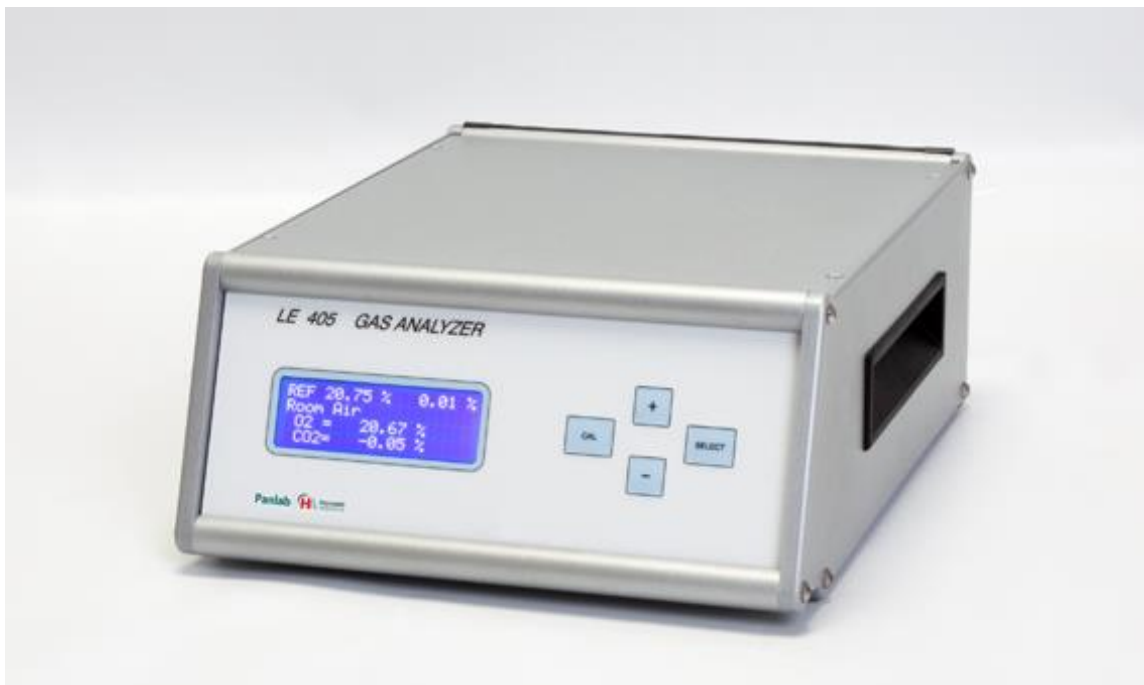


Hardware User's Manual

Gas Analyzer O₂/CO₂

OXYLET PRO



References:

LE405 (76-0810)

Publication:

PB-MF-MAN-011-REV2.1

Limitation of Liability








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Some symbols may have more than one interpretation by professionals unaccustomed to their usage.

PANLAB reserves the right to modify, in part or in total, the contents of this document without notice.

1. SYMBOLS TABLE

Recognising the symbols used in the manual will help to understand their meaning:

DESCRIPTION	SYMBOL
Warning about operations that must not be done because they can damage the equipment	
Warning about operations that must be done, otherwise the user can be exposed to a hazard.	
Protection terminal ground connection.	
Warning about a hot surface which temperature may exceed 65°C	
Warning about a metal surface that can supply electrical shock when it's touched.	
Decontamination of equipments prior to disposal at the end of their operative life	
Waste Electrical and Electronic Equipment Directive (WEEE)	

2. GOOD LABORATORY PRACTICE

Check all units periodically and after periods of storage to ensure they are still fit for purpose. Investigate all failures which may indicate a need for service or repair.

Good laboratory practice recommends that the unit be periodically serviced to ensure the unit is suitable for purpose. You must follow preventive maintenance instructions. In case equipment has to be serviced you can arrange this through your distributor. Prior to Inspection, Servicing, Repair or Return of Laboratory Equipment the unit must be cleaned and decontaminated.



Decontamination prior to equipment disposal

In use this product may have been in contact with bio hazardous materials and might therefore carry infectious material. Before disposal the unit and accessories should all be thoroughly decontaminated according to your local environmental safety laws.

3. UNPACKING AND EQUIPMENT INSTALATION



WARNING: Failure to follow the instructions in this section may cause equipment faults or injury to the user.


- A. No special equipment is required for lifting but you should consult your local regulations for safe handling and lifting of the equipment.
- B. Inspect the instrument for any signs of damage caused during transit. If any damage is discovered, do not use the instrument and report the problem to your supplier.
- C. Ensure all transport locks are removed before use. The original packing has been especially designed to protect the instrument during transportation. It is therefore recommended to keep the original carton with its foam parts and accessories box for re-use in case of future shipments. Warranty claims are void if improper packing results in damage during transport.
- D. Place the equipment on a flat surface and leave at least 10 cm of free space between the rear panel of the device and the wall. Never place the equipment in zones with vibration or direct sunlight.
- E. Once the equipment is installed in the final place, the main power switch must be easily accessible.
- F. Only use power cords that have been supplied with the equipment. In case that you have to replace them, the spare ones must have the same specs that the original ones.



- G. Make sure that the AC voltage in the electrical network is the same as the voltage selected in the equipment. **Never connect the equipment to a power outlet with voltage outside these limits.**



WARNING

For electrical safety reasons you only can connect equipment to power outlets provided with earth connections .

This equipment can be used in installations with category II over-voltage according to the General Safety Rules.

The manufacturer accepts no responsibility for improper use of the equipment or the consequences of use other than that for which it has been designed.

PC Control

Some of these instruments are designed to be controlled from a PC. To preserve the integrity of the equipment it is essential that the attached PC itself conforms to basic safety and EMC standards and is set up in accordance with the manufacturers' instructions. If in doubt consult the information that came with your PC. In common with all computer operation the following safety precautions are advised.



- WARNING**
- To reduce the chance of eye strain, set up the PC display with the correct viewing position, free from glare and with appropriate brightness and contrast settings
 - To reduce the chance of physical strain, set up the PC display, keyboard and mouse with correct ergonomic positioning, according to your local safety guidelines.

4. MAINTENANCE



WARNING: Failure to follow the instructions in this section may cause equipment fault.

- **PRESS KEYS SOFTLY** – Lightly pressing the keys is sufficient to activate them.
- Equipments do not require being disinfected, but cleaned for removing urine, faeces and odour. To do so, we recommend using a wet cloth or paper with soap (which has no strong odour). **NEVER USE ABRASIVE PRODUCTS OR DISSOLVENTS.**
- **NEVER** pour water or liquids on the equipment.
- Once you have finished using the equipment turn it off with the main switch. Clean and check the equipment so that it is in optimal condition for its next use.
- The user is only authorised to replace fuses with the specified type when necessary.

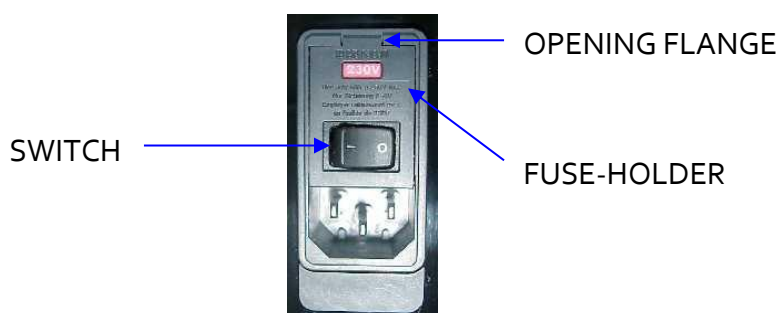


Figure 1. Power inlet, main switch and fuse holder.

FUSE REPLACEMENT

In case of an over-voltage or other incident in the AC net making it impossible to turn on the equipment, check fuses according to the following procedure.

- 1 Remove power cord from the power inlet.

- 2 Open fuse-holder by pulling the flange with a regular screwdriver.



Figure 2. Open fuse-holder door.

- 3 Extract fuse holder using the screwdriver.

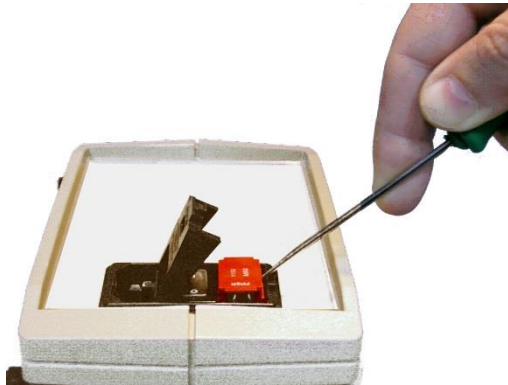


Figure 3. Extract fuse-holder.

- 4 Replace fuses if necessary. Insert fuses in the fuse-holder in the correct position.



CORRECT



INCORRECT

Figure 4. Fuses position.

- 5 Insert again fuse-holder, both possible positions are correct because power supply is universal.
- 6 If the fuses blow again, unplug the equipment and contact technical service.



WARNING

For electrical safety reasons, never open the equipment. The power supply has dangerous voltage levels.

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6. INTRODUCTION

The LE405 is a gas analyzer that measures O₂ and CO₂ concentrations in the air. The equipment has been especially designed to study the metabolism of small animals, such as rodents.



Figure 5. LE405 O₂/CO₂ Analyzer.

The LE405 works together with the LE 400, which regulates and switches the flow of air to the cages. The LE400 makes it possible to control up to 40 cages (4 cages per control unit). To do this you simply should connect the LE400 units through the interconnect bus supplied with the equipment.

- 1 Do not exceed the maximum allowed pressure of **1150mbar** in the **Sample Inlet** to avoid damaging the sensor.
- 2 If absolute measurements are required, a system must be used to dry the air before it enters the **Sample Inlet**. However, for relative measurements (most measurements involving animals are relative), the supplied **Nafion** tube will be sufficient. This tube equalizes the differences in moisture between ambient air and the cage being sampled.



- 3 In the **Sample Inlet**, a 0.45 µm dust filter (provided with equipment) has to be installed to prevent the entry of dust during normal operation that could damage the optical sensor.

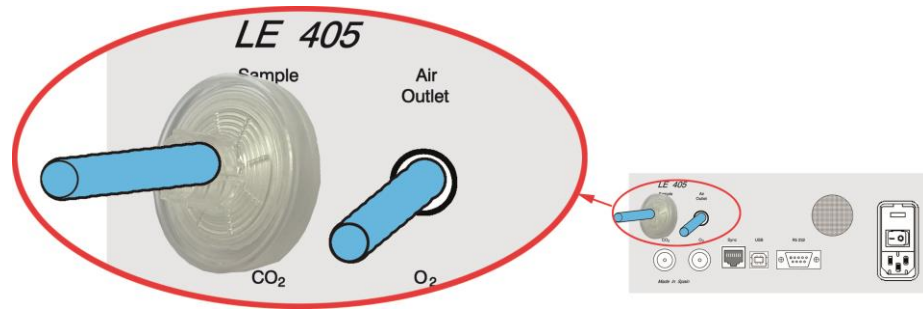


Figure 6. 0,45µm filter.

- 4 When the device is not to be used for a period of time, it is advisable to block the **Sample Inlet** and **Air Outlet** by connecting tube ends to them in order to prevent the entrance of dust that would affect the optical sensor. In normal operations, this tube can be connected to the **Air Outlet** only (this reduces the noise produced by the pump).

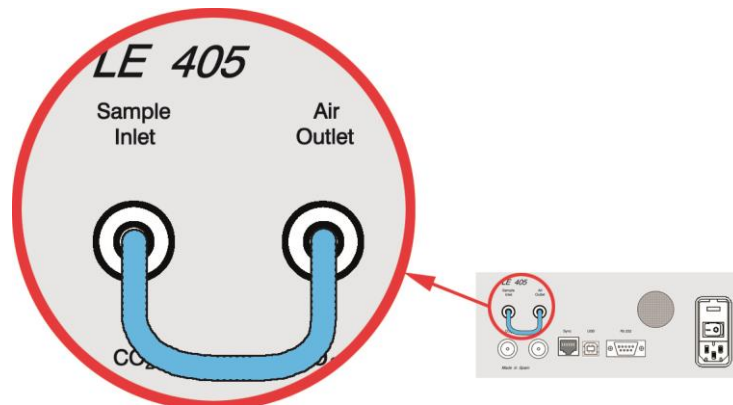


Figure 7. Connecting the inlet and outlet to store the equipment.

