

## USE AND MAINTENANCE



# N•VO

## Combustion Analyzer



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## 1.0 IMPORTANT INFORMATION

### 1.1 Information about this manual

- ◇ This manual describes operation, features and maintenance of this Combustion Analyzer.
- ◇ 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.*



Respect your environment: think before printing the full manual on paper

### 1.2 Danger levels and other symbols



#### WARNING!

The magnets on the back of the instrument can damage credit cards, hard driver, 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 25cm away from these devices.



#### WARNING!

Read these information carefully and prepare appropriate safety action!  
To prevent any danger to personnel or other goods. Disobey of this manual may cause danger to personnel, the plant or the environment and may lead to liability loss.



#### WARNING.

The client is solely and exclusively responsible for the integrity and preservation of their data. The customer must ensure, following each analysis, that the data stored in the analyzer is exported by making a back-up (backup copy) to a suitable and appropriate medium using the various methods made available (QR code, Seitron Smart Analysis mobile app and PC software), in order to be able to independently provide for a restoration in case of data loss for any cause. Seitron will not be liable in case of total or partial loss of data, resulting from failure, fortuitous event or any other cause.



#### WARNING! Ensure correct disposal

Dispose of the battery pack at the end of its working life only at the dedicated collecting bin.

The customer takes care, on his own costs, that at the end of its working life the product is collected separately and it gets correctly recycled.

## 2.0 SAFETY

### 2.1 Safety check

- Use the product according to what is described in the “Intended purpose” chapter.
- 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 assistance centers.
- Otherwise, Seitron 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 combustion analyzer is intended.**

Using the Novo 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 Novo are handheld measuring devices in professional flue gas analysis for:

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

Due to other configuration with electrochemical sensors it is possible to use the measuring instrument in following application area:

- Service engineers/mechanics of burner/boiler manufacturers
- Service industrial combustion plants

Additional functions of the measuring instrument:

- Flue gas analysis according to UNI 10389-1 (2019) standard
- Calculating of stack heat loss and efficiency
- CO- and NO ambient measurement
- Tightness test according to UNI 7129-1: 2015 and UNI 11137: 2019 standard
- Store Smoke value, calculating mean value
- Measuring differential pressure
- Draft measurement according to UNI 10845 standard
- Measurement of the gas supply line pressure

### 2.3 Improper use of the product

The use of Novo in application areas other than those specified in Section 2.1 “Intended use of the product” is to be considered at the operator’s risk and the manufacturer assumes no responsibility for the loss damage or costs that may result. It is compulsory to read and pay attention to the instructions in this use and maintenance manual.

Novo should not be used:

- For continuous measurements > 1h
- As safety alarm instrument

### 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 cause 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.

## 3.0 GENERAL OVERVIEW

The instrument is equipped with:

- Pneumatic circuit capable to store up to 4 sensors.
- Anti-condensation / Smoke filter unit integrated in the instrument, easily accessible for all verification and maintenance operations.
- CO dilution pump to protect the CO sensor placed in position 1.
- Solenoid valve, to perform the autozero with the probe inserted in the stack.
- Valve for zeroing the pressure sensor in order to measure the draft during the combustion analysis.
- Male hose connection  $\varnothing 8\text{mm}$ , for measuring the gas valve pressure at the same time as measuring the draft.
- Intuitive user interface: the instrument can be used without the support of the user manual.
- 7" Color display with CTP.
- Rechargeable 'Li-Ion' battery package.
- Impact protection system integrated on the instrument case.
- Ticket printing through printer module integrated in the instrument (if the instrument configuration provides for it) or via an external Bluetooth® printer (optional).
- QR code generation in order to download the analysis / measures data shown on the display, having previously installed the special APP "SEITRON SMART ANALYSIS" available on play-store and Apple iOS App store.
- Connectivity with a computer through the USB connection and/or Bluetooth®. Once the special software provided with the instrument is used, this allows for the storage of combustion analysis as well as the configuration of the main parameters.
- Connectivity with a smartphone through Bluetooth®. Once the specific APP "SEITRON SMART ANALYSIS" available on Google play-store is installed on the device, the user can start remote analysis of combustion and/or view real-time data of the analysis in progress.

