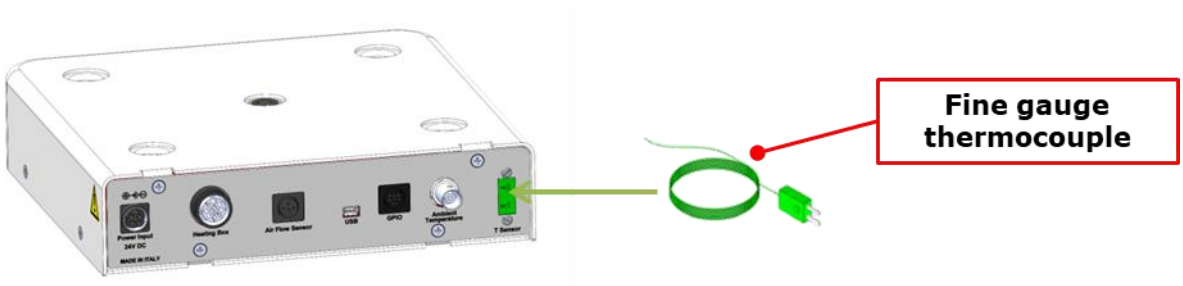



*Figure 29. Fine gauge thermocouple*

2. Insert the Fine Gauge Thermocouple into the chamber by threading the wire through one of the screw holes on the chamber riser
3. Secure the end of the Fine Gauge Thermocouple to the bottom of a 35mm or similar Petri dish using some tape making sure to avoid covering the head of the probe (see Figure 17).
4. Fill the Petri dish with distilled water to a level sufficient to fully immerse the Fine Gauge Thermocouple. This is a Reference Well simulating experimental conditions. Place the lid on the Petri dish, and insert the dish in the incubation chamber. You can also use SENSOR LID-# to close the dish (see the "Tip" below).

***Tip*** ► *It is recommended using an Okolab SENSOR LID (available for purchase) to secure the Fine Gauge Thermocouple in place in the Reference Well during calibration or operation in Sample Feedback Mode (see Figure 18 and Table 1).*

5. Press on the *Calibration* icon  (see Figure 30 a)
6. Press the Cage Offset button, as shown in Figure 30 b.

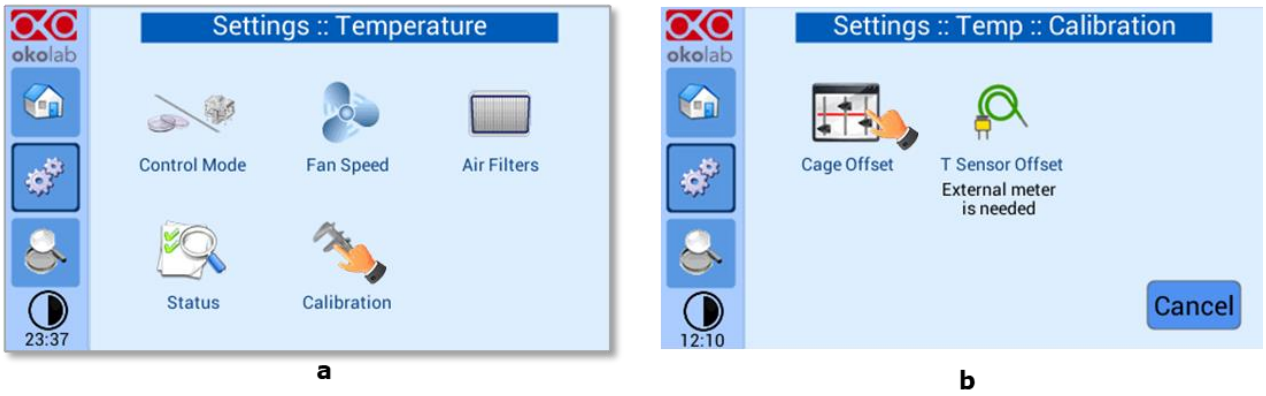



*Figure 30. Cage Calibration (a-b)*

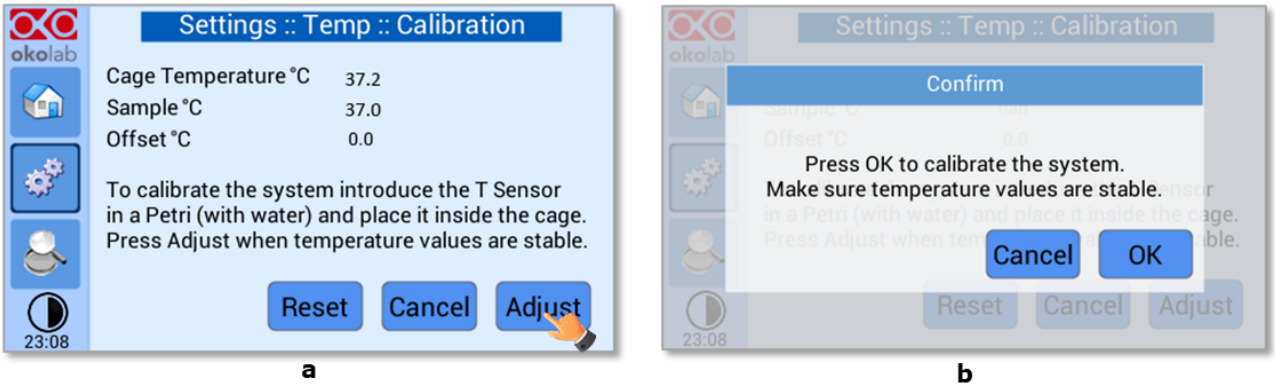



*Figure 31. Cage calibration Adjust and Warning (a-b)*

7. Press the *Adjust* button when the sample temperature is stable, as shown in Figure 31 a. The system will show the warning as in Figure 31 b, after pressing OK, the system will calculate the offset value to apply to the Cage Temperature to have the sample at the desired temperature.
8. After the offset has been calculated by the system, you can remove the Fine Gauge Thermocouple from the Reference Well petri-dish inside the incubating chamber.

#### *8.2.1.5.2 T Sensor Calibration*

The H201-T-UNIT-BL also allows the user to calibrate the Fine Gauge Thermocouple if deemed necessary (usually in case where this calibration was suggested to you by the OKOLAB technical support). In order to do so, perform the following the steps:

1. Place the Fine Gauge Thermocouple along with your external meter probe in a Thermostatic Bath
2. Press on the *Calibration* icon  (see Figure 30 a)
3. Press the T Sensor Offset button, as shown in Figure 32a.
4. Once the temperature reading of the external probe reaches a steady value, click on the pencil icon  as in Figure 32 b, and insert the value read by the external probe.

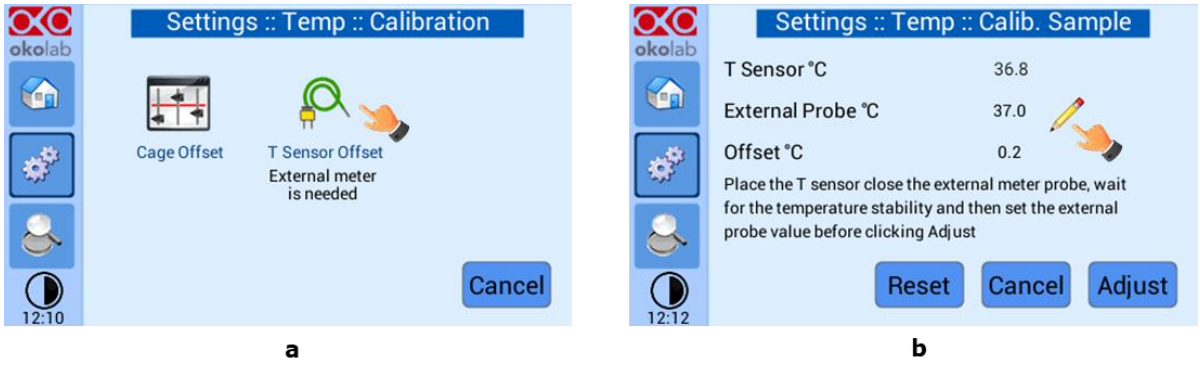



*Figure 32. T sensor calibration (a-b)*

5. Lastly, press OK after inserting the temperature value, followed by the Adjust option in Figure 33 a and Figure 33 b.

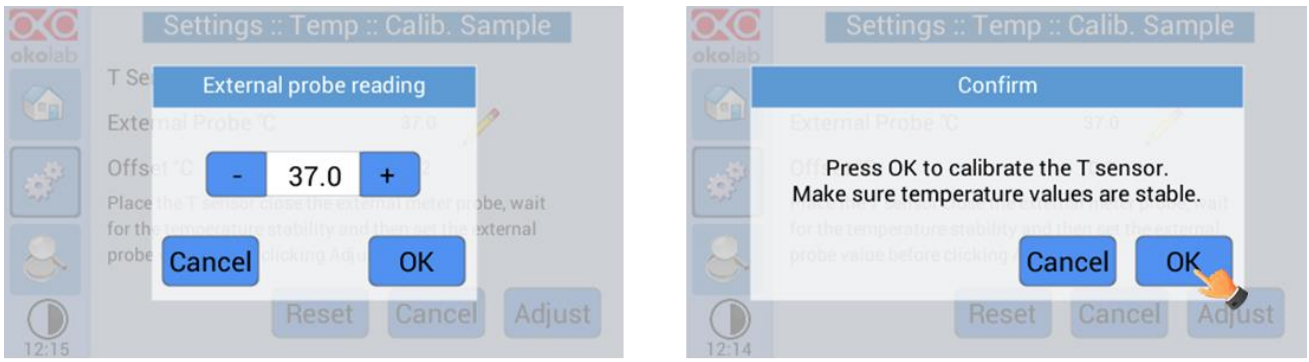



*Figure 33. External probe temperature and Offset adjustment*

### *8.2.1.6 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 34 b). 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 on the *Digital Input* icon IO to enable digital input feature, as shown in Figure 34 a and b.