7. EQUIPMENT DESCRIPTION

7.1. FRONT PANEL

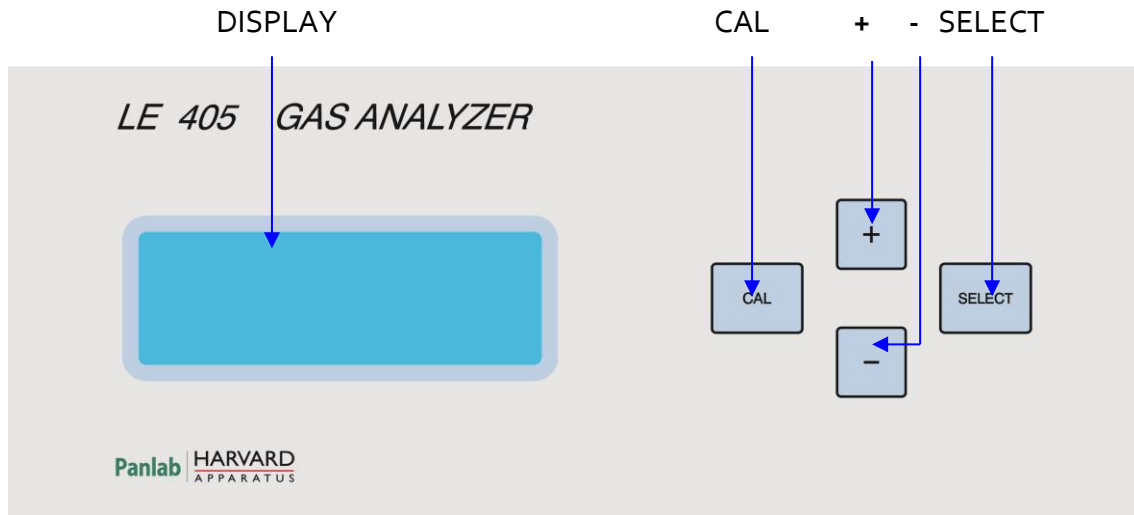


Figure 8. Front Panel.

- **CAL:** Enters the Calibration Menu to calibrate CO₂ and O₂ concentration.
- **SELECT:** Enters the Configuration Menu and moves among digits.
- **+:** Increases the digit value and goes to next menu.
- **-:** Decreases the digit value and goes to the previous menu.
- **DISPLAY:** Shows the information and menus.

7.2. REAR PANEL

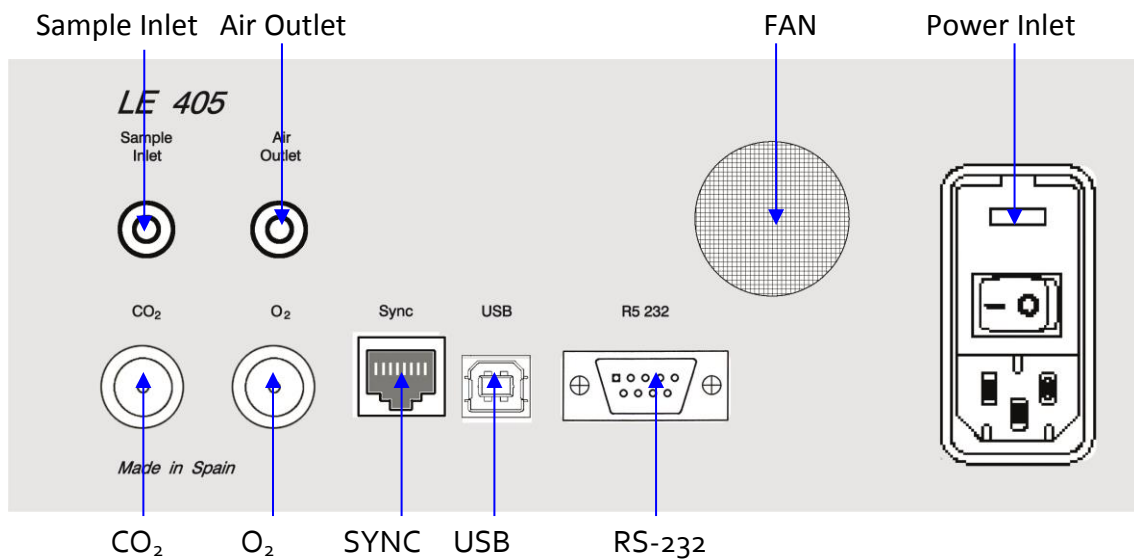


Figure 9. Rear Panel.

- **Sample Inlet:** The air enters the device through this inlet.



WARNING: **1150 mbar** is the maximum pressure accepted. Overpressure can cause permanent damage to the sensor. You must always use the filter in order to prevent that dust can damage the sensor.

- **Air Outlet:** The air exits the device by this outlet.
- **CO₂:** Analog output of the CO₂ concentration. (0.1V=0% and 1.1V=10%). The conversion factor is 0.01%CO₂/mV.
- **O₂:** Analog signal of the O₂ concentration (0mV=0% and 1000mV=100%). The conversion factor is 0.1%O₂/mV.
- **Sync:** Signal for synchronization with the LE 400.



WARNING: this is not an Ethernet inlet although the connector is the same.

- **USB:** USB port output for PC connection.
- **RS-232:** Serial port output to communicate with a PC or send data.
- **Power Inlet:** This is the power inlet, main switch and fuse holder.

7.3. FILTER

With the LE405 gas analyzer a 0.45µm filter is supplied. This filter must be plugged into the air inlet labelled **Sample Inlet** to prevent that dust could damage the optical O₂ - CO₂ sensors.



Figure 10. 0,45µm Filter.

7.4. NAFION TUBE

With the LE405 gas analyzer a **Nafion** tube is supplied. This tube must be connected to the 0.45µm filter and serves to balance the difference in relative humidity between ambient air "**Room Air** " and the air coming from the chambers where animals have been located for indirect calorimetry studies.



Figure 11. Nafion tube.

7.5. T-ADAPTOR

With the LE405 gas analyzer is supplied a **T-Adaptor**. This accessory is used whenever we calibrate the gas analyzer. One end is connected to the bottle with the reference gases, the other end is connected to the air inlet labelled **Sample Inlet** and the third end is opened to air, to try to prevent the reaching of excessive pressure to the sensor that could damage it.



Figure 12. T-Adaptor.

8. ELECTRICAL CONNECTIONS

8.1. INDIRECT CALORIMETRY

In the next figure is shown an example with two metabolic chambers:

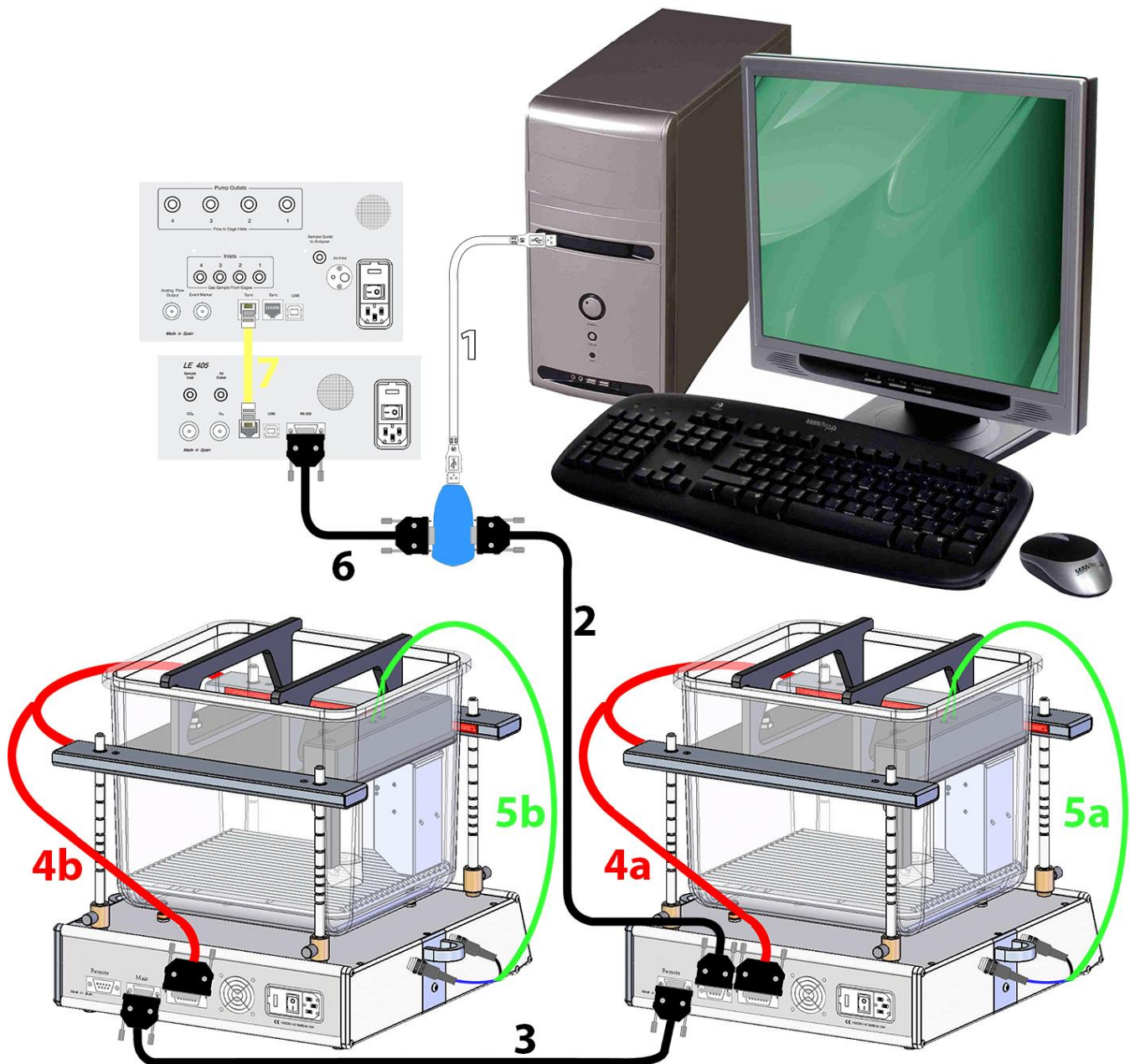


Figure 13. Electrical connections with two metabolic chambers.

For further information about this kind of experiment read the **LE1335** user's manual.

The following table details the connections:

	FROM	TO	CABLE
1 ¹	PC USB port	USB to RS232 adapter	USB A type male-female
2	USB to RS232 adapter	LE1335 1 MAIN	RS232 cable
3	LE1335 1 REMOTE	LE1335 2 MAIN	RS232 cable
4 ²	REARING IR BARRIER	REARING BEAMS	2 ANSLEYS 14 TO DB15
5 ³	FOOD & DRINK SENSORS	LE1335	2 MINI DIN 5 cable
6	USB to RS232 adapter	LE405 RS232	RS232 cable
7	LE405 SYNC	LE400 SYNC	SYNC cable

When more than 4 metabolic chambers are needed, you should use more than one LE400 units connected by the **SYNC** cables. Read the **LE400** user's manual for further information. In the following figure the MAIN-REMOTE connections of the **LE1335** units has been omitted to simplify the schematics, read the **LE1335** user's manual for further information.

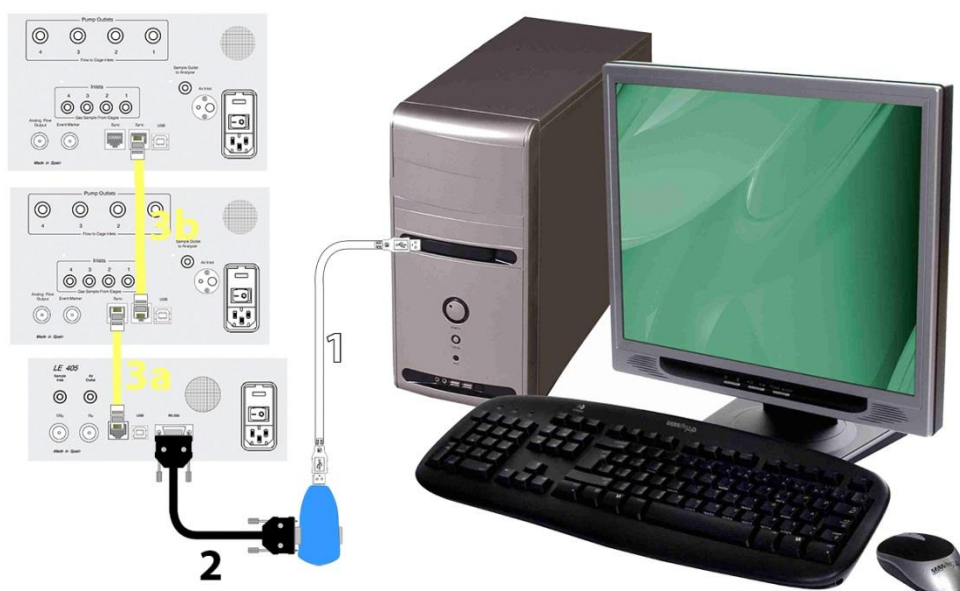


Figure 14. Connecting more than one LE400 units.

