



## USE AND MAINTENANCE



# S500

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# Combustion Analyzer



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# 1.0 IMPORTANT INFORMATION



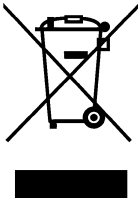

## 1.1 Information about this manual

- This manual describes the operation and the characteristics and the maintenance of the Combustion Analyzer model S500.
- Read this operation and maintenance manual before using the device. The operator must be familiar with the manual and follow the instructions carefully.
- This use and maintenance manual is *subject to change due to technical improvements - the manufacturer assumes no responsibility for any mistakes or misprints.*

## 1.2 Danger levels and other symbols



The magnets in the back of the instrument can damage credit cards, hard drives, mechanical watches, pacemakers, defibrillators and other devices proven sensitive to magnetic fields. It is recommended to keep the instrument at a distance of at least 10 inches away from these devices.

| Symbol  | Meaning   | Comments   |
|---|---|--|
|   | WARNING   | <p><b>Read information carefully and prepare safety appropriate action!</b></p> <p>To prevent any danger from personnel or other goods. Violating the information in this manual may cause danger to personnel, the plant or the environment and may lead to liability loss.</p> |
|  | Information on LCD  |  |
|  | Disposal Indications                                      | <p>Dispose of the battery pack at the end of its working life only at the dedicated collecting bin.</p> <p>This device must not be disposed as a urban litter. Dispose of the device according to national standards.</p>  |
|  | Keyboard with preformed keys with main control functions. |  |

## 2.1 Safety check

- Use the product according to what is described in chapter “Intended purpose”.
- During the instrument operation, comply with the current standards.
- Do not use the instrument if damaged on the outer cover, on the power supply plug or on the cables.
- Do not take measures on non-isolated components / voltage conductors.
- Keep the instrument away from solvents.
- For the maintenance of the instrument, strictly comply with what’s described in this manual at the “Maintenance” chapter.
- All the interventions not specified in this manual, may be performed exclusively by Seitron Americas assistance centres. Otherwise, Seitron Americas declines every responsibility about the normal operation of the instrument and on the validity of the several homologations.

## 2.2 Intended purpose

**This chapter describes the areas of application for which the S500 is intended.**

Using the S500 in other application areas is on the risk of the operator and the manufacturer assumes no responsibility and liability for loss, damage or costs which could be a result. It is mandatory to read and pay attention to the operating/maintenance manual.

All products of the series S500 are handheld measuring devices in professional flue gas analysis for:

- Small furnaces (burning oil, gas, wood, coal)
- Low-temperature and condensing boilers
- Gas heaters

## 2.3 Improper use of the product

S500 should not be used:

- As safety alarm instrument
- In classified zones with explosion risk (ATEX or equivalent)

## 2.4 Precautions for the usage of the Li-Ion battery package

Pay attention while handling the battery package inside the instrument; a wrong or improper usage may lead to heavy physical injuries and/or damages:

- Do not create a short circuit: make sure that the terminals are not in contact with metal or other conductive materials during transportation or storage.
- Do not apply with inverted polarities.
- Do not make the batteries come in contact with liquid substances.
- Do not burn the batteries nor expose to temperature higher than 140 °F (60°C).
- Do not try to disassemble the battery.
- Do not provoke collisions or pierce the batteries. Improper use can cause damages and internal short circuits not always externally visible. If the battery package has fallen or has been hit with an hard surface, regardless the external shell condition:
  - Stop operation;
  - Dispose of the battery in compliance with the disposal instructions.
- Do not use batteries with leaks or damages.
- Charge the batteries only inside the instrument.
- If a malfunction occurs or if over heating signs occur, immediately remove the battery package from the instrument. Warning: the battery may be hot.

### 3.1 General overview of the Analyzer

S500 is a portable industrial analyzer for flue gas and emissions monitoring.

**The instrument is equipped with:**

- Pneumatic line able to manage up to 2 sensors.
- Easy and immediate user interface so it could be used without the manual support.
- Wide and bright graphic display, White / Black (128x128 mm), thanks to an efficient backlighting.
- Rechargeable 'Li-Ion' battery.
- Supplied with the device is a feeder with output 5V  $\pm$  0.1V, 2A to charge the internal batteries.  
When needed, it is possible to recharge the instrument battery using a power bank, as long as it is equipped with 5 volts output and 1A minimum current.

**Main functions:**

- Combustion analysis in manual.
- Comes with the 12 most used fuel parameters (such as natural gas, LPG, gas oil and fuel oil).
- Generation and visualization of a QR code with the purpose of downloading the data of the acquired measures, having installed the App "**SEITRON SMART ANALYSIS**" which can be downloaded from the AppStore (if the version of the instrument foresees it).

**Measured values:**

- O<sub>2</sub>
- CO
- NO
- Combustion air temperature  
Gas pressure in the piping, pressure in the burning chamber and check of the pressure switches, using the measurement range up to 200hPa.
- Pressure measurement
- Pressure measurement of the gas alimentation line
- CO environment measurement (via the internal sensor)
- Draft measurement

**Calculated values:**

- Stack leaks
- Combustion efficiency
- CO<sub>2</sub>
- NO<sub>x</sub>
- Air excess
- Poison index (CO/CO<sub>2</sub> ratio)

**Maintenance:**

- Sensors can be replaced by the user without having to ship the instrument to the service center, because the spare sensors delivered are pre-calibrated.
- The instrument requires annual calibration.

**Certificate of calibration**

The instrument is accompanied with a calibration certificate, according to the ISO/EN 17025 standard.



## 4.0 DESCRIPTION OF THE PRODUCT

### 4.1 Working principle

The gas sample is taken in through the gas probe, by a diaphragm suction pump inside the instrument.

The measuring probe has a sliding cone that allows the probe to be inserted in holes with a diameter of 11 mm to 16 mm and to adjust the immersion depth: **it is recommended to have a gas sampling point roughly in the center of the flue/stack.**

The gas sample is cleaned of humidity and impurities by a condensate trap and filter located inside the instrument.

The gas is then analyzed in its components by electrochemical.

The electrochemical cell guarantees high precision results in a time interval of up to about 60 minutes during which the instrument can be considered very stable.

When measurement is going to take a long time, we suggest auto-zeroing the instrument again and flushing the inside of the pneumatic circuit with clean air.

During the zero calibrating phase, the instrument aspirates clean air from the environment and detects the cells' drifts from zero (20.95% for the O<sub>2</sub> cell), then compares them with the programmed values and compensates them.

### 4.2 Measurement cells

The instrument takes advantage of pre-calibrated gas sensors for the measurement of Oxygen (O<sub>2</sub>), Carbon Monoxide (CO) and Nitric Oxide (NO).

The sensors do not need particular maintenance yet they have to be replaced periodically when exhausted.

If sensors of toxic gases are submitted to concentrations higher than 50% of their measurement range for more than 10 minutes continuously, they can show up to  $\pm 2\%$  drift as well as a longer time to return to zero.

In this case, before turning off the analyzer, it is advisable to wait for the measured value be lower than 20ppm by in taking clean air.

Anyway, the instrument is intended to have a cleaning cycle of the pneumatic circuit, which duration depends on what has been set in the menu Configuration→Analysis→Autozero.

Exhausted cells can be easily replaced by the user without depriving himself of the instrument and without complicated calibration procedures with certified mixtures as they are pre-calibrated before being supplied.

Seitron americas certifies the accuracy of the measurements only upon a calibration certificate issued by its laboratory or other approved laboratory.

### 4.3 Fuel types

The device is provided with the technical data of the most common types of fuels stored in its memory.

For more details [see Annex D](#).

### 4.4 Sample treatment

The gas sample to be analyzed must be delivered to the measuring sensors properly dried and cleaned of solid residues of combustion; actually for this reason it is usually named 'dry analysis'.

For this purpose, on the gas suction line, is mounted an anti-condensation trap with dust filter.

### 4.5 Pressure sensor, piezoelectric, temperature compensated

The instrument is internally provided with a piezoresistive differential pressure sensor which can be used for measuring the draft (vacuum) in the stack for differential pressure measurement and possibly for other measurements (pressure of gas in the piping, pressure loss across a filter, etc.).

The measurement range is -10.000 Pa .. +20.000 Pa.

Any potential drift of the sensor are nulled thanks to the autozeroing system.



#### WARNING

**ANY PRESSURE APPLIED TO THE SENSOR GREATER THAN  $\pm 300$  hPa MAY CAUSE A PERMANENT DEFORMATION OF THE MEMBRANE, THUS DAMAGING IRREVERSIBLY THE SENSOR ITSELF.**

### 4.6 Suction pump

This diaphragm pump, located inside the instrument, is operated with a DC engine powered by the instrument in order to obtain the optimal suction flow rate of the flue gas for the ongoing analysis.

### 4.7 Draft measurement with sensor automatic autozero

S500 performs the draft measurement.

The sensor Autozero allows to make the zeroing of the sensor and must be done with the gas probe NOT inserted in the stack.

---

#### **4.8 Bluetooth® connection (if the version of the instrument foresees it)**

The S500 analyzer is internally equipped with a Bluetooth® module, which allows the communication with a remote Bluetooth® printer

The maximum transmission range in open field is 100 meters (Class 1 Bluetooth® module), provided that also the communication companion is equipped with a Class1 Bluetooth® interface.

This solution allows great freedom of movement for the operator who is no longer bound directly to the instrument for acquisition and analysis, with significant advantages for many applications.

#### **4.9 IR connection**

The S500 analyzer is internally equipped with an infrared light interface which uses the HP-IR protocol, which allows the communication with a remote IR printer.

#### **4.10 Software and available applications**

##### **Easy2print**

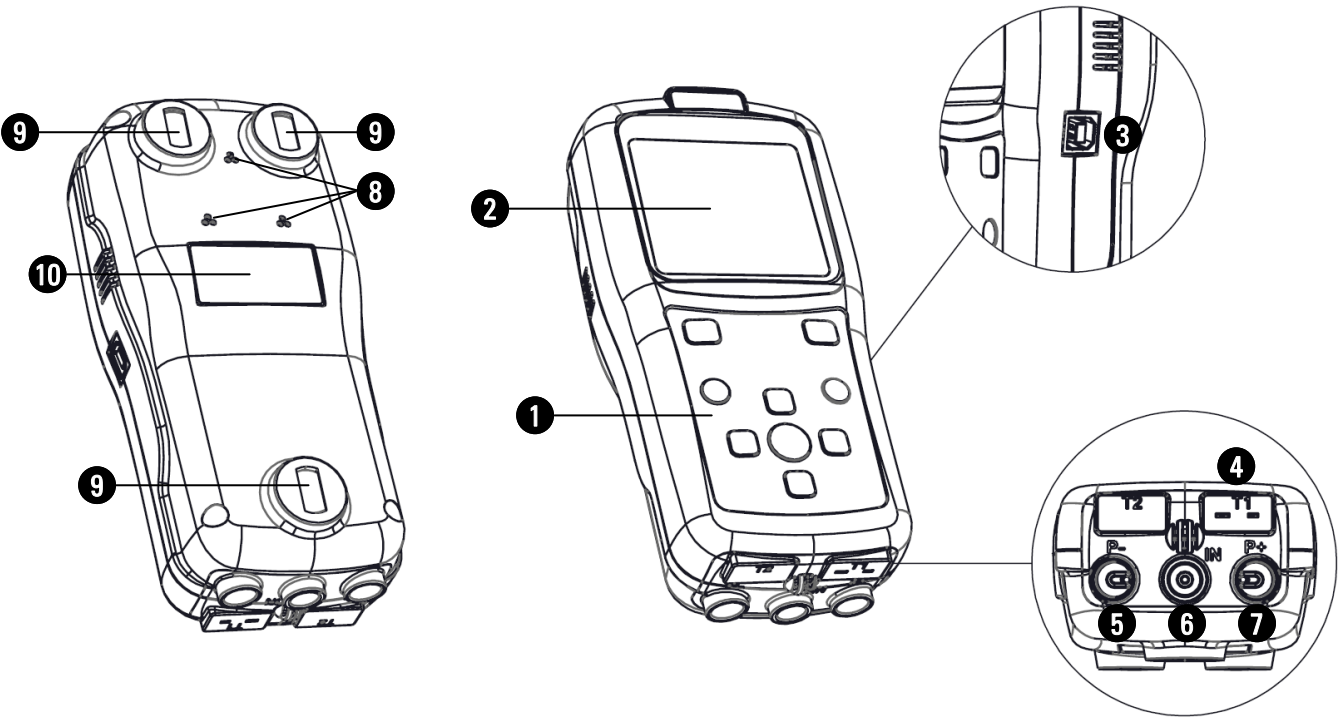
PC Software for systems provided with **Windows XP or later versions**, downloadable from the web site [www.seitronamericas.com](http://www.seitronamericas.com), allows to insert and to store in the instrument the heading of the ticket.

##### **SEITRON SMART ANALYSIS App**

This APP, allows to scan the QR code generated by the instrument, aiming to download the data of the performed analyses and/or measures.

# 5.0 COMPONENTS DESCRIPTION

## 5.1 Instrument interface



### DESCRIPTION:

#### 1 Polyester keyboard with preformed keys and main command functions:

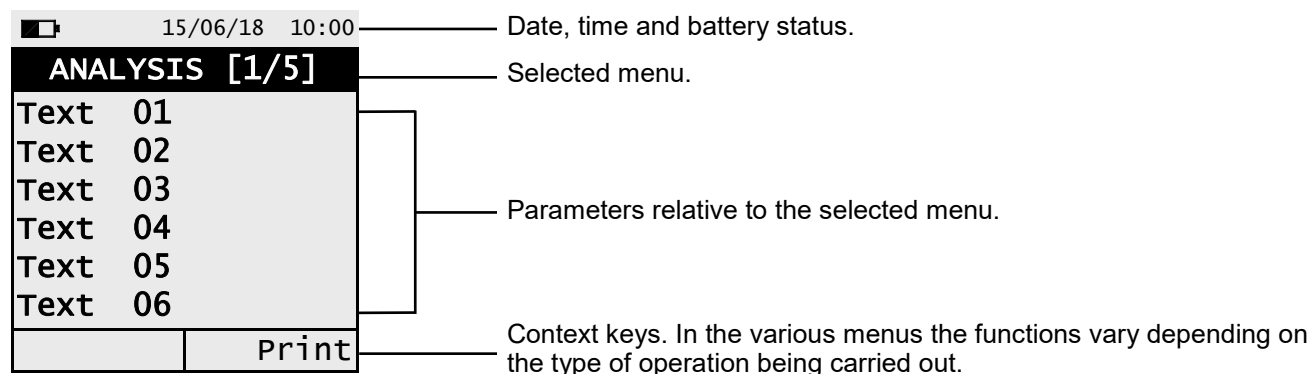
| KEYS | FUNCTION  |
|------|---|
|      | Activates the context keys shown on the display.  |
|      | <ul style="list-style-type: none"><li>- Turns on and off the instrument.</li><li>- If pressed briefly, accesses the instrument menu.</li><li>- If pressed for at least 2 seconds, turns off the instrument.</li></ul> |
|      | Exits the current screen.   |
|      | Confirm settings.   |
|      | Select and/or Modify.   |

## 2 Display

LCD backlit Display, White/Black 128 x 128 pixel with white LEDs.

### CAUTION:

If the instrument is exposed to extremely high or extremely low temperatures, the quality of the display may be temporarily impaired. Display appearance may be improved by acting on the contrast key.



## 3 B-Type USB connector

Connector to connect the device to a personal computer or to the battery charger.  
The device comes with a wall charger with 5V  $\overline{\text{---}}$ , 2A output to charge the internal batteries.

## 4 'T1' Connector

Used to connect the Tc-K male connector of the gas temperature probe.

## 5 'P-' pneumatic connector

Negative input (P-) to be used for the connection of the gas aspiration probe.

## 6 'IN' pneumatic connector

Input for the connection of the branch of the gas sampling probe with the condensation separating and anti-dust filter assembly.

## 7 'P+' pneumatic connector

Positive input (P+): For draft measurement.

## 8 Gas output

## 9 Magnets

## 10 Instrument data label.

## 6.0 TECHNICAL SPECIFICATIONS

### 6.1 Technical specifications

|   |   |
|---|---|
| Power:  | Li-Ion battery pack with internal protection circuit.   |
| Average life of the battery package:                          | 500 empty / full charge cycles.   |
| Battery charger:  | External 5Vdc 2A battery charger with female A-type USB connector + connection to the device with the same serial communication cable supplied.   |
| Charging time:  | 5 hours to charge from 0% to 90% (6 hours for 100%). The device can also be charged by connecting it to the PC, the device must be turned off, the charging time depends on the output current from the PC and may be more than 12 hours. |
| Instrument working time:                                      | 8 hours of non-stop operation with display brightness at 50%.   |
| Display:  | Graphic white LED backlit White / Black, 128 x 128 pixel  |
| Connectivity:   |   |
| Communication port:   | USB connector type B.   |
| Bluetooth®<br>(if the version of the instrument foresees it): | Class 1. Communication distance <100 meters (in open field)   |
| Infrared interface:   | For external printer (optional) using protocol HP-IR.   |
| Autozero:   | Settable (30 .. 600 seconds)  |
| Gas measurement sensors:                                      | Up to 3 electrochemical sensors   |
| Type of combustible:  | 12 predefined by the factory.   |
| Self-diagnosis:   | Checks all functions and internal sensors and reports any abnormal operation.   |
| Temperature measurement:                                      | Input for thermocouple type K with mignon connector (ASTM E 1684-96) for the temperature measurement.   |
| Room temperature measurement:                                 | Through the internal sensor and/or acquisition through the gas probe positioned in air.   |
| Internal data memory:   | 5 complete analyses.  |
| Suction pump:   | 0.26 gal. per minute (1.0 l/min) heads at the flue up to 80hPa.   |
| Condensate trap:  |   |
| Type:   | Outside the instrument.   |
| Line filter:  | With replaceable cartridge, 99% efficient with 20um particles.  |
| Condensing boiler efficiency:                                 | Automatic recognition of the condensing boiler, with calculation and printout of efficiency (>100%) on the LHV (Lower Heating Value).   |
| Environmental gases:  | Measurement and separate printout of the ambient CO values.   |
| Draft test:   | By using the internal sensor connected to the port P+.  |
| Operating temperature range:                                  | 23°F .. 113°F (-5°C .. +45°C)   |
| Storage temperature range:                                    | -4°F .. 122°F (-20°C .. +50°C)  |
| Humidity limit:   | 20% .. 80% RH   |
| Protection grade:   | IP42  |
| Air pressure:   | Atmospheric   |
| Outer dimensions:   | Analyzer: 2,8 x 2,4 x 6,7 inches (Width x Depth x Height)<br>Case: 15,7 x 11,4 x 4,7 inches (Width x Depth x Height)  |
| Weight:   | Analyzer: ~ 12,3 Oz   |

See the declaration of conformity (ANNEX E).

## 6.2 Measurement and Accuracy Ranges

| MEASUREMENT   | SENSOR                 | RANGE                       | RESOLUTION              | ACCURACY   | RESPONSE TIME T90 |
|---|------------------------|-----------------------------|-------------------------|--|-------------------|
| O <sub>2</sub>  | Electrochemical sensor | 0 .. 21.0% vol              | 0.1% vol                | ±0.2% vol  | <20 sec.          |
| CO<br>high H <sub>2</sub> immunity<br>with NO <sub>x</sub> filter | Electrochemical sensor | 0 .. 4000 ppm               | 1 ppm                   | ±20 ppm<br>±5% measured value<br>0 .. 400 ppm<br>401 .. 4000 ppm   | <30 sec.          |
| CO<br>with NO <sub>x</sub> filter                                 | Electrochemical sensor | 0 .. 4000 ppm               | 1 ppm                   | ±20 ppm<br>±5% measured value<br>0 .. 400 ppm<br>401 .. 4000 ppm   | <30 sec.          |
| NO  | Electrochemical sensor | 0 .. 2000 ppm               | 1 ppm                   | ±5 ppm<br>±5% measured value<br>±10% measured value<br>0 .. 100 ppm<br>101 .. 1000 ppm<br>1001 .. 2000 ppm   | <40 sec.          |
| NO <sub>x</sub>   | Calculated             |                             |                         |  |                   |
| CO <sub>2</sub>   | Calculated             | 0 .. 99.9% vol              | 0.1% vol                |  |                   |
| PI*<br>(CO/CO <sub>2</sub> ratio)                                 | Calculated             |                             | 0.01%                   |  |                   |
| Air temperature   | TcK sensor             | -4 .. 248 °F                | 0.2 °F                  | ±1 °F  | <30 sec.          |
| Flue gas temperature  | TcK sensor             | -4 .. 1472 °F               | 0.2 °F                  | ±1 °F<br>±1% measured value<br>32 .. 212 °F<br>213 .. 1472 °F  | <30 sec.          |
| Pressure<br>(draft & differential)                                | Piezoelectric sensor   | -40 .. 80 "H <sub>2</sub> O | 0.004 "H <sub>2</sub> O | ±1% measured value<br>±0.008 "H <sub>2</sub> O<br>±1% measured value<br>-40 .. +0.8 "H <sub>2</sub> O<br>-0.8 .. +0.8 "H <sub>2</sub> O<br>+0.8 .. +80 "H <sub>2</sub> O | <10 sec           |
| Differential temperature  | Calculated             | 32 .. 2282 °F               | 0.2 °F                  |  |                   |
| Air index   | Calculated             | 0.00 .. 9.50                | 0.01                    |  |                   |
| Excess air  | Calculated             | 0 .. 850 %                  | 1 %                     |  |                   |
| Stack loss  | Calculated             | 0.0 .. 100.0 %              | 0.1 %                   |  |                   |
| Efficiency  | Calculated             | 0.0 .. 100.0 %              | 0.1 %                   |  |                   |
| Efficiency<br>(condensing)  | Calculated             | 0.0 .. 120.0 %              | 0.1 %                   |  |                   |

\* The Poison Index ratio (P.I.) is a reliable indicator of a boiler or burner good operation. It only takes a simple flue gas test to determine whether or not a service is needed to fix the system.

## 7.0 USING THE FLUE GAS ANALYZER

### 7.1 Preliminary operations

Remove the instrument from its packing and check it for damage. Make sure that the content corresponds to the items ordered. If signs of tampering or damage are noticed, notify the Seitron Americas service center or agent immediately and keep the original packing. A label at the rear of the analyzer bears the serial number. This serial number should always be stated when requesting technical assistance, spare parts or clarification on the product or its use. Seitron Americas maintains an updated database for each and every instrument.

Before using for the first time we recommend you charge the batteries completely.

### 7.2 WARNING

- Use the instrument with an ambient temperature between 73 and 113°F (-5 and +45°C).



**IF THE INSTRUMENT HAS BEEN KEPT AT VERY LOW TEMPERATURES (BELOW OPERATING TEMPERATURES) WE SUGGEST WAITING A WHILE (1 HOUR) BEFORE SWITCHING IT ON TO HELP THE SYSTEM'S THERMAL BALANCE AND TO PREVENT CONDENSATE FORMING IN THE PNEUMATIC CIRCUIT.**

- Do not extract flue gas samples directly without using a particulate/water trap.
- Do not use the instrument if the filters are clogged or damp.
- Do not exceed sensor overload thresholds.
- When it has finished being used, before turning the instrument off remove the probe and let it aspirate ambient clean air for at least 30 seconds to purge the pneumatic path from all traces of gas.
- Before putting the measuring probe back in its case after use, make sure it is has cooled down enough and there is no condensate in the tube. It might be necessary to periodically disconnect the filter and the condensate separator and blow compressed air inside the tube to eliminate all residues.
- Remember to have the instrument checked and calibrated once a year in order to comply with the existing standards.

### 7.3 Analyzer power supply

The instrument contains a high-capacity Li-Ion rechargeable battery.

The battery powers up the instrument and any other probes or remote devices that may be connected. The instrument runs for approximately 8 hours if the printer is not used and with display brightness at 50%. Should the battery be too low to effect the necessary measurements, the instrument can be hooked up to the mains via the power pack provided, allowing operations (and analysis) to proceed.

The battery will be recharged whilst the instrument is being used.

The battery charging cycle takes up to 8 hours for a complete charge and finishes automatically.

**ATTENTION: If the instrument is not going to be used for a long time (for example summertime) we suggest recharging it completely at least once every 4 months.**

#### 7.3.1 Internal battery charge level

The display constantly shows the internal battery charge level shown with the symbol in the upper left corner of the display.

| SYMBOL | BATTERY CHARGE LEVEL  |
|--------|---|
|        | 100%  |
|        | 80%   |
|        | 60%   |
|        | 40%   |
|        | 20%<br>It's advisable to recharge the battery.                                    |
|        | Dead battery<br>Recharge the battery - The instrument may not function correctly. |



**THE INSTRUMENT IS SHIPPED WITH THE 30% OF BATTERY LIFE, ACCORDING TO CURRENT AIR TRANSPORTATION STANDARDS. IT IS ADVISABLE TO RECHARGE IT COMPLETELY BEFORE USE, TAKING 8 HOURS (ONE NIGHT).**

**IT IS ADVISABLE TO CHARGE THE BATTERY AT AN AMBIENT TEMPERATURE RANGING BETWEEN 50°F AND 86°F (10°C AND 30°C).**

According to the charging level of the battery, the instrument can be left in stock for a time correlated to the battery level itself. Below, a table that explains the correlation between battery charging level and stock time.

| BATTERY CHARGE LEVEL | STOCK TIME |
|----------------------|------------|
| 100%                 | 110 days   |
| 75%                  | 80 days    |
| 50%                  | 45 days    |
| 25%                  | 30 days    |

### 7.3.2 Use with external power pack

The instrument can work with the batteries fully discharged by connecting the external power pack provided.