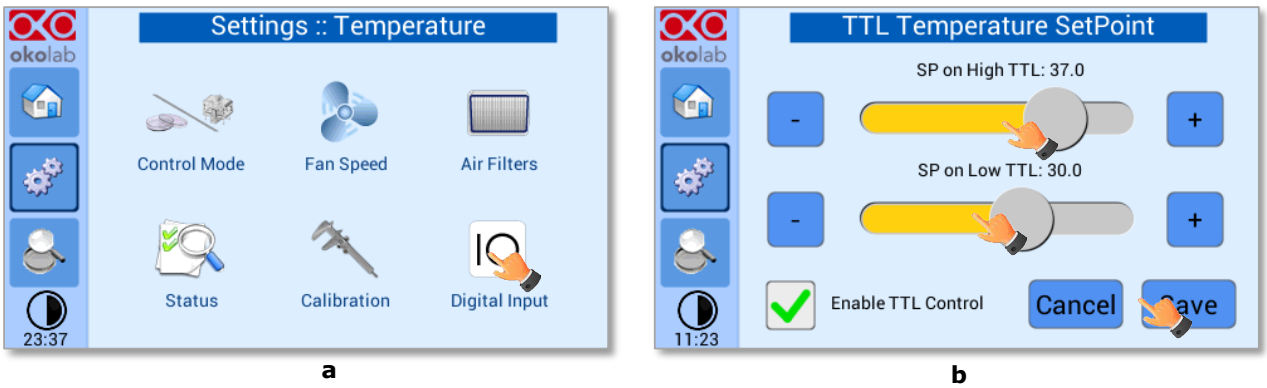



*Figure 34. Digital input ( a- b)*

### 8.2.2 Touch Screen

Press on the *Settings* icon  (see Figure 35 a), then press on the *Touch Screen* icon  (see Figure 35 b) to access to touch screen settings.

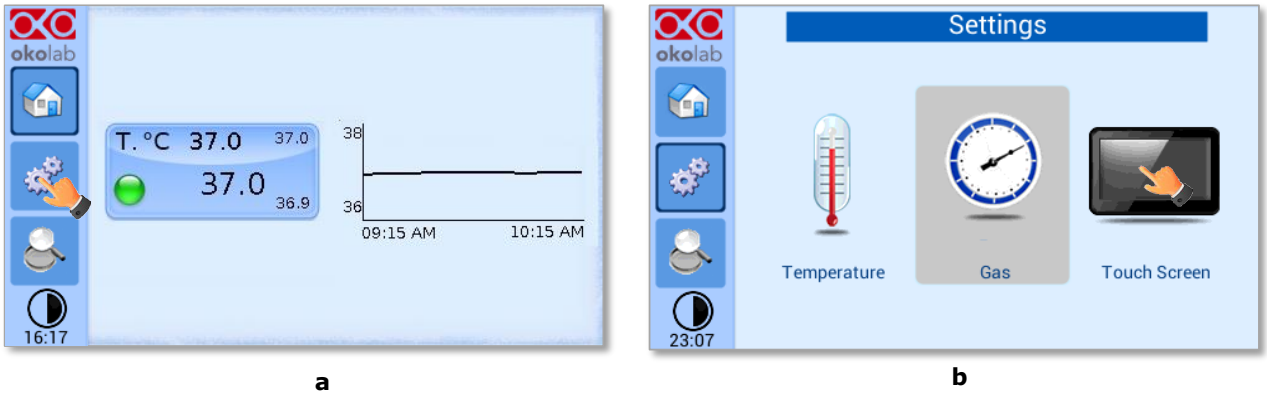



*Figure 35. Touch screen settings (a- b)*

#### *8.2.2.1 Options*

Press on the *Options* icon  (see Figure 36 a) to set the scale of the X axis (time duration) of the graphs displayed in the main page and the buzzer sound frequency (see Figure 36 b).

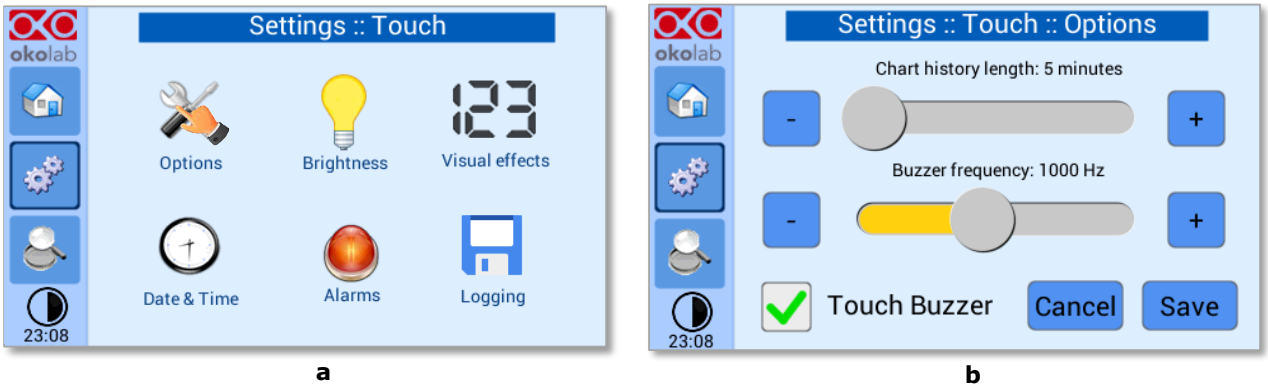


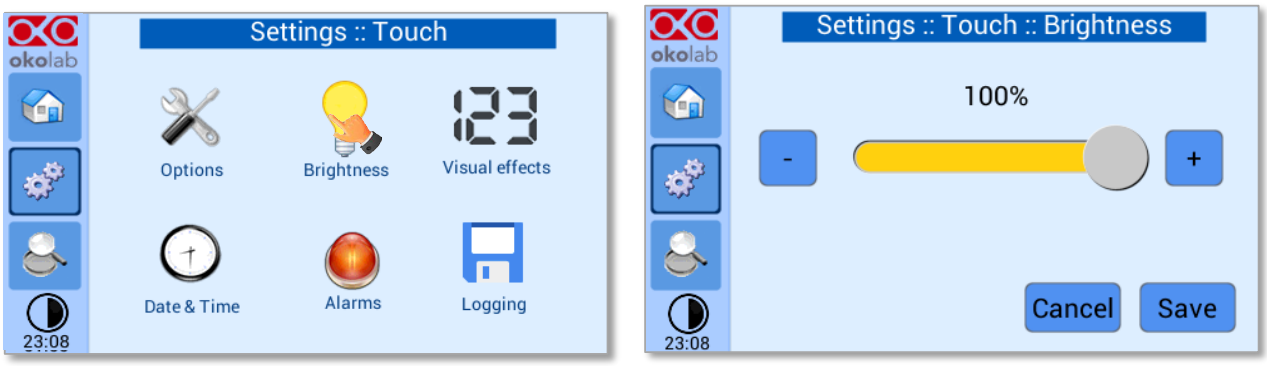

*Figure 36. Touch Options (a – b)*

Press and slide your finger along the setting bars or simply click +/- to set desired values, then press "Save" (see Figure 36 b).

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

#### *8.2.2.2 Brightness*

Press on the *Brightness* icon  (see Figure 37 a) to enter the display brightness setting, This page allows you to increase/reduce the brightness of the touch screen, scroll the bar or press the +/- buttons (see Figure 37 b).

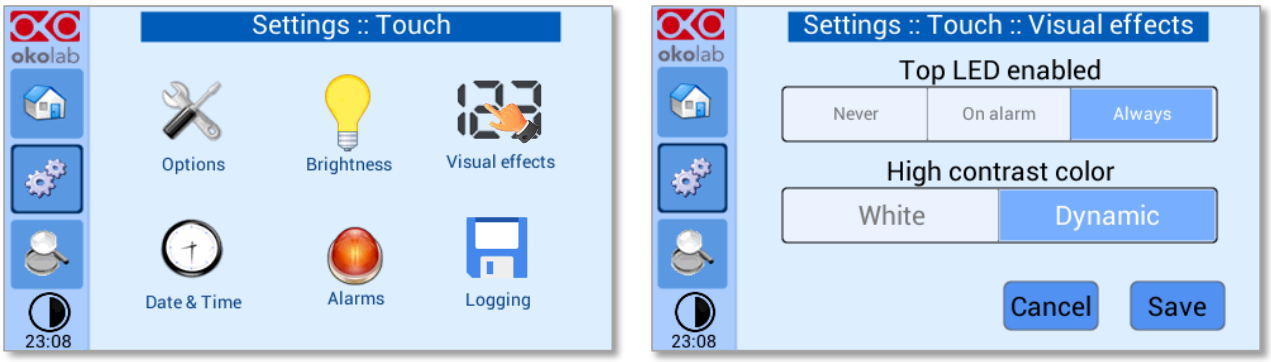



a b

*Figure 37. How to enter in Brightness page*

#### *8.2.2.3 Visual Effects*

To enter the display visual effects menu, press on the *Visual Effects* icon  (see Figure 38 a).



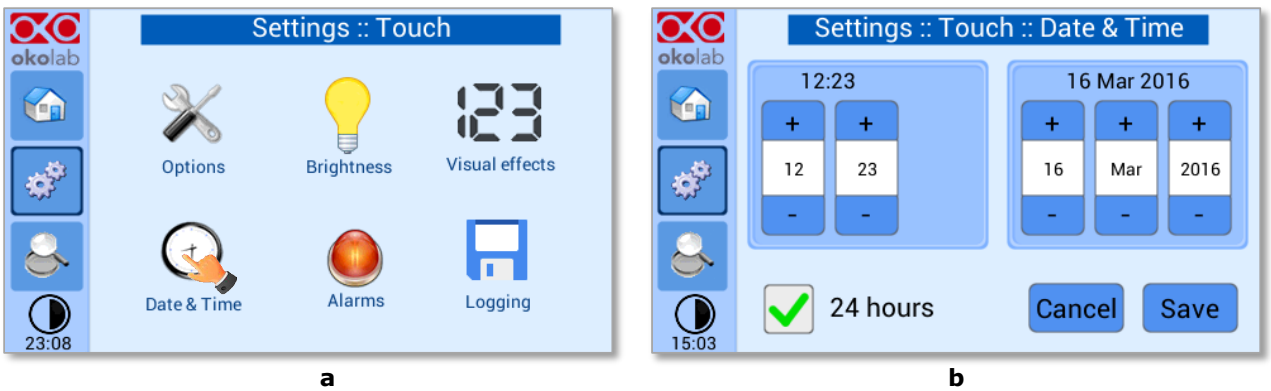

a b

*Figure 38. Visual effects page (a – b)*

The Top LED settings allows you to when the Top LED should be illuminated (see Figure 38 b): if you select *Never*, the Top LED will never illuminate, if you select On Alarm, the Top LED will illuminate only when the H201-T-UNIT-BL is in Alarm Status (see paragraph 8.1.2), if you select Always, the Top LED will always illuminate.