### Main functions:

- Combustion analysis in manual or automatic mode (according to the data logger function, user-defined mode).
- Comes with most used fuel parameters (such as natural gas, LPG, gas oil and fuel oil).
- Possibility to store in memory the parameters for additional further fuels, once their chemical composition is known.
- Monitoring of pollutants (emissions).
- Memory capable of storing up to 2,000 full analysis.
- Storing of acquired data and their averaging.

### Measurable gases

- $\text{O}_2$
- CO H2 compensated
- CO 20000 ppm
- CO 100000 ppm
- NO Extended Range
- $\text{NO}_2$  Extended Range
- $\text{SO}_2$  Extended Range
- NOX
- $\text{NH}_3$
- $\text{H}_2$
- $\text{H}_2\text{S}$
- CxHy referred to the methane
- $\text{CO}_2$  NDIR
- $\text{CH}_4$  NDIR

### Measurements

- Ambient CO (with the internal sensor)
- Simultaneous measurement of pressure,  $\text{O}_2$  and pollutants
- Stack draft



- Black smoke (with the use of the external manual pump)
- Gas pressure in the piping, pressure in the burning chamber and check of the pressure switches, using the measurement range up to 200hPa.
- Combustion air measurement
- Auxiliary temperatures
- Air speed for air or flue gas leaving the chimney with the use of Pitot tube
- Tightness test

**Maintenance**

- Only O<sub>2</sub> can be replaced by the user. In order to add a sensor or to replace one different from oxygen, send the instrument to an authorized service center.
- The instrument requires annual calibration to be carried out at any authorized service center.

**Certificate of calibration**

The instrument is accompanied a calibration certificate.

## 4.0 DESCRIPTION OF THE PRODUCT

### 4.1 Working principle

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

The probe is featured with a sliding fitting-cone that allows the probe itself to be inserted into holes with a diameter from 11 mm to 16 mm, and to set the immersion depth: the smoke pick-up point must approximately correspond to the center of the sack.

The gas sample which must be analyzed must be taken to the measurement sensors dehumidified and purified from solid combustion residues.

In order to achieve this, a water trap is used, which is a transparent plastic cylinder placed inside the instrument.

Its purpose is to decrease the speed of the air in order to precipitate the heavier dust particles and condense the vapor contained in the combustion gases.

During operation, the instrument must be placed in a vertical position (with the pneumatic connections facing downwards).

For the same reason it is important to drain the trap periodically and in any case after the end of the test. A low porosity replaceable line filter it is placed on the condensation trap and it has the purpose of retaining the solid particles remaining suspended in the gases. It is recommended to replace the filter if it is visibly dirty (see chapter "Maintenance").

The gas is then analyzed in its components by the installed sensors.

The electrochemical sensor grants very precise results in a time interval up to about 60 minutes, time interval when the instrument calibration can be considered very stable. When it is necessary to perform long time measurements, it is advisable to make a new instrument autozero by letting clean air flow inside the pneumatic circuit for three minutes. During the zero calibration phase, the instrument sucks in clean air from the environment and detects the zero drift of the sensors (20.95% for the O<sub>2</sub> sensor), it compares them with the programmed values, and then proceeds to their compensation.

During the autozero phase of the gas sensors, the zero of the pressure sensors is also performed.

The UNI 10389-1 (2019) standard requires that the instrument is calibrated in an authorized laboratory in order to obtain a calibration certificate once a year.

### 4.2 Measurement sensors

The instrument uses pre-calibrated gas sensors.

The sensors do not require special maintenance, but must be replaced periodically when exhausted.

The oxygen measurement (%O<sub>2</sub>) is performed with an electrochemical cell that behaves like a battery that is subject, over time, to lose sensitivity due to the fact that 20.9% oxygen is always present in the air.

Toxic gases measurements (CO, SO<sub>2</sub>, NO, NO<sub>2</sub>) are carried out with electrochemical sensors that are not subject to natural deterioration because they are intrinsically free from oxidation processes.