**THE POWER SUPPLY/BATTERY CHARGER IS A SWITCHING TYPE ONE.  
THE APPLICABLE INPUT VOLTAGE RANGES BETWEEN 90Vac AND 264Vac.  
INPUT FREQUENCY: 50-60Hz.  
THE LOW VOLTAGE OUTPUT IS 5 VOLT WITH AN OUTPUT CURRENT GREATER THAN 1.5A.  
LOW VOLTAGE POWER CONNECTOR: A-TYPE USB CONNECTOR + CONNECTION CABLE WITH B-TYPE PLUG.**

### 7.4 QR code generation

The instrument offers the possibility to generate and display a QR code with the purpose to download the data of the acquired measures, activating the interactive function "Print" visible on the display in the menu configuration, having installed the "**Seitron Smart Analysis**" downloadable from the AppStore.

#### Minimum requirements for the App installation "Seitron Smart Analysis"

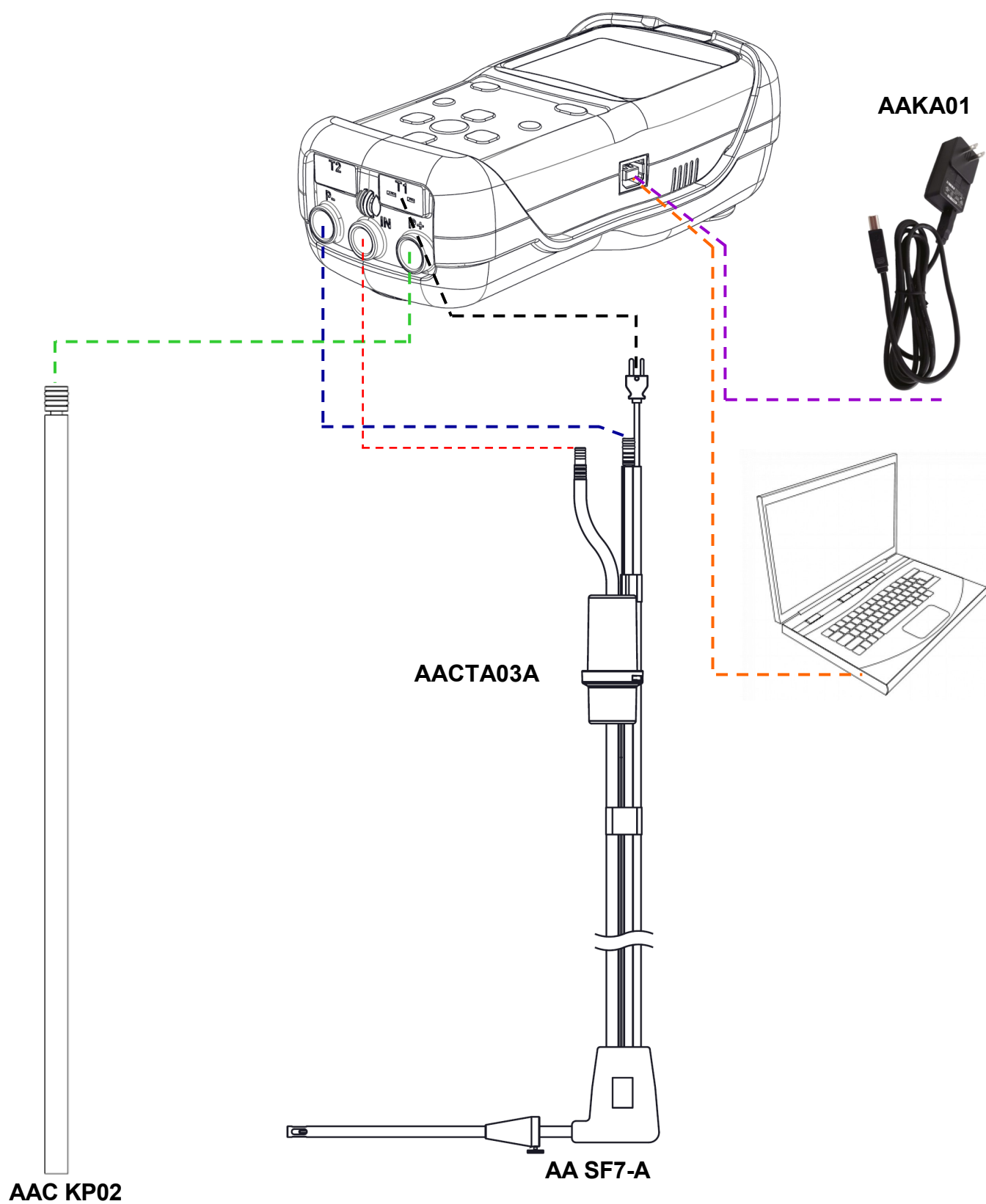
Operating systems:      Android from version 4.1  
                                     Apple (iOS)



**THE INSTRUMENT WILL GENERATE THE QR CODE ONLY IF ON THE DISPLAY THE INTERACTIVE FUNCTION "PRINT" IS SHOWN.**



## 7.5 Connection diagram



## 8.0 FLUE GAS ANALYSIS

### 8.1 FLUE GAS ANALYSIS



To perform complete flue gas analysis, follow the instructions below.



**SOME IMPORTANT WARNINGS TO CONSIDER DURING THE COMBUSTION ANALYSIS ARE LISTED BELOW:**

**FOR A CORRECT ANALYSIS NO AIR MUST FLOW INTO THE PIPE FROM OUTSIDE DUE TO A BAD TIGHTENING OF THE POSITIONING CONE OR A LEAK IN THE PIPELINE.**

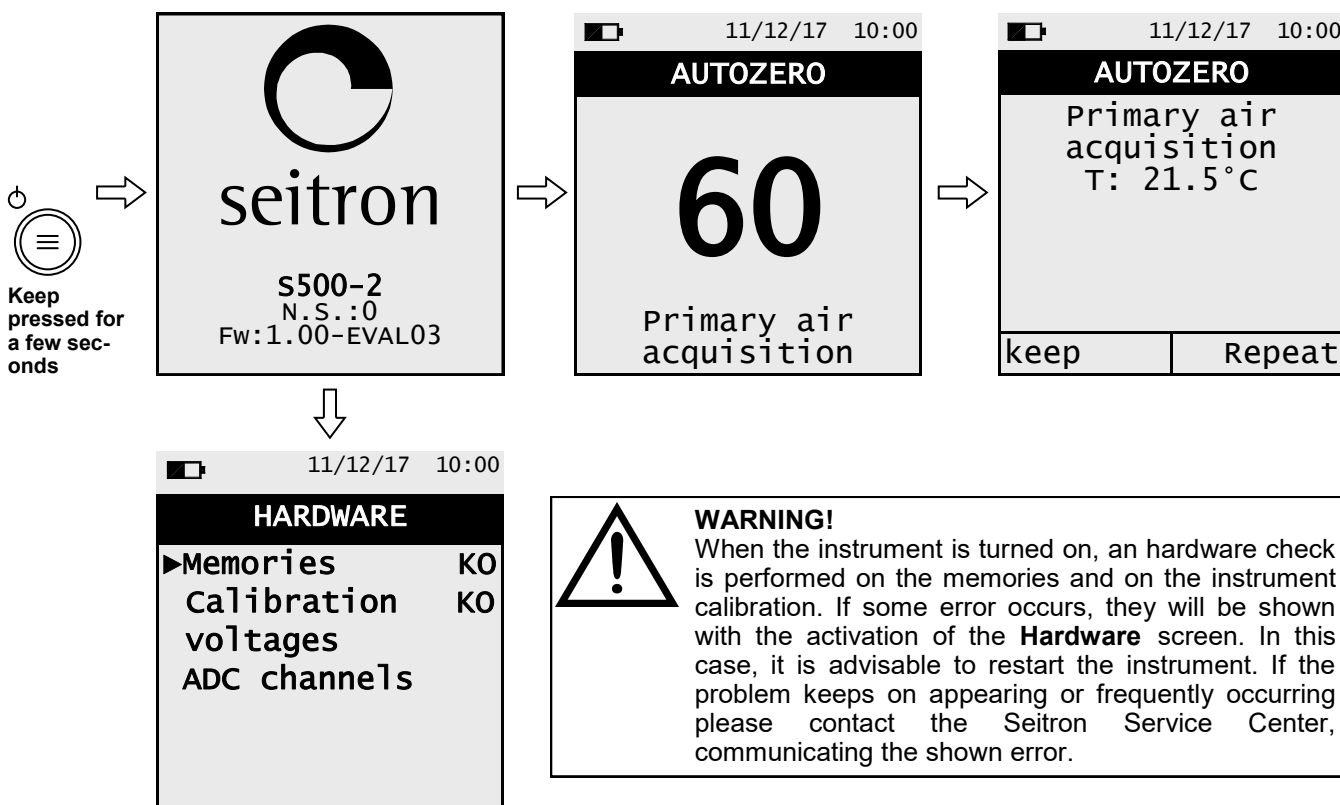
**THE GAS PIPE MUST BE CHECKED IN ORDER TO AVOID ANY LEAKAGES OR OBSTRUCTIONS ALONG THE PATH. THE CONNECTORS OF THE GAS SAMPLING PROBE AND OF THE CONDENSATION FILTER MUST BE WELL CONNECTED TO THE INSTRUMENT. KEEP THE CONDENSATION TRAP ON VERTICAL POSITION DURING THE ANALYSIS; A WRONG POSITIONING MAY CAUSE CONDENSATE INFILTRATIONS IN THE INSTRUMENT AND THUS DAMAGE THE SENSORS. AFTER EACH ANALYSIS CHECK FOR ANY PRESENCE OF WATER IN THE CONDENSATE COLLECTION BOWL AND REMOVE IT IF ANY. PUT THE PROBE BACK IN THE CASE ONLY AFTER YOU HAVE ELIMINATED CONDENSATE FROM THE TUBE AND THE EXPANSION TANK (SEE CHAPTER [MAINTENANCE](#)). REPLACE THE FINE DUST FILTER IF IT IS VISIBLY DIRTY OR WET (SEE CHAPTER [MAINTENANCE](#)). DO NOT PERFORM ANY MEASUREMENT WHEN THE FILTER IS REMOVED OR DIRTY IN ORDER TO AVOID ANY RISK OF IRREVERSIBLE DAMAGES TO SENSORS AND ANALYZER ITSELF.**

#### 8.1.1 Switching on the instrument and auto-calibration



**BEFORE TURNING ON THE INSTRUMENT:**

- **CONNECT THE GAS SAMPLING PROBE TO THE INSTRUMENT.**
- **STORING OF THE AMBIENT TEMPERATURE: UPON COMPLETION OF THE AUTOZERO IN FRESH OUTDOOR AIR, PRESS THE “KEEP” BUTTON TO STORE THE OUTSIDE TEMPERATURE BEING USED FOR PRIMARY AIR. IF THE Tc-K CONNECTOR IS NOT PLUGGED IN, THE TEMPERATURE WILL NOT BE ACQUIRED.**

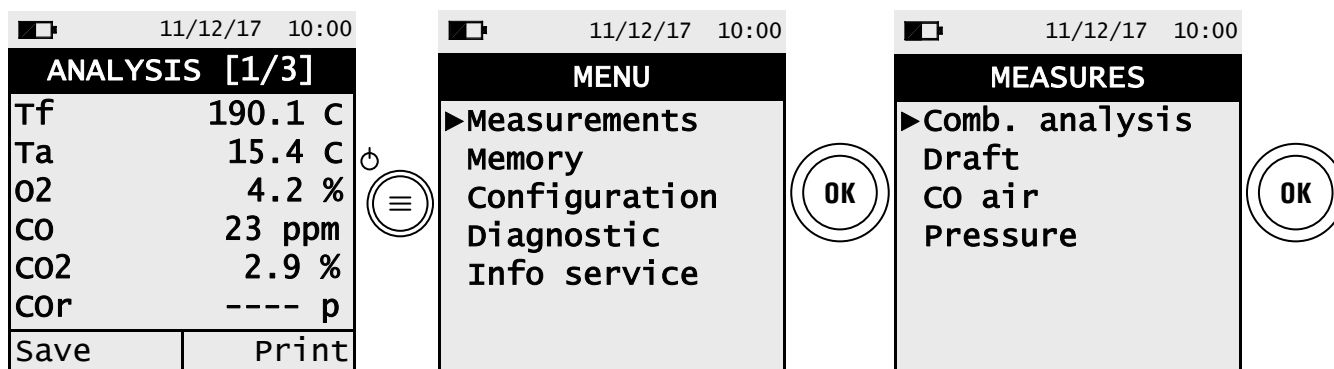


When the autozero phase is complete, push the key related to the interactive function “**Keep**”, to proceed with the combustion analysis or push the key related to the interactive function “**Repeat**”, to repeat the autozero phase.



## 8.1.2 Preliminary Operations

Following are reported the parameters to set before performing the combustion analysis:



**BEFORE PERFORMING THE COMBUSTION ANALYSIS, SET THE NECESSARY PARAMETERS ([SEE CHAPTER 12.2](#)).**

## 8.1.3 Inserting the probe inside the stack

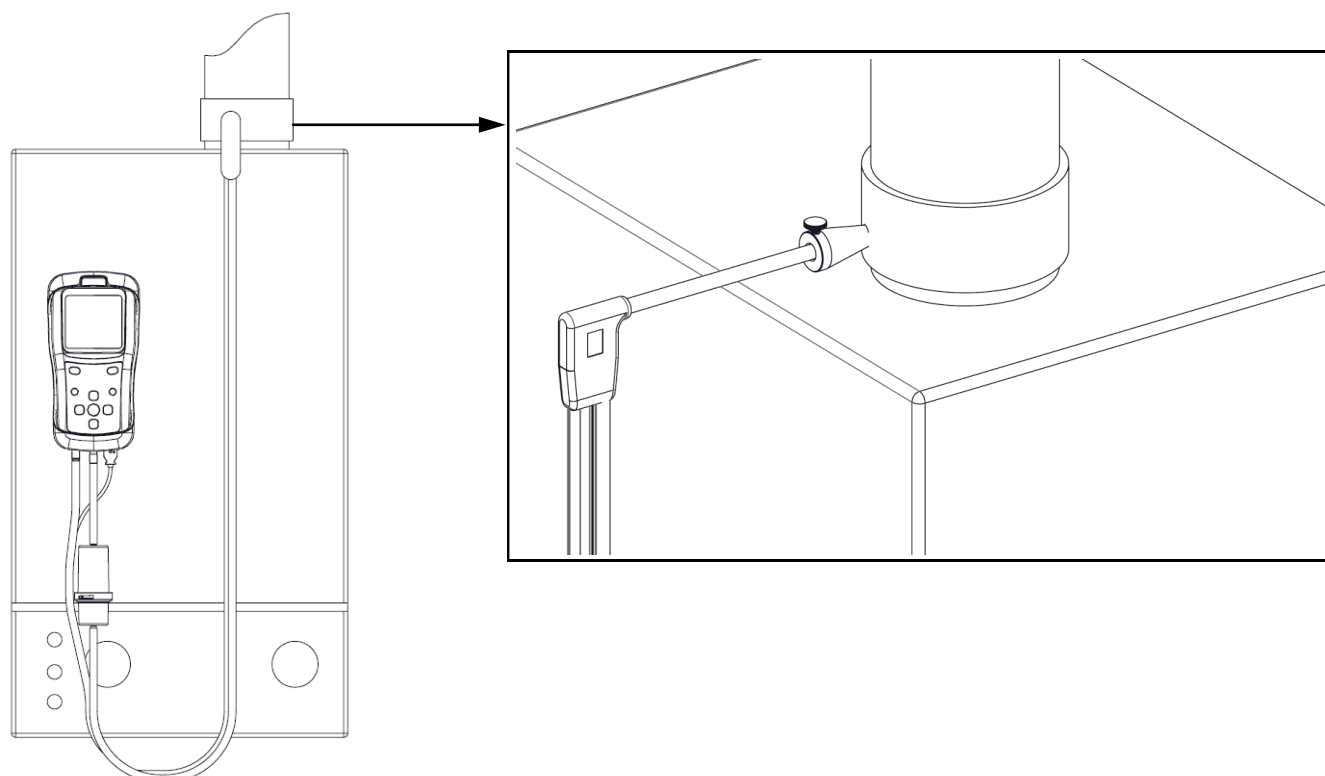
When the autozero is over, insert in the stack the gas sample probe, previously connected to the instrument.

In order for the probe to be inserted at the right point within the stack, its distance from the boiler has to be twice the diameter of the stack pipe itself or, if this is not possible, must comply with the boiler manufacturer's instructions.

In order to position the probe correctly drill a 13/16 mm hole in the manifold (unless already present), and screwing in the positioning cone provided with the probe - in this way no air is drawn from the outside during sampling.

The screw on the cone allows the probe to be stopped at the right measuring depth - this usually corresponds to the center of the flue pipe. For greater positioning accuracy, the user may insert the probe gradually into the pipe until the highest temperature is read.

The exhaust pipe must be inspected before carrying out the test, so as to ensure that no constrictions or losses are present in the piping or stack.





## 8.1.4 Performing the combustion analysis - Manual Mode

| 11/12/17 10:00 |             |
|----------------|-------------|
| AN. SETTINGS   |             |
| ►Mode          | Manual      |
| Fuel           | Natural gas |
| Memory         | 1/5         |
| Status         | Free        |
| Start          |             |

start

| 11/12/17 10:00  |         |
|-----------------|---------|
| ANALYSIS [1/3]  |         |
| Tf              | 190.1 C |
| Ta              | 15.4 C  |
| O2              | 4.2 %   |
| CO              | 23 ppm  |
| CO2             | 2.9 %   |
| CO <sub>r</sub> | ---- p  |
| Save            | Print   |

Print

Save

| 11/12/17 10:00 |       |
|----------------|-------|
| PRINT          |       |
| Curr. analysis |       |
| ►Copy number   | 1     |
| Printer        | OFF   |
| QR Code        | ON    |
| Pairing BT     |       |
|                | Print |

Print

IN THIS SCREEN IT IS POSSIBLE TO MODIFY THE NUMBER OF THE MEMORY IN WHICH THE CURRENT ANALYSIS IS BEING SAVED.  
([SEE CHAPTER 11.0](#))

| 11/12/17 10:00 |        |
|----------------|--------|
| MEMORY         |        |
| Curr. analysis |        |
| Mode           | Manual |
| ►Memory        | 1/5    |
| Status         | Free   |
| Save           |        |

Save



| 11/12/17 10:00  |         |
|-----------------|---------|
| ANALYSIS [1/3]  |         |
| Tf              | 190.1 C |
| Ta              | 15.4 C  |
| O2              | 4.2 %   |
| CO              | 23 ppm  |
| CO2             | 2.9 %   |
| CO <sub>r</sub> | ---- p  |
| Save            | Print   |



## 8.1.5 Performing the combustion analysis - Auto Mode

| 11/12/17 10:00 |             |
|----------------|-------------|
| AN. SETTINGS   |             |
| ►Modo          | Auto        |
| Fuel           | Natural gas |
| Interval       | 7 s         |
| Memory         | 1/5         |
| Start          |             |

Start

| 11/12/17 10:00  |         |
|-----------------|---------|
| ANALYSIS [1/3]  |         |
| Tf              | 190.1 C |
| Ta              | 15.4 C  |
| O2              | 4.2 %   |
| CO              | 23 ppm  |
| CO2             | 2.9 %   |
| CO <sub>r</sub> | ---- p  |
| Pause           | 1/3 7   |

Automatically stores the first sample when the interval time is over.

| 11/12/17 10:00  |         |
|-----------------|---------|
| ANALYSIS [1/3]  |         |
| Tf              | 190.1 C |
| Ta              | 15.4 C  |
| O2              | 4.2 %   |
| CO              | 23 ppm  |
| CO2             | 2.9 %   |
| CO <sub>r</sub> | ---- p  |
| Pause           | 2/3 7   |

Automatically stores the second sample when the interval time is over.

| 11/12/17 10:00  |         |
|-----------------|---------|
| ANALYSIS [1/3]  |         |
| Tf              | 190.1 C |
| Ta              | 15.4 C  |
| O2              | 4.2 %   |
| CO              | 23 ppm  |
| CO2             | 2.9 %   |
| CO <sub>r</sub> | ---- p  |
| Pause           | 3/3 7   |

Automatically stores the third sample when the interval time is over.

| 11/12/17 10:00 |         |
|----------------|---------|
| AVERAGE [1/3]  |         |
| O2             | 4.2 %   |
| CO             | 23 ppm  |
| CO2            | 2.9 %   |
| Tf             | 190.1 C |
| Ta             | 15.4 C  |
| Es             | 91.4 %  |
| Print          |         |

Print



- SCAN THE QR CODE WITH THE SEITRON APP "CHEMIST QR CODE", IN ORDER TO DOWNLOAD THE ACQUIRED DATA. THE VISUALIZED QR CODE IS REFERRING ONLY TO THE AVERAGE OF THE PERFORMED ANALYSIS.
- IF IT IS NEEDED TO PRINT THE AVERAGE ANALYSES AND ADDITIONAL MEASURES TICKET, ENABLE THE PRINTER IN THE MENU "CONFIGURATION→PRINT".
- IF IT IS DESIRED TO PRINT ON TICKET THE COMPLETE ANALYSIS AND THE PERFORMED MEASURES, ENTER THE "MEMORY" MENU, SELECT THE RELATED MEMORY NUMBER AND PUSH THE INTERACTIVE FUNCTION KEY "PRINT".
- TO DOWNLOAD THE SINGLE ANALYSIS DATA, IT'S NECESSARY TO ENTER THE "MEMORY" MENU, SELECT THE MEMORY NUMBER USED TO SAVE THE ANALYSES AND THE MEASURES THEN SELECT ONE AT A TIME THE SINGLE ROWS.  
(SEE CHAPTER 11.0).



## Additional Information

| INTERACTIVE OPERATION | DESCRIPTION   |
|-----------------------|---|
| <b>Pause</b>          | By pushing the button related to this interactive function, the instrument stops the current analysis when the set time interval is over. This condition is shown with the symbol " <b>Paused</b> ".          |
| <b>Keep</b>           | When the "Paused" phase is over, the interactive function "Keep" is shown. By activating this function the acquired sample is memorized and the instrument continues with the acquisition of the next sample. |



BY PRESSING AT ANY MOMENT THE  BUTTON, IT IS POSSIBLE TO INTERRUPT THE COMBUSTION ANALYSIS AND GO BACK TO THE MAIN SCREEN.



### 8.1.6 End of the Analysis

- At the end of the combustion analysis, carefully remove the sample probe and remote air temperature probe, if used, from their relative ducts, taking care not to get burnt.
- Switch off the instrument.  
Then, proceed to turn off the instrument.  
The instrument execute a cleaning cycle, according to what's set in the menu "Configuration→Analysis→Autozero→Purging", during which the pump sucks clean air until reducing the concentration of CO. The instrument automatically turns off within max. 10 minutes.

Note: It is always advisable to purge the instrument with clean air for at least 5 - 10 minutes before turning it off.



**WHEN THE GAS SAMPLING PROBE IS TAKEN OUT OF THE STACK, THE FORMATION OF SOME CONDENSATION IN THE PROBE TUBE AND IN THE ANTI-CONDENSATION TRAP MAY OCCUR.**

**IT IS ADVISED TO ACCURATELY CLEAN EVERY PART BEFORE PUTTING AWAY THE PROBE AND THE ANTI-CONDENSATION TRAP IN THE CASE.**

**IN ORDER NOT TO DAMAGE THE CASE MAKE SURE THAT THE METALLIC PROBE PIPE IS AT AN INFERIOR TEMPERATURE THAN 60°C.**

### Gas sampling probe cleaning

- When you finish using the sample probe clean it thoroughly as described below before returning it to its case:
  - Disconnect the sample probe from the instrument and from the water trap (Fig. a-b) then blow a jet of clean air into the hose of the probe (refer to Fig. b) to remove any residual condensate that may have formed within.