#### *8.2.2.4 Date & Time*

The first time you turn the system on, it is important to set date and time. To set date and time press on the *Date & Time* icon  (see Figure 39 a), then use the + and – to set correct date/time and then press "*Save*" (see Figure 39 b).




a b

*Figure 39. Touch screen settings. Date and Time (a – b)*

### *8.2.2.5 Alarms*

Press on the *Alarms* icon  as shown in Figure 40 a. Then press on the *Temperature* icon  (see Figure 40 b).

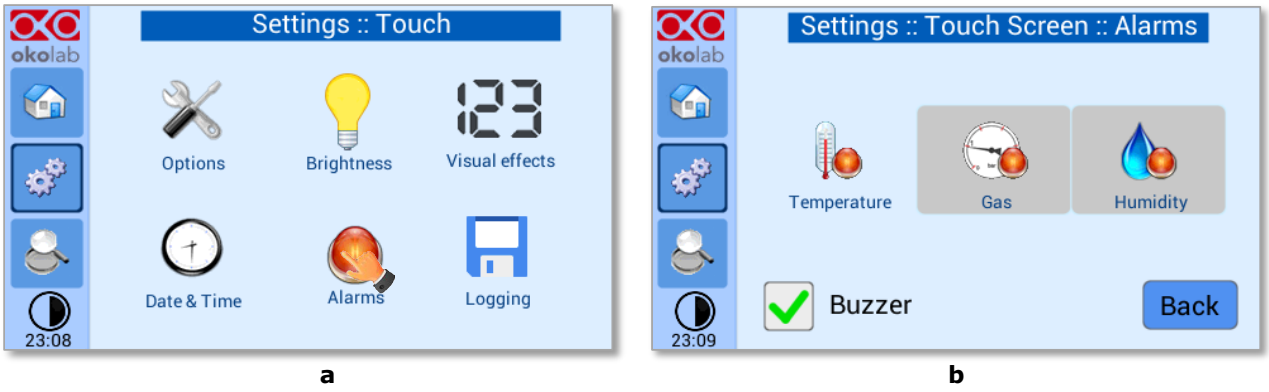



*Figure 40. How to enter in Alarms page (a – b).*

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

The page shown in Figure 41 will open and you can choose the "*Temp Deviation*" and "*Temp Time*".

***Tip*** ►*"Temp Deviation" is the value defining the allowed tolerance from the set point. "Temp Time" is the time for which the temperature may remain outside the allowed tolerance before the controller triggers in alarm.*

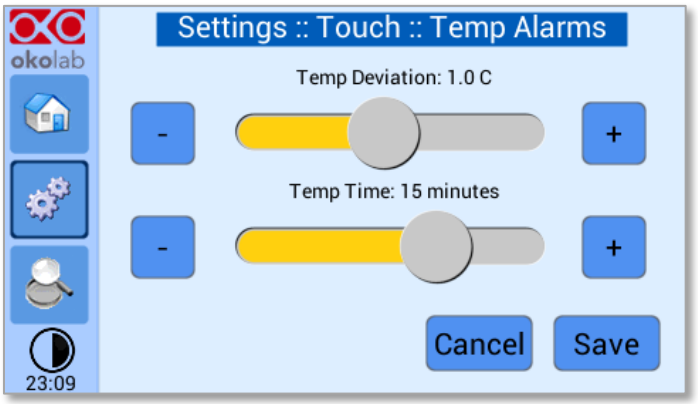



*Figure 41. How to set the Deviation and Time Alarm*

Figure 41. In this example the following settings are displayed (valid only after the system has reached its stationary state): if Temperature Deviation from set point is 1°C or greater (i.e. if set point temperature is 37°C and the temperature reaches a value equal or less than 36.0°C or equal or more than 38.0°C) for a period of time equal or longer than 15 minutes ("Temp time" set in this example) then the system triggers in alarm.

### *8.2.2.6 Data Logging*

H201-T-UNIT-BL 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 42.

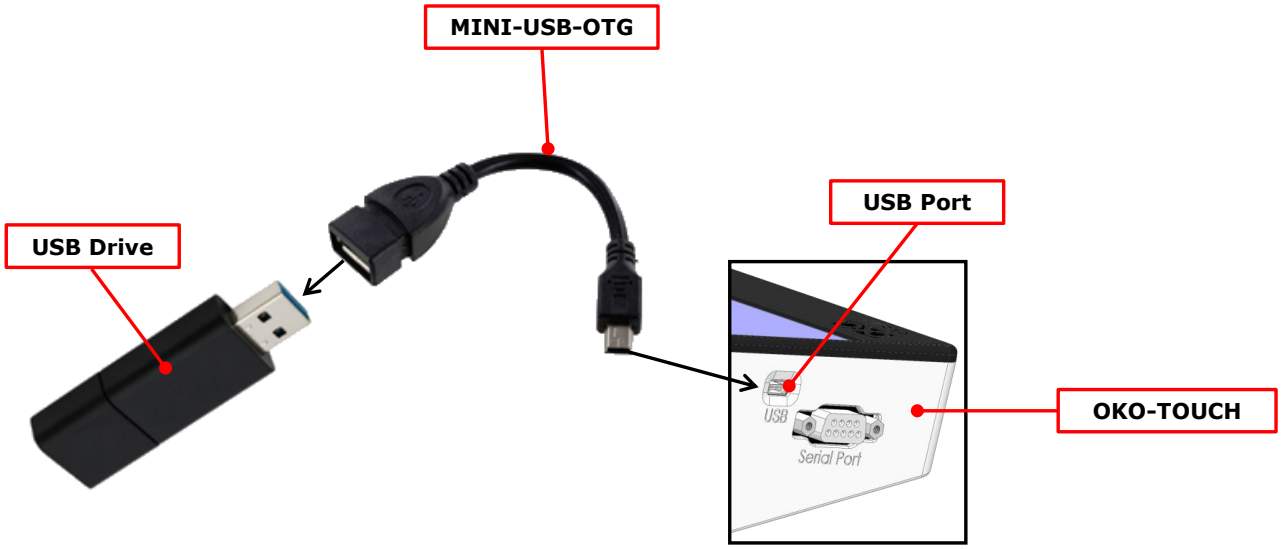



*Figure 42. USB drive connection*

To activate the logging, follow the steps indicated below:

1. Press on the *Settings* icon (Figure 43, a) and press on the *Touch screen* icon on the window that opens next (Figure 43, b).

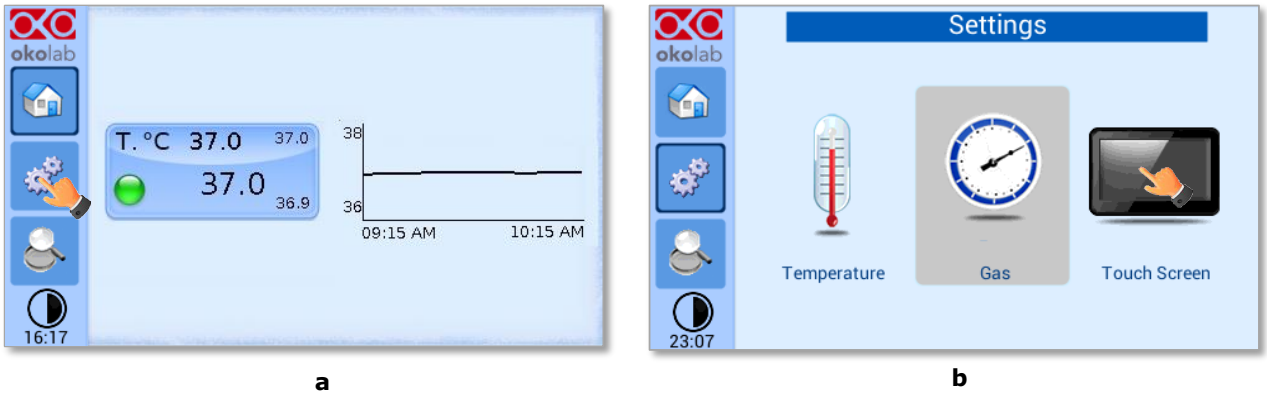
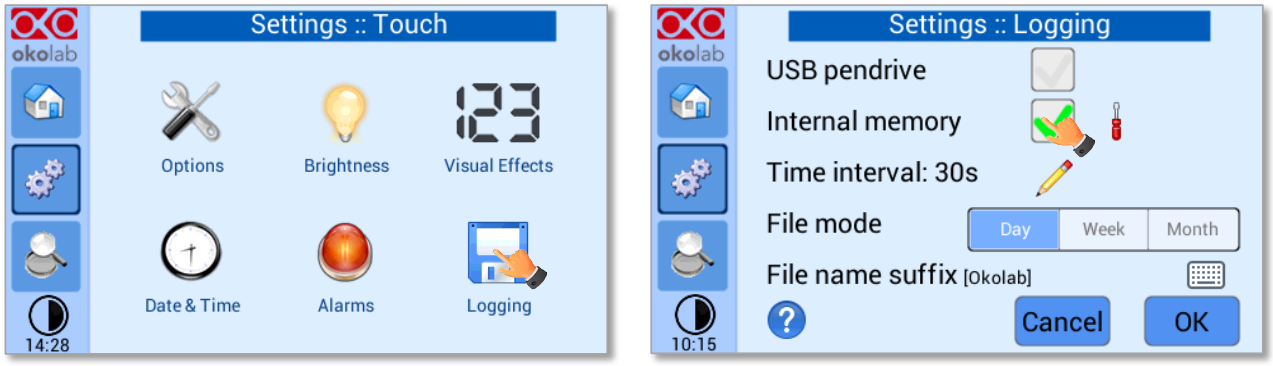



*Figure 43 (a) How to enter the setting menu; (b) how to enter the Touch Screen menu*

2. Press on the *Logging* icon and flag *Internal memory* in the page that appears, see Figure 44 a and 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 45*




a b

*Figure 44. Logging. (a) How to enter in the logging menu; (b) logging in internal memory*