Toxic gas sensors, if subjected to concentrations higher than 50% of their measuring range for more than 10 minutes continuously, may show a drift of  $\pm 2\%$  and an longer zeroing times.

In this case, before turning off the analyzer, it is advisable to wait until the measured value is less than 20ppm by sucking in clean air. In any case, the instrument provides a cleaning cycle of the pneumatic circuit, the duration of which depends on the setting made in the Configuration menu.

The gas must not be at a pressure that can damage or destroy the sensors; for this reason the suction pump is continuously regulated, so as to guarantee an appropriate flow to the sensors. The maximum allowed pressure is  $\pm 100$  hPa.

Equipped with a solenoid valve for automatic autozero, the instrument performs an automatic cleaning cycle and turns off when the sensors have returned to a value close to zero.



#### **WARNING!**

**Some sensors (for example NH<sub>3</sub>, H<sub>2</sub>, H<sub>2</sub>S, SO<sub>2</sub>,...) are sensible to other gases called interfering gases. On the analysis phase, the influence of interfering gases is compensated only if on the instrument are installed the correspondent sensors.**

### 4.3 CO dilution (if the configuration allows it)

One of the characteristics of the electrochemical sensor for the measurement of CO is the need to require very long self-calibration time in case it has been in contact with high gas concentration (greater than the full scale) for a long time.

The combustion analyzer is equipped with the CO dilution feature for the sensor on position 1. The CO sensor is protected by an automatic dilution system that allows to extend the measuring range of the sensor without overloading the sensor itself.

The dilution system allows to have the CO sensor efficient any time and ready to perform properly even in case of very high concentration of CO.

The dilution system also allows to extend the measurement range of the CO sensor as follows:

- up to 100,000 ppm for a CO sensor with 8000 ppm full scale
- up to 250,000 ppm for a CO sensor with 20,000 ppm full scale

In this way in addition to better manage the wearing of the sensor, it is also possible to continue sampling, without any work interruption.

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#### **4.4 Autozero**

The instrument is featured with a solenoid valve to perform the automatic autozero with the smoke sampling probe inserted in the stack. The autozero is performed using the ambient air of where the instrument is placed; it is important that this step is performed in an environment with clean air.

During the autozero, the zero of the pressure sensor is also performed.

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#### **4.5 Fuel types**

The device is provided with the technical data of the most common types of fuels stored in its memory. By using the PC configuration program, available as an optional, it is possible to add combustibles and their coefficients in order to define up to a maximum of 16 combustibles, other than the default ones.

For more details see Annex C.

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#### **4.6 Gas extraction pump**

The sample pump located inside the instrument is a DC-motor-driven diaphragm pump, powered by the instrument, and is such as to obtain optimal flow of the sampled gas being analysed.

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#### **4.7 Pressure sensor**

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

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

---

#### **4.8 Printer**

If the configuration allows it, the instrument is featured with a printer module permanently attached to the instrument and so the user can print the results of the measurements on a ticket that certifies the system performances.

If the instrument does not include the printer module, this can be installed at a later time by sending the instrument to a Seitron service center.

Alternatively, a remote Bluetooth® printer can be associated with the instrument.

In both cases, through the special parameter which is visible on the home page of the instrument, it is possible to select the printer to use (internal or external) and to set the related printing settings.

---

#### **4.9 Simultaneous measurement of pressures, O<sub>2</sub>, pollutants and efficiency calculation**

In order to obtain exact boiler combustion parameters, the instrument allows to measure simultaneously the input or output pressure of the gas valve, the level of O<sub>2</sub>, the levels of pollutants (CO) and all the calculated parameters needed to obtain the correct value of yield.

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#### **4.10 Smoke measurements**

It is possible to enter the smoke values measured according to the Bacharach scale. The instrument will calculate the average and print the results in the analysis report.

An external pump, available as an optional, must be used to perform this measurement.

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#### **4.11 Measuring ambient CO**

Probe for monitoring the concentration of CO and checking safe conditions in the boiler room.

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#### **4.12 Tightness test**

It is possible to check the tightness of a system.

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#### **4.13 Battery charger connection**

Supplied with the instrument comes a power adapter with 5V, 2A output for charging the internal battery.