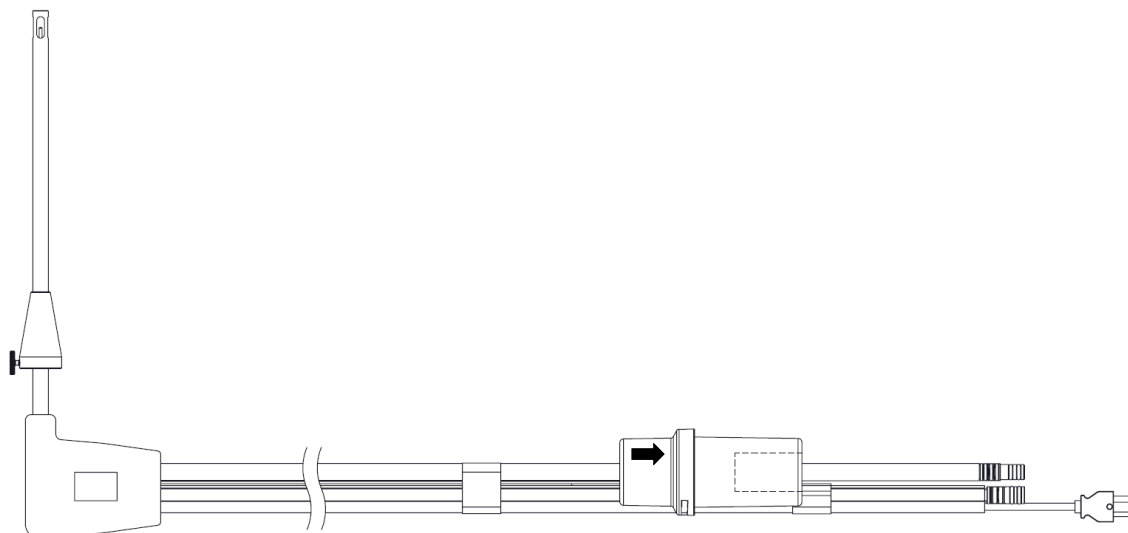
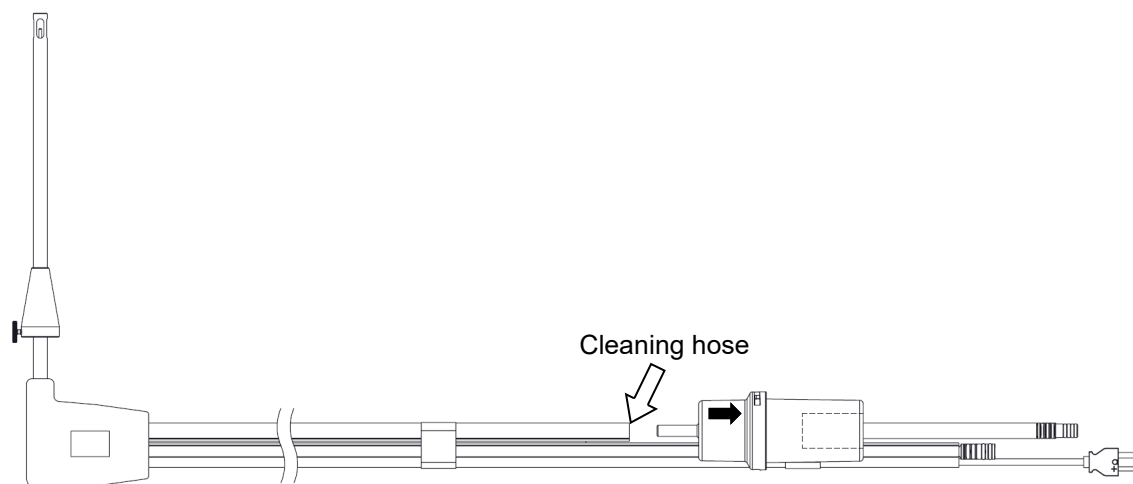


Fig. a

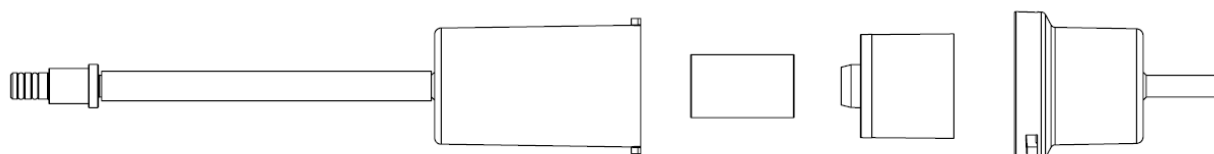


**Fig. b**

### Maintaining the water trap / filter unit

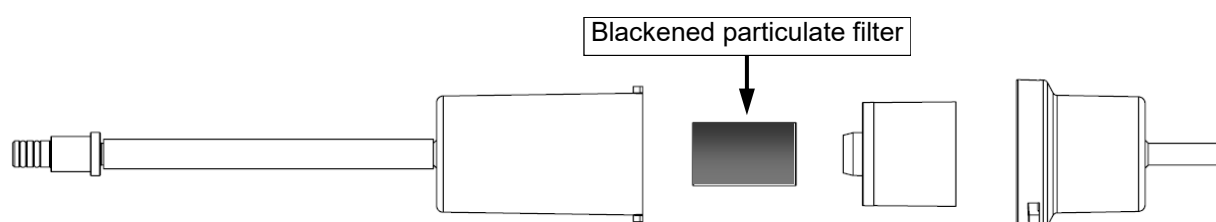
To remove the water trap, just rotate the cover and unhook the filter holder body; remove the internal cup and then replace the filter (see figure on the side).

Clean all the filter parts using water only, dry the components and reassemble the filter.



### Replacing the particulate filter

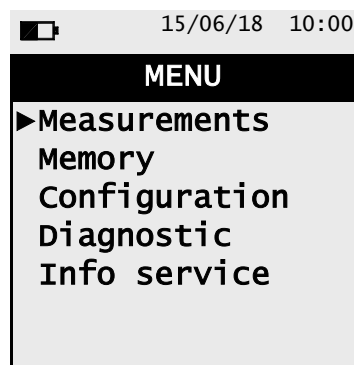
If the particulate filter appears black, especially on the inner surface (see adjacent example), it has to be replaced immediately. In this way gas flow is not obstructed.








## 9.0 INSTRUMENT PARAMETER

### 9.1 Menu

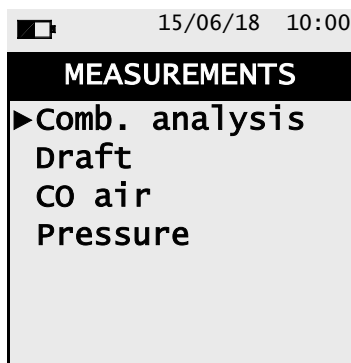


| KEY   | FUNCTION                                  |
|---|---|
|  | Returns to the previous screen.           |
|  | Selects the available parameters.         |
|  | Enters in the selected parameter setting. |


| SUB-MENU      | FUNCTION   |
|---------------|--|
| Measurements  | Through this menu, it is possible to execute the draft, ambient CO and pressure Measurements.<br><a href="#">SEE CHAPTER 10.0</a>  |
| Memory        | This parameter can set the number of the memory on which record the combustion analysis, the draft measurement, etc. Moreover, it shows the status (Full or Free) and the details (time and date) of the selected memory number (if the memory position is occupied by some data).<br>It can also visualize, print or delete the memorized data and the additional measures.<br><a href="#">SEE CHAPTER 11.0</a> |
| Configuration | The user can set the different reference parameters of the instrument in order to perform the combustion analysis.<br><a href="#">SEE CHAPTER 12.0</a>   |
| Diagnostic    | The user can verify any anomalies of the instrument.<br><a href="#">SEE CHAPTER 13.0</a>   |
| Info service  | Display the info about the current condition of the instrument.<br><a href="#">SEE CHAPTER 14.0</a>  |

# 10.0 MEASUREMENTS

## 10.1 Menu→Measurements










| KEY | FUNCTION                                  |
|-----|---|
|     | Returns to the previous screen.           |
|     | Selects the available parameters.         |
|     | Enters in the selected parameter setting. |

| SUB MENU              | FUNCTION  |
|-----------------------|---|
| <b>Comb. analysis</b> | The user, with this menu, can set the different reference parameters of the instrument to perform the combustion analysis.<br><a href="#">SEE CHAPTER 10.2</a>  |
| <b>Draft</b>          | The DRAFT menu gives access to the stack draft measurement.<br><b>NOTE:</b> The measurement may not be accurate due to condensation inside the gas probe. Should you notice an inaccurate or unstable reading on the instrument, it is advisable to disconnect the gas probe from the instrument itself, and purge pipes by blowing with a compressor. In order to be sure there is no humidity, it is suggested to perform the measurement by means of the transparent rubber pipe supplied on issue.<br><a href="#">SEE CHAPTER 10.3</a>  |
| <b>CO air</b>         | This type of analysis lets the user measure the CO value present in the environment, with the scope of checking the personal safety conditions of a specific working environment. The instrument leaves our factory with the following pre-set threshold values:<br><b>COmax:</b> 35 ppm Recommended exposure limit (REL) stipulated by the National Institute for Occupational Safety and Health (NIOSH), equivalent to 40 mg/m <sup>3</sup> and calculated as an 8-hour Time-Weighted Average (TWA).<br> <b>It is compulsory to perform the autozero in the clean air, so that the ambient CO measurement is correct. It is advisable to turn on the instrument and wait for the autozero completion outside the area where the test is being performed.</b><br><a href="#">SEE CHAPTER 10.4</a> |
| <b>Pressure</b>       | Through the use of the external flexible pipe made in RAUCLAIR (supplied) is possible to measure a pressure value within the range stated in the technical features (connect the pipe to P+ input).<br><a href="#">SEE CHAPTER 10.5</a>   |

## 10.2 Menu→Measurements→Comb. analysis

|                     |             |
|---------------------|-------------|
| 11/12/17 10:00      |             |
| <b>SET ANALYSIS</b> |             |
| ►Mode               | Auto        |
| Fuel                | Natural gas |
| Interval            | 7 s         |
| Memory              | 1/5         |
| Status              | Free        |
| Start               |             |

| KEY   | FUNCTION  |
|---|---|
|   | Activate the context keys shown on the display.             |
|    | Returns to the previous screen.                             |
|   | Selects the available parameters.                           |
|    | Enters the selected parameter and confirms the choice made. |

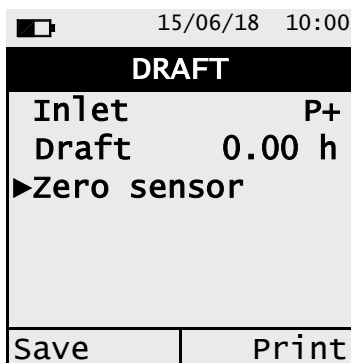
| INTERACTIVE OPERATION   | FUNCTION                                   |
|---|--|
|  | Starts the analysis with the selected mode |

| PARAMETER       | DESCRIPTION   |
|-----------------|---|
| <b>Mode</b>     | <p>This menu allows the user to choose among 2 different analysis modes: Manual or Auto</p> <p><b>Manual:</b><br/>In manual mode, the combustion analysis is performed manually by prior setting the ' Fuel ' parameter.<br/>Then, the manual analysis can start but waiting, at the beginning, at least two minutes that the shown values are stable; at this moment it is possible to proceed with the memorization or directly to print depending on the setting made.</p> <p><b>Auto:</b><br/>In this mode it is possible to print or save just one combustion analysis containing all the data necessary to fill in the booklet of the system or plant.<br/>In this mode the instrument performs 3 different measures divided by a time gap defined by the user using the sub parameter ' interval '. Moreover, it is possible to select the memory in which is needed to store the analysis and set the used fuel.</p> <p>In all modes, the data displayed regarding the pollutants CO / NO / NO<sub>x</sub> can be translated into normalized values (with reference to the concentration of O<sub>2</sub> previously set in "configuration =&gt; analysis" menu).</p> |
| <b>Fuel</b>     | Allows the choice of the fuel to be used in analysis phase. This data can be changed not only in this menu, but also in configuration menu.   |
| <b>Interval</b> | <b>ONLY IN 'AUTO MODE'.</b><br>Sets the time interval for the sample acquisition with a value variable from 1 to 900 seconds.   |
| <b>Memory</b>   | <b>ONLY IN 'AUTO MODE'.</b><br>Allows to select the memory number where to save the analysis. If the memory is full it is possible to choose whether to overwrite the values of the analysis formerly acquired.   |



TO PERFORM THE COMBUSTION ANALYSIS REFER TO [CHAPTER 8.0](#)

### 10.3 Menu→Measurements→Draft



| KEY | FUNCTION  |
|-----|---|
|     | Activate the context keys shown on the display. |
|     | Returns to the previous screen.                 |
|     | Starts the pressure sensor autozero.            |

| INTERACTIVE OPERATION | FUNCTION   |
|-----------------------|--|
| Save                  | The measure will be printed on the ticket of the current combustion analysis   |
| Print                 | According to the version of the instrument and/or according with the related setting, it is possible to print or visualize the QR code |



To measure the draft proceed as follows:




- Connect the probe pressure input hose to the instrument **P+** input.
- Before starting the pressure zeroing sequence pay attention to remove the gas probe from the stack.
- Having carried out the pressure zeroing sequence, insert the probe in the stack and measure the draft.

Example:



## 10.4 Menu→Measurements→CO air

| 15/06/18 10:00 |       |
|----------------|-------|
| CO AIR         |       |
| CO             | 412 p |
| CO Max         | 413 p |
| Save Print     |       |

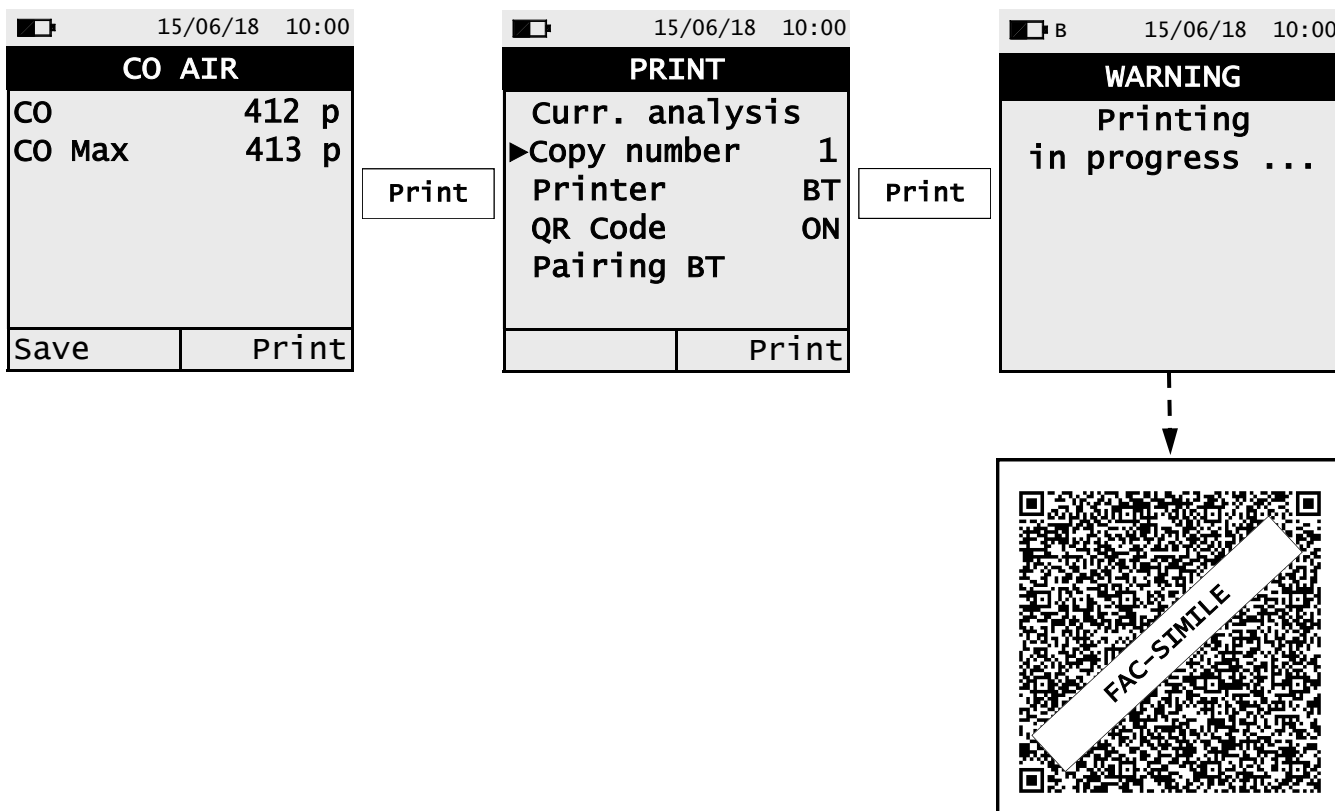
| KEY   | FUNCTION  |
|---|---|
|   | Activate the context keys shown on the display. |
|    | Returns to the previous screen.                 |

| INTERACTIVE OPERATION | FUNCTION   |
|-----------------------|--|
| Save                  | The measure will be printed on the ticket of the current combustion analysis   |
| Print                 | According to the version of the instrument and/or according with the related setting, it is possible to print or visualize the QR code |

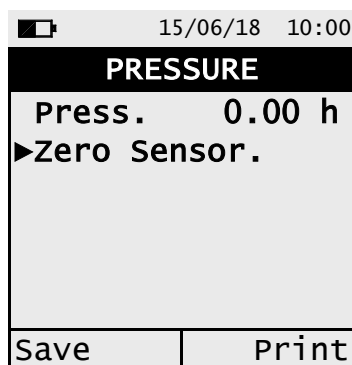


It is compulsory to perform the autozero in the clean air, so that the ambient CO measurement is correct. It is advisable to turn on the instrument and wait for the autozero completion outside the area where the test is being performed.

Example:



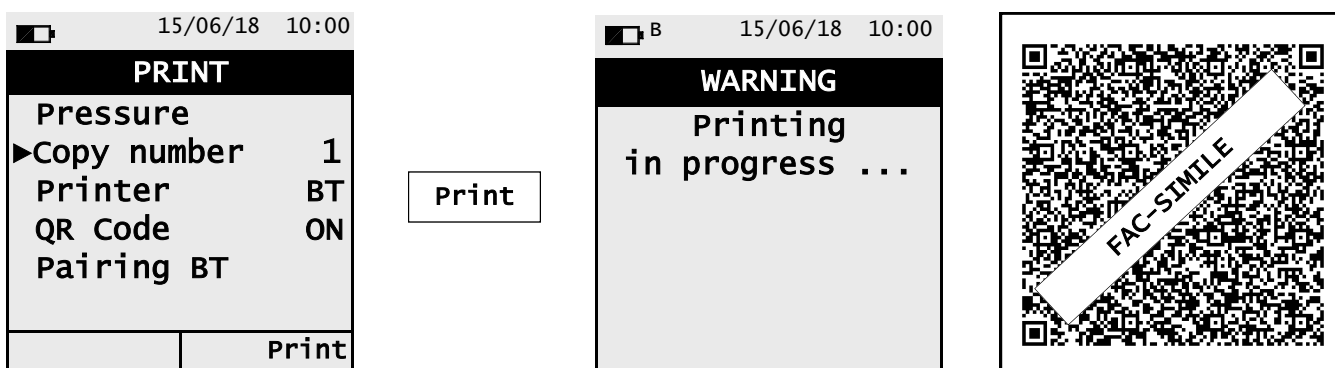
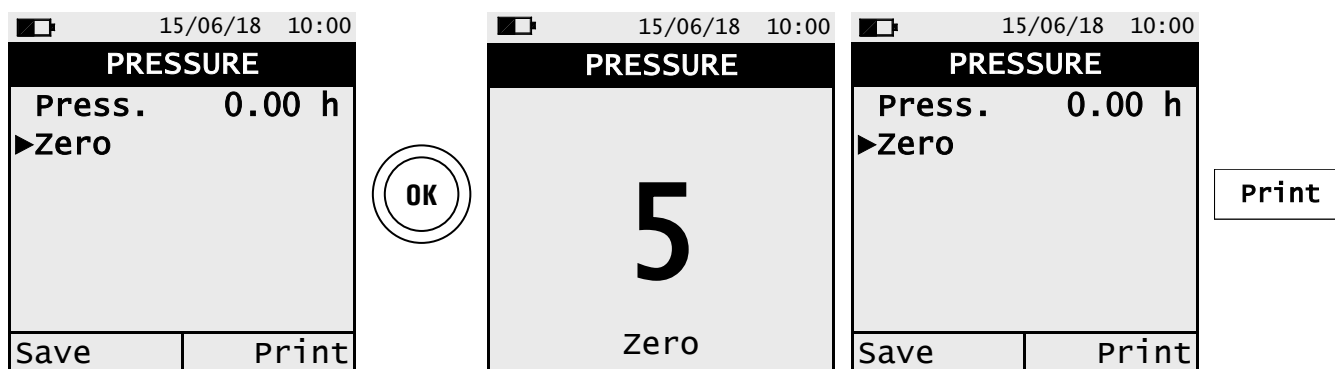
## 10.5 Menu→Measurements→Pressure



| KEY | FUNCTION  |
|-----|---|
|     | Activate the context keys shown on the display. |
|     | Returns to the previous screen.                 |
|     | Perform the Zero Sensor of the pressure sensor. |

| INTERACTIVE OPERATION | FUNCTION   |
|-----------------------|--|
| Save                  | The measure will be printed on the ticket of the current combustion analysis   |
| Print                 | According to the version of the instrument and/or according with the related setting, it is possible to print or visualize the QR code |







Example:



# 11.0 MEMORY

## 11.1 Menu→Memory

| 11/12/17 10:00 |          |
|----------------|----------|
| MEMORY         |          |
| ►Memory        | 1/5      |
| Status         | full     |
| Time           | 09:50    |
| Date           | 11/12/17 |
| Select         |          |

| KEY   | FUNCTION  |
|---|---|
|   | Activate the context keys shown on the display.   |
|    | Modifies the memory number and then confirms the changed setting.<br>When selecting the analysis, shows the detail of the evidenced analysis. |
|   | Selects the available parameters.   |
|    | Returns to the previous screen.<br>In modification mode, cancels the setting made.  |

| INTERACTIVE OPERATION | DESCRIPTION   |
|-----------------------|---|
| Select                | Shows the list of measures within the selected memory number.         |
| Delete                | Deletes the entire contents of the selected memory.                   |
| Print                 | Prints the ticket or shows the QR code of the selected memory number. |

### 1. Set memory detail

| 11/12/17 10:00 |          |
|----------------|----------|
| MEMORY         |          |
| ►Memory        | 1/5      |
| Status         | full     |
| Time           | 09:50    |
| Date           | 11/12/17 |
| Select         |          |



| 11/12/17 10:00 |            |
|----------------|------------|
| MEMORY         |            |
| ►Memory        | <b>1/5</b> |
| Status         | full       |
| Time           | 09:50      |
| Date           | 11/12/17   |
| Select         |            |



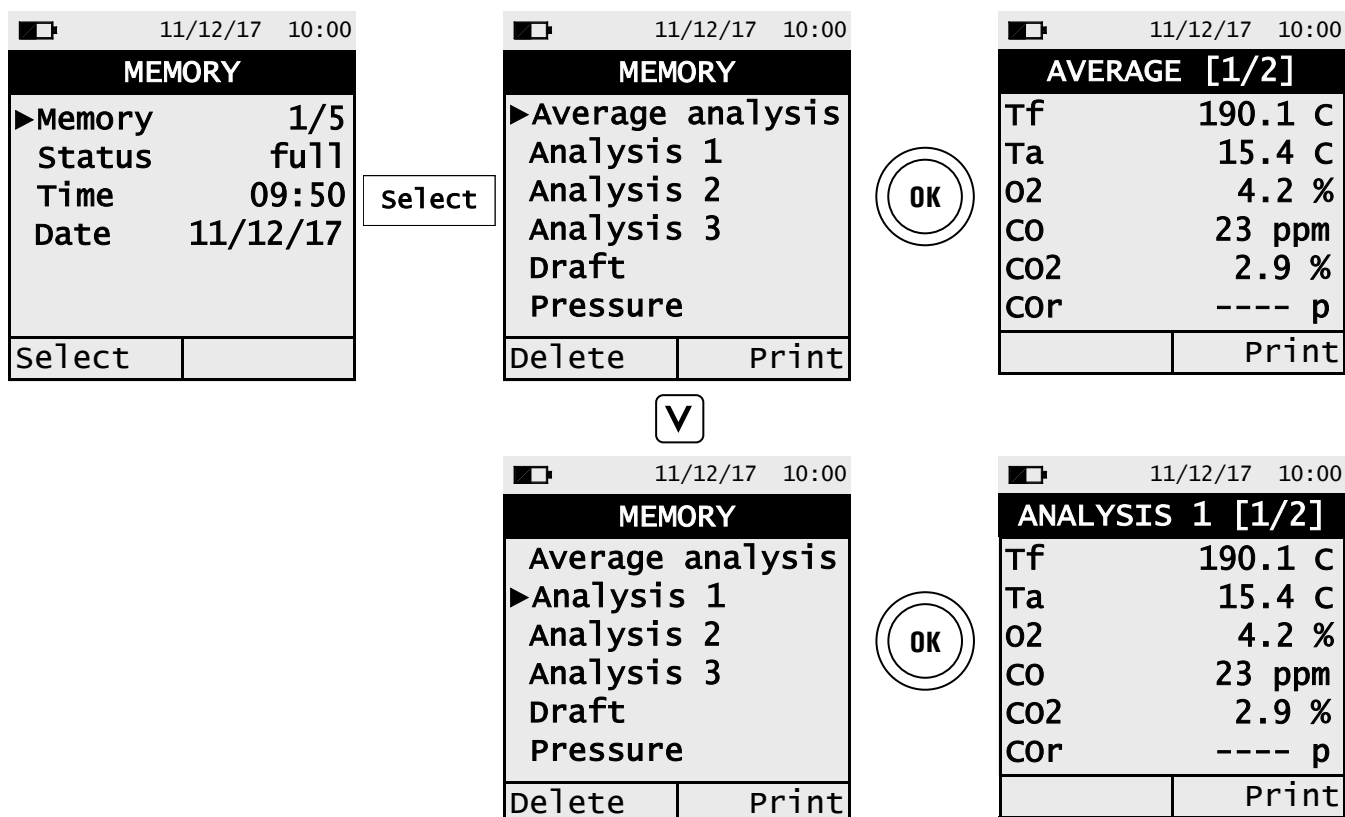
| 11/12/17 10:00 |            |
|----------------|------------|
| MEMORY         |            |
| ►Memory        | <b>2/5</b> |
| Status         | full       |
| Time           | 09:50      |
| Date           | 11/12/17   |
| Select         |            |



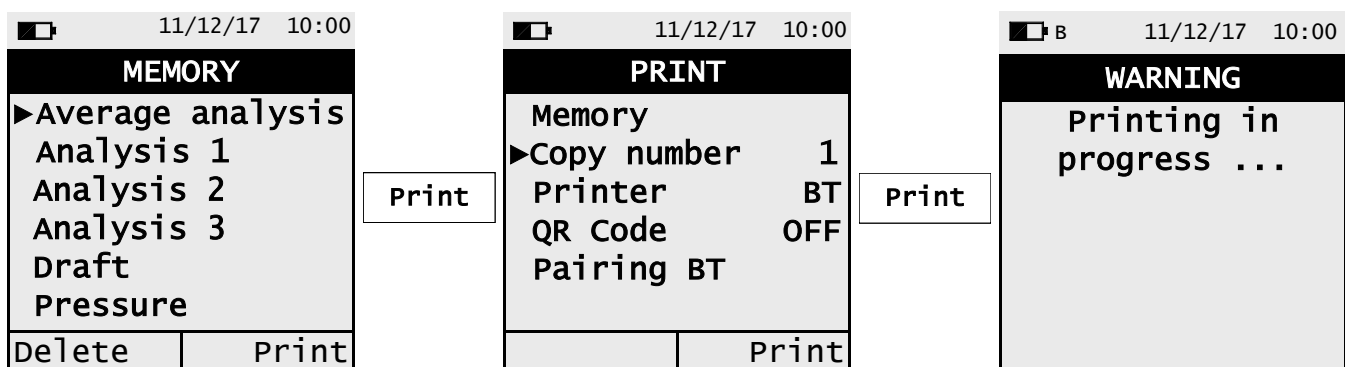
| 11/12/17 10:00 |      |
|----------------|------|
| MEMORY         |      |
| ►Memory        | 1/5  |
| Status         | free |
| Select         |      |