The following table details the connections

	FROM	TO	CABLE
1 ¹	PC USB port	USB to RS232 adapter	USB A type male-female
2	USB to RS232 adapter	LE405 RS232	RS232 cable
3a	LE405 SYNC	LE400 1 SYNC	SYNC cable
3b	LE400 1 SYNC	LE400 2 SYNC	SYNC cable

¹ If your PC has 2 COM ports, you will not need the USB to RS232 adapter.

² This connection is repeated for each metabolic chamber.

³ This connection is repeated for each metabolic chamber.

8.2. TREADMILL

In the next figure is shown an example with a Treadmill:

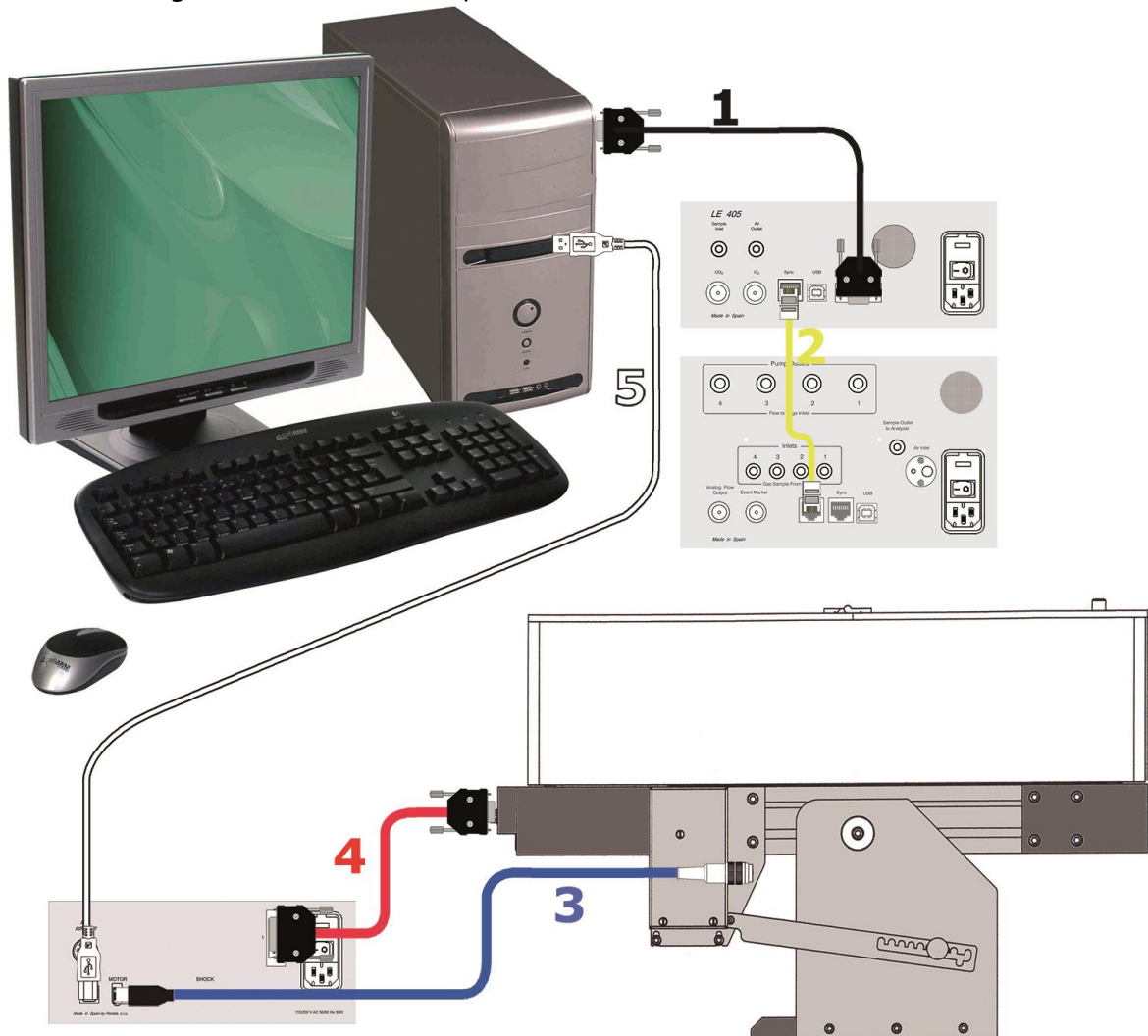


Figure 15. Electrical connections with the Treadmill.

The following table details the connections:

	FROM	TO	CABLE
1 ⁴	PC COM port	LE405 RS232	RS232 cable
2	LE405 SYNC	LE400 SYNC	SYNC cable
3	LE8700 TS MOTOR	MOTOR	MOTOR cable
4	LE8700 TS SHOCK	GRID	DB15 TO DB9 cable
5	LE8700 TS USB	PC USB port	USB type B-A

For further information about this kind of experiment read the **Treadmill** user's manual.

⁴ If your computer does not have available a COM port you will need an USB to RS232 adapter.

9. PNEUMATICAL CONNECTIONS

9.1. INLET AND OUTLET TUBE CONNECTIONS

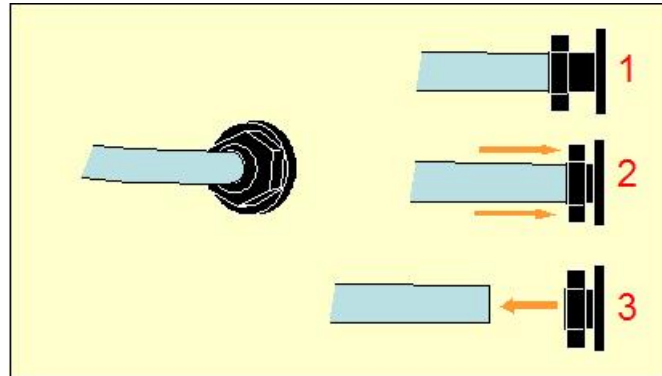


Figure 16. Inlet and outlet tubes connection and disconnection.



WARNING: This equipment features a system that keeps the tube affixed into the Inlets and Outlets. Simply push the tube firmly to connect it. To remove any tube from the outlets (see Figure 16), press the plastic ring inwards (2) and then pull the tube to remove it (3).



a)



b)

Figure 17. Tubes connected to the a) SAMPLE INLET and b) AIR OUTLET.

9.2. FILTER CONNECTION

To connect the 0.45 μm filter, you must turn it in clockwise direction, to fit the female luer connector in the nylon tube inserted into the air inlet labelled **Sample Inlet**.

To disconnect the filter from the nylon tube, simply turn it counter-clockwise.



Figure 18. 0.45 μm Filter connection.

9.3. NAFION TUBE CONNECTION

To connect the **Nafion** tube to the 0.45 μm filter, you must turn it in clockwise direction, in order to fit it in the free end of the filter.

To disconnect the **Nafion** tube from the filter, simply turn it counter-clockwise while you hold the filter.

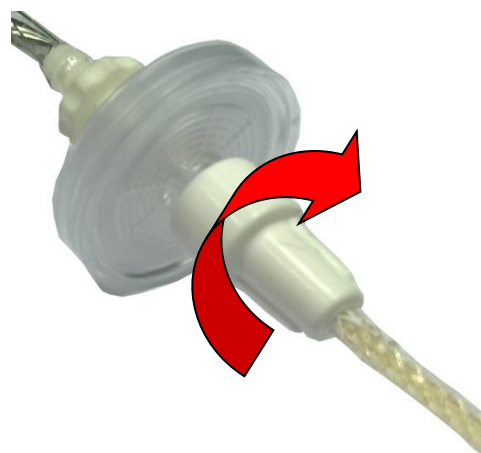


Figure 19. Nafion tube connection to the 0.45 μm filter.

9.4. INDIRECT CALOTIMETRY CONNECTION

The following figure shows the pneumatic circuit in a system with one **LE400**, four chambers and one **LE405** gas analyzer.

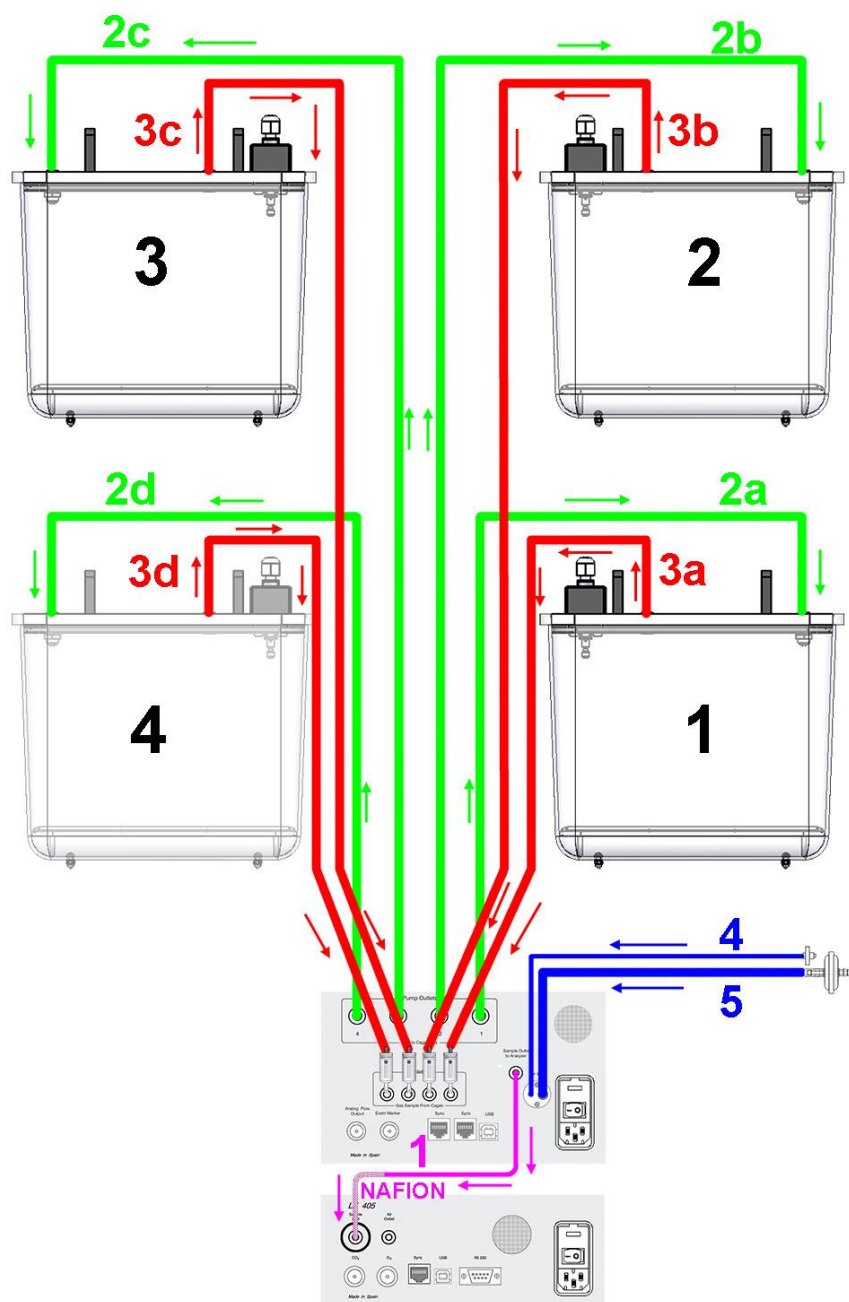


Figure 20. Pneumatic connections for indirect calorimetry.

The arrows indicate the direction of airflow. In this schematic is not used the **Room Air reservoir** that is available as accessory, for further information about it read the **LE400** user's manual.



WARNING: The tubes 4 and 5 which respectively serve for sampling the room air and the air inlet to the pump must be placed as far away as possible from the fan outlet to prevent air pollution as electro valves system expels air from chambers inside the equipment. Both tubes are attached and should be placed away from sources of air pollution. "Air pollution" refers to breathing from either animals or people.