Paragraph 5.1 shows the socket for inserting the battery charger into the instrument.

Once recharging has started, the LED on the front will turn red, while when the batteries are fully charged the LED will remain green.

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#### **4.14 Calibration certificate**

The device comes with a calibration certificate.

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#### **4.15 Electromagnetic compatibility**

The instrument was designed to comply with Council Directive 2014/30/EC governing electromagnetic compatibility. Seitron Americas' declaration of conformity may be found in Annex E.

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#### **4.16 PC Connection**

With the provided USB cable or in Bluetooth (optional) mode it is possible to connect the instrument to a personal computer with Microsoft Windows 7 or later operative system, after installing the appropriate software "Seitron Smart Analysis", which can be downloaded from the website [www.seitron.com](http://www.seitron.com).

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#### **4.17 Bluetooth® connection**

The analyzer is internally equipped with a Bluetooth® module, which allows the communication with the following remote devices:

- Bluetooth® printer
- Smartphone or tablet of latest generation on which the Google Android v.4.1 (Jelly Bean) or latter operative system is installed, after installing the proper "Seitron Smart Analysis" APP available on Google Play store.
- PC with Microsoft Windows 7 or later operative system and Bluetooth® connection after installing the proper software "Seitron Smart Analysis" which can be downloaded from the web site [www.seitron.com](http://www.seitron.com).

The maximum transmission range in open field is 100 meters, with the condition that the connected device has a Bluetooth® class 1 connection.

This solution allows superior operator freedom of movement, who is not directly connected to the instrument for acquisition and analysis operations, with remarkable advantages for many applications.

Available Software and applications

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#### **4.18 Available applications and software**

- **Seitron Smart Analysis**

PC software, with Microsoft Windows 7 or later operative system, which can be downloaded from the web site [www.seitron.com](http://www.seitron.com)

Software for devices with Google Android OS v.5.0 and later

Software for devices with Apple iOS v.12.2 and later

Features:

Displays the label data of the instrument.

Configures the instrument.

Remotely displays the real-time analysis coming from the portable analyzer and to save the acquired data.

Displays and/or exports (in csv format, which can be opened with excel, and/or pdf) or delete the stored analyses.

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

## 5.0 MECHANICAL DESCRIPTION

### 5.1 Front view



1*	<b>Printer module</b>	4	<b>On / Off button</b>
1a*	<b>Lid to access the paper socket of the printer</b>	5	<b>Inputs</b>
2	<b>USB type C interface, for connecting the instrument to a personal computer or to the battery charger.</b>		
3	<b>User interface</b>		

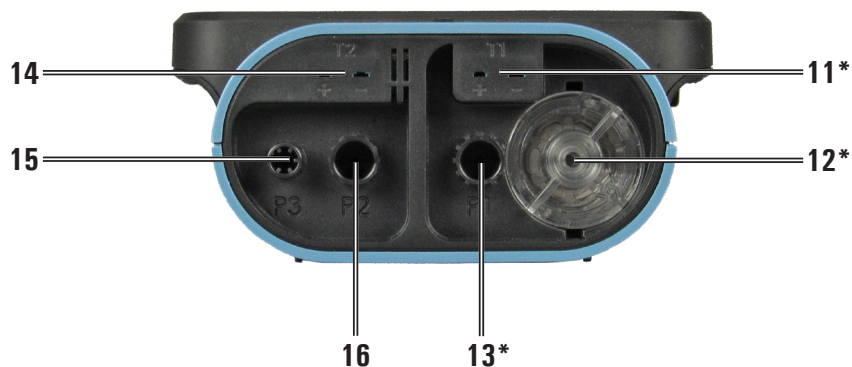
\* This component is present only if the instrument model is featured with the internal printer module.