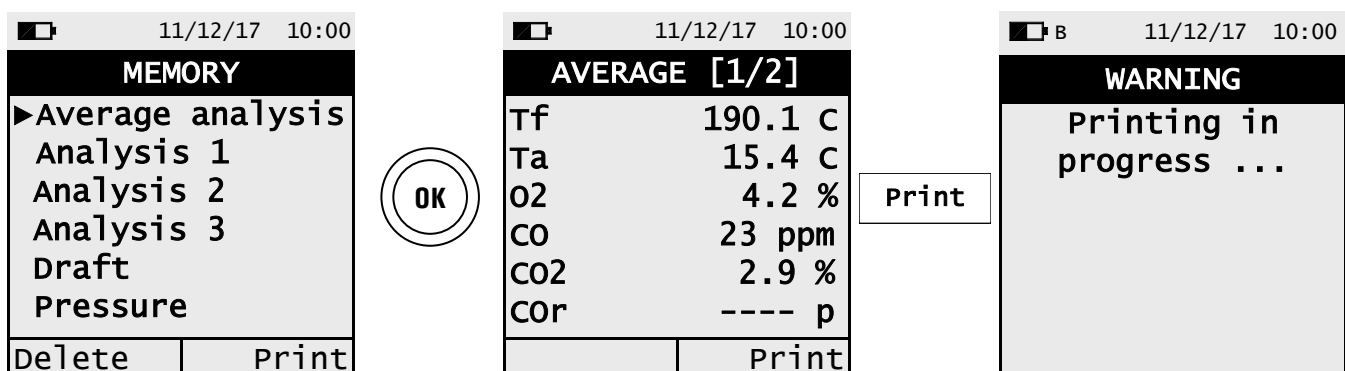
## 2. Visualization of the memory content



## 3. Print ticket detail of the entire selected memory

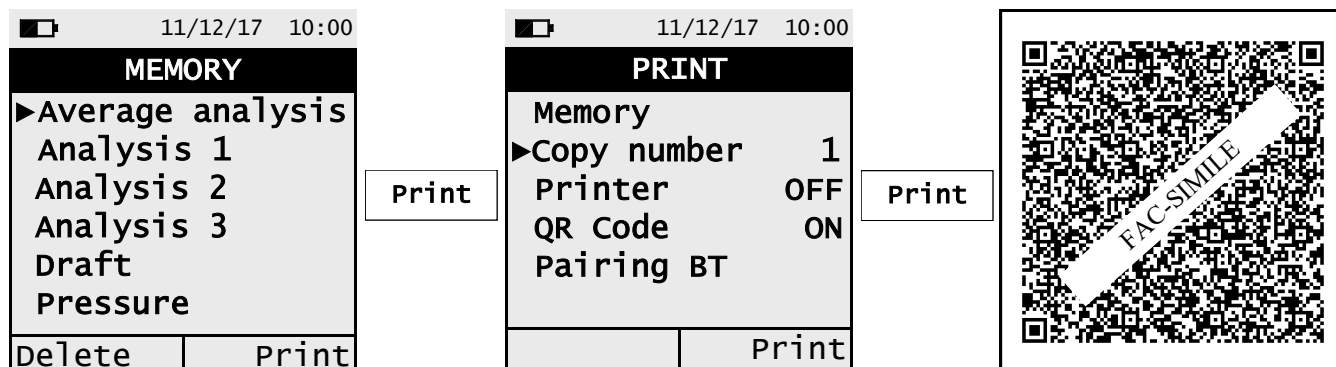


## 4. Print ticket detail of the single analysis / measure

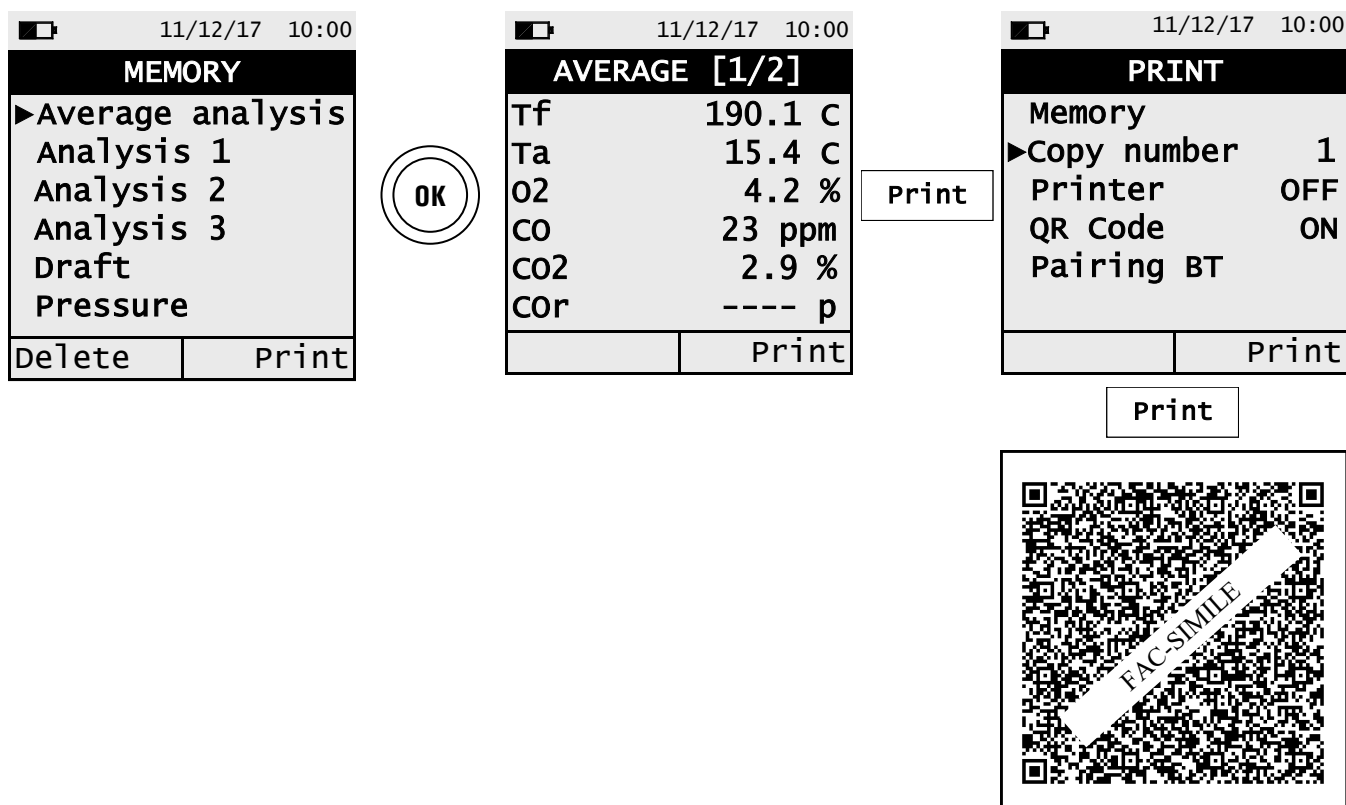




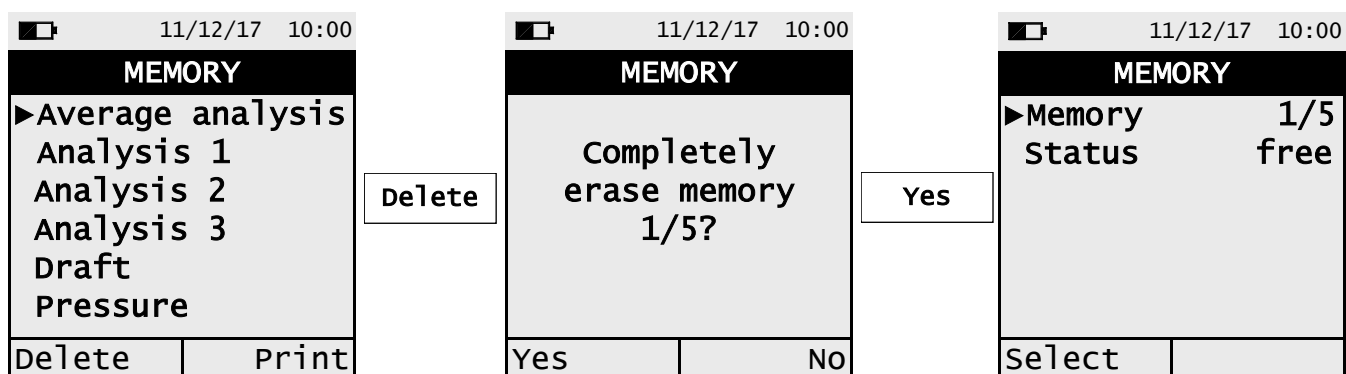
## 5. Detail of QR code generation to download the average analysis data and the additional measures.



## 6. Detail of QR code generation to download the data of each single analysis / measure

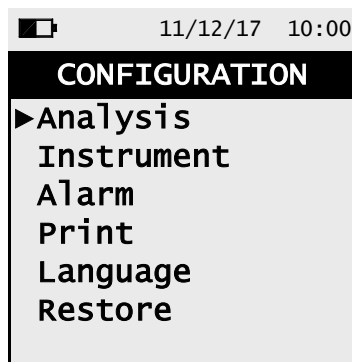


## 7. Detail of deleting the entire selected memory content



# 12.0 CONFIGURATION

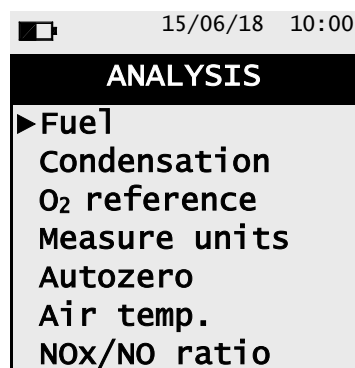
## 12.1 Menu→Configuration



| KEY  | FUNCTION                          |
|------|-----------------------------------|
|      | Enters in the selected parameter. |
| <br> | Selects the available parameters. |
|      | Returns to the previous screen.   |

| SUB MENU          | FUNCTION  |
|-------------------|---|
| <b>Analysis</b>   | The user, through this menu, can set the different reference parameters of the instrument in order to perform the combustion analysis and/or additional measures.<br><a href="#">SEE CHAPTER 12.2</a>   |
| <b>Instrument</b> | The user, through this menu, can set the different reference parameters of the instrument.<br><a href="#">SEE CHAPTER 12.3</a>  |
| <b>Alarm</b>      | <p>Alarm management - In this menu it is possible to set and store only one alarm of which it is possible to define the observed gas, the intervention threshold and the kind of alarm: Minimum, Maximum or Off. The Minimum alarm type will ring when the measured gas drops below the set threshold, while the Maximum alarm type will ring when the measured gas goes above the set threshold. If the alarm is in Off mode, it is deactivated.</p> <p>The graph illustrates gas concentration over time. The y-axis is labeled 'Gas Concentration' and the x-axis is labeled 'Time'. A solid line represents the 'Measured Value'. Two horizontal dashed lines represent 'Threshold' levels. The lower threshold is labeled 'Minimum Alarm' and the upper threshold is labeled 'Maximum Alarm'. The graph shows the measured value dipping below the minimum threshold (labeled 'Alarm') and rising above the maximum threshold (labeled 'Alarm').</p> <p><a href="#">SEE CHAPTER 12.4</a></p> |
| <b>Print</b>      | This menu allows the user to set the printing parameters, such as copy number, printer type (OFF, BT or IR) and the visualization of the QR code so to download the data of the performed analysis.<br><a href="#">SEE CHAPTER 12.5</a>   |
| <b>Language</b>   | Select the desired language of the instrument for all the menus.<br><a href="#">SEE CHAPTER 12.6</a>  |
| <b>Restore</b>    | Reset default data.<br><a href="#">SEE CHAPTER 12.7</a>   |

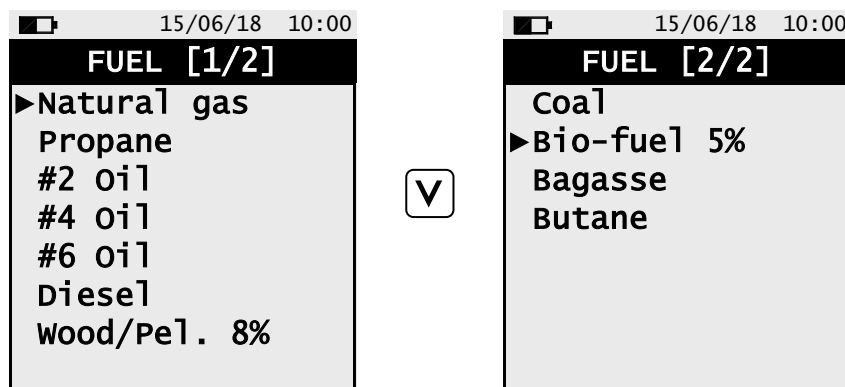
## 12.2 Menu→Configuration→Analysis



| KEY | FUNCTION                          |
|-----|-----------------------------------|
|     | Returns to the previous screen.   |
|     | Selects the available parameters. |
|     | Enters in the selected parameter. |

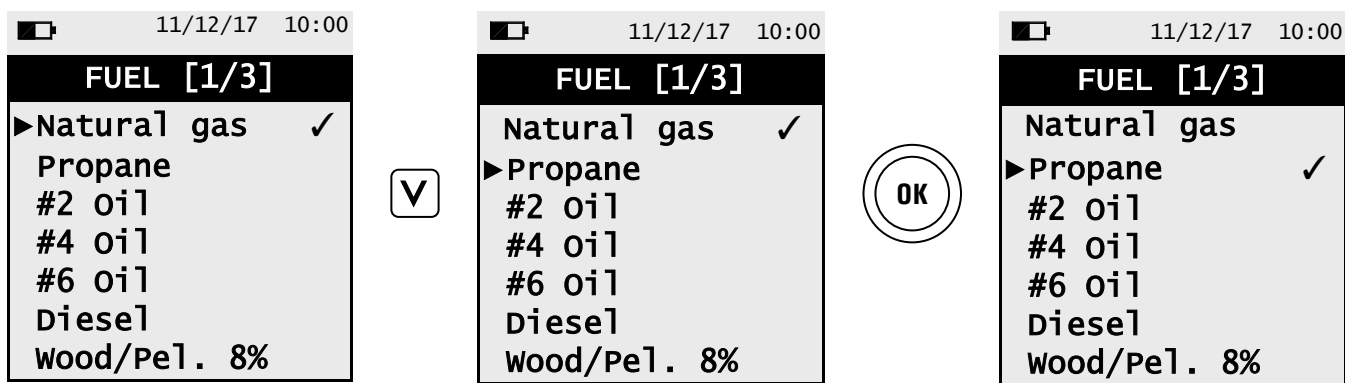
| SUB MENU  | FUNCTION   |
|---|--|
| <b>Fuel</b>   | Lets the user select the type of fuel to be used during analysis.<br><a href="#">SEE CHAPTER 12.2.1.</a>   |
| <b>Condensation</b>                                 | The burner efficiency figure when condensation takes place is influenced by atmospheric pressure and humidity of the combustion air. As the atmospheric pressure is hardly precisely known, the operator is asked to enter a related parameter, i.e. the altitude of the place above the sea level, from which the pressure is then derived once the dependency from atmospheric conditions is neglected. In calculations the value of 101325 Pa is assumed as atmospheric pressure at sea level. Further the air relative humidity input is allowed, being this calculated at the combustion air temperature as measured from the instrument; in case this value is unknown the operator is recommended to enter 50% for this value.<br><a href="#">SEE CHAPTER 12.2.2.</a> |
| <b>O<sub>2</sub> reference</b>                      | In this mode the user can set the oxygen percentage level to which pollutant emission values detected during analysis will be referenced.<br><a href="#">SEE CHAPTER 12.2.3.</a>   |
| <b>Measure units</b>                                | Through this submenu the user can modify the units of measurement for all the analysis parameters, depending on how they are used.<br><a href="#">SEE CHAPTER 12.2.4.</a>  |
| <b>Autozero</b>                                     | In this sub menu it is possible to modify the auto zero cycle duration and the duration of the sensor cleaning cycle.<br><a href="#">SEE CHAPTER 12.2.5.</a>   |
| <b>Air temp.</b>                                    | In this submenu there is a possibility to acquire or manually enter the combustion air temperature.<br><a href="#">SEE CHAPTER 12.2.6</a>  |
| <b>Nox/NO Ratio</b><br>(If NOx Sensor is installed) | NOx/NO: all the nitrogen oxides which are present in the flue emissions (Nitric oxide = NO, Nitrogen dioxide = NO <sub>2</sub> ); total nitrogen oxides = NOx (NO + NO <sub>2</sub> ). In the combustion processes, it is found out that the NO <sub>2</sub> percentage contained in the gas is not far from very low values (3%); hence it is possible to obtain the NOx value by a simple calculation without using a direct measurement with a further NO <sub>2</sub> sensor. The NO <sub>2</sub> percentage value contained in the gas can be however set at a value other than 3% (default value).<br><a href="#">SEE CHAPTER 12.2.7</a>   |

## 12.2.1 Menu→Configuration→Analysis→Fuel

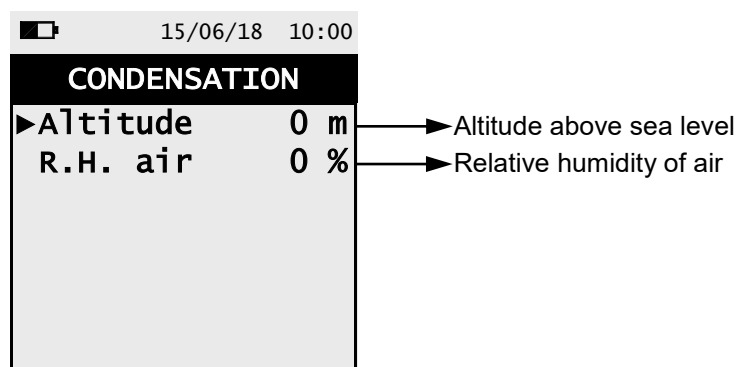


| KEY  | FUNCTION  |
|------|---|
|      | Returns to the previous screen.                             |
| <br> | Scrolls through the pages.                                  |
|      | Confirms the choice of fuel to be used during the analysis. |

Example:

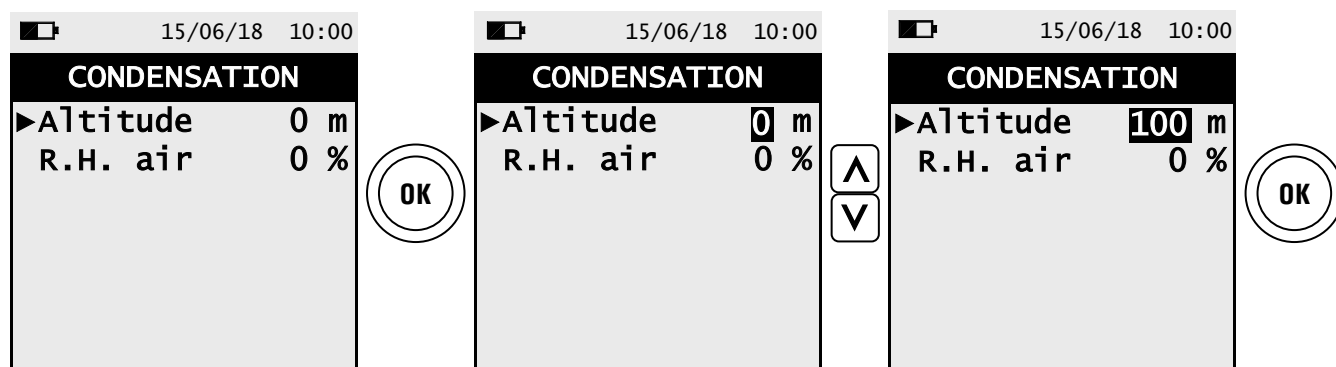


## 12.2.2 Menu→Configuration→Analysis→Condensation

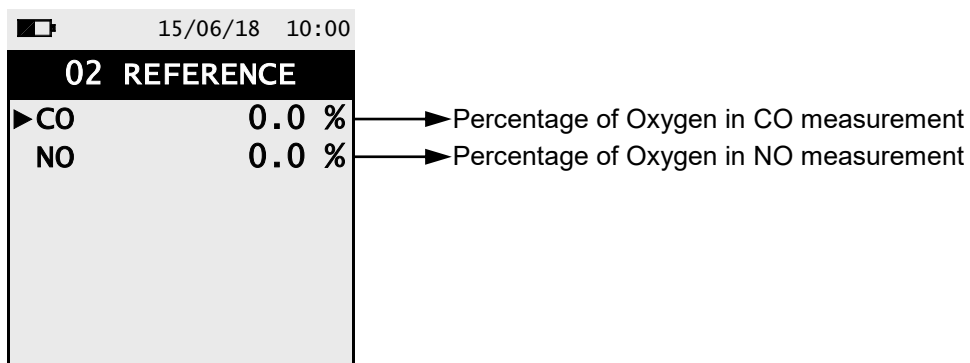


| KEY | FUNCTION  |
|-----|---|
|     | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |
|     | The arrows select each line displayed. In edit mode, it scrolls through the suggested values.     |
|     | Enters the modify mode for the selected parameter, then confirms the modification.                |

Example:

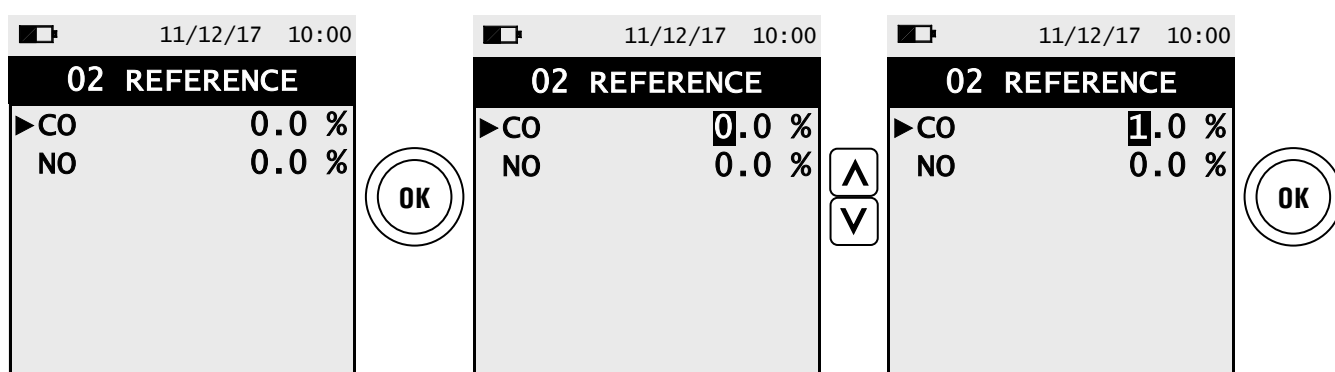


## 12.2.3 Menu→Configuration→Analysis→O2 Reference



| KEY  | FUNCTION  |
|------|---|
|      | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |
| <br> | The arrows select each line displayed. In edit mode, it scrolls through the suggested values.     |
|      | Enters the modify mode for the selected parameter, then confirms the modification.                |

Example:



## 12.2.4 Menu→Configuration→Analysis→Measure units

15/06/18 10:00

**MEASURE UNITS**

► CO ppm

Pressure hPa

Draft mmH2O

Temperature oC

Altitude ft




→ Measurement unit can be set as: ppm - mg/m<sup>3</sup> - mg/kWh - g/GJ - g/m<sup>3</sup> ng/J - g/kWh - %

→ Measurement unit can be set as: ppm - mg/m<sup>3</sup> - mg/kWh - g/GJ - g/m<sup>3</sup> ng/J - g/kWh - %

→ Measurement unit can be set as: hPa - Pa - mbar - mmH2O - mmHg - inH2O - psi

→ Measurement unit can be set as: °C - °F

→ Measurement unit can be set as: m - ft

| KEY   | FUNCTION  |
|---|---|
|    | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |
|    | The arrows select each line displayed. In edit mode, it scrolls through the suggested values.     |
|  | Enters the modify mode for the selected parameter, then confirms the modification.                |

Example:

15/06/18 10:00

**MEASURE UNITS**

► CO ppm

Pressure hPa

Draft mmH2O

Temperature oC

Altitude ft

OK

15/06/18 10:00

**MEASURE UNITS**

► CO ppm

Pressure hPa

Draft mmH2O

Temperature oC

Altitude ft

↑  
↓

15/06/18 10:00

**MEASURE UNITS**

► CO mg/m<sup>3</sup>

Pressure hPa

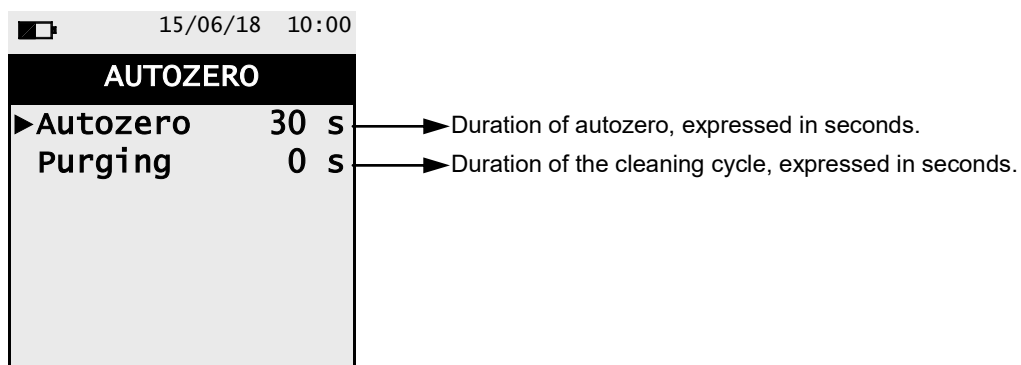
Draft mmH2O

Temperature oC

Altitude ft

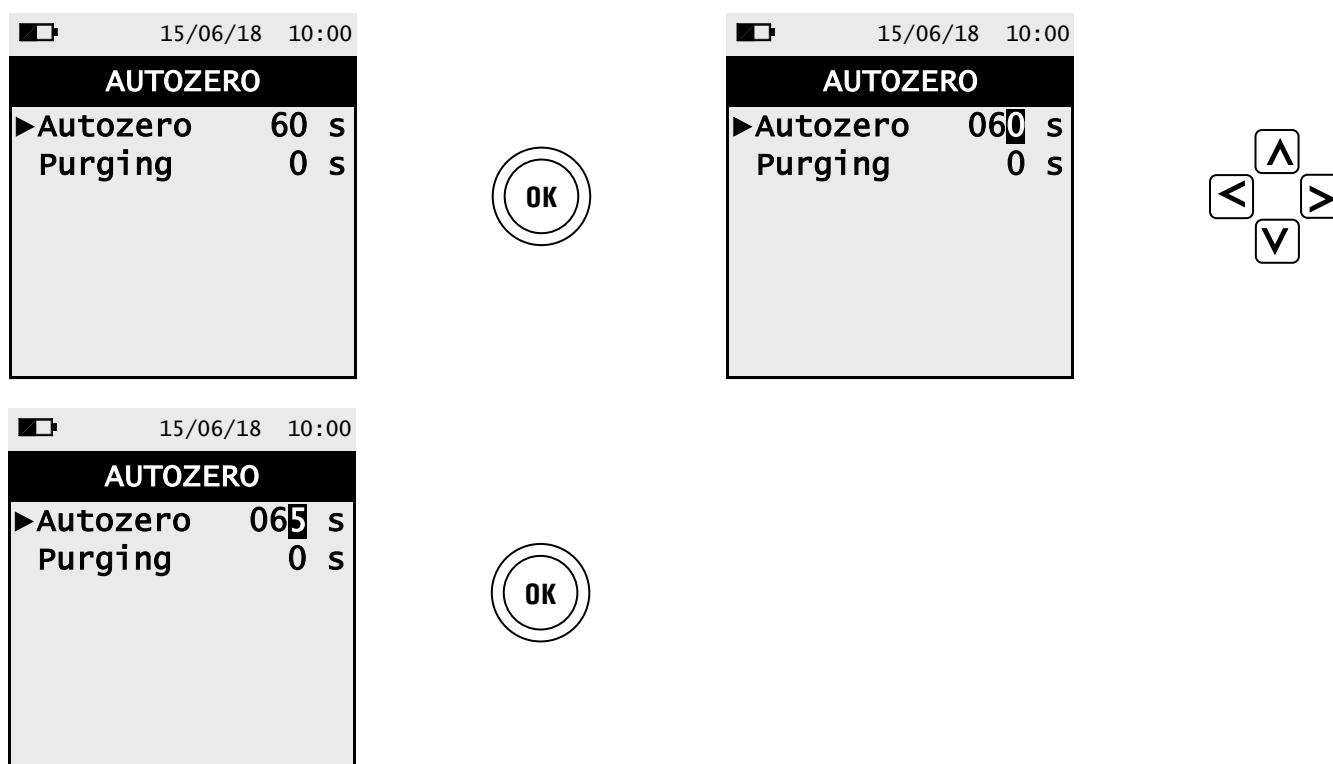
OK

## 12.2.5 Menu→Configuration→Analysis→Autozero



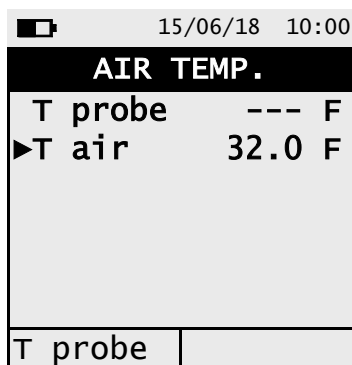
| KEY | FUNCTION  |
|-----|---|
|     | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |
|     | When in modify mode, sets the desired value.  |
|     | Enters edit mode of the selected element and then confirms the change.                            |

Example:





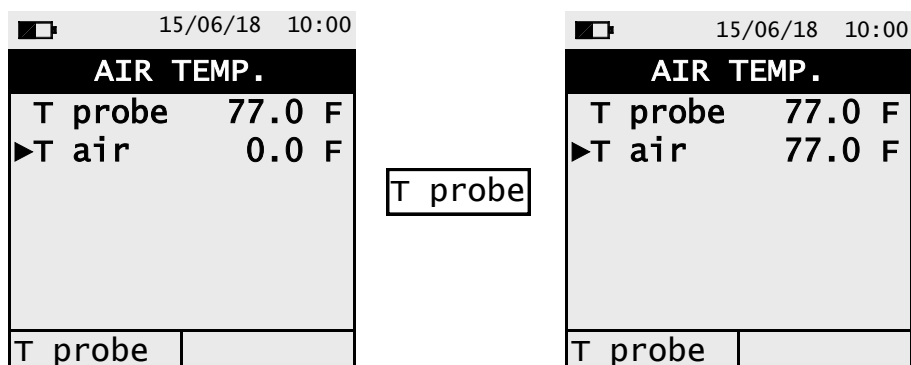
## 12.2.6 Menu→Configuration→Analysis→Air temp



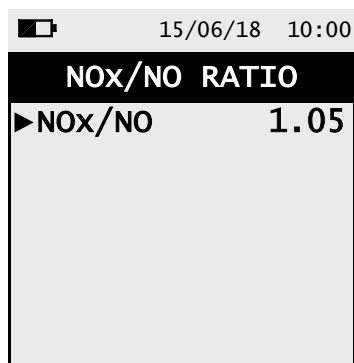
| KEY | FUNCTION  |
|-----|---|
|     | Enters edit mode of the selected element and then confirms the change.                            |
|     | When in modify mode, sets the desired value.  |
|     | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |


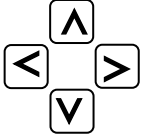

| INTERACTIVE OPERATION | DESCRIPTION   |
|-----------------------|---|
| T probe               | Acquires the detected temperature by the Tc-K probe connected to the instrument and uses it as primary air temperature. |

Example with probe connected to the instrument:

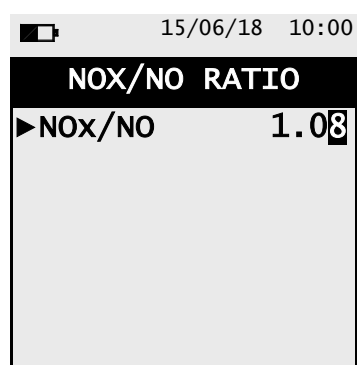
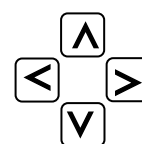
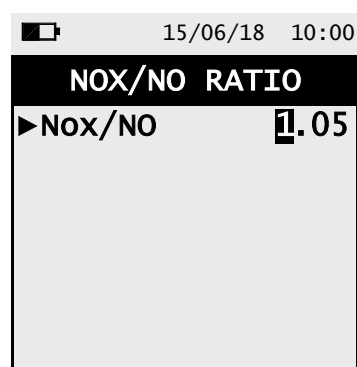
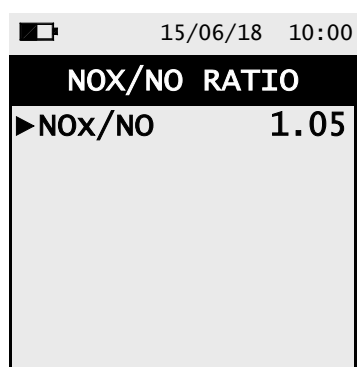


## 12.2.7 Menu→Configuration→Analysis→NOx/NO Ratio (If NOx Sensor is installed)






| KEY   | FUNCTION  |
|---|---|
|    | Enters edit mode of the selected element and then confirms the change.                            |
|   | When in modify mode, sets the desired value.  |
|  | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |

Example:



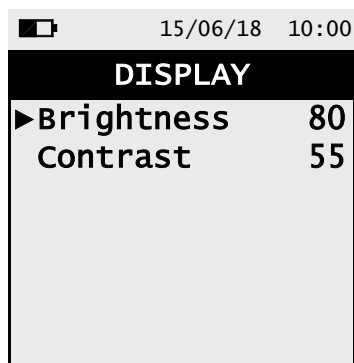
## 12.3 Menu→Configuration→Instrument






| KEY   | FUNCTION                          |
|---|-----------------------------------|
|  | Returns to the previous screen.   |
|  | Selects the available parameters. |
|  | Enters in the selected parameter. |

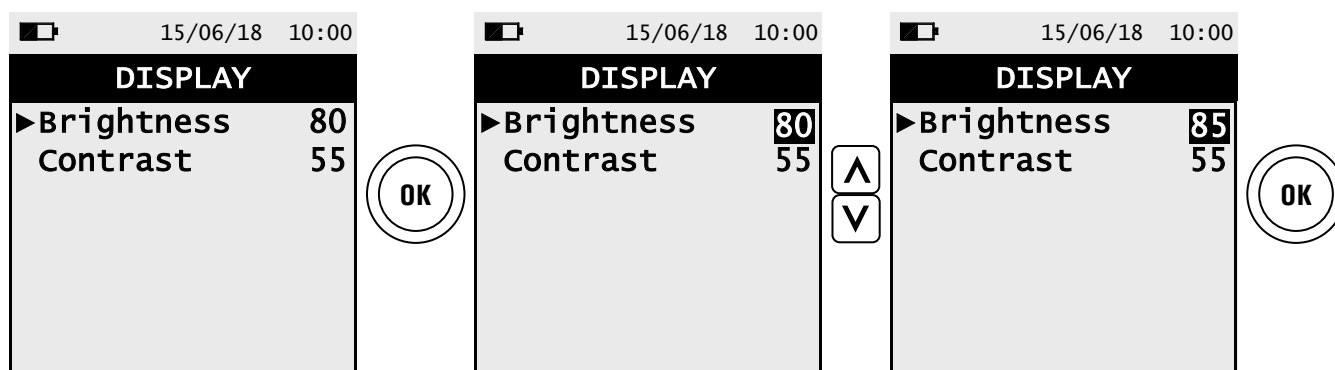
| SUB MENU  | FUNCTION  |
|---|---|
| Display   | With the arrow keys it is possible to increase or decrease the brightness and the contrast of the display.<br><a href="#">SEE CHAPTER 12.3.1.</a>   |
| On site calib.  | It is possible to make a recalibration of the instrument's gas sensors with suitable known concentration gas cylinders. Recalibration of Oxygen (O <sub>2</sub> ) sensor is not available since it is already recalibrated during every autozero sequence.<br><b>The access to the sensor recalibration is password protected, the password is '1111'.</b><br><a href="#">SEE CHAPTER 12.3.2.</a> |
| Clock   | This allows the current time and date to be set. The user can select the date and hour format either in EU (European) or USA (American) mode.<br><a href="#">SEE CHAPTER 12.3.3.</a>  |
| Bluetooth<br>(if the version of the instrument foresees it) | In this sub menu it is possible to turn on and off the Bluetooth <sup>®</sup> communication of the instrument and to visualize the related codes.<br><a href="#">SEE CHAPTER 12.3.4</a>   |

## 12.3.1 Menu→Configuration→Instrument→Display

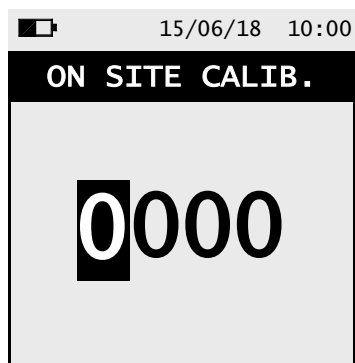


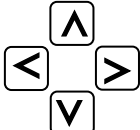



| KEY   | FUNCTION  |
|---|---|
|    | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |
|   | The arrows select each line displayed. In edit mode, it scrolls through the suggested values.     |
|  | Enters the modify mode for the selected parameter, then confirms the modification.                |

Example:



## 12.3.2 Menu→Configuration→Instrument→On site calib.



| KEY   | FUNCTION   |
|---|--|
|    | Sets the password.   |
|   | Selects line; in modification sets the value or the desired mode.                          |
|  | Once password is entered, gives access to the 'On site calibration' menu.                  |
|  | Returns to the previous screen.<br>When in modify mode cancels the modification just made. |

## On site calibration procedure

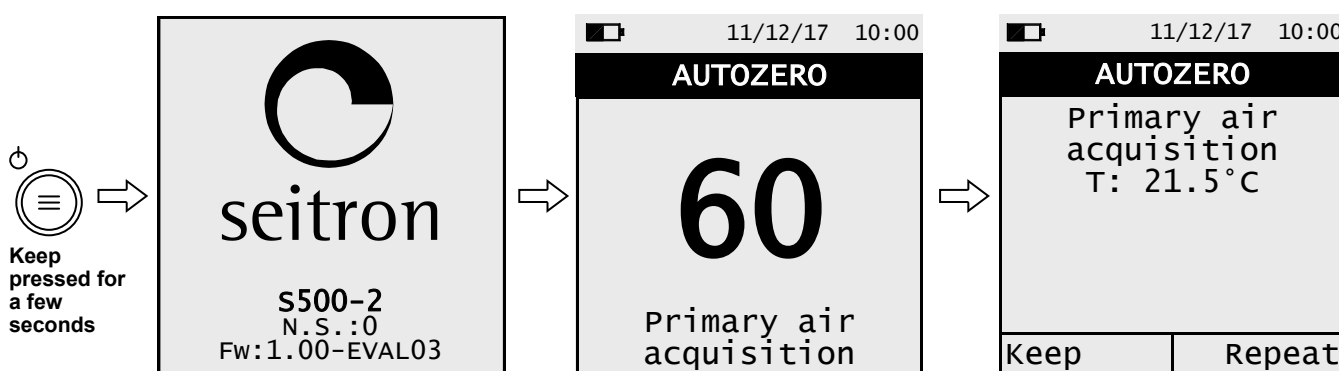
To perform the recalibration the following instruments are needed:

- Known concentration gas cylinder suitable for the sensor, equipped with a pressure regulator
- Flow meter
- Hose with T-fitting to connect the cylinder to the flowmeter and to the instrument

### WARNING!


For the oxygen sensor on site calibration, the zero value calibration must be carried out with nitrogen or any other gas mixture which **DOES NOT** contain oxygen.

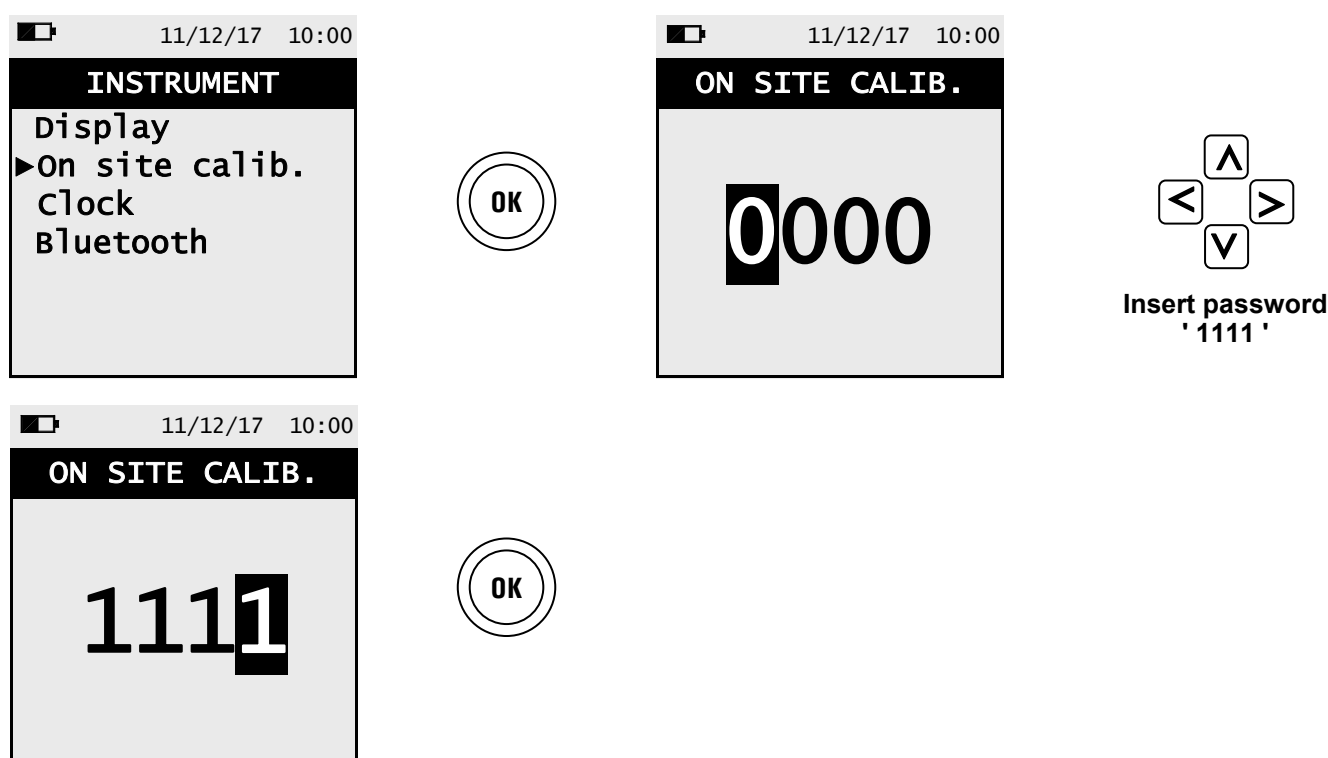
#### 1. Start the instrument



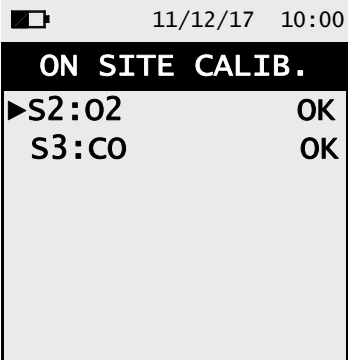
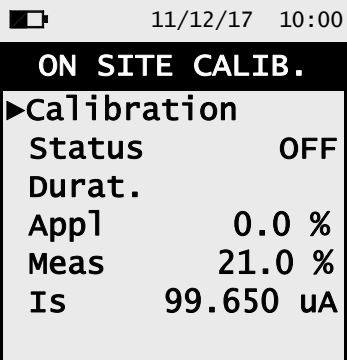
### WARNING

- Be sure that the autozero is performed in clean fresh air and that it terminates correctly.
- Do not connect the gas probe to the instrument.
- Check the battery charge level or connect the power adapter to avoid data loss during recalibration.

2. Once the autozero is completed press the  button and select the menu Configuration→Instrument→on site calib.



3. The 'On site calibration' menu shows the list of the installed sensors for which the recalibration is available. In the recalibration screen all information related to the last performed calibration is shown, as well as the relevant values.

**Calibrate:** saves new calibration

**Status:** OFF: returns to the factory calibration

ON: returns to the last calibration made by the user

----: no 'on site calibration' has been previously stored

**Elapsed time:** timer

**Applied gas:** enters the concentration of the applied calibration gas

**Measured gas:** measures the concentration of the applied gas

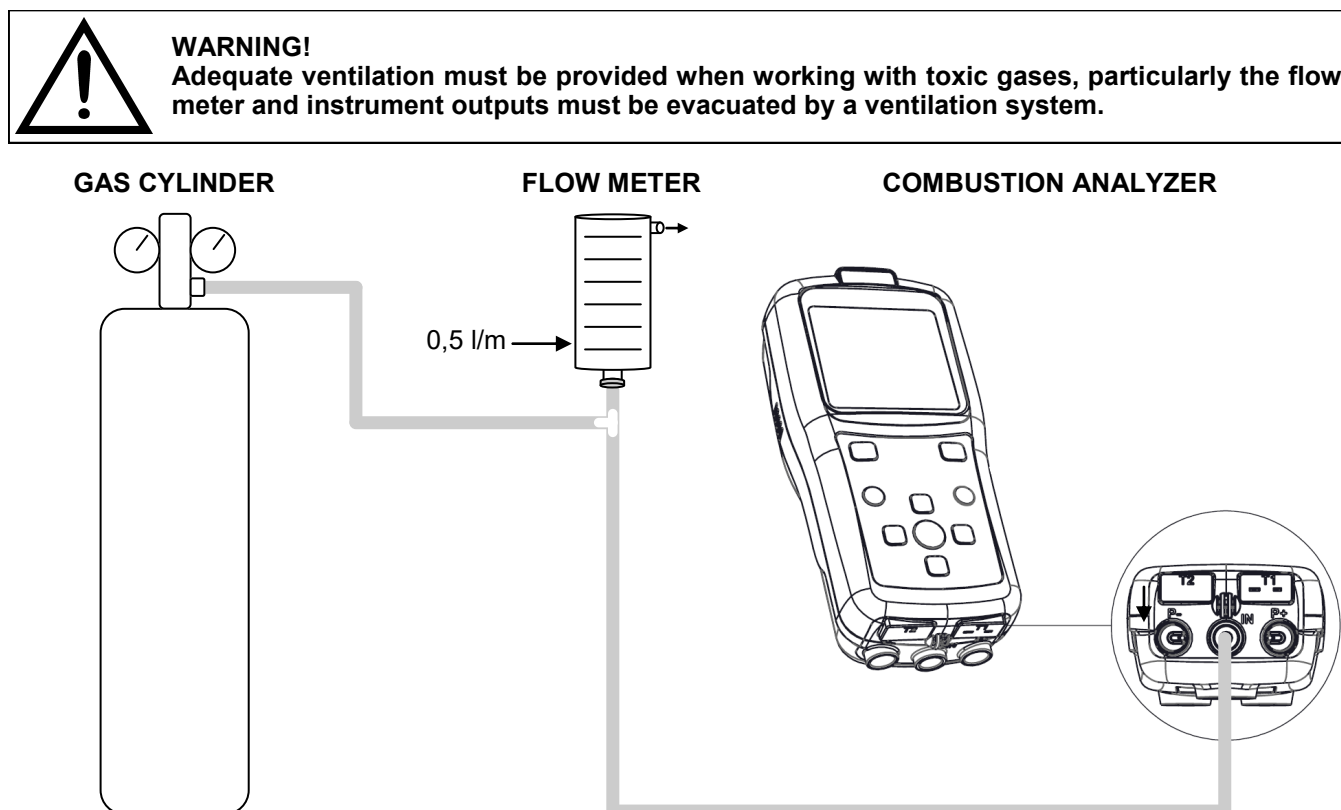
**Is:** 'Is' current from the sensor

**Ia:** 'Ia' current from the sensor (Only available with compensated CO sensor)

4. In the following a detailed recalibration example will be described for O2 and CO sensors.

**CHOOSE THE SENSOR TO BE RECALIBRATED AND PROCEED AS DESCRIBED (CO SENSOR EXAMPLE):**

- Connect the known concentration gas cylinder to the instrument as shown in the following scheme:



## OXIGEN SENSOR (O<sub>2</sub>) CALIBRATION DETAIL

- The calibration is **possible** only when the status is set to '----' (sensors that have never been calibrated before) otherwise it is necessary to set 'Status' to '**OFF**' (see example below).

|                       |           |
|-----------------------|-----------|
| 11/12/17 10:00        |           |
| <b>ON SITE CALIB.</b> |           |
| Calibration           |           |
| ►Status               | ----      |
| Durat.                | 00:00:00  |
| App1                  | 0.0 %     |
| Meas                  | 21.0 %    |
| Is                    | 99.650 uA |

or

|                       |           |
|-----------------------|-----------|
| 11/12/17 10:00        |           |
| <b>ON SITE CALIB.</b> |           |
| Calibration           |           |
| ►Status               | ON        |
| Durat.                | 00:00:02  |
| App1                  | 0.0 %     |
| Meas                  | 21.0 %    |
| Is                    | 99.650 uA |



|                       |           |
|-----------------------|-----------|
| 11/12/17 10:00        |           |
| <b>ON SITE CALIB.</b> |           |
| Calibration           |           |
| ►Status               | ON        |
| Durat.                | 00:00:03  |
| App1                  | 0.0 %     |
| Meas                  | 21.0 %    |
| Is                    | 99.650 uA |



|                       |           |
|-----------------------|-----------|
| 11/12/17 10:00        |           |
| <b>ON SITE CALIB.</b> |           |
| Calibration           |           |
| ►Status               | OFF       |
| Durat.                | 00:00:04  |
| App1                  | 0.0 %     |
| Meas                  | 21.0 %    |
| Is                    | 99.650 uA |



- Apply gas to the instrument and adjust the output pressure of the gas from the cylinder so that the flow meter indicates a minimum flow of 0.5 l/m: this guarantees that the instrument is taking the exact amount of gas required by the internal pump.
- The instrument measures the concentration of gas applied; **wait at least 3 minutes to allow the reading to stabilize**. The reading is shown in line 'Meas'.

|                       |           |
|-----------------------|-----------|
| 11/12/17 10:00        |           |
| <b>ON SITE CALIB.</b> |           |
| Calibration           |           |
| ►Status               | ----      |
| Durat.                | 01:30:11  |
| App1                  | 0.0 %     |
| Meas                  | 21.0 %    |
| Is                    | 99.650 uA |



|                       |           |
|-----------------------|-----------|
| 11/12/17 10:00        |           |
| <b>ON SITE CALIB.</b> |           |
| Calibration           |           |
| Status                | ----      |
| ►Durat.               | 01:03:15  |
| App1                  | 0.0 %     |
| Meas                  | 21.0 %    |
| Is                    | 99.650 uA |



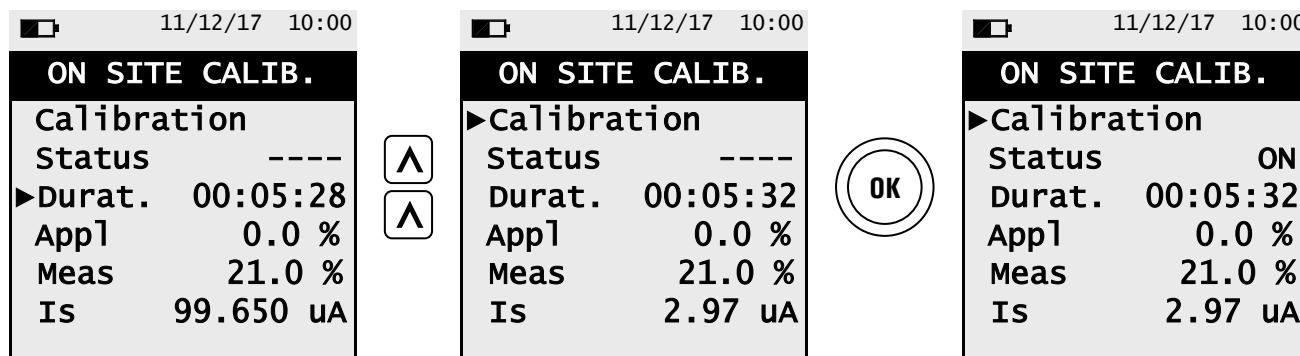
Resets the timer (helps to control the elapsed time during the stabilization phase)

|                       |           |
|-----------------------|-----------|
| 11/12/17 10:00        |           |
| <b>ON SITE CALIB.</b> |           |
| Calibration           |           |
| Status                | ----      |
| ►Durat.               | 00:00:00  |
| App1                  | 0.0 %     |
| Meas                  | 21.0 %    |
| Is                    | 99.650 uA |





- When the stabilization time is over, select 'Calibration' and store the new calibration.