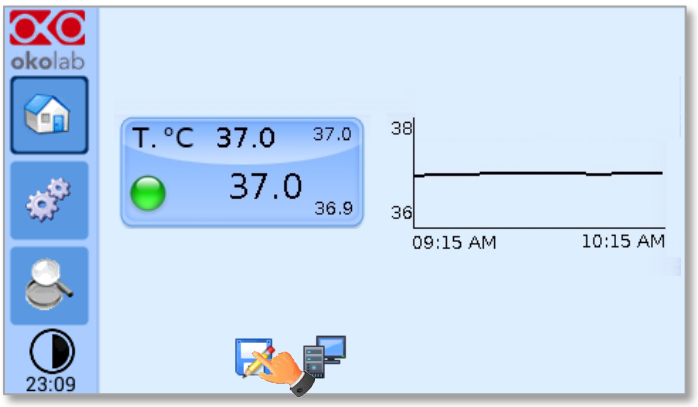
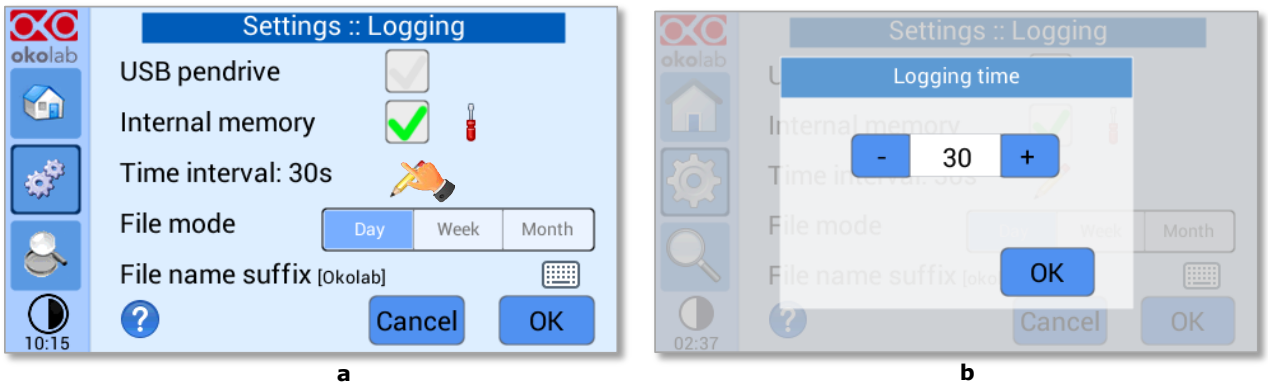



*Figure 45. How to access the Logging page from the Homepage*

3. Press on the icon  (see Figure 46 a) to insert the *Time Interval* i.e. the frequency with which you want to record a data point, as shown in Figure 46 b. 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 46. 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 46 (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 47 a.

6. Then press *Save*, see Figure 47 b.

***Tip*** ► *With the selections as in Figure 46 and in Figure 47, the data will be downloaded on the USB drive as shown in Figure 48.*

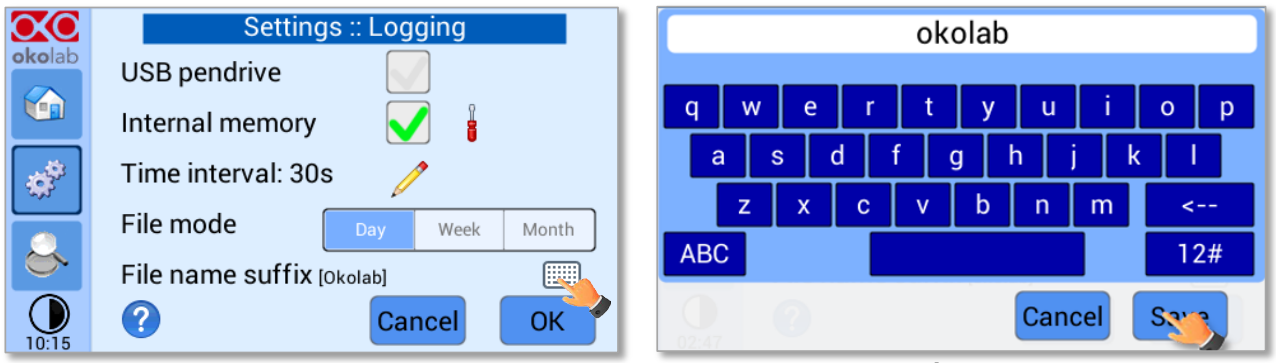



*Figure 47. Data Logging. How to define the suffix for the downloaded files (a – b)*

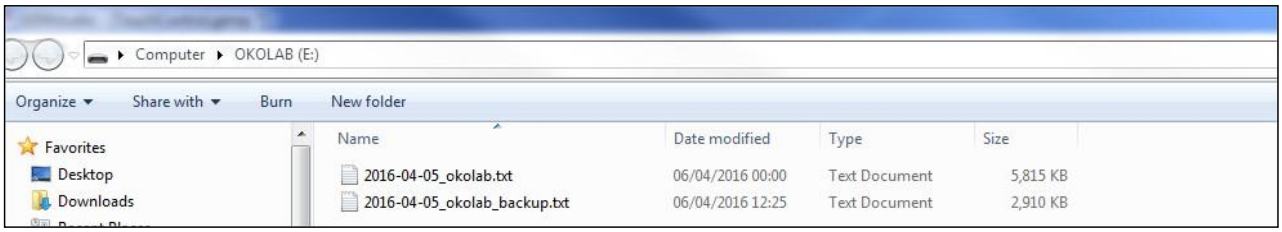



*Figure 48. Downloaded files on the pen drive*

***Note*** ► *If you press on the screwdriver*  *, see Figure 49(a) you can view the logging starting date, the available memory and the latest download, see Figure 49(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.*

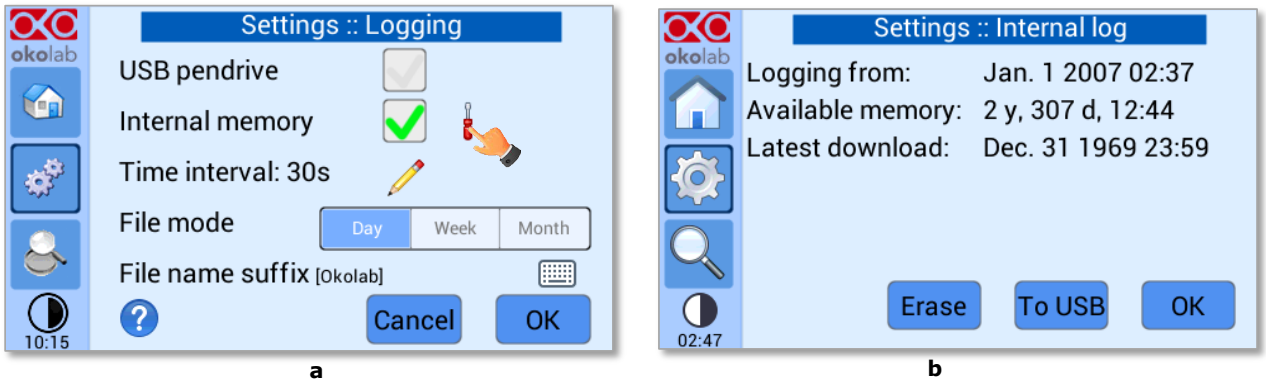



*Figure 49. Internal memory status. (a) Logging page settings; (b) Internal log page settings*

To download the data, press on *To USB* or on *Erase* if you want to delete the data, see Figure 50 b.

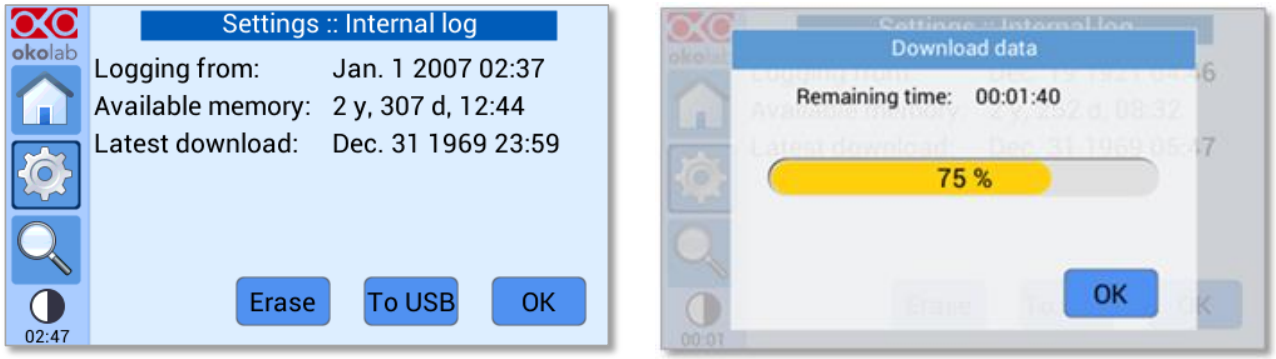



*Figure 50. Download to USB*

You can activate the logging also on the *USB drive*, by flagging on *USB drive*, see Figure 51(a).

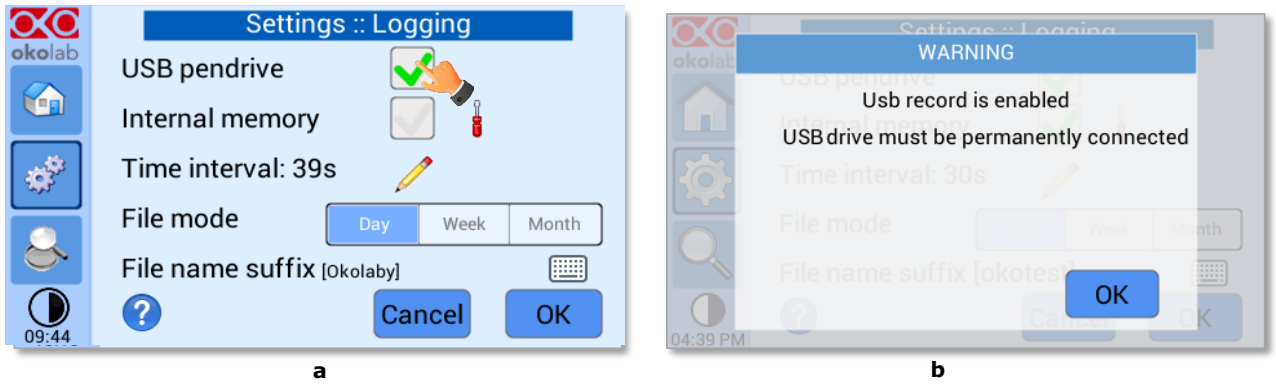



*Figure 51. Logging on USB flash drive. (a) USB drive selection; (b) Reminder to connect the USB drive*

In this case, OKO-TOUCH warns you that a USB drive must be connected to the USB port, see Figure 51(b), and will store the data on the USB drive.