The tubes and the necessary connections are listed in the following table:

	FROM	TO	Diameter of Tube	Colour
1	LE400 Sample Outlet	LE405 Sample Inlet	4mm+Nafion	purple
2 ⁵	LE400 Chamber N Outlet	Chamber N Inlet	6mm	Green
3 ⁵	Chamber N Outlet	LE400 Chamber N Inlet	4mm/6mm ⁶ + Manifold	Red
4	Air Inlet	Room	4.5mm	Blue
5	Air Inlet	Room	9.5mm	Blue

For further information read the **LE400** and **LE1335** user's manuals.

⁵ These connections are repeated for each chamber.

⁶ The diameter of these tubes is 6mm for Rats chamber and 4mm for Mice chambers.

9.5. TREADMILL CONNECTION

The diagram below shows the pneumatic connections needed for the special airtight treadmill used with the OxyletPro system for respiratory metabolism studies. The arrows indicate the direction of airflow.

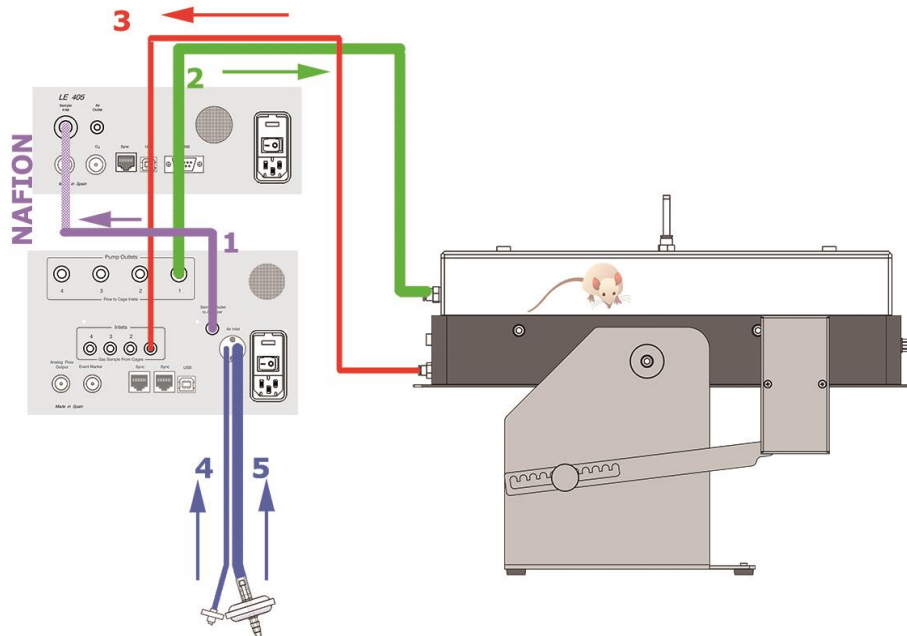


Figure 21. Pneumatic connections with the Treadmill.

The tubes and the necessary connections are listed in the following table:

	FROM	TO	Diameter of Tube	Colour
1	LE400 Sample Outlet	LE405 Sample Inlet	4mm+Nafion	Purple
2	LE400 Cage Outlet	Treadmill Inlet	4mm	Green
3	Treadmill Outlet	LE400 Cage Inlet	4mm	Red
4	Air Inlet	Room	4,5mm	Blue
5	Air Inlet	Room	9,5mm	Blue



WARNING: The tubes 4 and 5 which respectively are used for sampling the room air and the air inlet to the pump must be placed as far away as possible from the air supply fan outlet to prevent air pollution as electro valves system expels air from the Treadmill inside the equipment. Both tubes are linked together and should be placed away from any source of air "pollution". Both tubes have a filter at the end.

By source of air pollution, we refer to changes resulting from the breathing of other animals or of the researcher/facility staff. For further information read the **LE400** and **Treadmill** user's manuals.

10. WORKING WITH THE EQUIPMENT

10.1. STARTING OPERATIONS

The following diagram shows the sequence of screens when you conduct indirect calorimetry experiments.

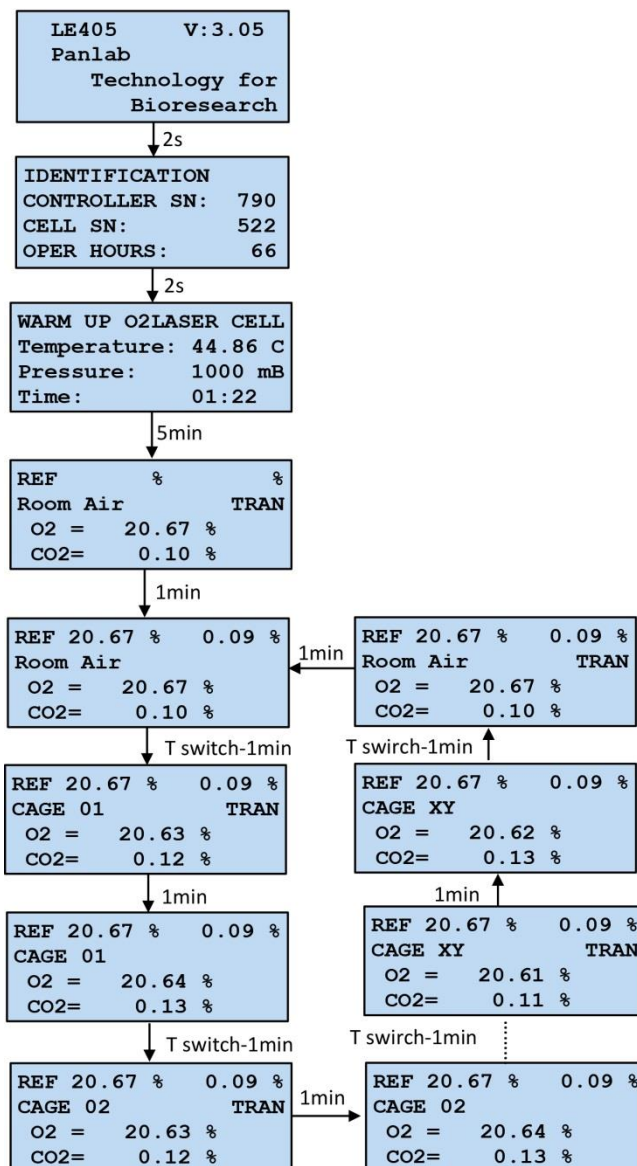


Figure 22. Sequence of screens working with the equipment.

T switch means the switching time selected in the LE400 in order to change among the different chambers and Room Air.

When the LE405 is turned on by the rear panel switch, the display will show the following screen:

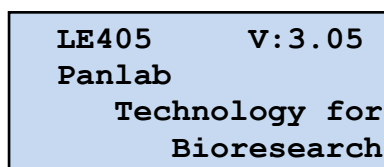


Figure 23. Start-up screen.

After 2 seconds the display will show the following screen

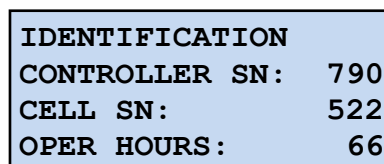


Figure 24. Identification screen.

The information shown is:

- **CONTROLLER SN:** The serial number of the board that controls the O₂ sensor.
- **CELL SN:** The serial number of the O₂ sensor.
- **OPER HOURS:** The number of hours that the equipment has been working.

After two seconds, the display will change to the following screen:

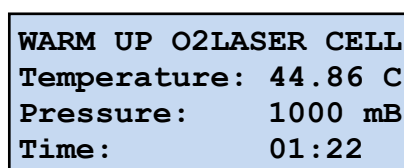



Figure 25. Warm-up screen.

The information shown is:

- **Temperature:** O₂ cell temperature in °C.
- **Pressure:** Pressure in the O₂ Cell in mbar.
- **Time:** Heating Time.

The user may press the  button to skip this screen and jump to the Operation screen (Figure 26).



WARNING: It is strongly recommended to wait at least 1 hour after powering the unit up before using the system for calibration or indirect calorimetry evaluation. This delay is needed for the LE405 to achieve a stable working temperature, needed to provide reliable data.

10.2. STANDARD OPERATION

After this period the following screen will be shown:

REF	%	%
Room Air		TRAN
O2 =	20.67	%
CO2=	0.10	%

Figure 26. Room Air Operation screen

After a short period of time (TRAN) the system will begin to provide the concentration of O₂ and CO₂ evaluated from the room air (air of the room taken from the LE405 sample inlet).

The first O₂ and CO₂ concentration values evaluated after the TRAN period will be automatically considered as the room air reference value and will be shown in the first line of the screen ("REF" line)

The information shown in the screen is the following:

- **Room Air/CAGE xy:** This indicator shows the source of air used for evaluation: Room Air or Cage xy. The LE400 equipment controls the switch between the cages, so indicate the source of air to be taken. The first digit after Cage "x" indicates the number assigned to the LE400 in the measuring process (start from 0) and the second digit "y" indicates the cage number (start from 1). For instance, "CAGE 03" refers to the cage connected to Channel 3 of the first LE400 in the chain and "CAGE 11" refers to the cage connected to Channel 1 of the second LE400 in the chain.
- **REF:** First measurements of the O₂ and CO₂ concentrations in the room air and taken as reference for the calculations provided on the screen.
- **O2:** Current measurement of the O₂ concentration (20 samples per second).
- **CO2:** Current measurement of the CO₂ concentration (20 samples per second).

The last 4 characters of the second line show the status of the evaluation process:

- **TRAN:** Indicates a transitory period due to cage change.
- **C-O2:** The equipment is performing an O₂ calibration.
- **CCO2:** The equipment is performing a CO₂ calibration.
- **ERR:** An error in the calibration process has occurred due to a cage change or an unexpected event.
- **:** Steady measuring state.

NOTE: The C-O₂, CCO₂, ERR status are not currently shown when the system is used for standard indirect calorimetry experiment in rat and mice. These status will only appear when the system is used for internal technical process (or in very specific applications) in which the system is working in calibration cycle mode or in auto calibration mode (see chapters 14.5 and 14.6).

When the equipment is receiving air from a cage, the display will show the next screen:

REF	20.67 %	0.09 %
CAGE 01		TRAN
O2 =	20.63 %	
CO2=	0.12 %	

Figure 27. Operation Cage screen.

Remember that the LE400 controls the switch between the cages and indicates the source of the evaluated air (Room Air, Cage 01, Cage 02 ,....).

11. CALIBRATION



WARNING: The calibration process is CRITICAL for obtaining reliable data. It is then very important to strictly follow the steps described in this chapter.

Even though the LE405 is calibrated at factory before its delivery, it is highly recommended to calibrate again the unit once it is placed in the final location where the experiments will take place.

In the case of a constant use of the system, we recommend the calibration process to be performed every day before beginning the next set of experiments. The calibration is also recommended each time the system is moved to another place or if it has not been used during a long period of time.

During the calibration process, the percentages of O₂ and CO₂ are calculated from the average values of measured absorption and linear interpolation between the high and low calibration points.

Needed material:

1. Calibration bottle (gas tank) with regulator (to be ordered to a local provider, see requirements in next paragraph).
2. T-adaptor (supplied with the system).

11.1. CALIBRATION BOTTLE

- The calibration tanks have to be purchased from a local provider.
- Two gas bottles (gas tanks) with different concentrations of O₂ and CO₂ are required.
- The higher concentration will be used to determine the High point and the lower concentration to determine the Low point.
- **HIGH:** is the higher concentration of the 2 reference samples.
- **LOW:** is the lower concentration of the 2 reference samples.

The tank concentrations values should be close to these values:

	High point	Low point
O ₂	50%	20%
CO ₂	1.5%	0%
N ₂	48,5%	80%

Basically, the two reference gases must have a difference of at least 15% for O₂ and 1% for CO₂.

Other recommended requirements for the 2 bottles:

- 10 liters volume.
- 150 bar pressure.
- Output with a stem for 6mm inner diameter.
- 2 pressure regulators of 3 bar pressure each (the model supplied will depend on the local provider).



WARNING: Please ask the local provider to provide a calibration certificate for each purchased bottle. A reliable calibration is only ensured when the calibration certificate is provided.

11.2. T-ADAPTOR

For the calibration process, a T-adaptor is needed to equalize the pressure of the bottle containing the reference gas to a value close to the atmospheric pressure (see the figure below). This operation avoids any overpressure to be applied on the sensor. To do so, a T-adaptor with a small hole is needed to connect with the room air atmosphere (supplied with the equipment).