**5.2 Back view**



<b>6</b>	<b>Magnets</b>	<b>9</b>	<b>Water trap low level notch</b>
<b>7</b>	<b>Water trap /smoke filtering unit</b>	<b>10</b>	<b>Water trap high level notch</b>
<b>8</b>	<b>Gas output</b>		

### 5.3 Inputs



11*	<b>(T1) Female connector Tc-K Tc-K input male connector for the flue gas probe.</b>	14	<b>(T2) Tc-K female connector Ingress for combustion probe Tc-K male connector.</b>
12*	<b>Pneumatic female connector ø int. 8mm. Anti-condensation pneumatic inlet group / smoke filtering.</b>	15	<b>(P3) Pneumatic male connector ø int. 8mm. Pneumatic inlet for gas valve pressure measurement and for tightness test.</b>
13*	<b>(P1) Pneumatic female connector ø int. 8mm. Positive input of the pressure sensor to be used for pressure measures, differential pressure (together with P2) and draft</b>	16	<b>(P2) Pneumatic female connector ø int. 8mm. Negative input of the pressure sensor to be used for differential pressure measurement together with P1.</b>

\* A maximum of 3 extensions, each 3 meters long, can be connected between these inputs and the flue gas probe. These extensions increase the response time of the instrument by about 5 sec. for each meter of extension and consequently the pump decreases its performance by 10mbar for each 3m extension.

## 6.0 USING THE FLUE GAS ANALYSER

### 6.1 Preliminary operations

Remove the instrument from its packing and check it for damage. Make sure that the content corresponds to the ordered items. If signs of tampering or damage are noticed, notify that to the SEITRON service center or agent immediately and keep the original packing.

The serial number and model of the instrument are shown in the data plate of the instrument.

**This serial number should always be kept in mind when requesting technical assistance, spare parts or clarification on the product or its use.**

Seitron maintains an updated database for each and every instrument.

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

### 6.2 Analyzer power supply

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

If the battery is too drained to perform the measurements, the instrument can be connected to mains power using the provided power pack, so to allow it to operate and proceed with the analysis.

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

The battery charging cycle takes up to 6 hours for a complete charge and finishes automatically.

#### WARNING

**If the instrument is not going to be used for a long time (e.g. summer) it is advised to store it after a complete charging cycle; furthermore, perform a complete charging cycle once every 3 months.**

#### 6.2.1 Internal battery charge level

The display constantly shows the status of the internal battery, through the symbol at the top right of the display, with the relative percentage of residual charge.







#### WARNING!

**THE INSTRUMENT IS SHIPPED WITH A BATTERY LEVEL LOWER THAN 30% AS REQUIRED BY CURRENT AIR TRANSPORTATION STANDARDS. BEFORE USE PERFORM A COMPLETE CHARGING CYCLE OF 6 HOURS.**

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

Pay particular attention to the following symbols:

SYMBOL	BATTERY STATUS
 Fast blinking (1 sec.)	20% residual charge - Operation remaining time 2 hours.
 Fast blinking	5% residual charge - Operation remaining time 1 hour. Charge the battery.
	Charging the battery.
	Battery not connected or damaged.


The instrument can be left in stock for a period of time depending on the charging level of the battery; below there is a table showing the correlation between stock time and charging level.

BATTERY LEVEL	STOCK TIME
100%	120 days
75%	80 days
50%	45 days
25%	30 days



### 6.2.2 Use with external power pack

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



**WARNING!**  
**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 C-TYPE PLUG.**

### 6.3 Power ON / OFF

INSTRUMENT STATUS	ACTION	FUNCTION
OFF (turned off)	Hold down the key indicated by the arrow for a long time (> 3sec.)	The instrument turns on * and starts the automatic autozero.
ON (switched on)	Hold down the key indicated by the arrow for a long time (> 3sec.)	The instrument turns off after completing the cleaning cycle for the set time.



\*: At the first start, the instrument guides the user step-by-step to configure the following data:

- Language
- Country
- Time format
- Current time setting
- Date format
- Current date setting

On the start-up phase, the instrument switches on the dilution pump and opens the solenoid valve for the automatic autozero.

At the end of the autozero cycle, the instrument switches off the dilution pump and disables the solenoid valve for automatic autozero and turns on the smoke pump.