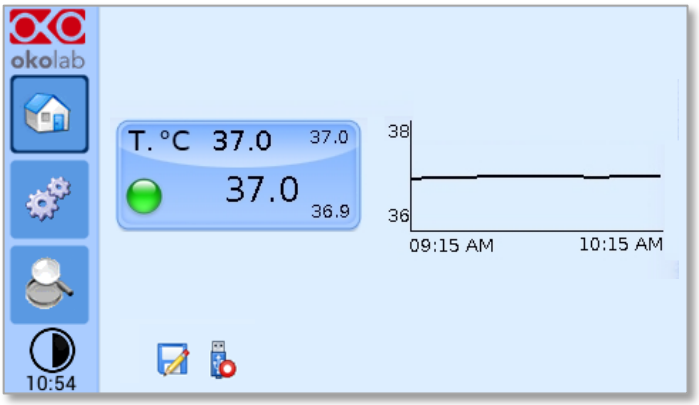



*Figure 52. Logging to USB drive*

***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 52.*

## 8.3 Overview

Press on the icon  to open the overview page as show in Figure 53 a.

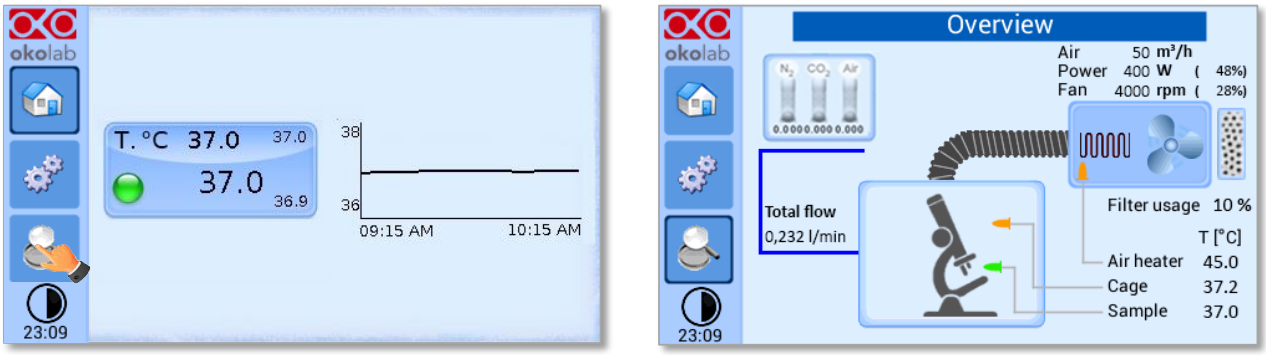



*Figure 53. How to enter in the Overview Page (a – b).*

***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*

## 8.4 Icon and Glance Mode View

The H201-T-UNIT-BL features two display modalities: Icon mode and Glance Mode, as shown in Figure 54, a and b. You can swap between the two display modalities by pressing on icon  , as shown in Figure 54 a.

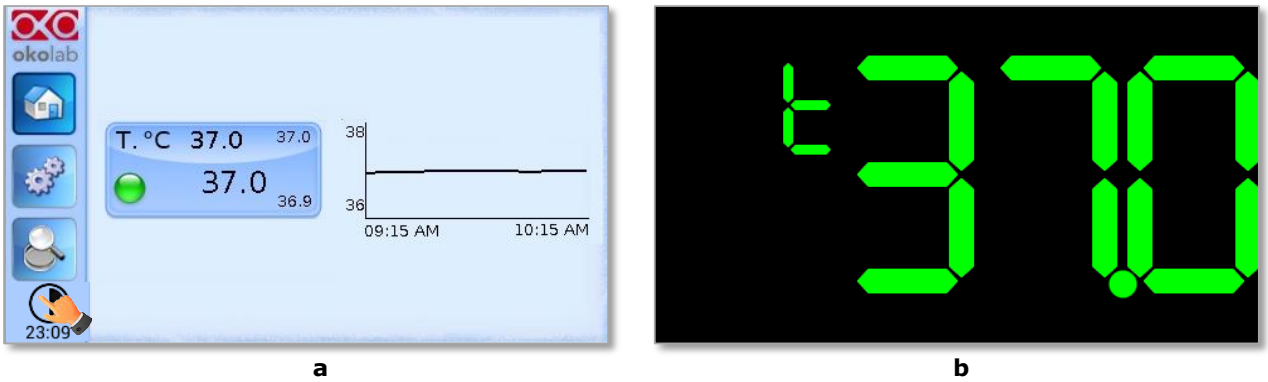



*Figure 54. Display modalities: Icon Mode (a); Glance Mode (b).*

## 8.5 Info page

Press on the icon okolab to access the Info Page, as shown in Figure 55. This page contains the information related to the OKO-TOUCH and to the H201-T-UNIT-BL version (as shown in Figure 56 a and b).

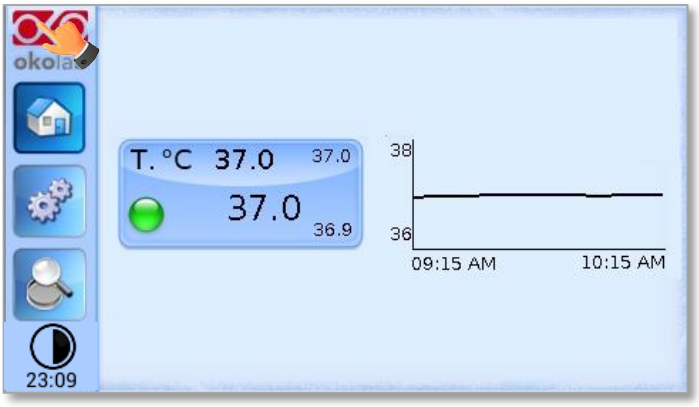
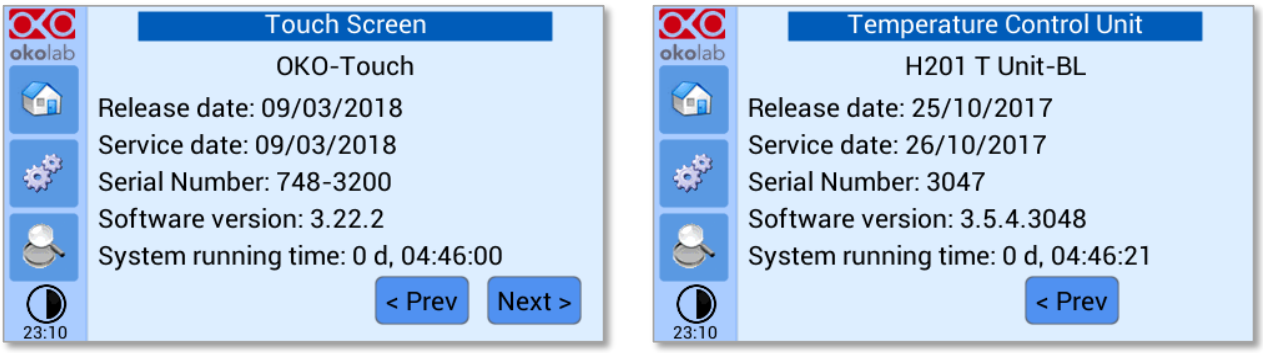



*Figure 55. Info page selection*




**a** **b**

*Figure 56. Info page OKO-Touch and H201-T-UNIT-BL (a – b).*

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

# 9 Enclosure standard components

H201-T-UNIT-BL includes the enclosure (cage) surrounding the microscope (*purchased separately*). The enclosure depends on the user's microscope therefore it can be different for each microscope. There are some parts of the enclosure that are, however, the same for all. The standard parts are shown in the following images.

A. **Humidity Module (included in HM-VF) positioning on the enclosure top panel**. You can insert this part of the HM-VF also at the end of the assembly of the whole cage. See Figure 57.

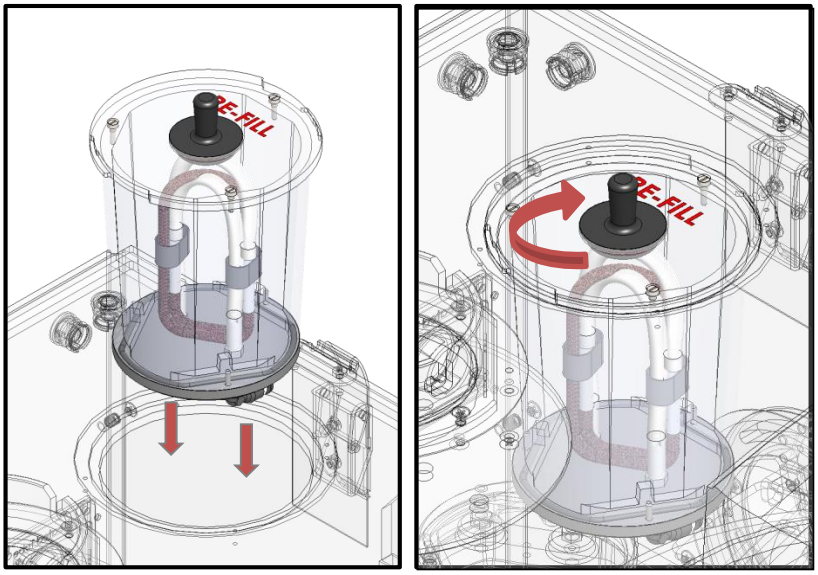



*Figure 57.HM-VF inserting in the appropriate slot*

***Tip*** ► *The Humidity Module allows to humidifying the mixed gas coming from the Gas Mixer by a permeable water membrane. The dry gas flows through this permeable membrane immersed in water before arriving to the chamber incubator. The Humidity Module has to be filled with distilled water until to cover entirely the tubing into the reservoir, this operation can be done before inserting it into its housing or after the insertion, you have to lift the black plug only (see Figure 58).*

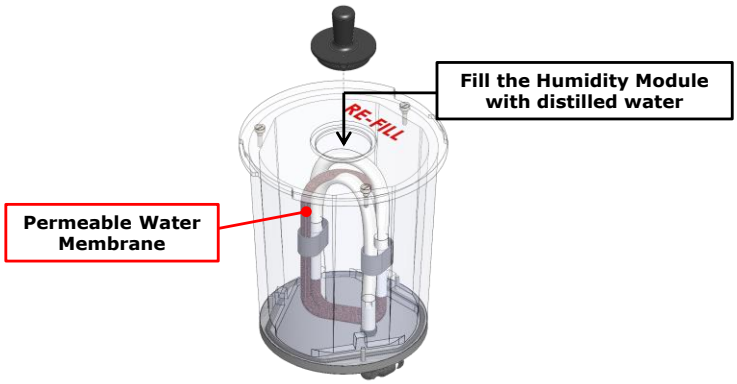



*Figure 58. How to fill the Humidity Module.*

***Note*** ► *This particular component is not present if you have purchased HM-CTIVE as Humidity Module. In this case this bore is covered by a plug while the system configuration becomes the one shown in*

B. **Water Trap (included in HM-VF) positioning inside the enclosure**. You can insert this part of the HM-VF or before mounting the frontal panel or after have mounted the frontal panel simply opening the slide door on the left panel of the enclosure. See Figure 59.