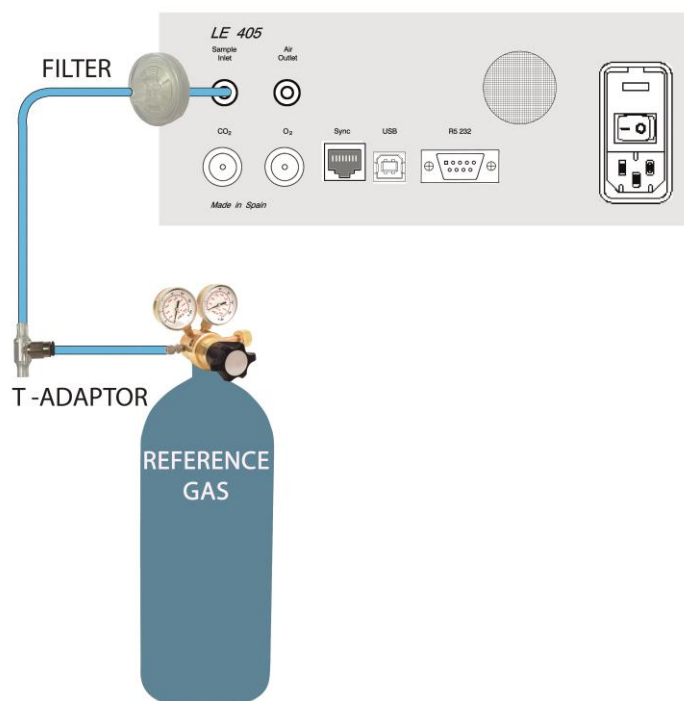



Figure 28. Calibration connections.

11.3. BEFORE BEGINNING THE CALIBRATION

Please follow the next steps for calibration the LE405 unit (the LE405 doesn't need to be connected to the LE400 switching unit during this operation):


1. When the LE405 unit has just been switched on, press the  button when you see the **Warm up** screen (see Figure 25). Then you will access to the configuration menu (see Figure 47 on page 39).

```

→ Filter selection
Enter|Exit|Next|Last
Cal  |Sel  | +   | -

```

Figure 29. Filter selection screen.



2. From the **Filter selection** screen press two times the  button to access to the **Switching Unit** screen.

```

→ Switching Unit
Enter|Exit|Next|Last
Cal  |Sel  | +   | -

```

Figure 30. Switching unit screen.

3. From the **Switching Unit** screen press the  button to enter in this menu.
4. Press several times the  button to select **None**. In this mode we will activate the **Sampling Pump** during the calibration procedure.

```



Switching Unit:
NONE
OK   |      |Next|Last
Cal  |Sel  | +   | -

```

Figure 31. Switching Unit None.




WARNING: If the **Sampling Pump** does not work during the calibration procedure, the calibration will be defective.

5. Then press the  button to save the configuration and return to the **Switching Unit** screen (see Figure 30).
6. From the **Switching Unit** screen press the  button to accept and return to the **Warm Up** screen (see Figure 25).
7. Please wait at least 1 hour before starting the calibration process.
8. Connect the **High point reference gas bottle** to the T-adaptor (without connecting the LE405, as we will begin to calibrate by the **High points**).

9. Slowly open the pressure regulator until the gas begins to come off through the free outlet in the T-adaptor (should be hardly perceptible).
10. Remove the **Nafion** tube from the LE405 (see chapter 9.3) and connect the other T-adaptor end directly to the 0.45 micron filter connected to the LE405 **Sample Inlet**.
11. Check that only a small amount (hardly noticeable) of gas comes off through the free outlet of the T-adaptor.
12. VERY IMPORTANT: Wait at least 5 min before going to the next point.

11.4. CALIBRATION MENU

13. By pressing the  button from the **Warm Up** screen (see Figure 25) or from any of the measurement screen (either the **Room Air** or **Cage XY**) (see Figure 22) you will access to the **Room Air Calibrate** screen.

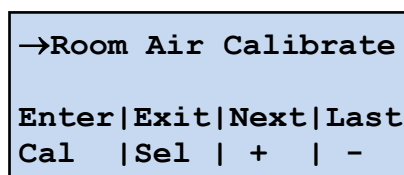


Figure 32. Room Air Calibrate screen.

In the following diagram is illustrated the map of screens in the **Calibration menu**.



WARNING: Only the area backlighted in yellow colour in the **Calibration menu** must be used when conducting standard experiments.



WARNING: The other two options (**Room Air Calibrate** and **Maximum SPAN O₂**) in the **Calibration menu** are for an exclusive use by our technical staff or very specific application in Physics. Please, do not choose them when conducting a standard experiment.

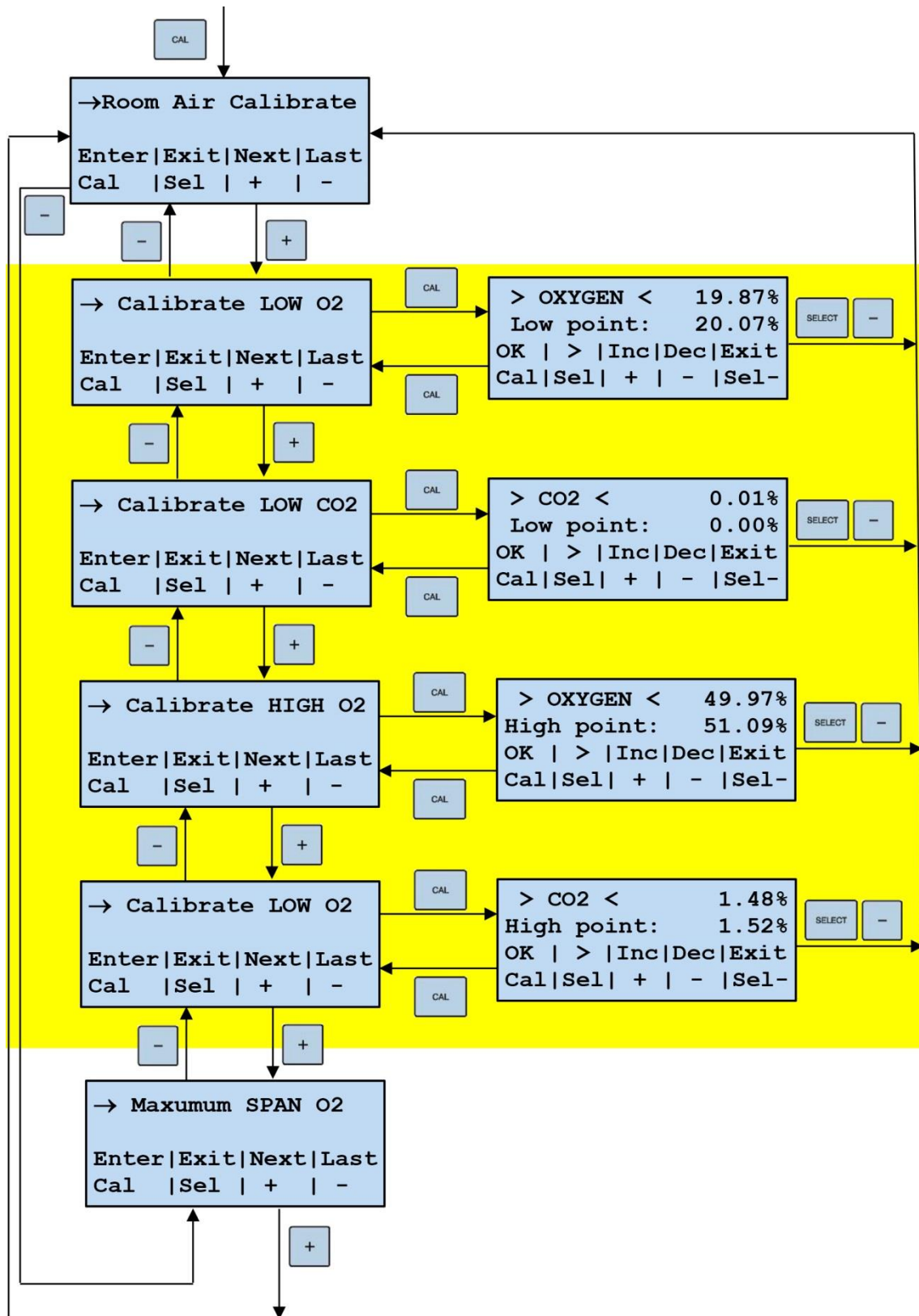



Figure 33. Calibration screens diagram.

11.5. GAS HIGH POINT CALIBRATION

14. Once you are in the **Room Air Calibrate** screen (see Figure 32), press three times the  button to access to the **Oxygen High Point selection** screen.

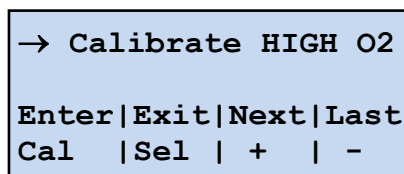


Figure 34. Oxygen High point selection screen.

15. Press the  button for entering. The following screen will appear:

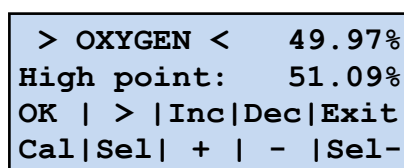








Figure 35. Oxygen High point calibration screen.

The current measured value is shown on the first line. The concentration of the reference gas is shown on the second line. This value can be changed by the user and must be substituted by the exact value of the **concentration of O₂ in the bottle as is indicated in the calibration certification** (51,09% in our example).


16. Enter the value of O₂ concentration shown in the calibration certificate of the bottle used as reference.



- Press the  button for jumping between digits.
- Press the  button for increasing the value of the current digit.
- Press the  button for decreasing the value of the current digit.



17. Press the  button for accepting the value of the high point. After a few seconds, the system will return to the previous screen.


NOTE: Press the  and  buttons for aborting the calibration process from the step (17) and then returning to the **Room Air Calibrate** screen.

18. Wait until the calibration process is complete and check the accuracy (this process may take some minutes).

To do that, enter the calibrated point by pressing the  button again and check whether the measured value is close enough to the reference value. The calibration is considered as finished when the variation between these 2 values is no more than

0.01% during at least 3 minutes. If this criterion is not reached after some minutes, press the  button to accept the reference value and press again the  button to check again the progress of calibration. Repeat this operation (accepting the value, checking the value) until reaching the criterion.

When the calibration is correct press   to exit to come back to the calibration screen and follow with the calibration of the CO₂ high point.

19. From the **Oxygen High point selection screen** (see Figure 34) press once the  button to access to the **CO₂ High point selection screen**.

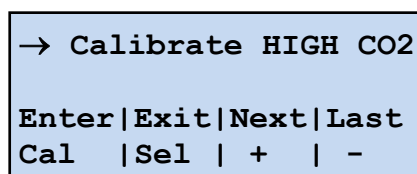


Figure 36. CO₂ High point selection screen.

20. Press the  button for entering. The following screen will appear:

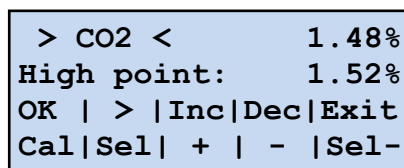










Figure 37. CO₂ High point calibration screen.

21. Enter the value of CO₂ concentration shown in the calibration certificate of the gas bottle (in our example 1.52%).

- Press the  button for jumping between digits.
- Press the  button for increasing the value of the current digit.
- Press the  button for decreasing the value of the current digit.

22. Wait until the calibration process is complete and check the accuracy (this process may last some minutes).

To do that, enter the calibrated point by pressing the  button again and check whether the measured value is close enough to the reference value. The calibration is considered as finished when the variation between these 2 values is no more than 0.01% during at least 3 minutes. If this criterion is not reached after some minutes, press the  button to accept the reference value and press again the  button to check again the progress of calibration. Repeat this operation (accepting the value, checking the value) until reaching the criterion.

When the calibration is correct press   to exit to come back to the calibration screen and follow with the calibration of the gas low points.

23. Disconnect the LE405 unit and gas tank to the extremities of the tubes connected to the T-adaptor.

11.6. GAS LOW POINT CALIBRATION

24. Connect the **Low point reference gas bottle** to the T-adaptor (without connecting the LE405, as we will begin to calibrate the **Low points**).
25. Slowly open the pressure regulator until the gas begins to come off through the free outlet in the T-adaptor (should be hardly perceptible).
26. Connect the other T-adaptor end directly to the 0.45 micron filter at the LE405 **Sample Inlet**.
27. Check that only a small amount (hardly noticeable) of gas comes off through the free outlet of the T-adaptor.
28. VERY IMPORTANT: Wait at least 5 min before going to the next point.