#### Messages in the 'Status' line:

##### Saving

the instrument is saving the performed calibration

##### Error

the sensor has NOT been recalibrated for any of the following reasons:

- The calibration gas cannot properly reach the instrument.
- The user didn't allow for the stabilization time to properly elapse.
- The sensor could be damaged or exhausted and must therefore be replaced.



#### **WARNING**

- At any time the user can restore the factory calibration in the instrument by setting 'Status' to 'OFF'.
- The advised stabilization time for the on-site calibration of the sensors is 3 minutes.

## SENSOR CALIBRATION DETAIL FOR TOXIC GASES (EXAMPLE REFERRED TO CO).

- The calibration is **possible** only when the status is set to '----' (sensors that have never been calibrated before) otherwise it is necessary to set 'Status' to 'OFF' (see example below).

11/12/17 10:00

**ON SITE CALIB.**

Calibration

►Status ----

Durat. 00:00:03

App1. 1000 ppm

Meas 0 ppm

Is 0.059 uA

or

11/12/17 10:00

**ON SITE CALIB.**

Calibration

►Status ON

Durat. 00:00:00

App1 1000 ppm

Meas 0 ppm

Is 0.059 uA

OK

11/12/17 10:00

**ON SITE CALIB.**

Calibration

►Status ON

Durat. 00:00:00

App1 1000 ppm

Meas 0 ppm

Is 0.059 uA

▲

▼

11/12/17 10:00

**ON SITE CALIB.**

Calibration

►Status OFF

Durat. 00:00:00

App1 1000 ppm

Meas 0 ppm

Is 0.059 uA

OK

- Enter the value of the concentration of the gas applied.

11/12/17 10:00

**ON SITE CALIB.**

Calibration

Status OFF

Durat. 00:03:00

►App1 1000 ppm

Meas 0 ppm

Is 0.059 uA

▼

▼

OK

11/12/17 10:00

**ON SITE CALIB.**

Calibration

Status OFF

Durat. 00:03:50

►App1 1000 ppm

Meas 0 ppm

Is 0.059 uA

▲

▼

<

>

11/12/17 10:00

**ON SITE CALIB.**

Calibration

Status OFF

Durat. 00:03:50

►App1 0300 ppm

Meas 0 ppm

Is 0.059 uA

OK

- Apply gas to the instrument and adjust the output pressure of the gas from the cylinder so that the flow meter indicates a minimum flow of 0.5 l/m: this guarantees that the instrument is taking the exact amount of gas required by the internal pump.

- The instrument measures the concentration of gas applied; **wait at least 3 minutes to allow the reading to stabilize**. The reading is shown in line 'Meas'.

|                       |          |
|-----------------------|----------|
| 11/12/17 10:00        |          |
| <b>ON SITE CALIB.</b> |          |
| Calibration           |          |
| Status                | ----     |
| ►Durat.               | 00:03:60 |
| App1                  | 800 ppm  |
| Meas                  | 0 ppm    |
| Is                    | 0.52 uA  |



Resets the timer (helps to control the elapsed time during the stabilization phase)

|                       |          |
|-----------------------|----------|
| 11/12/17 10:00        |          |
| <b>ON SITE CALIB.</b> |          |
| Calibration           |          |
| Status                | ----     |
| ►Durat.               | 00:00:00 |
| App1                  | 800 ppm  |
| Meas                  | 0 ppm    |
| Is                    | 0.52 uA  |

- When the stabilization time is over, select 'Calibration' and store the new calibration.

|                       |          |
|-----------------------|----------|
| 11/12/17 10:00        |          |
| <b>ON SITE CALIB.</b> |          |
| ►Calibration          |          |
| Status                | ----     |
| Durat.                | 00:00:00 |
| App1                  | 800 ppm  |
| Meas                  | 800 ppm  |
| Is                    | 0.52 uA  |



|                       |          |
|-----------------------|----------|
| 11/12/17 10:00        |          |
| <b>ON SITE CALIB.</b> |          |
| ►Calibration          |          |
| Status                | ON       |
| Durat.                | 00:00:00 |
| App1                  | 800 ppm  |
| Meas                  | 800 ppm  |
| Is                    | 0.52 uA  |

#### Messages in the 'Status' line:

##### Saving

the instrument is saving the performed calibration

##### Error

the sensor has NOT been recalibrated for any of the following reasons:

- The calibration gas cannot properly reach the instrument.
- Concentration for the calibration gas has not been set in the relevant line 'Applied gas'.
- The user didn't allow for the stabilization time to properly elapse.
- The sensor could be damaged or exhausted and must therefore be replaced.




#### **WARNING!**

At any time the user can restore the factory calibration in the instrument by setting the 'Status' line on 'OFF'.

**Below are listed the suggested stabilization times for the 'on site calibration' of the sensors:**

CO sensor: 3 minutes  
NO sensor: 3 minutes

### 12.3.3 Menu→Configuration→Instrument→Clock

 15/06/18 10:00

**CLOCK**

**Time**
9:00PM

**Date**
06/15/20

**Mode**
USA




**Mode**
24h

Time, in the chosen format

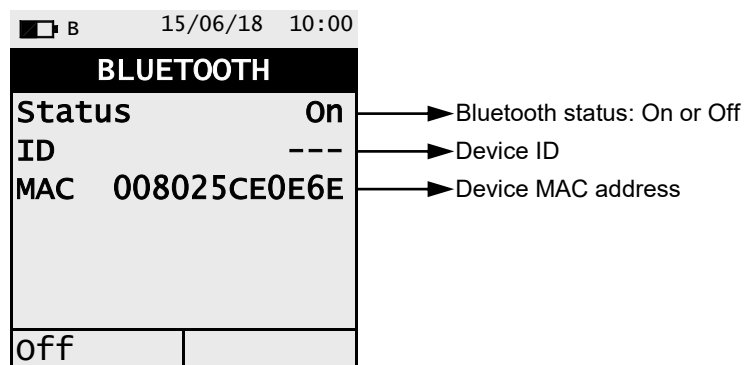
Date, in the chosen format

Date format: EU (Europe) or USA (America)

Time format: 24h or 12h

| KEY   | FUNCTION  |
|---|---|
|    | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |
|   | Selects line; in modification sets the value or the desired mode.                                 |
|  | Enters the modify mode for the selected parameter, then confirms the modification.                |

## 12.3.4 Menu→Configuration→Instrument→Bluetooth (if available)



| KEY | FUNCTION  |
|-----|---|
|     | Activate the context keys shown on the display. |
|     | Goes back to the previous screen.               |

| INTERACTIVE OPERATIONS | DESCRIPTION           |
|------------------------|-----------------------|
| Off                    | Turns off Bluetooth®. |
| On                     | Turns on Bluetooth®.  |

## 12.4 Menu→Configuration→Alarm

11/12/17 10:00

**ALARM**

►Measure
O2


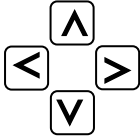

Mode
Min

Limit
18.0 %

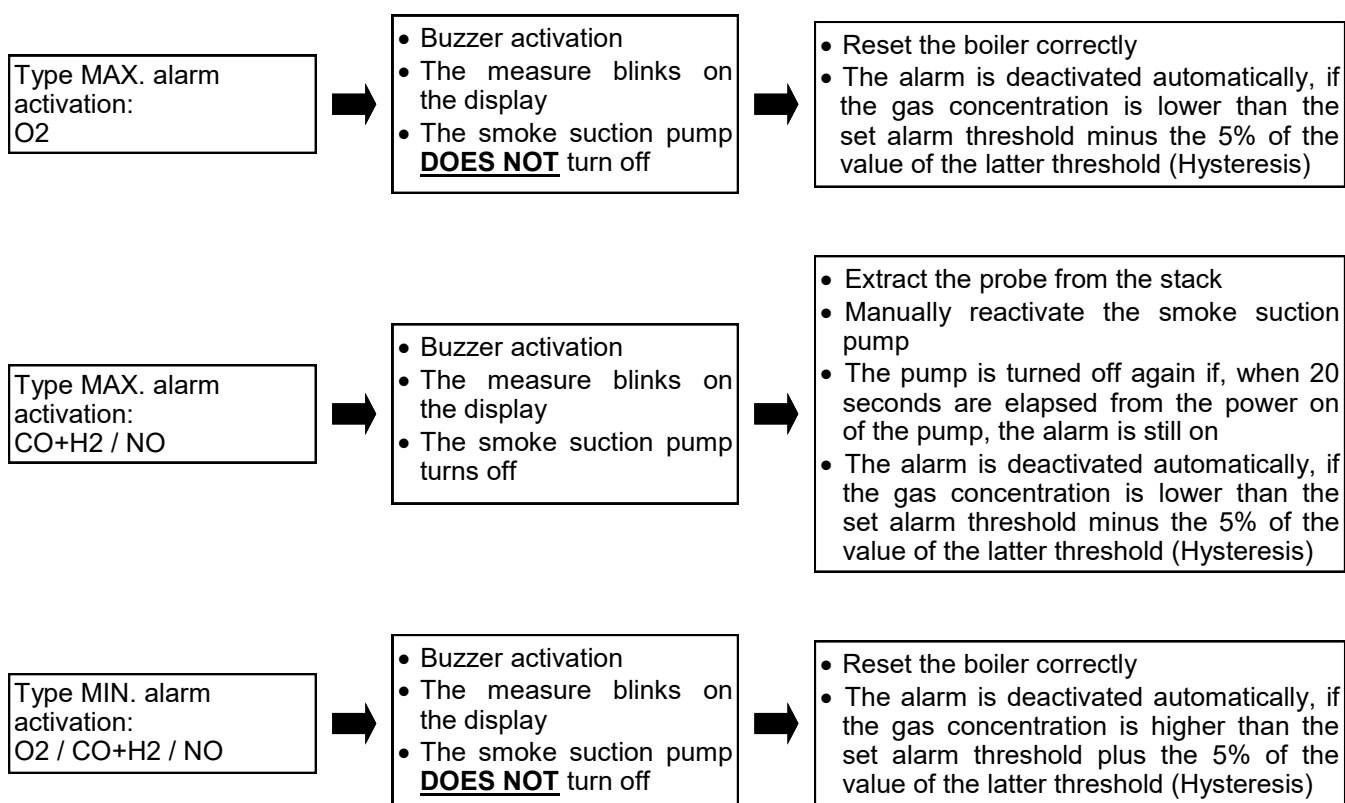
Observed parameter: CO - NO - O2

Kind of set alarm: Max / Min / Off

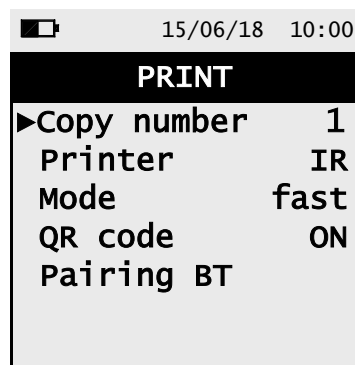
Concentration threshold of the observed gas.




| KEY   | FUNCTION  |
|---|---|
|    | Enters the modify mode for the selected parameter, then confirms the modification.                  |
|   | Selects line; in setting mode, sets the value or the desired mode.                                  |
|  | When pressed in modify mode cancels the selection made, otherwise re- turns to the previous screen. |

### Alarm activation flow chart and suggested correctional actions



## 12.5. Menu→Configuration→Print

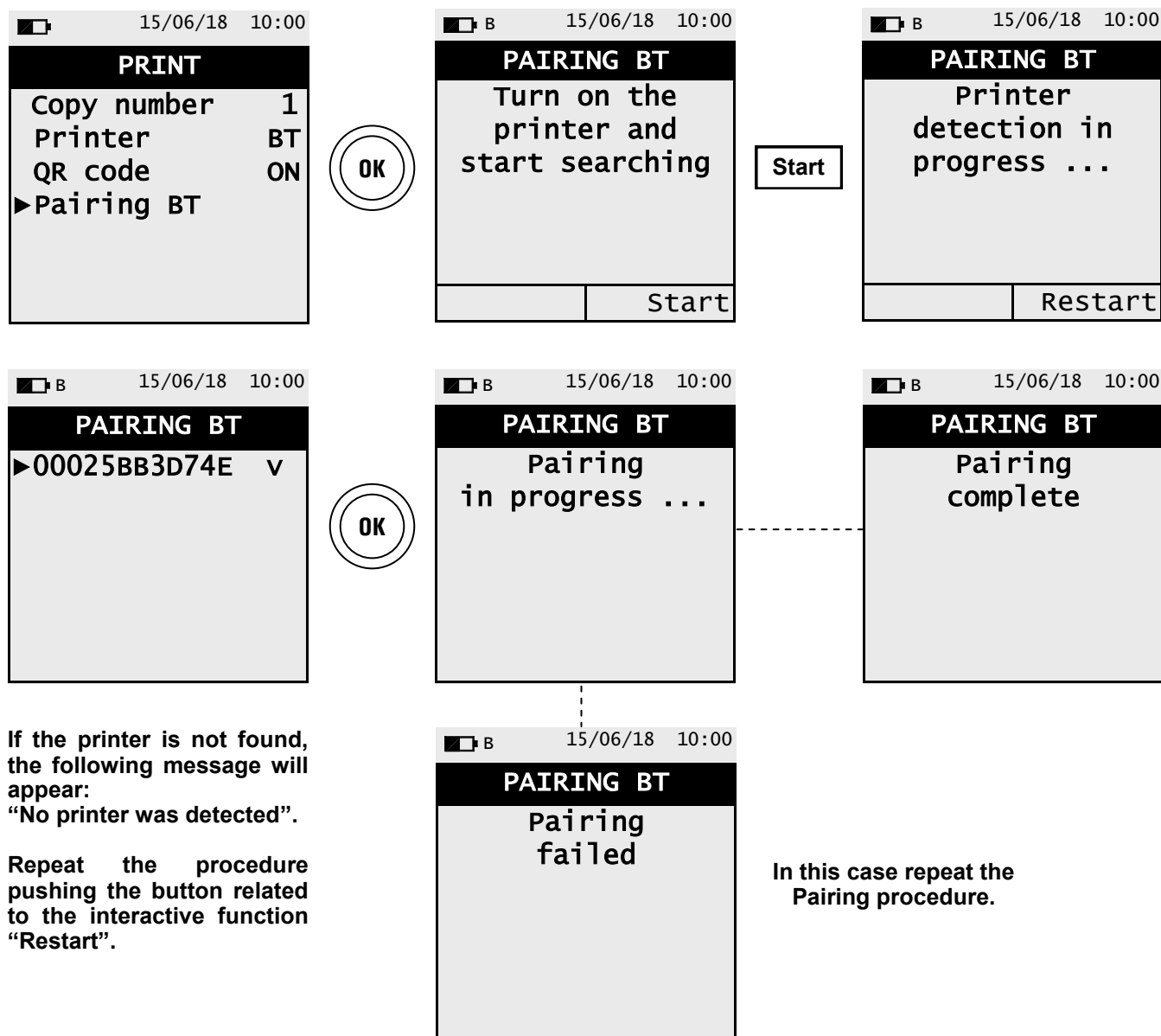


| KEY   | FUNCTION  |
|---|---|
|  | Enters the modification mode of the selected data and then confirms it.                           |
|  | Selects the available parameters. In modification mode, scrolls the available values.             |
|  | When pressed in modify mode cancels the selection made, otherwise returns to the previous screen. |

| PARAMETER   | DESCRIPTION  |
|---|--|
| Copy number   | Sets the number of ticket copy to be printed.<br>This is a valid setting only if a printer has been selected.  |
| Printer   | Select the type of printer with which the ticket is printed:<br><b>BT:</b> Bluetooth® - at the first start up it is necessary to perform the pairing procedure described below. (if the instrument version foresees it)<br><b>IR:</b> Infrared.<br><b>OFF:</b> none - the printer is turned off.   |
| Mode  | <b>This parameter is visible only if the IR printer has been selected.</b><br>Selects the printing speed of the IR printer between 'fast' and 'slow'.<br>Select 'slow' in order to make the printing process compatible when an HP IR printer is used.   |
| QR code   | <b>QR code generation (if the instrument version foresees it):</b><br><b>ON:</b> pushing the button related to the interactive function "Print" the instrument generates a QR code, which can be read with the " <a href="#">Seitron Smart Analysis app</a> " and allows to download the data acquired of the performed combustion analysis and the additional measures.<br><b>OFF:</b> the QR code will not be shown. |
| Pairing BT<br>(If the instrument foresees the on-board Bluetooth interface) | Carry out the instrument association procedure to pair the Bluetooth® printer.   |

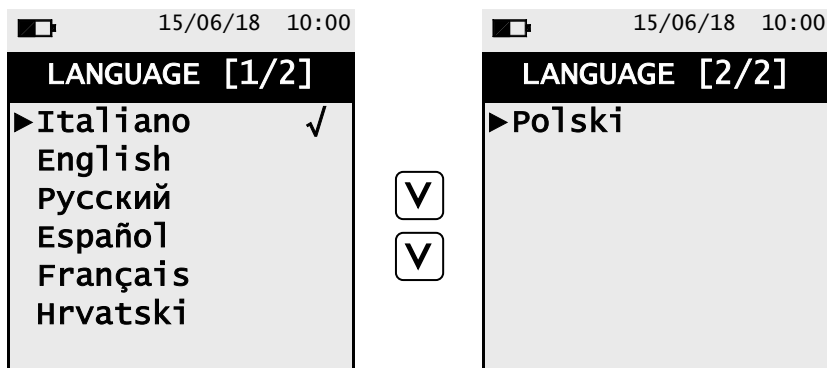
## 12.5.1 Menu→Configuration→Print→Pairing

1. When the Bluetooth printer is set, proceed with the following procedure:





## 12.6 Menu→Configuration→Language

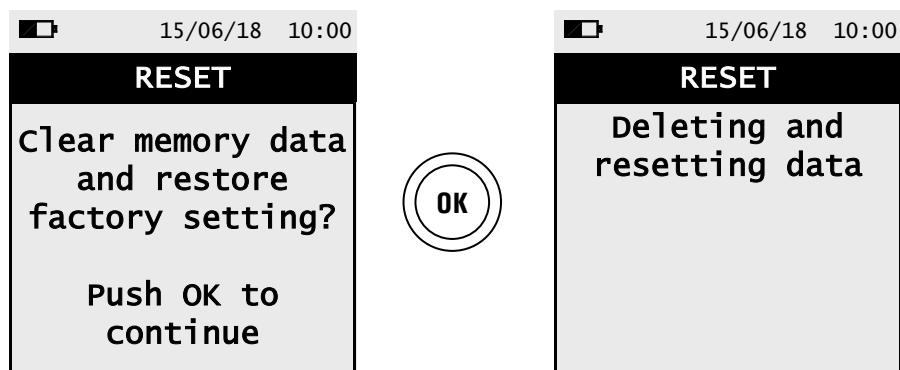




| KEY | FUNCTION                                 |
|-----|--|
|     | Returns to the previous screen.          |
|     | Scrolls through the available languages. |
|     | Sets the selected language.              |

Example:



## 12.7 Menu→Configuration→Reset



| KEY  | FUNCTION                                    |
|--|---|
|   | Exits the current screen without resetting. |
|  | Starts the factory data reset phase.        |

# 13.0 DIAGNOSTIC

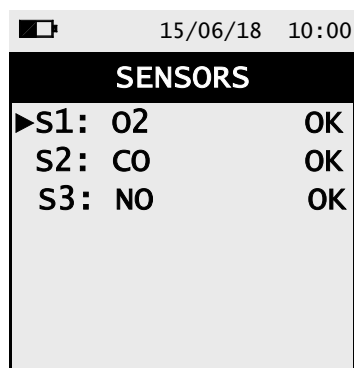
## 13.1 Menu→Diagnostic



| KEY | FUNCTION                          |
|-----|-----------------------------------|
|     | Returns to the previous screen.   |
|     | Selects the available parameters. |
|     | Enters in the selected parameter. |

| SUB MENU  | DESCRIPTION   |
|-----------|---|
| Sensors   | Displays information on the state and calibration of the electrochemical sensors. Moreover, accesses to the ID data of the sensor:<br>Code<br>Serial number<br>Manufacturing and calibration date.<br>Measured currents (to perform a quick diagnosis in case of malfunction).<br><a href="#">SEE CHAPTER 13.1.1.</a> |
| Gas probe | Tests the tightness of the gas probe pneumatic path.<br><a href="#">SEE CHAPTER 13.1.2.</a>   |
| Hardware  | If a malfunction happens, before contacting the Customer care service collect and/or send the data present in this menu.<br><a href="#">SEE CHAPTER 13.1.3.</a>   |

### 13.1.1 Menu→Diagnostic→Sensors

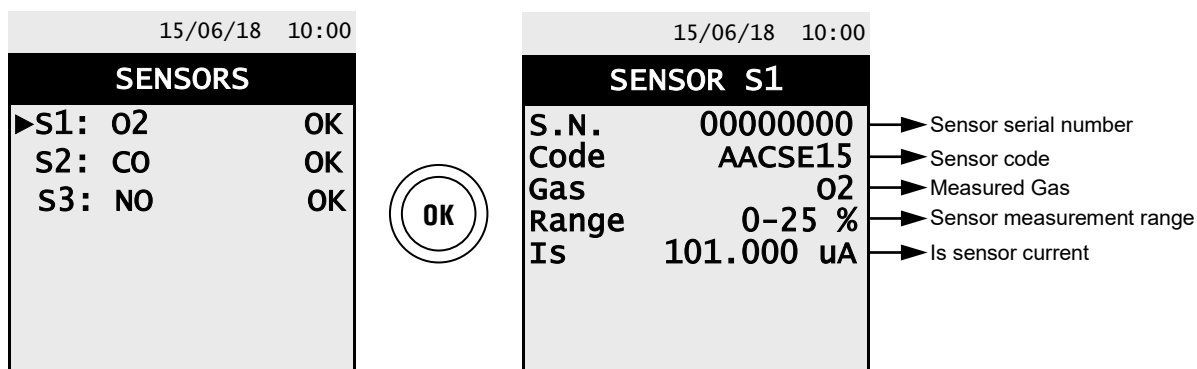


Messages on the state and calibration of the electrochemical sensors:

|                 |  |
|-----------------|--|
| <b>Ok</b>       | No problem detected  |
| <b>absent</b>   | The sensor was not detected  |
| <b>err data</b> | Memory data error of the sensor  |
| <b>unknown</b>  | It is necessary to update the FW of the device                                       |
| <b>err pos</b>  | The sensor has been installed in the wrong position                                  |
| <b>err cal</b>  | Calibration error (sensor not calibrated)  |
| <b>err curr</b> | Currents outside the range   |
| <b>err cfg</b>  | Do not use this sensor as it has not been accepted on the screen "types of sensors". |

| KEY | DESCRIPTION                                  |
|-----|--|
|     | Returns to the previous screen.              |
|     | Selects the available parameters.            |
|     | Shows the details about the selected sensor. |

Example:



### 13.1.2 Menu→Diagnostic→Gas probe

15/06/18 10:00

**GAS PROBE**

Close the flue  
gas probe

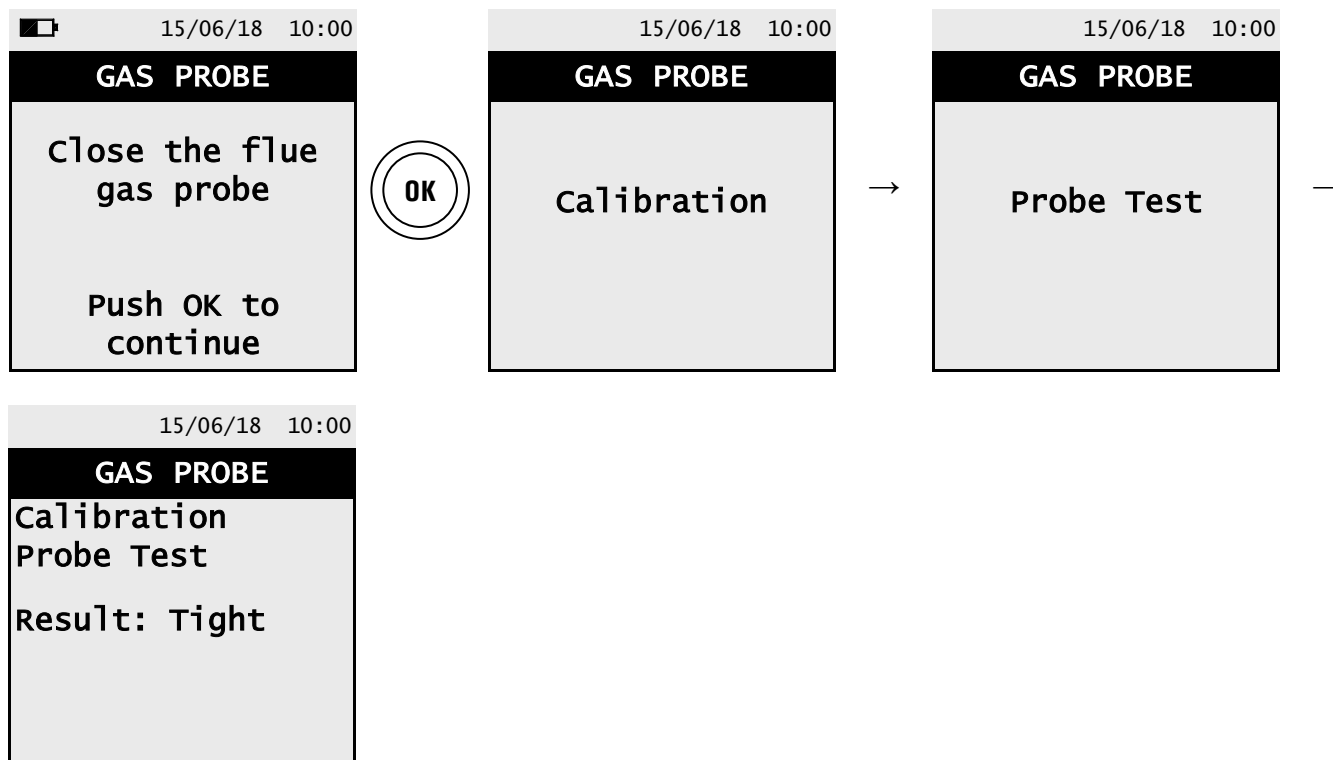
Push OK to  
continue

Connect the flue gas sampling probe and filter unit assembly to the instrument;  
Fully insert the black rubber cap on the gas probe tip, as shown in the following picture:

Provided black rubber cap

| KEY | FUNCTION  |
|-----|---|
|     | Returns to the previous screen.                                   |
|     | Starts the test to check the tightness of the gas sampling probe. |

#### Tightness test of the probe.



#### Results:

**Tightness:** The system is OK





**Leak:** Make sure that the probe is connected to the input P- or P+, check the seals of the pneumatic connections and/or the seal of the condensation trap and check that the test cap is correctly inserted on the tip of the probe. **WARNING: a damaged probe tip may impair the test.**

**Error:** It is not possible to perform the test because the sensor is not calibrated.



### 13.1.3 Menu→Diagnostic→Hardware

| 15/06/18 10:00 |    |
|----------------|----|
| HARDWARE       |    |
| Memory         | OK |
| Calibration    | OK |
| ▶ Voltages     |    |
| ADC channels   |    |

| KEY  | FUNCTION                          |
|--|-----------------------------------|
|   | Returns to the previous screen.   |
| <br> | Selects the available parameters. |
|   | Enters in the selected parameter. |

| INTERACTIVE OPERATIONS | DESCRIPTION              |
|------------------------|--------------------------|
| mV                     | Shows the values in mV.  |
| Bit                    | Shows the values in Bit. |

**Note:** the memory and calibration parameters are not accessible if their condition is OK.

Visualization example:

| 11/12/17 10:00 |    |
|----------------|----|
| HARDWARE       |    |
| Memories       | OK |
| Calibration    | OK |
| ▶ Voltages     |    |
| ADC channels   |    |



| 11/12/17 10:00 |        |
|----------------|--------|
| VOLTAGES       |        |
| VBAT           | 3001 m |
| VIN            | 4712 m |
| VRTC           | 2602 m |

| 11/12/17 10:00 |    |
|----------------|----|
| HARDWARE       |    |
| Memories       | OK |
| Calibration    | OK |
| Voltages       |    |
| ▶ ADC channels |    |

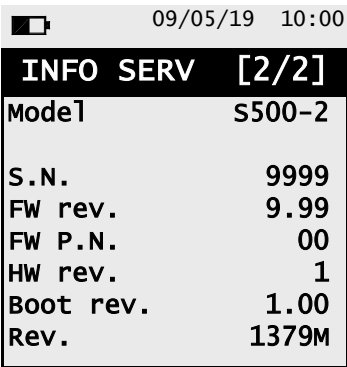





| 11/12/17 10:00 |        |
|----------------|--------|
| ADC CH. [1/2]  |        |
| O2-GAS         | 1016 m |
| CO-SEN         | 58 m   |
| CO-AUX         | 58 m   |
| NO             | 60 m   |
| PRESS          | 225 m  |
| EM-SEL         | 1499 m |
|                | Bit    |



| 11/12/17 10:00 |        |
|----------------|--------|
| ADC CH. [2/2]  |        |
| T-FLUE         | 1499 m |
| T-SPAN         | 58 m   |
| T-ZERO         | 60 m   |
| T-GND          | 225 m  |
| TCOLDJ         | 1499 m |
|                | Bit    |



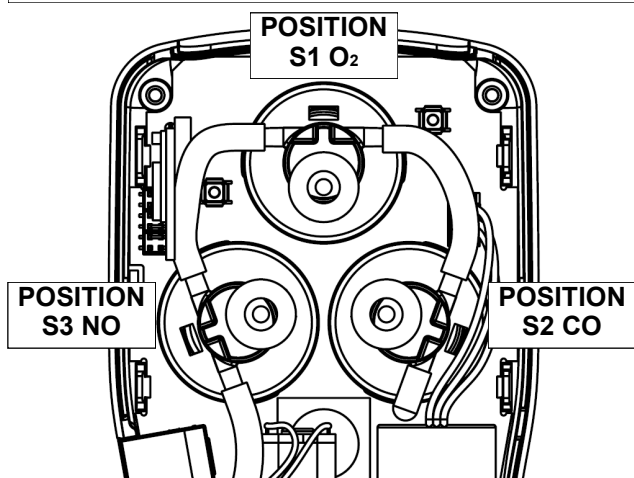


| KEY  | FUNCTION                                     |
|--|--|
|   | Returns to the previous screen.              |
| <br> | Toggle view between next or previous screen. |

# 15.0 SENSORS

## 15.1 Sensors arrangement

SENSORS ARRANGEMENT INSIDE THE SENSORS COMPARTMENT



GRAPHICAL DISPLAY OF ARRANGEMENT

| 15/06/18 10:00 |    |
|----------------|----|
| SENSOR         |    |
| ►S1:O2         | OK |
| S2:CO          | OK |
| S3:NO          | OK |

## 15.2 Sensor types and relevant positioning

| CODE   | POSITION | S1 | S2 | S3 |
|--|----------|----|----|----|
| <b>O<sub>2</sub> Sensor</b><br>Cod. AACSE50                          |          | ✓  |    |    |
| <b>CO Sensor with NOx filter</b><br><b>0-4000ppm</b><br>Cod. AACSE58 |          |    | ✓  |    |
| <b>NO Sensor</b><br>Cod. AACSE60                                     |          |    |    | ✓  |

## 15.3 Gas sensors life

The gas sensors used in this instrument are electrochemical: thus, when the relative gas is detected, a chemical reaction takes place inside them that generates an electrical current.

The electrical current acquired by the instrument is then converted into the corresponding gas concentration. Sensor life is strongly related to the consumption of the reagents within.

Sensor characteristics diminish as the reagents are consumed and when these have been used up completely the sensor must be replaced. The sensors must be recalibrated on a regular basis to assure measuring accuracy: recalibration can only be performed by a qualified Seitron Americas service center.

Table 15.4 illustrates the characteristics inherent to each sensor.

## 15.4 Gas sensors life table

| CODE   | MEASURED GAS             | AVERAGE LIFE | RECALIBRATION |
|--|--------------------------|--------------|---------------|
| <b>O<sub>2</sub> Sensor</b><br>Cod. AACSE50  | O <sub>2</sub><br>Oxygen | 24 months    | not necessary |
| <b>CO Sensor with NOx filter + H2 immunity</b><br><b>0-4000ppm</b><br>Cod. AACSE58 | CO<br>Carbon Monoxide    | 24 months    | Yearly        |
| <b>NO Sensor</b><br>Cod. AACSE60   | NO<br>Nitric Oxide       | >36 months   | Yearly        |



## 16.1 Routine maintenance

This instrument was designed and manufactured using top-quality components. Proper and systematic maintenance will prevent the onset of malfunctions and will increase instrument life altogether.

The following basic requisites are to be respected:

- When the analysis is over extract the sample probe from the stack and let the analyzer draw fresh air for a few minutes, or at least until the displayed parameters return to their original values:  
O<sub>2</sub>: >20.0%  
Toxic gases: <20ppm
- Clean the filter unit when necessary, replacing the particulate filter and applying a jet of air to the sample probe hose to eliminate any condensate that may have formed.

Do not clean the instrument with abrasive cleaners, thinners or other similar detergents.

## 16.2 Preventive maintenance

At least once a year send the instrument to a SERVICE CENTER for a complete overhaul and thorough internal cleaning.

SEITRON AMERICAS highly qualified staff is always at your disposal and will provide you with all the sales, technical, application and maintenance details required.

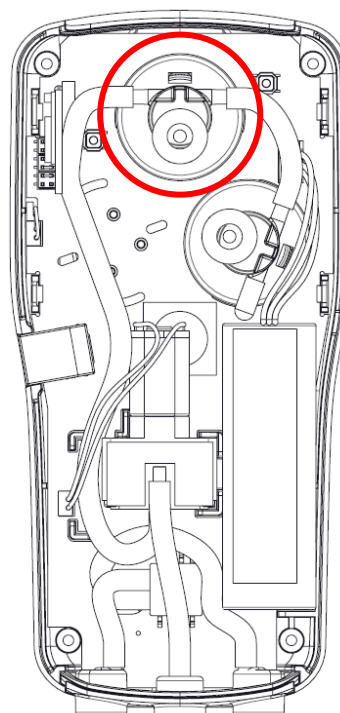
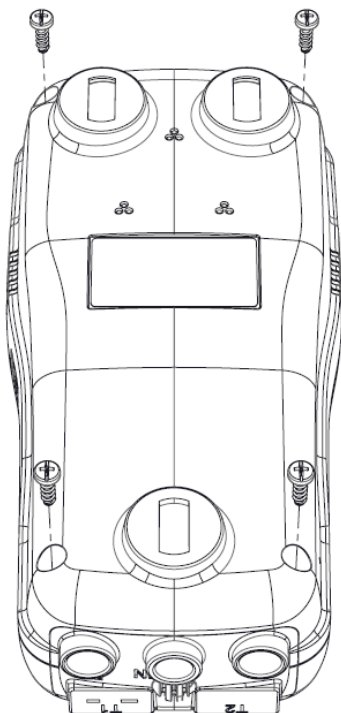
The service centre will always return the instrument to you as new and in the shortest time possible. Calibration is performed using gases and instruments comparable with National and International Specimens. Annual servicing is accompanied by a specific calibration certificate that is a guarantee of perfect instrument performance, and it is indispensable for users wishing to maintain ISO 9000 status.

### 16.3 Gas sensors replacing

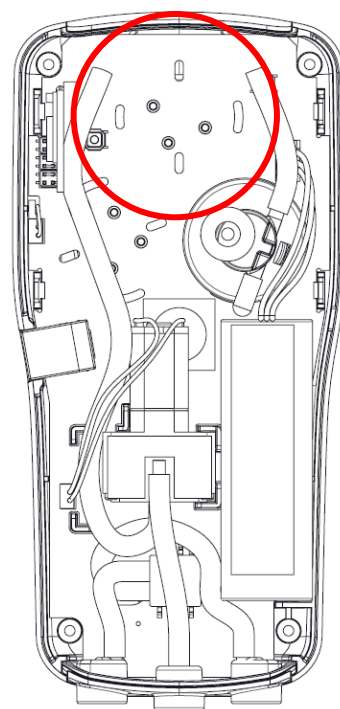
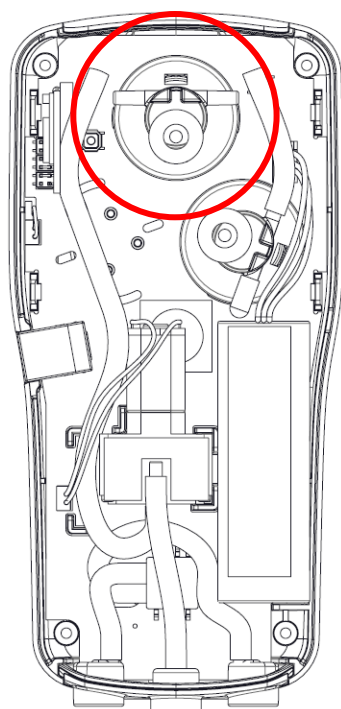
In order to be authorized to the sensors replacing, it is necessary to install on the PC the “Easy2Swap” program; to obtain this program send an e-mail to this address: [info@seitronamericas.com](mailto:info@seitronamericas.com). The procedure for the sensor replacement is described in detail on the manual which comes with the Software.

Note: the metrological chain validation can be only obtained with the calibration through referable samples.

- 1 Before proceeding with the replacement of the sensor, it is necessary to insert in the instrument the ID code of the new sensor, after installing the appropriate PC software downloadable from the website [www.seitronamericas.com](http://www.seitronamericas.com).
- 2 Once inserted the new ID code in the instrument, unscrew the four fixing screws of the instrument base; then slide the base of the instrument to access the internal parts.
- 3 Locate the position of the sensor to be replaced; below is an example of a sensor to be replaced.



- 4 Remove the tubes from the sensor to be replaced; below is an example of a sensor with the disconnected pipes.
- 5 After disconnecting the pipes, pull the sensor upwards; below is an example of the sensor compartment without the sensor.



- 6 Insert the new sensor paying attention to match the sensor connectors with the relevant supports on the circuit board.
- 7 Place back the tubes (See point 4).
- 8 Close back the base of the instrument and screw back the four screws (See point 2).

Turn on the instrument to check the new sensor works correctly through the menu "Sensor Troubleshooting".  
It is normal if a newly installed sensor gives a 'current error': it is necessary to wait some time, so that the sensor polarization can settle.

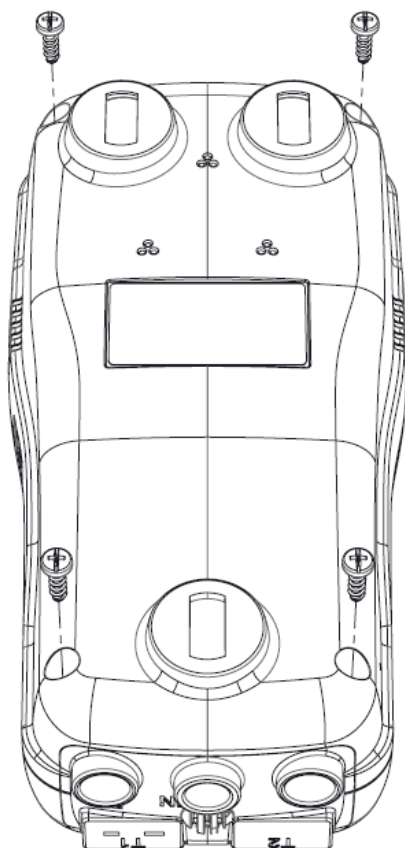
The table here below shows the minimum settling time for each sensor.

| CODE   | DETECTED GAS             | POSITION | SETTLING TIME |
|--|--------------------------|----------|---------------|
| <b>O<sub>2</sub> Sensor</b><br>Cod. AACSE50                          | O <sub>2</sub><br>Oxygen | S1       | 8 hours       |
| <b>CO Sensor with NOx filter</b><br><b>0-4000ppm</b><br>Cod. AACSE58 | CO<br>Carbon Monoxide    | S2       | 2 hours       |
| <b>NO Sensor</b><br>Cod. AACSE60                                     | NO<br>Nitric Oxide       | S3       | 8 hours       |

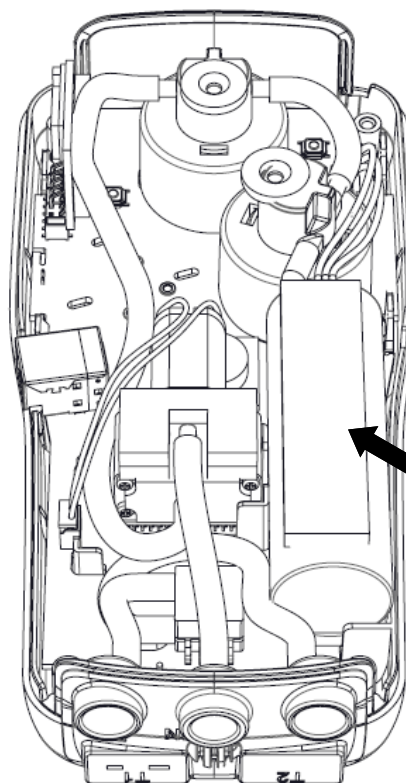
## 16.4 Replacing the battery pack

Follow these instructions to replace the battery pack:

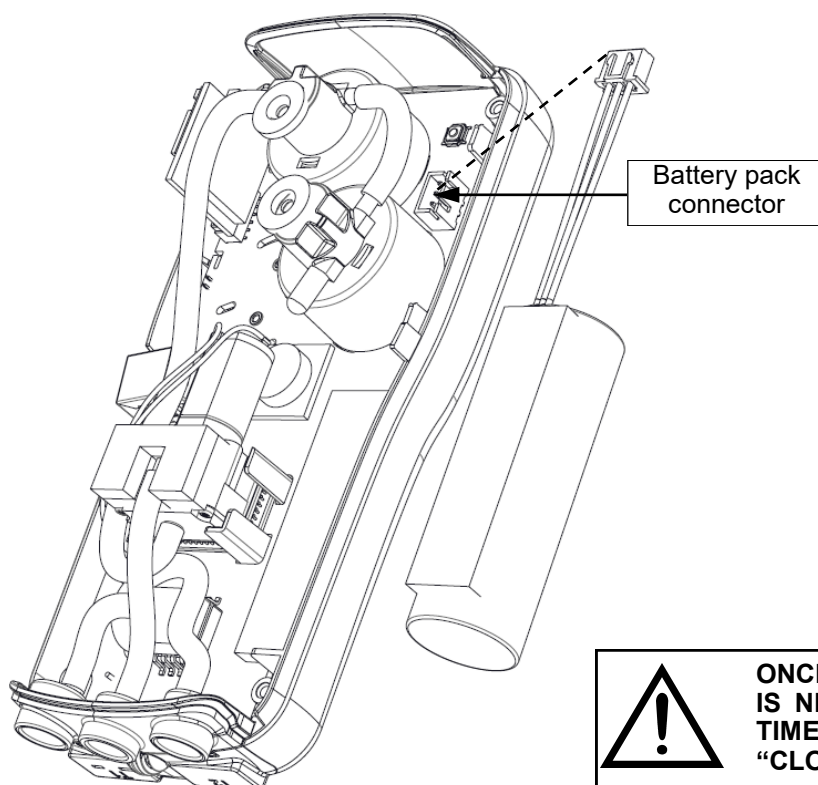
**1** Remove the base of the instrument



**2** Extract the battery pack.



**3** Remove the battery pack connector, and replace the pack with a new one following the reverse procedure described above.



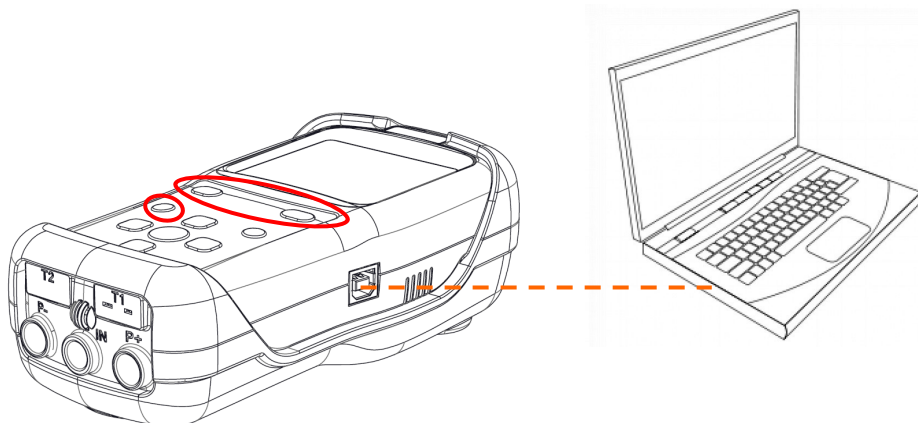
ONCE THE BATTERY IS REPLACED IT IS NECESSARY TO RESET DATE AND TIME THROUGH THE PARAMETER "CLOCK" ([SEE CHAPTER 12.3.3](#)).

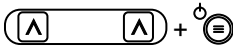

# 17.0 FIRMWARE UPDATE

The manufacturer periodically releases firmware updates of the instrument in order to correct unavoidable mistakes or improve the instrument performance or add new functions.

This update can be performed by the user by following the simple instructions below.