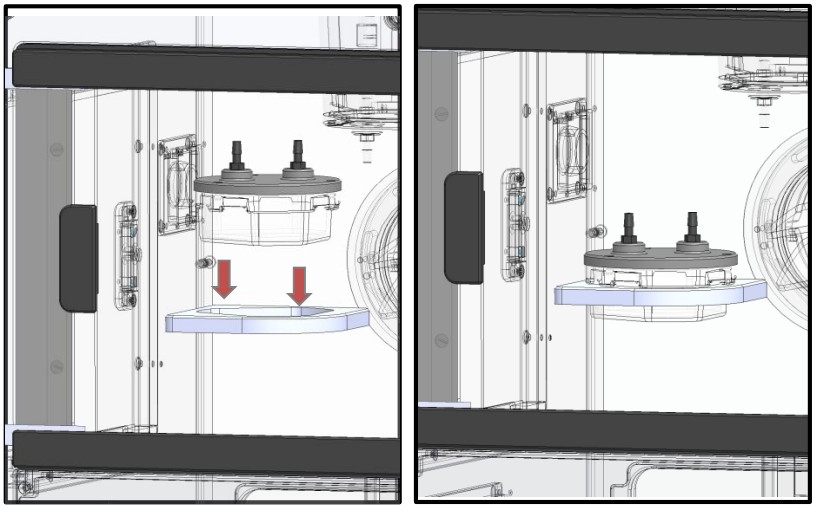


*Figure 59. Water Trap inserting in the appropriate slot*

***Tip*** ►*This component allows recovering the condensation water (HM-VF) or the water accumulated into the permeable membrane tube (for HM-VF) in order to prevent the water reaches the chamber incubator. For example, in the case of HM-VF, when you switch your gas mixer off, the gas stops flowing through the permeable water membrane for a little time but the membrane continues to permeate the water and its little tube fills. When you switch your gas mixer on again, the stored water is recovered into the water trap and it does not reach the chamber incubator. The Water Trap is directly connected to the Humidity Module by the TUBE H (for HM-VF, see Figure 70)*

C. The Water Trap should not fill because the stored water evaporates when the system restarts in the standard working condition. If it fills because of anomalous operating condition, you have to open it to empty it:

- *Loosen the water trap cover screws (M2x8, A in Figure 60)*
- *Lift the cover and empty the water trap*

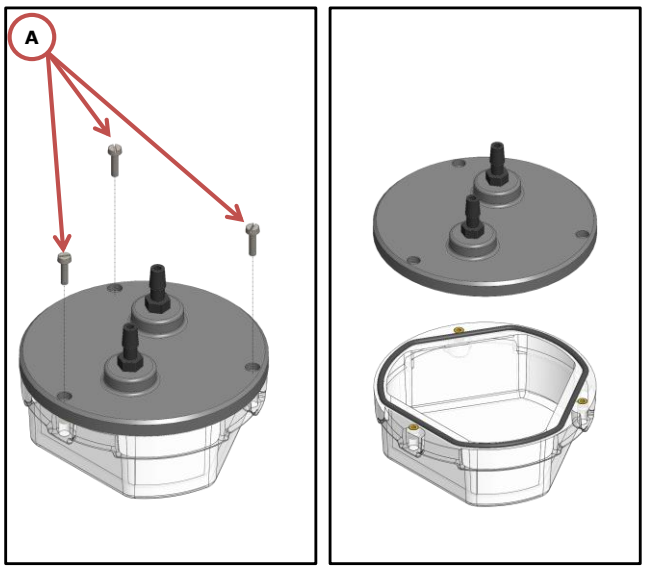



*Figure 60. How to empty the water trap*

D. **Calorflex tubes (x4)** (see paragraph 5) **provide connection between the Heating Box and the Enclosure**. The two tubes labeled red (TUBE-DE) allow to connect the RED colored side of the Heating Box to enclosure hoses red labeled. The tubes labeled blue (TUBE-DF) connect the BLUE colored side of the Heating Box to the enclosure hoses labeled blue.

E. **Connection with the Heating Box**. Insert the hose bayonet connector ring that is on the end part of the tubes labeled blue (TUBE-DF) on the hose bayonet connector flange mounted on the blue side of the Heating Box. Then rotate the bayonet connector ring until the screws do not fit into their housings. Repeat the same procedure for connecting the red colored tubes (TUBE-DE) on the red side of the Heating Box.

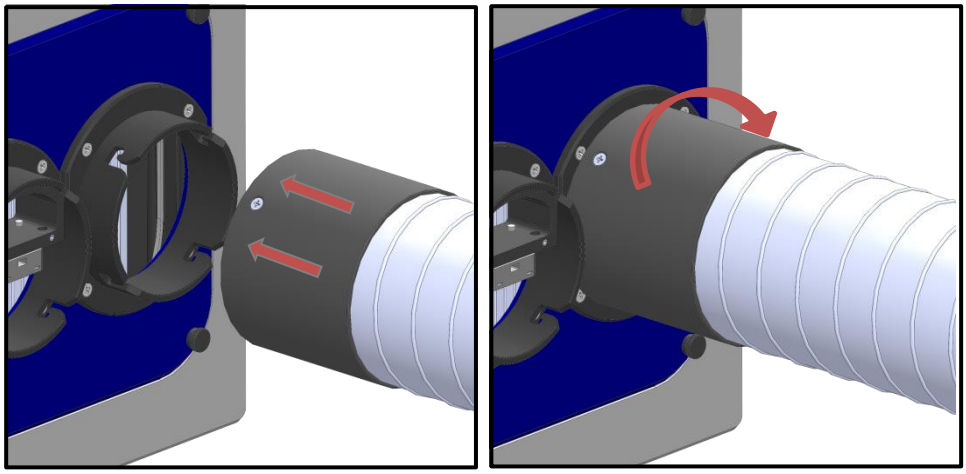


*Figure 61. Connection with the Heating Box.*

F. **Connection with the Enclosure**. Insert the hose bayonet connector ring that is on the end part of tubes labeled blue (TUBE-DF) on the hose bayonet connector flange of the Enclosure labeled blue. Then rotate the bayonet connector ring until the screws do not fit into their housings. Repeat the same procedure for connecting the tubes labeled red on the enclosure hoses labeled red (TUBE-DE).

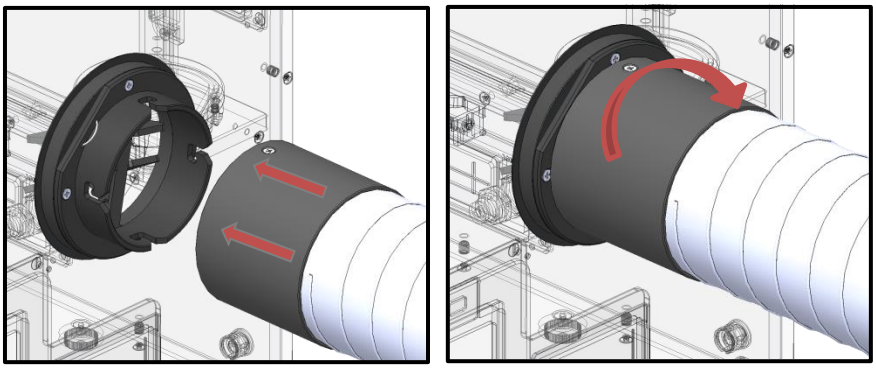


*Figure 62. Connection with the Enclosure.*

**Tube Length Optimization.** You can cut the tubes if they are too long for your configuration. Follow the instructions below to cut the tubes:

1. Remove the black hose from gray tube. See Figure 63 a. Cut with the help of a scissors the gray tube to the desired length, see Figure 63 b.

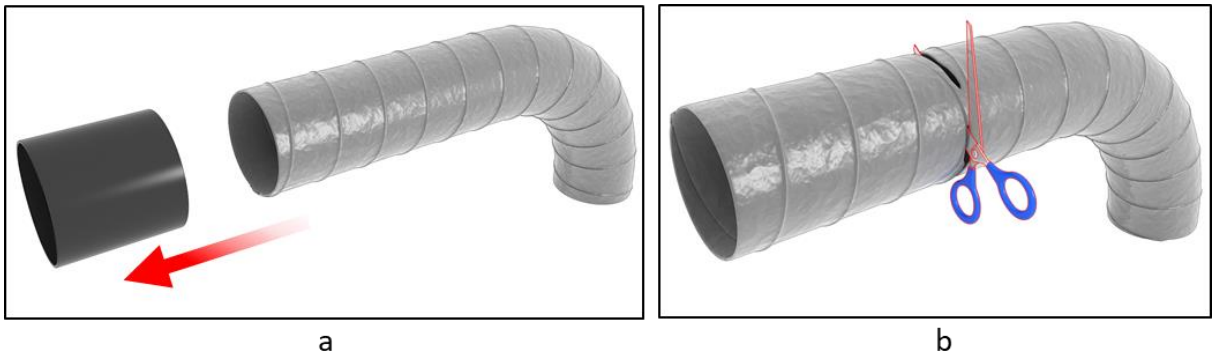



*Figure 63. Remove black hose and cut the tube (a – b)*

2. Cut with the help of a nipper the metal wire inside the grey tube, see Figure 64 a. Hold the metal wire tip with some scotch tape. See Figure 64 b.