Repeat the same steps described here above with the second calibration bottle obtaining the low point gas concentrations.

→ Calibrate LOW O2
Enter|Exit|Next|Last
Cal |Sel | + | -

→ Calibrate LOW CO2
Enter|Exit|Next|Last
Cal |Sel | + | -

Figure 38. Selection screens for Oxygen and CO2 low points.



WARNING: If you are using a 0% CO₂ concentration for the low CO₂ point calibration; sometimes would be able to appear a negative value (-0.01%) when you are checking the calibration. This value is due to electronic noise in the circuit that measures CO₂. This will not affect any calculations performed by the system. The calculations within OxyletPro are based mainly on the differences between **Room Air** and **Cage** concentrations.

11.7. EXIT FROM THE CALIBRATION PROCESS

The following diagram shows the map of the screens when we are saving the Calibration.

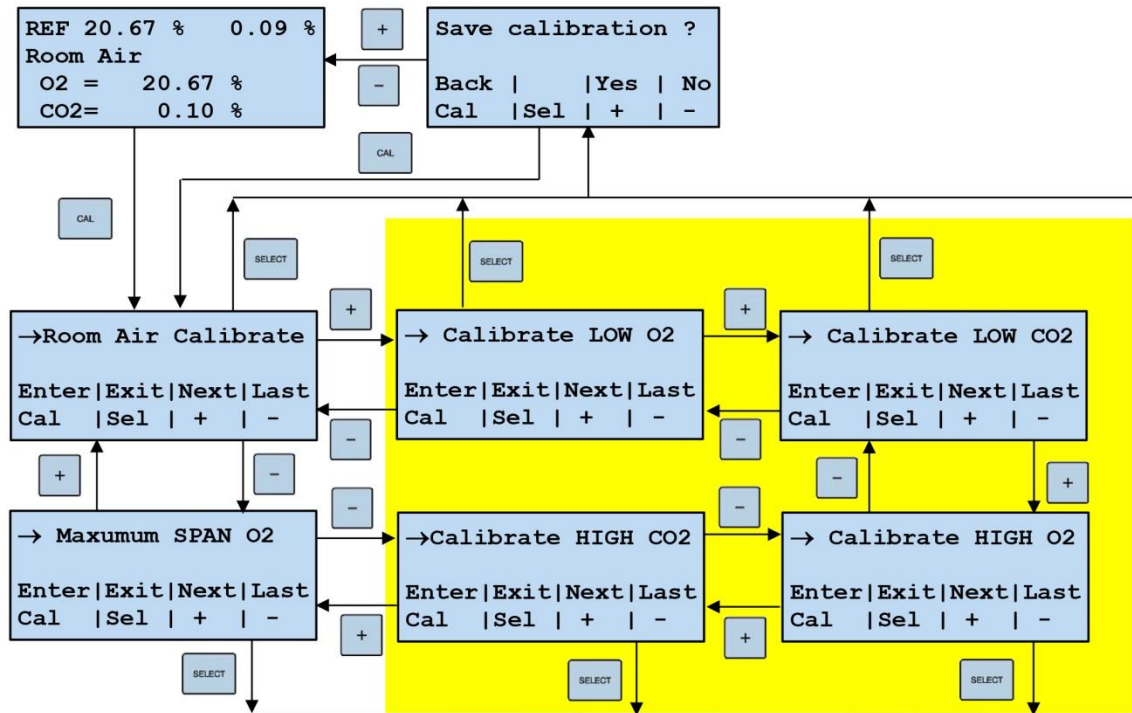



Figure 39. Map of the screens saving the calibration.



WARNING: Only the area backlighted in yellow colour in the **Calibration menu** must be used when conducting standard experiments.







WARNING: The other two options (**Room Air Calibrate** and **Maximum SPAN O2**) in the **Calibration menu** are for an exclusive use by our technical staff or very specific application in Physics. Please, do not choose them when conducting a standard experiment.





29. Being on the initial calibration screen, press  to exit the calibration menu. The following screen will appear:

Save calibration ?			
Back		Yes	No
Cal	Sel	+	-

Figure 40. Save Calibration screen.

- Press the  button for entering again into the Calibration screen to perform a new calibration or calibrate with another gas.
- The  button has no function on this screen.
- Press the  button for accepting the calibration and return to the **Measurement** screen (**Room Air** or **Cage XY**).
- Press the  button for exiting the calibration process **without saving** the calibration and return to the **Measurement** screen (**Room Air** or **Cage XY**).

11.8. SETUP AGAIN SWITCHING UNIT

- Restart the control unit.
- Once you have saved the calibration, press the  button when you see the **Warm up** screen (see Figure 25). Then you will access to the configuration menu (see Figure 47 on page 39).
- From the **Filter selection** screen (see Figure 29) press two times the  button to access to the **Switching Unit** screen.
- From the **Switching Unit** screen (see Figure 30) press the  button to enter in this menu.
- Press several times the  button to select **LE400**. In this mode we will inform to the control unit is connected to the LE400.

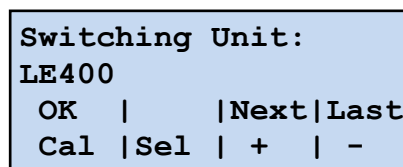




Figure 41. Switching Unit LE400.



WARNING: There are other modes like **LE4004** and **LE4008** that are used with very old models of **Air Switch and Flow**, in addition you will need an especial **Link** cable to connect them to the **LE405 gas analyzer**.

- Then press the  button to save the configuration and return to the **Switching Unit** screen (see Figure 30).
- From the **Switching Unit** screen press the  button to return to the **Warm Up** screen (see Figure 25).


12. GETTING A NEW REFERENCE

Getting a new reference value consists in rejecting the reference value taken automatically by replacing it by a new one chosen by the user from the next Room Air sample evaluated in the same cycle.

NOTE: In a general manner, users running a standard indirect calorimetry experiment in rodent will not need to take a new reference, so they can directly jump to the next chapter.

A change in the reference value can be considered in very specific cases such as an internal technical use of the system for checking the gas concentrations of a given air mixture or for very specific applications in which the system is working in calibration cycle mode or in auto calibration mode (see chapters 14.5 and 14.6).

This option is only used for specific technical considerations.

If the user would like to consider another Room Air value as REF value, the  key has to be pressed on the following screen:

REF	20.67 %	0.09 %
Room Air		
O2 =	20.64 %	
CO2=	0.10 %	

Figure 42. Operation screen.



NOTE: This operation can only be executed when the system is evaluating the Room Air.

The display will then show the following message:

Get	20.64%	0.09%
as a new reference ?		
	Yes	No
	+	-

Figure 43. New reference screen.

These are the O₂ and CO₂ to be taken as new references.

Press  to accept it (then the current room air values will be considered then as the new REF value used for the calculations shown on the display) and  to reject it.

13. OTHER CALIBRATION MODES

Additionally to the next calibration points; Calibrate HIGH O₂, Calibrate HIGH CO₂, Calibrate LOW O₂ and Calibrate LOW CO₂, other points are available from the calibration menu. These calibration modes are indicated here only as information; they are not used in standard indirect calorimetry in rodents.

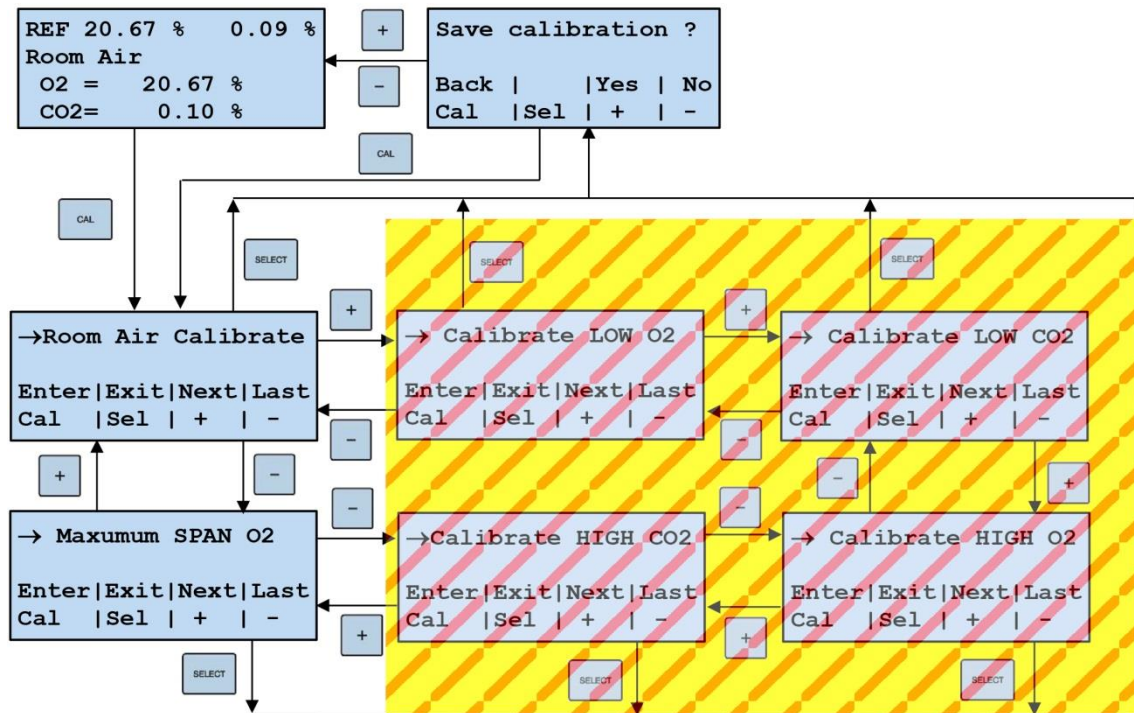


Figure 44. Other Calibration modes.

13.1. ROOM AIR CALIBRATE

Allows calibration of the LOW O₂ and LOW CO₂ points using as reference the gas concentrations evaluated in the **Room Air**. This option is useful only if the stability of the Room Air can be ensured (and that is not the case in standard indirect calorimetry in rodents).

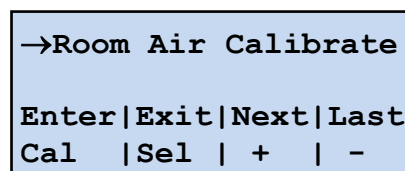


Figure 45. Room Air Calibrate screen.

13.2. MAXIMUM SPAN O₂

Briefly, the Maximum SPAN O₂ sets the maximal O₂ measured value. This sensor then adjusts the gain of its internal amplifiers for achieving maximal precision in these conditions. Using the SPAN O₂ option fixes the SPAN O₂ at the maximum expected O₂ value and then performs the Low and High points of the O₂ calibration. The measured values and the values used for calibration should then be lower than the set SPAN value. If these conditions are followed, the values supplied by the LE405 will be correct.

However, the recommended calibration process for standard indirect calorimetry experiments in laboratory animals is the one described chapter 11 implicating the 4 calibration points (high and low points). If incoherent values are found using the **MAXIMUM SPAN O₂** calibration, the standard calibration should be repeated using the recommended procedure in chapter 11.

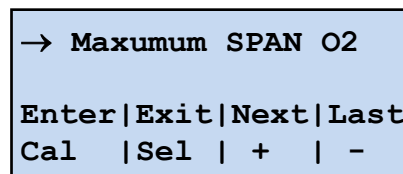


Figure 46. Maximum SPAN O₂ screen.