The autozero time interval can be modified by the user from a minimum of 30 to a maximum of 600 sec. with 1 second resolution (default 60 sec). During the start-up phase the instrument measures the values of:

- gas sensors
- ambient temperature T2
- smoke temperature T1

On turning off phase, the instrument starts the pneumatic circuit cleaning cycle (turns off the smoke pump and enables the solenoid valve for automatic autozero and the CO dilution pump); the display shows a countdown, and when it is over the instrument will be turned off if the current values are found acceptable below the threshold of the zero value.

The cleaning cycle is settable on the "Configuration" parameter on the instrument home page.

### 6.3.1 Home Page of the instrument


Once the instrument has been switched on, the display shows the home page screen.

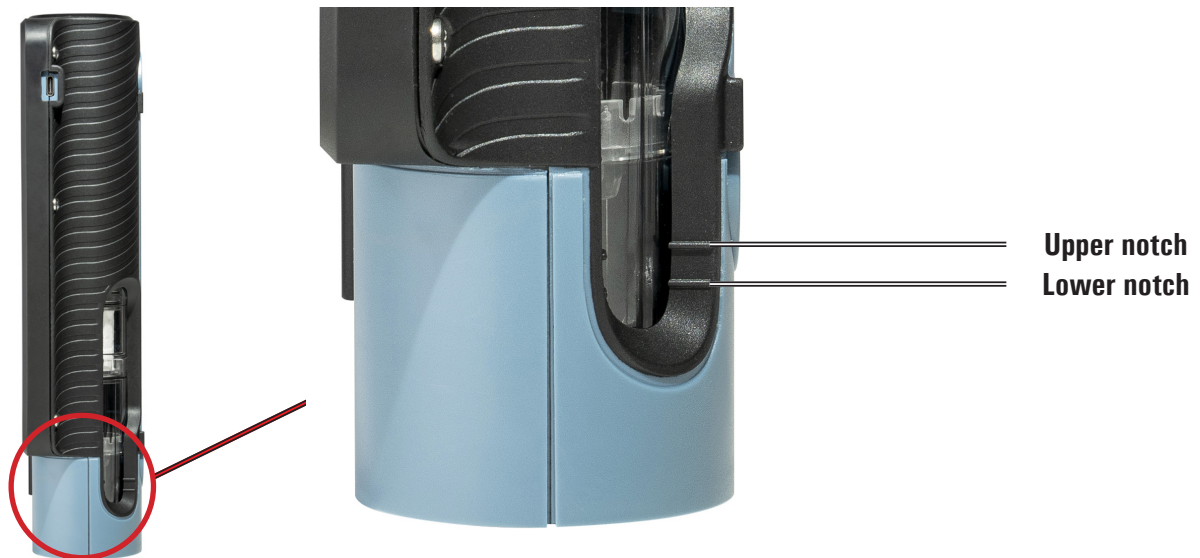


1	<p><b>Carry out the complete combustion analysis.</b>  <b>Also, access the analysis configuration menu; the user can set the different reference parameters of the instrument to carry out the combustion analysis.</b>  <b>FOR ALL DETAILS, REFER TO CHAPTER 8.0.</b></p>
2	<p><b>Enters the Operator menu.</b>  <b>It is possible to select the name of the operator who will perform the analysis, which will be printed on the analysis ticket report.</b>  <b>FOR ALL DETAILS, REFER TO CHAPTER 9.0.</b></p>
3	<p><b>Accesses the Measurements menu.</b>  <b>The user accesses all the accessory measurements that the instrument can perform.</b>  <b>FOR ALL DETAILS, REFER TO CHAPTER 10.0.</b></p>
4	<p><b>Access the Configuration menu; the user can set the various reference parameters of the instrument.</b>  <b>FOR ALL DETAILS, REFER TO CHAPTER 11.0.</b></p>
5	<p><b>Access the Print menu.</b>  <b>FOR ALL DETAILS, REFER TO CHAPTER 12.0.</b></p>
6	<p><b>Access the Archive menu.</b>  <b>The user views the stored measurements.</b>  <b>FOR ALL DETAILS, REFER TO CHAPTER 13.0.</b></p>


## 6.4 Warning

- Use the instrument with an ambient temperature between -5 and +45°C.