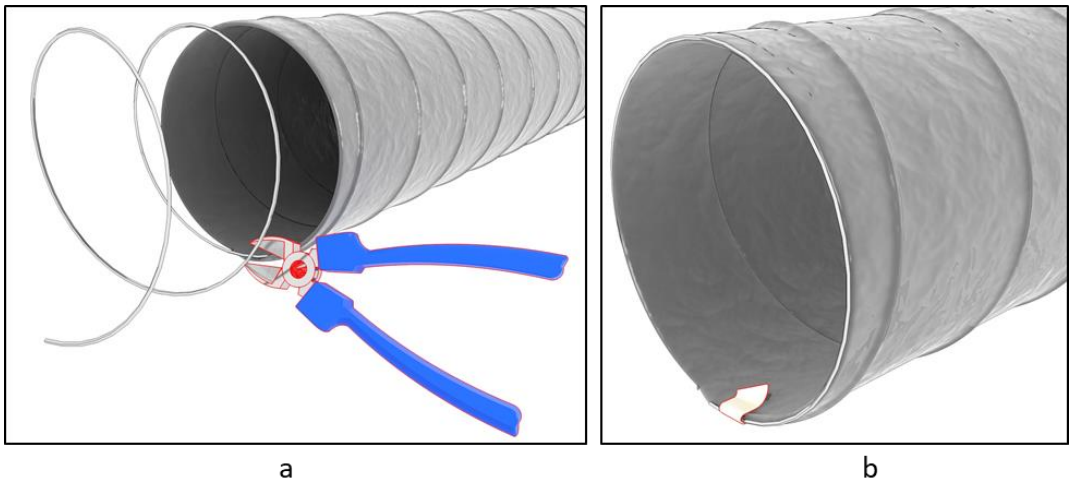



*Figure 64. Cut the metal wire and hold the metal wire with scotch tape (a – b).*

3. Insert the black hose back in its position, see Figure 65

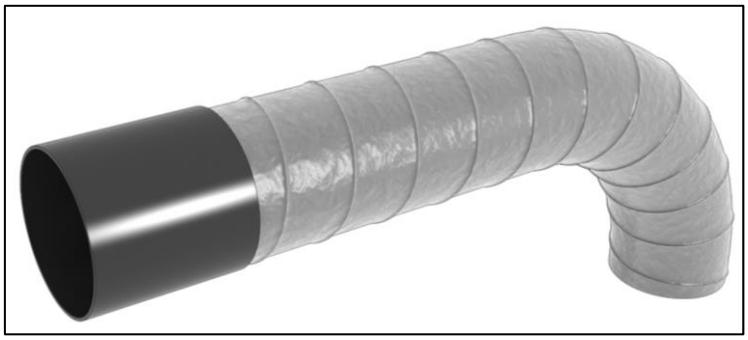


*Figure 65. Insert the black hose.*

Okolab suggests to cut the tubes in order to save space especially when:

1. the Heating Box is put on the same desk of the enclosure, very close to the enclosure (see Figure 66 for Configuration A). Figure 66 a shows configuration where tubes have not been cutting. Figure 66 b shows the space-saving after cutting the tubes.


*Figure 66. Before vs after cutting the tubes – Configuration A (a -b).*

2. the Heating Box is put on a shelf placed just above the enclosure (see Figure 67 for Configuration B). Figure 67 a shows configuration where tubes have not been cutting. Figure 67 b shows the space-saving after cutting the tubes.


*Figure 67. Before vs after cutting the tubes – Configuration B (a -b).*

You don't need to cut the tubes when the Heating Box is placed under the enclosure's level (see Figure 68 a for Configuration C) or above the enclosure but not precisely centered with it (see Figure 68 b for Configuration D).


*Figure 68. Configuration C – Configuration D (a -b).*

G. **Chamber Incubator insertion inside the enclosure**. You can insert the chamber incubator on the stage before mounting the frontal panel or after have mounted the frontal panel simply opening the slide door on the left or on the right panel of the enclosure. See Figure 69.

***Tip*** ► *Please refer to the chamber user manual in order to have more information on the chamber incubator positioning on the stage.*

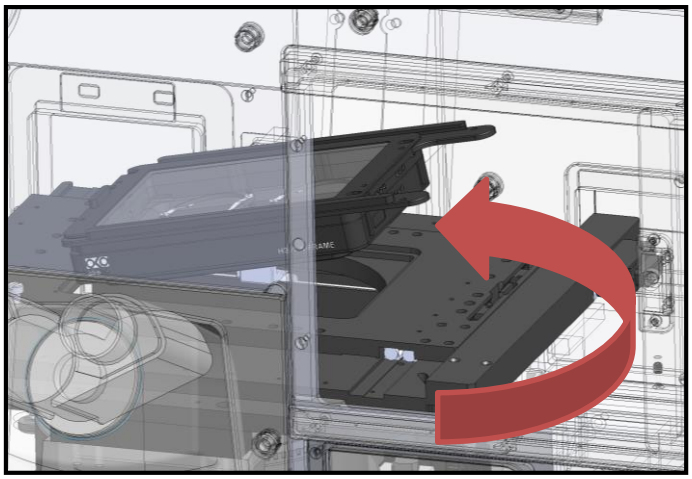


*Figure 69. Chamber Incubator insertion inside the enclosure*

H. **HM-VF tubing connection inside the Enclosure**. If you have purchased also HM-VF, you have to connect the tubes between the Water Trap and Humidity Module (Tube H), between the Water Trap and the Chamber Incubator (TUBE G) and between the Input of the gas coming from the Gas Mixer and the Humidity Module (TUBE I). See Figure 70.

***Note*** ►*The 3 mm ID silicon end of TUBE G must be connected to the Water Trap while the 2 mm ID silicon end to the Chamber Incubator.*

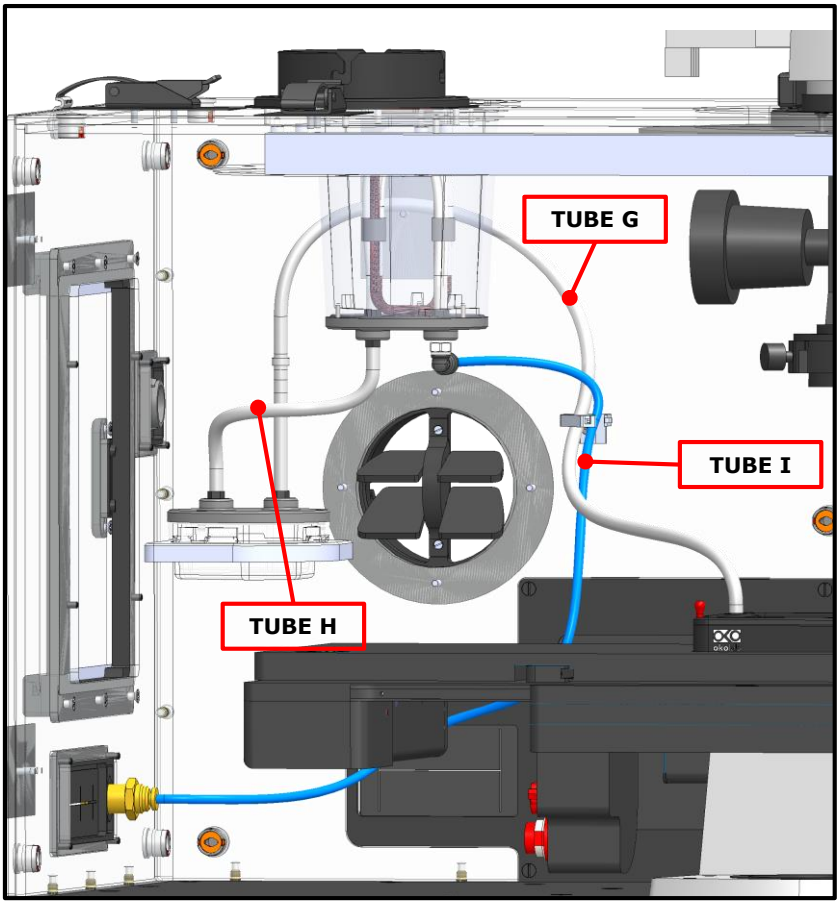



*Figure 70. Tubing connection inside the Enclosure with HM-VF.*

I. **HM-ACTIVE tubing connection inside the Enclosure**. If you have purchased also a digital gas mixer including HM-ACTIVE as humidity module, you have to connect the heated tube of HM-ACTIVE to the Chamber Incubator. See Figure 71.

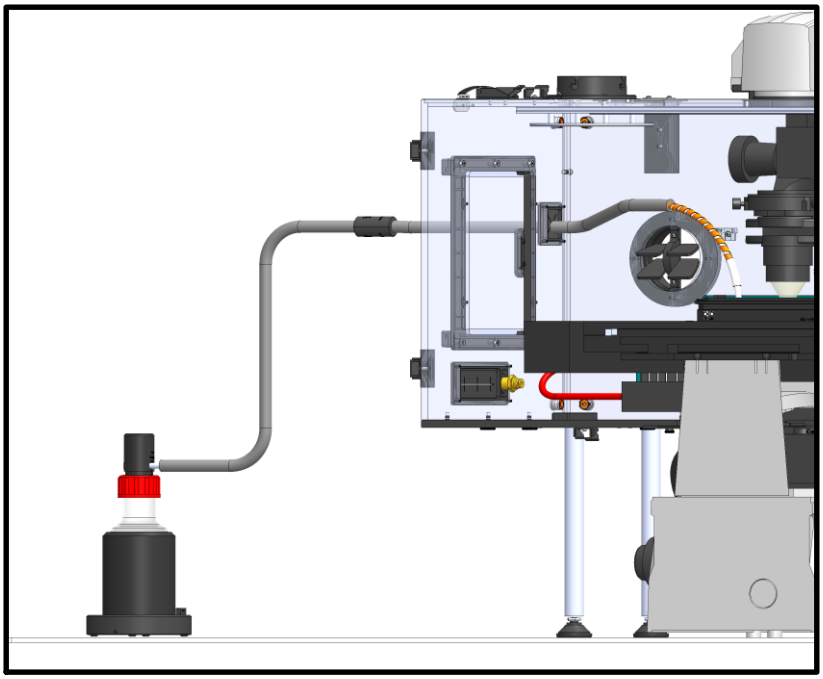


*Figure 71. Tubing connection inside the Enclosure with HM-ACTIVE*

J. On the all Okolab enclosures there are some standard components which allow simplifying the layout of cables and pipes in your experimental environment. The Figure 72 shows for example an opening that you can find on the back panels, Image 2, useful for the passage of the electrical cables of the microscope or of the other components that you use for your experimental apparatus. In Image 3 of Figure 72 there are the connector for the input of the gas coming from Gas Mixer and the opening where you can pass the temperature sensors cables (the fine gauge thermocouple and the NTC thermistor). The Image 1 shows the Heated Tube Input (a component of the HM-ACTIVE), this is tapped in the configuration H201-T-UNIT-BL with HM-VF as humidifier.