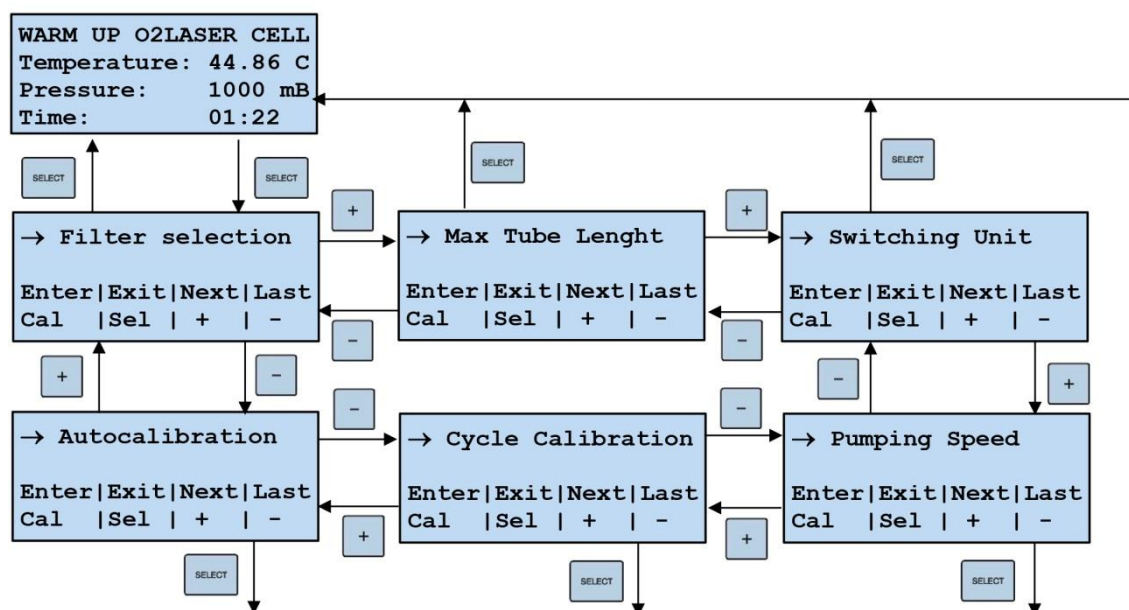
14. LE405 CONFIGURATION

Before using the LE405 for the experiments, the following configurations have to be considered:

- LE405 Calibration (see chapter 11)
- LE400 Switching Unit (see chapters 11.3, 11.8 and 14.3)

Other configurations are available for very specific technical uses or applications. Users running a standard indirect calorimetry experiment in a rodent will not need to consider these configurations, so they can directly jump these chapters.

- Filter selection (see chapter 14.1).
- Max Tube Length (see chapter 14.2).
- Switching Unit (see chapter 14.3).
- Pumping speed (see chapter 14.4).
- Cycle calibration (see chapter 14.5).
- Auto calibration (see chapter 14.6).




➤ Figure 47. Map of Screens in the Configuration menu.

14.1. FILTER SELECTION

The function of the filter is to eliminate any noise in the detection of the O₂ and CO₂ gas performed by the LE405 unit. This is an internal configuration performed in the factory. The filter providing an optimal reliability for standard indirect calorimetry experiment in rodents has been chosen and cannot be changed by the user.



WARNING: This menu is for an exclusive use by our technical staff or very specific application in Physics. Please, do not change it when running a standard experiment.

- From the **Warm-up** screen (Figure 25), press the  button. The **Filter Selection** screen will appear:

```

→ Filter selection
Enter|Exit|Next|Last
Cal  |Sel  | +   | -

```

Figure 48. Filter selection screen.




- Press the  button to enter. The next screen will appear:

```

-> O2 FILTER: 11
   CO2 FILTER: 11
   OK  | -> |Inc  |Dec
Cal  |Sel  | +   | -



```

Figure 49. O₂ y CO₂ Filter selection.

- Press the  button for selecting the O₂ FILTER or the CO₂ FILTER.
- Press the  or  buttons for increasing or decreasing the value of the filter. Please refers to the folloiwng table to know the filter asociated to each value.

N	STEP RESPONSE
0	No filtering
1	20 ms running average
2	40 ms running average
3	80 ms running average
4	160 ms running average
5	200ms exponential response
6	300ms exponential response
7	500ms exponential response
8	1 second exponential response
9	2 second exponential response
10	4 second exponential response
11	8 second exponential response
12	16 second exponential response
13	Prediction filter to enhance response time

The values set by default at Factory are 11 for O₂ and 11 for CO₂.



5. Press the  button for accepting the value and returning to the **Filter selection** screen (see Figure 48).
6. Press the  button to return to the **Warm Up** screen (see Figure 25).

14.2. MAX TUBE LENGTH

The Max Tube Length providing an optimal reliability for standard indirect calorimetry experiment in rodents has been chosen at factory and cannot be changed by the user.



WARNING: This menu is for an exclusive use by our technical staff or very specific application in Physics. Please, do not change it when running a standard experiment.


1. From the **Warm-up** screen (Figure 25), press the  button. The **Filter Selection** screen (see Figure 48) will appear.
2. Press once the  button to access to the **Max Tube Length** screen.

```

→ Max Tube Length

Enter|Exit|Next|Last
Cal |Sel | + | -
  
```





➤ Figure 50. Max Tube Length screen.

3. Press the  button to enter. The next screen will appear:

```

TUBE LENGTH:    3 m
TRANS. TIME:    01:00
OK  |   | Inc | Dec
Cal |Sel | +  | -
  
```



Figure 51. Max Tube Length change screen.

4. By pressing the  or  buttons, the **Length** value is increased or decreased, and automatically the **Transistion Time** parameter is changed. But this parameter **must not be changed** and is set at factory to 3 meters as optimal value.
5. Press the  button for accepting the value and returning to the **Max Tube Length** screen (see Figure 50).
6. Press the  button to return to the **Warm Up** screen (see Figure 25).

14.3. SWITCHING UNIT

The LE405 unit can be connected to various models of switching devices. The switching device model connected to the gas analyzer needs to be indicated to the LE405 to ensure optimal synchronization of their respective functions. The LE400 switching unit series (LE4002FL, LE4004FL) is configured by default in the factory. This configuration should only to be changed if a different model is used (old LE400-4 and LE400-8 models) or no switching unit is connected.

To do that, follow the next steps:

1. From the **Warm-up** screen (Figure 25), press the  button. The **Filter Selection** (see Figure 48) screen will appear.
2. Pres twice the  button to access to the **Switching Unit** screen.

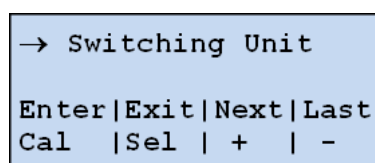



Figure 52. Switching Unit screen.

3. Press the  button to enter in the Switching Unit configuration panel:

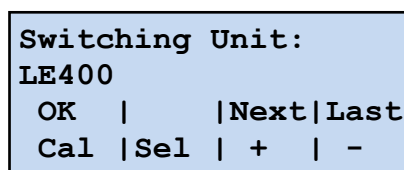







Figure 53. Switching unit selector.

4. Use the  and  buttons for selecting the switching device model connected to the LE405.
 - **LE400** (by default setting): standard switching unit (LE4002FL, LE4004FL,) with digital synchronization port.
 - **LE400-4** and **LE400-8**: old models, requires additional hardware.
 - **NONE**: this mode has only to be selected when the LE405 unit works in an independent manner (without connected switching unit) or when the user prefers that the air flow is not stopped in the cages when there are no cages selected.

In this screen, the  button has no function.



5. Press the  button to accept the selection and return to the **Switching Unit** screen (see Figure 52).
6. Press the  button to return to the **Warm Up** screen (see Figure 25).

14.4. PUMPING SPEED

Pumping Speed setting corresponds to the setting of the air flow received by the LE405. The **Low Speed Pump** corresponds to airflow in the LE405 during measurement and **High Speed Pump** corresponds to airflow in the LE405 during the transition from one cage to another one.



WARNING. The pump speed is set by default in the factory for ensuring optimal measurements related to the standard use of the system for indirect calorimetry experiment in rodents. Users should not change these settings; its use is limited to technical use by the manufacturer.

1. From the **Warm-up** screen (Figure 25), press the  button. The **Filter Selection** (see Figure 48) screen will appear.
2. Press three times the  button to access to the **Pumping Speed** screen.

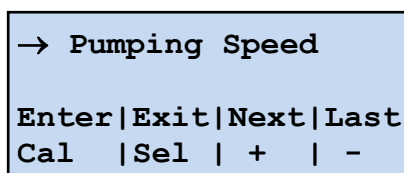


Figure 54. Pumping Speed screen.

3. Press the  button for entering into the speed management screen.

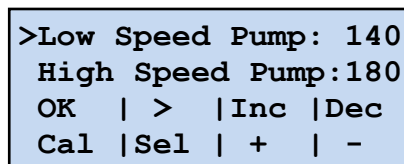







Figure 55. Speed management screen.

4. Press the  button for changing between the Low Speed (measurement) settings or High Speed (transition) settings.
5. Press the  and  buttons to increase or decrease the speed values. If the button is held pressed, the values will increase or decrease with a constant rhythm. The default values are 140 ml/min for **Low Speed Pump** and 180 ml/min for **High Speed Pump**.
6. Press the  button to accept the selected values and return to the **Pumping Speed** screen (see Figure 54).
7. Press the  button to return to the **Warm Up** screen (see Figure 25).



14.5. CYCLE CALIBRATION

The LE405 unit can work with other calibration modes than the one used for standard indirect calorimetry in rodents.

When using the Cycle Calibration, the device will perform a new calibration process using the reference values evaluated in the Room Air each time a switch is performed for the Room Air.



WARNING. This calibration mode is only reliable when the room air is strictly controlled; any change during the experiment may provide unreliable data. As indicated in previous paragraphs and chapter, this configuration is then not recommended for using the system in standard indirect calorimetry experiments in rodents, so it should not be chosen by the user. Its use will be limited to technical use by the manufacturer or very specific application in Physics.

1. From the **Warm-up** screen (Figure 25), press the  button. The **Filter Selection** (see Figure 48) screen will appear.
2. Press twice the  button to access to the **Cycle Calibration** screen.

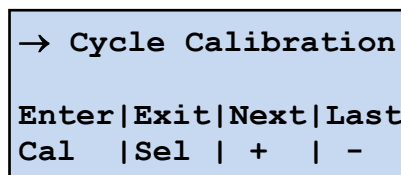



Figure 56. Cycle calibration screen.

3. Press the  button for entering the configuration screen:

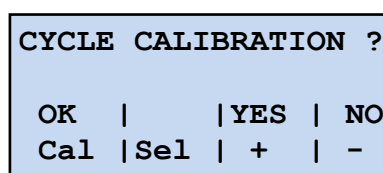






Figure 57: Cycle calibration configuration screen.

4. Press the  button for selecting the Cycle Calibration mode or the  button for cancelling the selection. The label **YES** or **NO** will appear in the second row of the display.
5. Press the  button to accept the selected values and return to the **Cycle Calibration** screen (see Figure 56).
6. Press the  button to return to the **Warm Up** screen (see Figure 25).

14.6. AUTOCALIBRATION

The LE405 unit can work with other calibration modes than the one used for standard indirect calorimetry in rodents.

When using the Autocalibration mode, the device will perform a new calibration process using the reference values evaluated in the room air each time the value of the detected gases (O_2 or CO_2) are out of a user-defined margins (see next illustration).

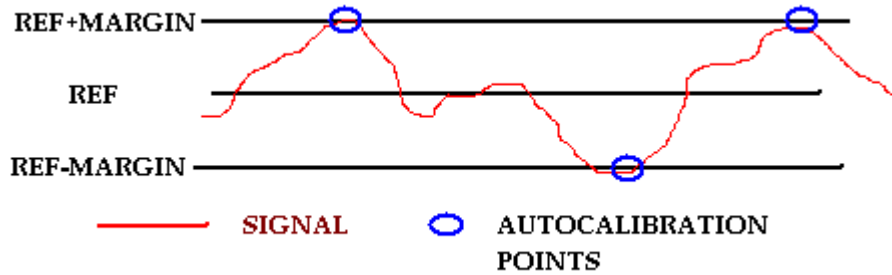




Figure 58. Auto Calibration margins.



WARNING: This calibration model is only reliable when the Room Air is strictly controlled; any change during the experiment may provide unreliable data. As indicated in previous paragraphs and chapter, this configuration is then not recommended for using the system in standard indirect calorimetry experiments in rodents, so it should not be chosen by the user. Its use will be limited to technical use by the manufacturer or very specific application in Physics.

1. From the **Warm-up** screen (Figure 25), press the  button. The **Filter Selection** (see Figure 48) screen will appear.
2. Press once the  button to access to the **Autocalibration** screen.

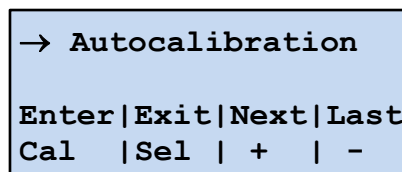


Figure 59. Autocalibration screen.