 **WARNING!**  
**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.**

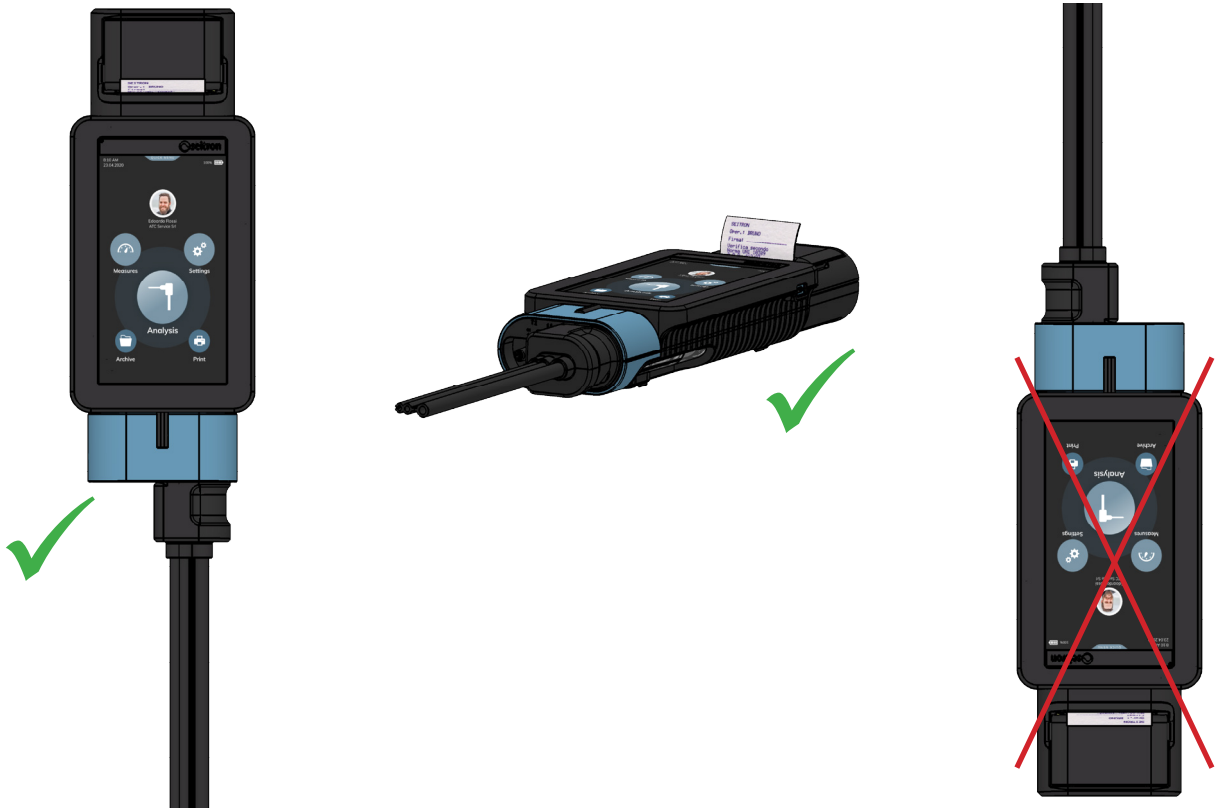


- When the use is terminated, before turning the instrument off remove the probe and let it aspirate ambient clean air for at least 30 seconds to purge the pneumatic path from all traces of gas
- After every use, before storing the instrument, check the condensation level inside the water trap / smoke filter and, if necessary, empty the container. Also check that the filter present is not particularly dirty or impregnated with humidity; in this case, replace it with a new one.