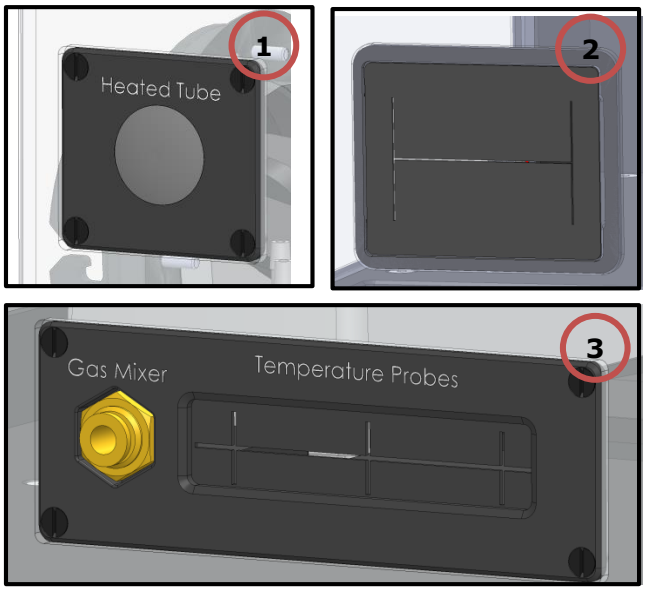



*Figure 72. Standard components on the enclosure panels.*

# 10 Cleaning & Maintenance

## 10.1 Control Unit

To maintain proper Temperature Control Unit operation over time:

- Use a polishing cloth or dry cloth to wipe off dust and dirt.
- Never use thinners, benzene, solvents on or near the devices, since these could corrode their surfaces.
- To polish the Stage Incubator and the Humidifying Module, if it is present, you can use distilled water or alcohol
- Verify the status of all cables and if some cable is damaged, contact Okolab to receive assistance

---

Before cleaning the unit, pull out the mains plug.
Water must not be entered in the system.

---

## 10.2 Enclosure

The Cage enclosure is composed by several parts, in total five materials are present, see the list below:


Lexan (for transparent panels),


Acrylic (for obscuring panels),


Polycarbonate (for black seals for light obscuring)


Aluminum (for opening viewing window, not present in all the configurations)


Anodized Aluminum (for opening viewing window, not present in all the configurations)

In order to keep the Cage clean they are needed:

1. **Wipe:** Use a clean soft and dry sterilized cloth.
2. **Disinfectant:** Quaternary ammonium compound: Benzyl-alkyldimethyl chloride 1.3 mg/g. Effective against hepatitis B, HIV, rota virus within 1 minute, mycobacterium within 5 minutes, bacteria, fungi (Candida), influenza A virus (H5N1/H1N1) within 15 minutes. Make sure it won't release any VOC after application.

The procedure to clean the Cage is:

1. Spray the **Disinfectant** on the chosen piece and let it act for 15 minutes.
2. Rub the piece gently with the **Wipe**.
3. If some halos are present on the piece (this may be the case of **Acrylic**), spray the **Disinfectant** again and immediately remove it gently with the **Wipe**.

*Note ► Please contact Okolab if you need further information about which Disinfectant and Wipe to use.*

## 10.3 Filters Replacement

If you have purchased also H201-T-FILTER-BOX, a module containing a filters kit composed by a prefilter and a HEPA filter (High Efficiency Particulate Air Filter) has been added to the Heating Box, as described in paragraph 8.2.1.3. When activating the Filter Monitoring, the counting of the usage days, indicated with 'Update Time', starts. The maximum usage time for the Prefilter is 180 days, while for the Hepa Filter is 360 days. When the usage time exceeds one or both these values, you should replace them in order to avoid contaminations of the sample.

---

Before opening the H201-FILTER-BOX, make sure that the Heating Box is unplugged from an outlet. Before opening the H201-FILTER-BOX to change the Prefilter or the HEPA Filter wear personal protective equipment, breathing mask and gloves.

---

Follow the indications below for the filters replacement:

1. Open the two soft draw latches on the sides of the H201-FILTER-BOX, see A in Image 1 Figure 73
2. Slip off the frontal panel of the H201-FILTER-BOX and pull out the prefilter and HEPA filter. See Image 2 and 3 of Figure 73.
3. Replace one or both the filters that you need to replace with the new filters.
4. Reassembly the H201-FILTER-BOX.

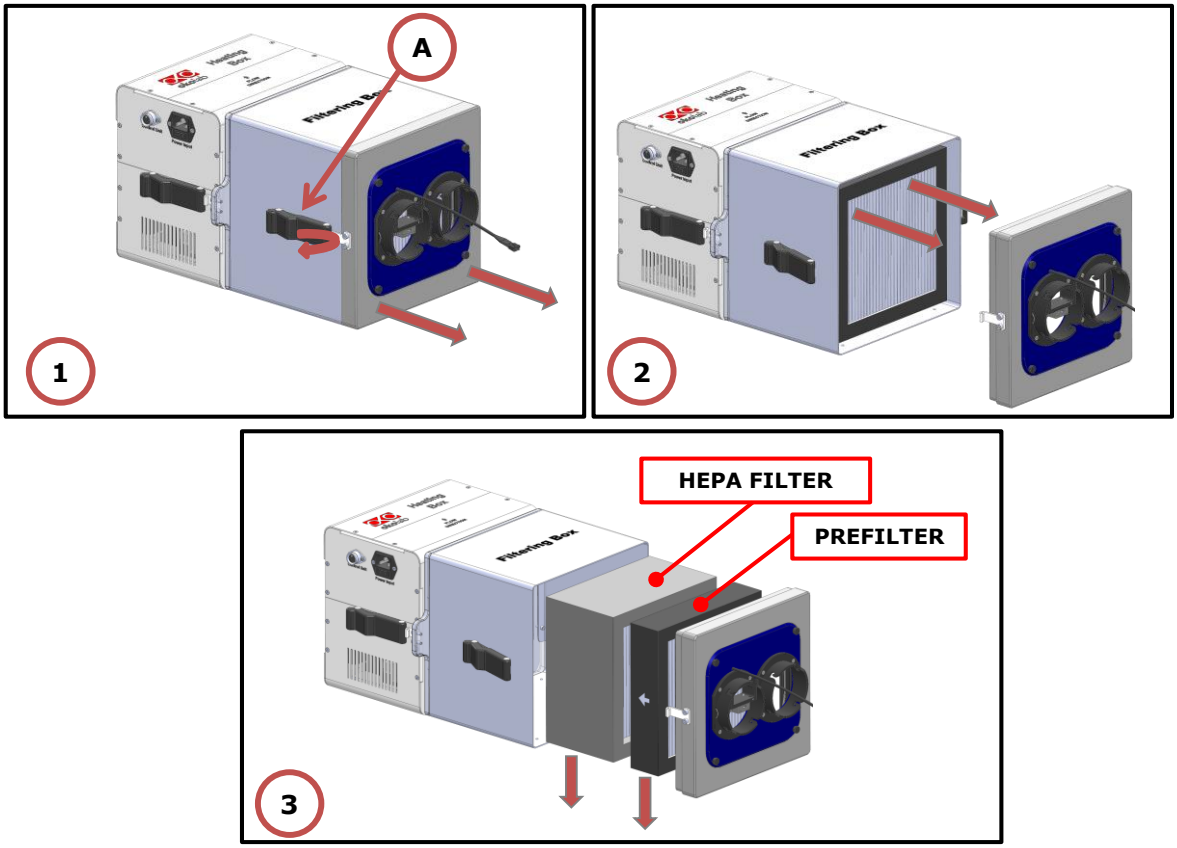



*Figure 73. Filters Replacement*

After replacing one or both the filters, do not dispose it/them as urban solid waste. The filters must be treated as special waste.

# 11 Support

In order to send directly an email to the Okolab staff, you can use the QR codes shown in the following images:

- For commercial info:

*Figure 74. QR code for commercial info contact*

- For technical info:

*Figure 75.QR code for technical info contact*

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

- Contact our technical support (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 HARDWARE SUPPORT: sibillo@oko-lab.com
Phone +39 081 806 3470
Fax: +39 081 876 4410
Mobile: +39 348 96807 18

For COMMERCIAL SUPPORT WORLDWIDE: 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

For COMMERCIAL SUPPORT CHINA: tong@oko-lab.cn

# 12 Technical Specifications

| **H201-T-UNIT-BL - Technical Specifications** | |
|---|---|
| Temperature | Cage Temperature Range: 25-50°C<br>Sample Temperature range: 3°C above ambient temperature to 42°C<br>Step size: 0.1°C<br>Accuracy:0.2°C in Sample Mode and in Cage Mode if room temperature remains within ± 1°C |
| Regime temperature time | about 30 min |
| Operating Temperature | 0°C ~ +55°C |
| Storage Temperature | -5°C ~ +60°C |
| Operating Humidity | 0-70% |
| Power Consumption | 24 V DC 75 W max |
| Weight | 1.5 Kg |
| **Heating Box – Technical Specifications** | |
| Operating Temperature | 0°C ~.+55°C |
| Storage Temperature | -5°C ~ +60°C |
| Operating Humidity | 0-70% |
| Power Consumption | 230V AC 50 Hz Fuse 5AF 250V 5x20<br>800 W max |

*Table 2. Technical specifications.*

# 13 Troubleshooting

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

| **Symptom** | **Probable cause** | **Remedy** |
|---|---|---|
| Device off | Supply cable disconnected | Properly connect the cable |
| | Supply cable damaged | Substitute the cable |
| No temperature displayed or “nan" | Thermocouple cable disconnected | Properly connect the cable |
| | Thermocouple cable damaged | Contact Okolab to receive assistance |
| | NTC Thermistor cable disconnected | Properly connect the cable |
| | NTC Thermistor cable damaged | Contact Okolab to receive assistance |
| Heating Box fan turned off | 8-pins cable is not connected to Heating Box or T-Unit | Properly connect the cable |
| | Blown Fuses | Replace the fuse in the Heating Box (see Technical Specifications) |
| Heating Box is cold | Power supply cable is not connected to Heating Box | Properly connect the cable |
| | Heating Box Blown fuses | Replace the fuses in the Heating Box (see Technical Specifications) |
| Heating Box fan is turned on, the speed reported by OKO-Touch is 0 RPM but the system is still properly working | 8-pins cable or Unit is damaged | Contact Okolab for support |
| Heating Box fan is turned on but Air Flow reported by OKO-TOUCH is null and the enclosure temperature doesn’t increase | 3-pins – Flow Sensor” Cable is not connected to Heating Box or T-Unit | Properly connect the cable |
| I check the previous troubleshooting but I cannot solve the problem | | Contact Okolab to receive assistance |

# 14 Figure List

## 15 Manual Revision Table

| Revision Number | Additions or changes | Date |
|---|---|---|
| 01 | Edited | May 2018 |
| 02 | Replaced some images and layout | July 2018 |
| 03 | Equipment correction | May 2019 |
| 04 | Heating tubes | April 2021 |
| 05 | Edited section on Control Mode and the section on T Sensor Calibration; deleted the Chapter 9 Calibration. | September 2023 |
| 06 | Updated range of Controller to 25-42°C | February 2024 |

# WARRANTY

Okolab S.r.l. warrants the “H201-T-UNIT-BL” 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.