3. Press the  button for entering into the configuration screen:

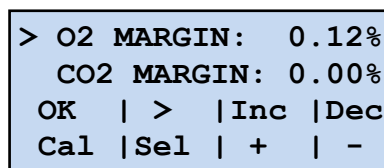







Figure 60. O_2 and CO_2 Autocalibration screen.

4. Press the  button for changing between O₂ MARGIN and CO₂ MARGIN.
5. Press the  or  buttons for increasing or decreasing the value of the margin. For the O₂ gas, a margin lower than 0.10% is recommended. The CO₂ sensor is extremely stable, so the use of the Autocalibration is not needed (except in very specific cases in which the precision of the sensor needs to be enhanced).
6. Press the  button for accepting the values and returning to the **Auticalibration** screen (see Figure 59).
7. Press the  button to return to the **Warm Up** screen (see Figure 25).

15. TROUBLESHOOTING

This table features instructions to solve the most frequent problems.

ISSUE	SOLUTION
The equipment does not turn on.	<ul style="list-style-type: none"> • Check that the mains voltage is the same for which the equipment is designed. • Check that the mains cable is connected. • Check the fuses.
Metabolism V3.0 PC software doesn't identify the LE405 device connected in the communication serial port.	<ul style="list-style-type: none"> • Turn off the LE405. Reconnect the RS232 connection cable between the PC and the LE405. Turn on the LE405 and Check the connection from Metabolism V3.0. • Repeat the previous step using a different free RS232 connection port in the USB-RS232 converter. • Replace the USB-RS232 converter or use a different free USB port in the computer.
The active cage is not properly shown on the front panel of the LE405.	<ul style="list-style-type: none"> • Check the correct connection of the cable RJ45 between the LE405 and the LE400X device. • Check the correct selection of the LE400 model in the Switching Unit menu option. Refer to chapter 14.3 in order to complete this task.
There is no change in the O ₂ , CO ₂ gas concentrations when the system changes the active channel from room air to cage.	<ul style="list-style-type: none"> • Check that the sampling tube with the Nafion tube (see Figure 11) is connected properly between the LE405 inlet and the LE400X outlet and there are no leaks. • Check any damage on the Nafion tube. Replace if necessary. • Check that the sampling pump speed is in the proper working range (100-220ml/min). Refer to chapter 14.4 in order to adjust the speed. • There is a possible failure in the sampling pump. Contact the technical service department for more instructions.
The equipment emits an unusual loud noise.	<ul style="list-style-type: none"> • If the noise comes from the sampling pump, then Check that the sampling pump speed is in the proper working range (100-220ml/min). Refer to chapter 14.4 in order to adjust the speed. • If the noise persists then contact the technical service department.

ISSUE	SOLUTION
The O ₂ , CO ₂ figures shown on the front panel of the LE405 are out of normal Room Air / Cage concentrations range.	<ul style="list-style-type: none"> • Proceed to recalibrate the LE405. Refer to chapter 11 Calibration.

17. PREVENTIVE MAINTENANCE

	EXPERIMENT	WHEN NECESSARY
CALIBRATION	<input checked="" type="checkbox"/> ⁷	
CHANGE THE FILTER		<input checked="" type="checkbox"/> ⁸
CHANGE THE TUBES		<input checked="" type="checkbox"/>
CHECK THE CONNECTIONS	<input checked="" type="checkbox"/>	

⁷ See Chapter 11.

⁸ See Chapter 9.2.

18. TECHNICAL SPECIFICATIONS

POWER SUPPLY Input voltage: Frequency: Input surge current: Fuse type: Maximum Power: Conducted Noise: Safety Ground Leakage Current:	Universal 100-240VAC 50/60 Hz <18 A at 115VAC/ <36 A at 230VAC 2 fuses 5x20 mm 2A 250V fast 25 W EN55022 /CISPR22/CISPR16 class B 0.62 mA maximum at 130 V 1.0 mA maximum at 260V
GENERAL SPECIFICATIONS Warm-up time: Maximum pressure at inlet sample: Maximum sample flow: Measuring sample flow: Anti-dust filter:	<10 min to be operative (3 hours for the best thermal stability) 1150 mB 300 ml/min 80 ml/min 0.45 µm replace every 3000 hours or before in dusty environments
OXYGEN SENSOR Technology: Sensor Cell temperature: Measurement range: Resolution: Linearity: Noise: Accuracy: Cross-Sensitivity: Median Lifetime of laser: Sampling period/ frequency: Response time:	Laser Diode Absorption Controlled at 45°C 0-100% (Only limited by the high calibration point used) 0.01% +/- 0.2% +/-0.03% (20ms avg.) +/- 0.2% (24 hours) +/- 0.2% (limited to atmospheric gases and CO ₂ concentration below 6%) >100 000 hours (> 11 years) 10ms / 100Hz 1.5 s (with filter 6)
CARBON DIOXIDE SENSOR Technology: Measurement range: Resolution: Accuracy:	Infrared Spectroscopy 0-10% 0.01% <10% of reading between 5%-10% CO ₂ <0.3% absolute for readings <5% CO ₂
RS232-C SERIAL OUTPUT Connector in rear panel: Output Format:	DB9 female 9600 baud, 8 data bits, even parity, 1 stop bit
ANALOGIC SIGNAL OUTPUTS Connectors: Output O ₂ : Range O ₂ : Output CO ₂ : Range CO ₂ :	Panel BNC female 10mV/%O ₂ 0-1V 100mV+(100mV/%CO ₂) 0.1-1.1V

ENVIRONMENTAL CONDITIONS Operating temperature: Operating relative humidity: Storage temperature:	10°C to +40°C 0% to 85% RH, non-condensing 0°C to +50°C, non-condensing
USB OUTPUT Version: Connector:	1.1 Low Speed (1.5Mbps/s) Type B
DIMENSIONS Width x Height x Depth: Weight:	235 x 110 x 300 mm 4.2 kg

**DECLARACIÓN DE CONFORMIDAD
DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITÉ**

Nombre del fabricante: **Panlab s.l.u.**
 Manufacturer's name: www.panlab.com
 Nom du fabricant: info@panlab.com

Dirección del fabricante: **Energía, 112**
 Manufacturer's address: **08940 Cornellà de Llobregat**
 Adresse du fabricant: **Barcelona SPAIN**

Declara bajo su responsabilidad que el producto: **GAS ANALYZER**
 Declares under his responsibility that the product:
 Déclare sous sa responsabilité que le produit:

Marca / Brand / Marque: **PANLAB**

Modelo / Model / Modèle: **LE 405**

Cumple los requisitos esenciales establecidos por la Unión Europea en las directivas siguientes:
 Fulfills the essential requirements established by The European Union in the following directives:
 Remplit les exigences essentielles établies pour l'Union Européenne selon les directives suivantes:

2006/95/EC	Directiva de baja tensión / Low Voltage / Basse tension
2004/108/EC	Directiva EMC / EMC Directive / Directive CEM
2012/19/EU	La Directiva de Residuos de Aparatos Eléctricos y Electrónicos (WEEE) / The Waste Electrical and Electronic Equipment Directive (WEEE) / Les déchets d'équipements électriques et électroniques (WEEE)
2011/65/EU	Restricción de ciertas Sustancias Peligrosas en aparatos eléctricos y electrónicos (ROHS) / Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (ROHS) / Restriction de l'utilisation de certaines substances dangereuses dans les équipements électriques et électroniques (ROHS)
2006/42/EC	Directiva mecánica / Machinery directive / Directive mécanique

Para su evaluación se han aplicado las normas armonizadas siguientes:
 For its evaluation, the following harmonized standards were applied:
 Pour son évaluation, nous avons appliqué les normes harmonisées suivantes:

Seguridad / Safety / Sécurité:	EN61010-1:2011
EMC:	EN61326-1:2012 Class B
FCC:	FCC47CFR 15B Class B
Safety of machinery:	EN ISO 12100:2010

En consecuencia, este producto puede incorporar el marcado CE y FCC:
 Consequently, this product can incorporate the CE marking and FCC:
 En conséquence, ce produit peut incorporer le marquage CE et FCC:



En representación del fabricante:
 Manufacturer's representative:
 En représentation du fabricant: **Carme Canalís**
General Manager
Panlab s.l.u., a division of Harvard BioScience

Cornellà de Llobregat, Spain
 27/06/2014

(GB) Note on environmental protection:



After the implementation of the European Directive 2002/96/EU in the national legal system, the following applies:

Electrical and electronic devices may not be disposed of with domestic waste. Consumers are obliged by law to return electrical and electronic devices at the end of their service lives to the public collecting points set up for this purpose or point of sale. Details to this are defined by the national law of the respective country. This symbol on the product, the instruction manual or the package indicates that a product is subject to these regulations. By recycling, reusing the materials or other forms of utilising old devices, you are making an important contribution to protecting our environment.

(E) Nota sobre la protección medioambiental:



Después de la puesta en marcha de la directiva Europea 2002/96/EU en el sistema legislativo nacional, Se aplicara lo siguiente:

Los aparatos eléctricos y electrónicos, así como pilas y baterías, no se deben tirar a la basura doméstica. El usuario está legalmente obligado a llevar los aparatos eléctricos y electrónicos, así como pilas y baterías, al final de su vida útil a los puntos de recogida municipales o devolverlos al lugar donde los adquirió. Los detalles quedaran definidos por la ley de cada país. El símbolo en el producto, en las instrucciones de uso o en el embalaje hace referencia a ello. Gracias al reciclaje, a la reutilización de materiales i a otras formas de reciclaje de aparatos usados, usted contribuirá de forma importante a la protección de nuestro medio ambiente.

(F) Remarques concernant la protection de l'environnement :



Conformément à la directive européenne 2002/96/CE, et afin d'atteindre un certain nombre d'objectifs en matière de protection de l'environnement, les règles suivantes doivent être appliquées.

Elles concernent les déchets d'équipement électriques et électroniques. Le pictogramme "picto" présent sur le produit, son manuel d'utilisation ou son emballage indique que le produit est soumis à cette réglementation. Le consommateur doit retourner le produit usager aux points de collecte prévus à cet effet. Il peut aussi le remettre à un revendeur. En permettant enfin le recyclage des produits, le consommateur contribuera à la protection de notre environnement. C'est un acte écologique.

(D) Hinweis zum Umweltschutz:



Ab dem Zeitpunkt der Umsetzung der europäischen Richtlinie 2002/96/EU in nationales Recht gilt folgendes:

Elektrische und elektronische Geräte dürfen nicht mit dem Hausmüll entsorgt werden. Der Verbraucher ist gesetzlich verpflichtet, elektrische und elektronische Geräte am Ende ihrer Lebensdauer an den dafür eingerichteten, öffentlichen Sammelstellen oder an die Verkaufsstelle zurückzugeben. Einzelheiten dazu regelt das jeweilige Landesrecht. Das Symbol auf dem Produkt, der Gebrauchsanleitung oder der Verpackung weist auf diese Bestimmungen hin. Mit der Wiederverwertung, der stofflichen Verwertung oder anderer Formen der Verwertung von Altgeräten leisten Sie einen wichtigen Beitrag zum Schutz unserer Umwelt.

(I) Informazioni per protezione ambientale:



Dopo l'implementazione della Direttiva Europea 2002/96/EU nel sistema legale nazionale, ci sono le seguenti applicazioni:

I dispositivi elettrici ed elettronici non devono essere considerati rifiuti domestici. I consumatori sono obbligati dalla legge a restituire i dispositivi elettrici ed elettronici alla fine della loro vita utile ai punti di raccolta collerici preposti per questo scopo o nei punti vendita. Dettagli di quanto riportato sono definiti dalle leggi nazionali di ogni stato. Questo simbolo sul prodotto, sul manuale d'istruzioni o sull'imballo indicano che questo prodotto è soggetto a queste regole. Dal riciclo, e re-utilizzo del material o altre forme di utilizzo di dispositivi obsoleti, voi renderete un importante contributo alla protezione dell'ambiente.

(P) Nota em Protecção Ambiental:



Após a implementação da directiva comunitária 2002/96/EU no sistema legal nacional, o seguinte aplica-se:

Todos os aparelhos eléctricos e electrónicos não podem ser despejados juntamente com o lixo doméstico. Consumidores estão obrigados por lei a colocar os aparelhos eléctricos e electrónicos sem uso em locais públicos específicos para este efeito ou no ponto de venda. Os detalhes para este processo são definidos por lei pelos respectivos países. Este símbolo no produto, o manual de instruções ou a embalagem indicam que o produto está sujeito a estes regulamentos. Reciclando, reutilizando os materiais dos seus velhos aparelhos, esta a fazer uma enorme contribuição para a protecção do ambiente.