## **Instructions to update the combustion analyzer with a new firmware:**





1. Log in to the website [www.seitronamericas.com](http://www.seitronamericas.com) and download the firmware file available in the "combustion analyzers" section. This file is in a compressed version .zip.
2. Unzip the file thus obtaining the contents of the .zip file (extension .srec)
3. Plug in the analyzer to the PC via the USB cable
4. Hold down the three red buttons on the analyzer for at least 10 seconds:  

5. The display turns off
6. Release only the power  button
7. The analyzer will be recognized by the operating system as a portable device drive: the display starts blinking
8. Release the remaining two buttons
9. Copy the firmware file (extension .srec) to the directory of the analyzer: the display continues to blink faster
10. Wait till the end of the file copy operation
11. The file copy directory will be closed and the analyzer will restart
12. The analyzer is now updated, it can be powered off and it can be unplugged from the PC

# 18.0 TROUBLESHOOTING

## 18.1 Troubleshooting guide

| SYMPTOM  | PROBABLE CAUSES AND REMEDIES  |
|--|---|
| The instrument does not work at all. Pushing the  button the instrument does not turn on. | <ul style="list-style-type: none"> <li>a. Press the  for at least 2 seconds.</li> <li>b. The battery is low; connect the battery charger to the instrument.</li> <li>c. The battery pack is not connected to the instrument. Access the internal parts of the instrument and verify that the connector of the battery pack is inserted in the proper connector (<a href="#">SEE CHAPTER 16.4</a>).</li> <li>d. The instrument is faulty: send it to a service center.</li> </ul>   |
| The battery symbol is empty on the inside and blinking.  | The batteries are low. The instrument will remain on for a couple of minutes after which it will switch off; connect the battery charger.   |
| The instrument battery autonomy is lower than what stated in the “Technical features” chapter.   | <ul style="list-style-type: none"> <li>a. The battery capacity is limited at a low temperature. To obtain a greater autonomy it is advised to keep the instrument in higher temperatures.</li> <li>b. Perform a 100% complete charge cycle connecting the instrument to the plug for at least 6 hrs.</li> <li>c. That battery pack is old. Aging can cause the batteries to reduce their capacity. If the autonomy has become unacceptable change the internal battery with an original part Seitron Americas.</li> <li>d. Verify the measured voltage values in “<b>Menu→Diagnostic→Hardware→Voltages</b>”: <ul style="list-style-type: none"> <li>- If VBAT&lt;3000mV: the battery needs to be changed.</li> <li>- If VIN &lt;4700mV: the output voltage of the battery charger is not sufficient to recharge the instrument battery. In this case verify the connections and the plate data of the battery charger in use: 5Vdc 2A.</li> </ul> </li> <li>d. If the problem keeps on happening contact the SERVICE CENTER.</li> </ul> |
| Date and time are not memorized.   | <ul style="list-style-type: none"> <li>a. Verify the voltage value VRTC showed in “<b>Menu→Diagnostic→Hardware→Voltages</b>”: If &lt;2600mV contact the SERVICE CENTER.</li> <li>b. The battery is completely drained (VBAT&lt;2500mV)</li> </ul>   |
| After the autozero, the sensor diagnostic screen appears, which indicates an error in one or more cells.   | <ul style="list-style-type: none"> <li>a. The autozero has been performed while the combustion gas sample was still being taken.</li> <li>b. The O<sub>2</sub> sensor is broken, incorrectly connected or not connected at all. Check the described points, with the help of the paragraph 5.3, 5.4, 6.6.</li> <li>c. The waited settling time of the sensor was not enough or the instrument has been left with a low battery charge for a long time.</li> </ul>   |
| In the Pressure / Draft screen there is an error of the pressure sensor.   | There is a calibration problem. Send the instrument to the service center.  |
| In the analysis screen there is an error in the smoke temperature measurement (Tf).  | <ul style="list-style-type: none"> <li>a. Thermocouple not connected; connect the thermocouple to the analyzer.</li> <li>b. The sensor has been exposed to temperature higher or lower than its functioning.</li> <li>c. The thermocouple is faulty. Send the entire probe to the service center.</li> </ul>  |

## Troubleshooting guide

| SYMPTOM  | PROBABLE CAUSES AND REMEDIES   |
|--|--|
| The following symbol "----" appears on the analysis screen.                                  | The instrument is not able to calculate a numerical value based on the flue gas analysis conducted. The "----" are replaced by numbers when the analyzer detects valid combustion data.  |
| "Max. Lim." or "Min. Lim" appears on the analysis screen.                                    | The relative sensor is detecting a value that is beyond the analyzer measuring range. "Max. Lim" or "Min. Lim." are replaced by numbers when the instrument reveals values that are within the measuring range.  |
| The sample pump sounds as though it is running slowly, tends to stop or does not even start. | <p><b>a.</b> Sample flow is obstructed. Check that the water filter is clean and that it is not completely soaked. Also check that the hose connected to the probe is not crushed.</p> <p><b>b.</b> Sample intake flow is obstructed. Check that the particulate filter is clean.</p> <p><b>c.</b> Pump is disabled. The key combination   has been pressed. To re-enable the pump, switch off the instrument and then switch it on again.</p> |
| The back lighting of the display does not turn on.   | The instrument is faulty. Send it to the service center for repairing.   |
| The values shown in the analysis screen are not reliable.                                    | <p><b>a.</b> Sensor/s is/are faulty. Check that the sensors are installed correctly by accessing the sensor diagnostics menu.</p> <p><b>b.</b> The sample probe connection presents a leak. Check all joints and the conditions of the hose.</p> <p><b>c.</b> The instrument is faulty: Send it to a service center for repairing.</p>   |

# 19.0 SPARE PARTS AND SERVICING

## 19.1 Spare parts

| CODE     | DESCRIPTION                    |
|----------|--------------------------------|
| AAC FA01 | Particulate filter             |
| AAPB00   | Li-Ion 7,2V 2,4Ah battery pack |

## 19.2 Accessories

| CODE      | DESCRIPTION   |
|-----------|---|
| AAKA01    | AC Power Adapter Kit For ALL Analyzers (Power adapter w/ US plug adapter + USB A / USB B cable) |
| AA CR09   | Rigid plastic case  |
| AAC KP02  | Pressure measurement kit  |
| AA SF71A  | 7 inches (180 mm) gas probe, maximum working temperature: 752°F, with 6.5 ft (2 mt) cable       |
| AA SF72A  | 12 inches (300 mm) gas probe, maximum working temperature: 1112°F, with 6.5 ft (2 mt) cable     |
| AAC EX02S | 10 ft. (3 m) extension cable for gas sampling probe   |
| AA SM07   | Rubber protective cover   |
| AAC TA03  | Particulate/water filter assembly   |
| AAC TA03A | Particulate/water filter assembly with steel pipe and connector                                 |
| AA UA01   | Adapter cable USB-A / USB-B   |

## 19.3 Service Centers

### Seitron Americas Inc.

Seitron Americas Inc., 4622 E. Street Road, Trevose, PA 19053 USA

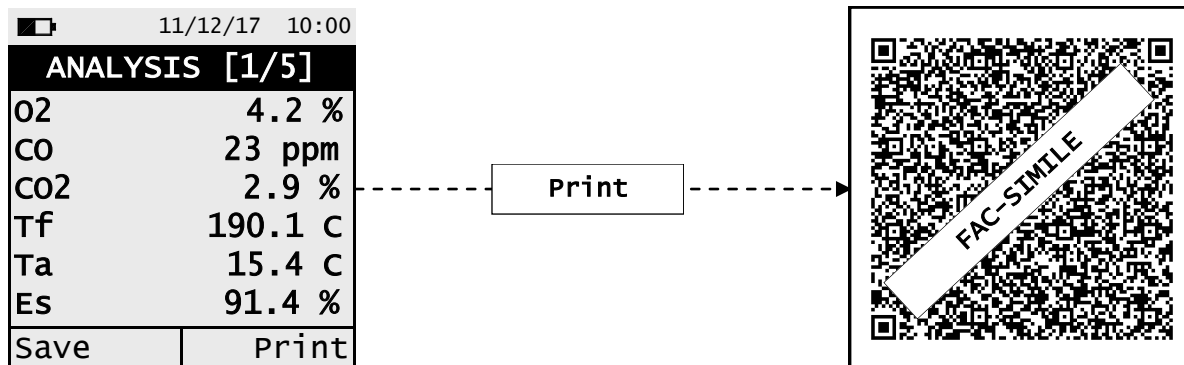
Tel.: (215) 660-9777

E-mail: [service@seitronamericas.com](mailto:service@seitronamericas.com)

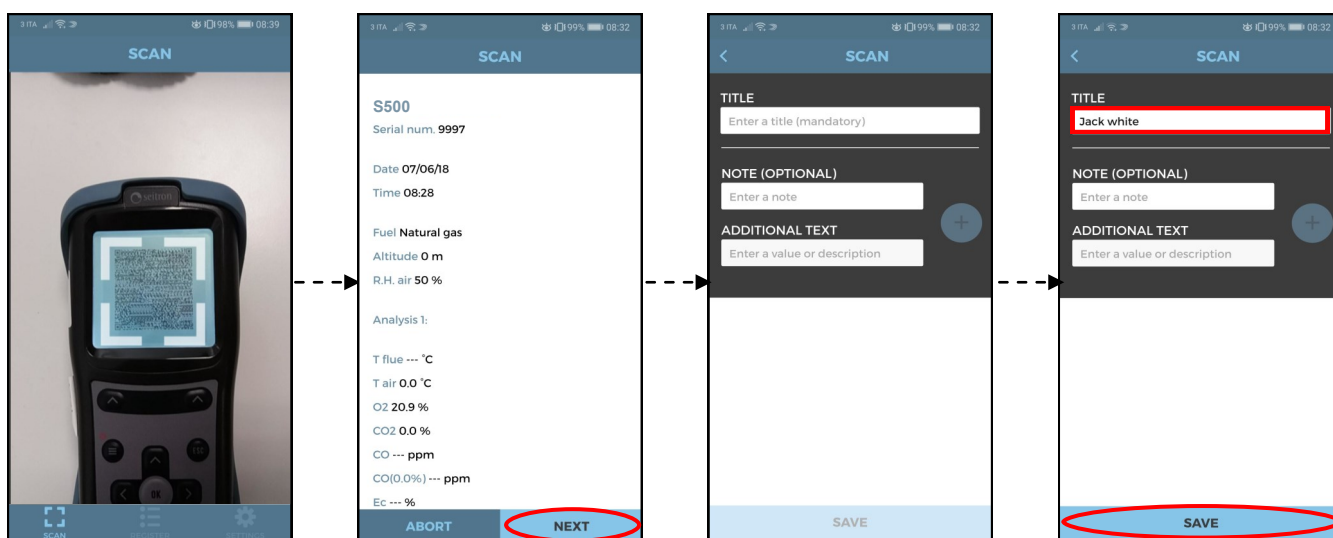
<http://www.seitronamericas.com>



## Data Management with “SEITRON SMART ANALYSIS” APP

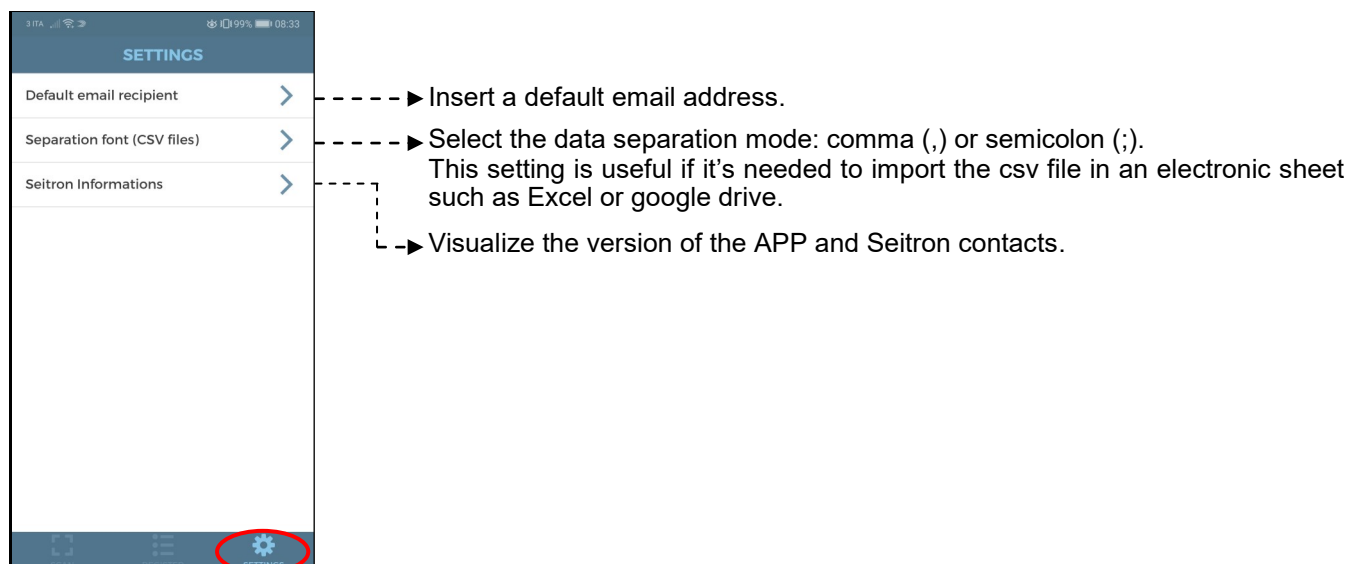


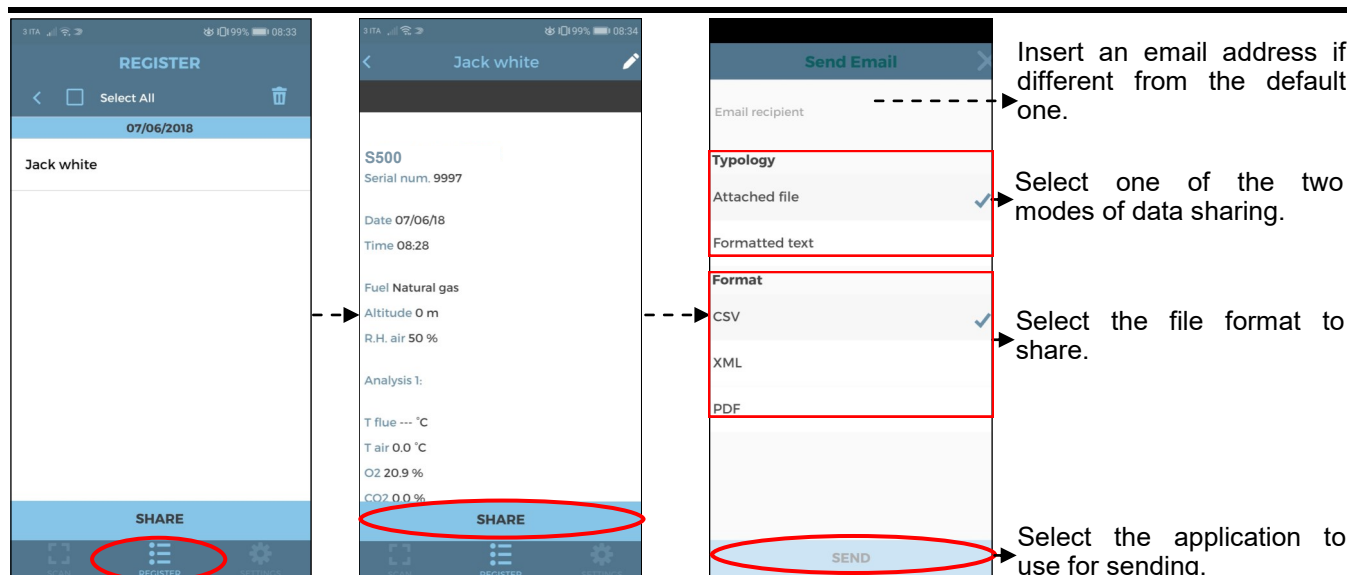
SCAN THE QR CODE USING SEITRON APP “SEITRON SMART ANALYSIS”, TO DOWNLOAD THE ACQUIRED DATA.



THE ACQUIRED DATA ARE SAVED IN THE INSTRUMENT MEMORY.

## APP settings.





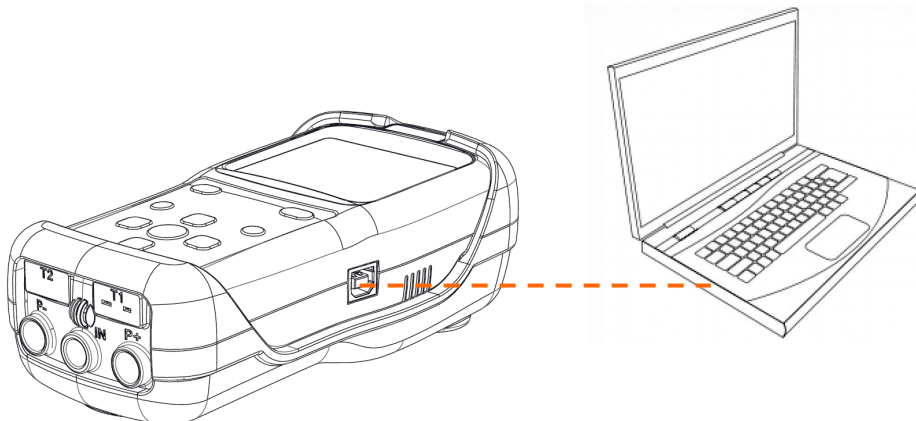
### Example of the exported csv file and imported in an excel file:

|             |             |  |
|-------------|-------------|--|
| S500-2      |             |  |
| Serial num. | 1100        |  |
| Date        | 22/12/2017  |  |
| Time        | 12:00       |  |
| Fuel        | Natural Gas |  |
| Altitude    | 0.000000m   |  |
| RH air      | 50%         |  |
| O2          | 15.7%       |  |
| CO          | 23ppm       |  |
| CO2         | 2.9%        |  |
| T flue      | 100.6°C     |  |
| T air       | 27.0°C      |  |
| ηs          | 90.0%       |  |
| NO          | 0.000mV     |  |
| CO-SEN      | 258.270mV   |  |
| O2          | 1.131.867mV |  |
| I sen       | 0.000uA     |  |
| I sen       | 0.000uA     |  |
| I sen       | 100.346uA   |  |
| T az        | 22.5°C      |  |
| ΔT          | 73.6°C      |  |
| Qs          | 10.0%       |  |
| λ,n         | 4.01        |  |
| Exc. air    | 4.01        |  |
| ηc          | 0.0%        |  |
| ηt          | 90.0%       |  |
| Qs (PCS)    | 10.0%       |  |
| Qt (PCS)    | 10.0%       |  |
| ηs (PCS)    | 90.0%       |  |
| ηc (PCS)    | 0.0%        |  |
| ηt (PCS)    | 90.0%       |  |
| NO          | 0ppm        |  |
| NOx         | 0ppm        |  |
| CO (0.0%)   | 0ppm        |  |
| NO (0.0%)   | 0ppm        |  |
| NOx (0.0%)  | 0ppm        |  |
| Draft       | 4.5Pa       |  |

## Heading of the printed report with the PC Software “Easy2print”

The ticket heading is easily settable by the user following the simple instructions below.

1. Connect the analyzer to the PC (with Windows XP operative system or later) through the USB cable.



2. Browse the internet site [www.seitronamericas.com](http://www.seitronamericas.com) and download the file of the software which it is possible to find in the “Combustion analyzer” section. This file is in compressed version .zip.
3. Decompress the file so obtaining the content of the .zip file (.exe extension) and start the executable:
4. Details about the usage:

**Insert the data that will be printed as header of every report:**  
**6 rows with 24 digits are available (including spaces) for each.**

**Click to store the inserted data on the instrument**

**Information about the Software**

**Status of the PC connection with the instrument**

**Language set**

5. By pressing the “SAVE” button, the analyzer will store the inserted data and can be switched off and/or disconnected from the PC.



- THIS SOFTWARE IS A SIMPLE EXECUTABLE FILE (IT DOES NOT REQUIRE THE INSTALLATION ON THE PC) AND IT IS COMPATIBLE WITH THE COMBUSTION ANALYZER FIRMWARE VERSION 1.05 AND LATER.
- IF THE HEADER IS NOT INSERTED, THERE WON'T BE ANY EMPTY LINES OR ERRORS IN THE TICKETS.

## Optional measures list:

| MEASURE  | DEFINITION   |
|--|--|
| $\lambda, n$ (l,n)   | <b>Air index</b> (defined as $\lambda$ , sometimes also indicated as $n$ ).  |
| <b>e (Exc. Air)</b>  | <b>Air excess.</b> Expressed as a percentage according to the formula in the appendix D, is the ratio between the volume of air actually entering the combustion chamber and the one theoretically needed.   |
| $\Delta T$ (dT)  | <b>Differential temperature:</b><br>It is the difference between the smoke temperature and the air combustion temperature.   |
| <b>Qs (LHV)</b>  | <b>Stack losses in relation to the Lower Heating Value:</b><br>It is the percentage of dissipated heat through the stack referred to the lower heating value (LHV)   |
| <b><math>\eta_s</math> (Es) (LHV)</b>  | <b>Sensible efficiency in relation to the Lower Heating Value:</b><br>It is the burner efficiency calculated as the ratio between conventional heating power and the burner heating power. Among the combustion losses, only the sensible heat lost with flue gasses is taken into account, thus neglecting the radiation losses and incomplete combustion losses. This value is referred to the Lower Heating Value (LHV) of the fuel and cannot exceed 100%.<br>The sensible efficiency value is to be compared against minimum efficiency stated for the heating system performances. |
| <b><math>\eta_c</math> (Ec) (LHV)</b>  | <b>Condensation efficiency in relation to the Lower Heating Value:</b><br>Efficiency deriving from the condensation of water vapor contained in flue gases it is referred to the LHV.  |
| <b><math>\eta_t</math> (Eff) (LHV)</b><br><b><math>\eta_t = \eta_s + \eta_c</math></b> | <b>Total efficiency in relation to the Lower Heating Value:</b><br>Total efficiency. It is the sum of sensible efficiency and condensation efficiency. It is referred to LHV (Lower Heating Value) and can exceed 100%.  |
| <b>NOx</b>   | Measure of nitrogen oxides quantity; the measurement unit can be set in the special menu.  |
| <b>NOx ppm *</b>   | Measure of nitrogen oxides quantity; the measurement unit can not be set but it is fixed in ppm.   |
| <b>NOx (rif. O2)</b>   | Measure of nitrogen oxides quantity referring to O2; the measurement unit can be set in the special menu.  |
| <b>NOx (rif. O2) ppm *</b>   | Measure of nitrogen oxides quantity referring to O2; the measurement unit can not be set but it is fixed in ppm.   |
| <b>PI</b>  | <b>Poison Index (CO/CO2 ratio):</b><br>It is defined as the ratio between CO and CO2 useful to determine whether the system needs maintenance.   |
| <b>CO</b>  | CO quantity measurement. Measurement units: ppm - mg/m <sup>3</sup> - mg/kWh - ng/J - g/GJ - g/m <sup>3</sup> - mg/kWh - %   |
| <b>CO (RIF)</b>  | CO quantity measurement with O2 reference. Measurement units: ppm - mg/m <sup>3</sup> - mg/kWh - ng/J - g/GJ - g/m <sup>3</sup> - mg/kWh - %   |

\* : Valid for Piemonte region only (Italy only).

## Measurement units matching → abbreviations

|                    |    |
|--------------------|----|
| ppm                | p  |
| mg/m <sup>3</sup>  | g  |
| mg/Kwh             | w  |
| g/GJ               | J  |
| ng/J               | J  |
| g/m <sup>3</sup>   | G  |
| g/Kwh              | W  |
| hPa                | h  |
| Pa                 | P  |
| mbar               | b  |
| mmH <sub>2</sub> O | H  |
| mmHg               | g  |
| inH <sub>2</sub> O | i  |
| psi                | p  |
| °C                 | C  |
| °F                 | F  |
| m                  | m  |
| ft                 | ft |

## Coefficients of the fuels and Formulas

The following chart, lists the coefficients of the memorised fuels, used for calculating losses and efficiencies. Details of the coefficients of the fuels:

| Coefficients for calculating combustion efficiency |        |        |                       |             |             |               |                            |                                |
|--|--------|--------|-----------------------|-------------|-------------|---------------|----------------------------|--------------------------------|
| Fuel   | A1 USA | B      | CO <sub>2</sub> t (%) | PCI (KJ/Kg) | PCS (KJ/Kg) | M air (Kg/Kg) | M H <sub>2</sub> O (Kg/Kg) | V dry gas (m <sup>3</sup> /Kg) |
| Natural Gas  | 0,0280 | 0,0090 | 11,70                 | 50050       | 55550       | 17,17         | 2,250                      | 11,94                          |
| Propane  | 0,0277 | 0,0073 | 13,70                 | 45950       | 49950       | 15,61         | 1,638                      | 11,11                          |
| #2 Oil   | 0,0305 | 0,0066 | 15,70                 | 42900       | 45700       | 14,30         | 1,136                      | 10,34                          |
| #4 Oil   | 0,0306 | 0,0066 | 15,80                 | 41100       | 43500       | 13,80         | 0,973                      | 10,06                          |
| #6 Oil   | 0,0346 | 0,0048 | 16,00                 | 39800       | 42197       | 13,61         | 0,981                      | 9,97                           |
| Diesel   | 0,0305 | 0,0066 | 15,70                 | 42900       | 45700       | 14,30         | 1,136                      | 10,34                          |
| Wood/Pellets 8%                                    | 0,0354 | 0,0071 | 19,01                 | 18150       | 19750       | 6,02          | 0,660                      | 4,58                           |
| Bagasse  | 0,0395 | 0,0219 | 20,45                 | 6950        | 8834        | 2,50          | 0,779                      | 1,93                           |
| Coal   | 0,0320 | 0,0000 | 18,60                 | 31400       | 32300       | 10,70         | 0,370                      | 8,14                           |
| Biogas   | 0,0353 | 0,0091 | 17,33                 | 17800       | 19800       | 6,08          | 0,830                      | 4,55                           |
| Bio-Fuel 5%  | 0,0305 | 0,0066 | 15,70                 | 42600       | 45400       | 14,22         | 1,133                      | 10,64                          |
| Butane   | 0,0277 | 0,0073 | 14,00                 | 45360       | 49150       | 15,38         | 1,548                      | 10,99                          |

- **CO<sub>2</sub> t:** The value of CO<sub>2</sub> generated by combustion in stoichiometric condition, i.e. without excess Oxygen and therefore maximum.
- **A1, B:** Also please have a look at the Siegert formulas from the European standard EN50379-1 (in the following).  
A1 is the parameter in the Siegert Formula when the O<sub>2</sub> measurement is available.  
Note: - Please also consider that in the U.S. usually the A1 parameter is the same as the 'European' A1 BUT divided by 2.

Flue gas heat losses are calculated from measured oxygen content according to the relationship:

$$q_A = (t_A - t_L) \times \left( A1 \frac{21}{21 - O_2} + B \right)$$

Flue gas heat losses are calculated from measured carbon dioxide content according to the relationship:

$$q_A = (t_A - t_L) \times \left( A1 \frac{CO_2t}{CO_2} + B \right)$$

Air index is calculated with the formula:

$\lambda = 21 / (21 - O_2)$ , where O<sub>2</sub> is the oxygen residual concentration in the combustion smokes.

Air excess is calculated with the formula:

$$e = (\lambda - 1) * 100$$

- **CO conv:** Conversion coefficient from ppm to mg/KWh. It can be expressed as a function of the gas density (CO in this case) and the volume of the dry smoke.
- **NO conv:** Same as CO conv, but for NO.
- **NO<sub>x</sub> conv:** Same as CO conv, but for NO<sub>x</sub>.
- **SO<sub>2</sub> conv:** Same as CO conv, but for SO<sub>2</sub>.
- **PCI:** Potere Calorifico Inferiore. Italian for LHV (Lower Heating Value).
- **PCS:** Potere Calorifico Superiore. Italian for HHV (Higher Heating Value).
- **m H<sub>2</sub>O:** Mass of the air produced (per each Kg of fuel) in the combustion in stoichiometric condition.
- **m Air:** Mass of the air needed for combustion in stoichiometric condition.
- **V g.d.:** Volume of dry smokes produced in the combustion.

# WARRANTY CERTIFICATE

## WARRANTY

The S500 flue gas analyzer is guaranteed for **24 months** from purchasing document date including the electronic parts, the internal electro-chemical sensors and the printer.

Seitron undertakes to repair or replace, free of charge, those parts that, in its opinion, are found to be faulty during the warranty period. The products which are found defective during the above mentioned periods of time have to be delivered to Seitron Laboratories carriage paid. The following cases are not covered by this warranty: accidental breakage due to transport, inappropriate use or use that does not comply with the indications in the product's instruction leaflet.

Any mistreatment, repairs and modifications to the product not explicitly authorized by Seitron shall invalidate the present warranty.

## IMPORTANT

For the product to be repaired under Warranty, please send a copy of this Certificate along with the instrument to be repaired, together with a brief explanation of the fault observed.

-----

*Space reserved for user*

Name: \_\_\_\_\_

Company: \_\_\_\_\_

User's notes:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date: \_\_\_\_\_

S.N.: \_\_\_\_\_



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