 **WARNING!**  
**DO NOT PERFORM ANY MEASURE WITHOUT THE FILTER OR WITH A DIRTY FILTER, FOR THAT COULD RESULT IN AN IRREVERSIBLE DAMAGING TO THE SENSORS.**  
**DO NOT USE THE INSTRUMENT WITH THE FILTERS CLOGGED OR IMPREGNATED WITH HUMIDITY AND WITH A CONDENSATION LEVEL BETWEEN THE TWO NOTCHES (SEE THE FIGURE BELOW).**

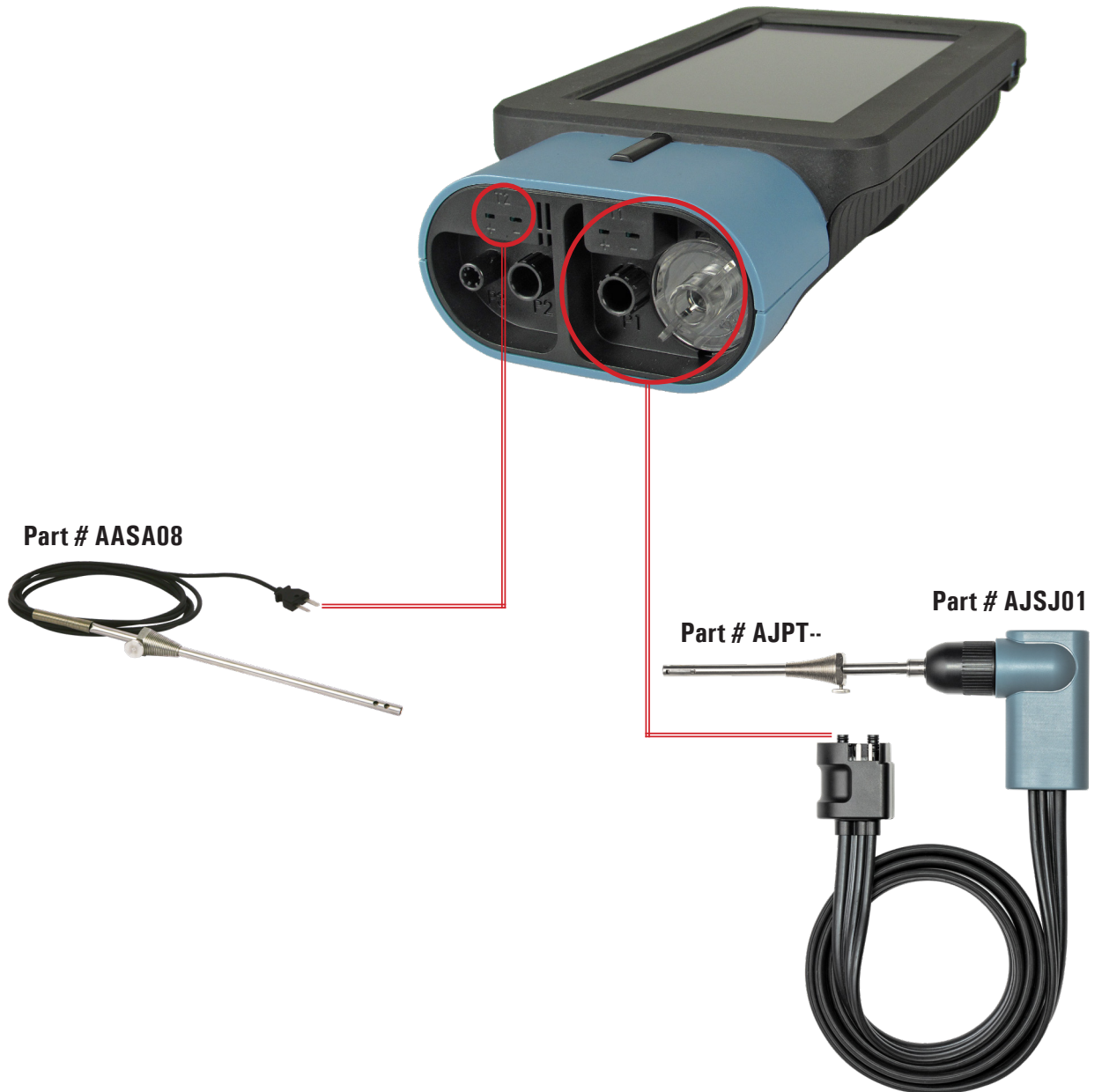
- Before putting the measuring probe back in its case after use, make sure it is has cooled down enough and there is no condensate in the tube. It might be necessary to periodically disconnect the filter and the condensate separator and blow compressed air inside the tube to eliminate all residues.
- Remember to have the instrument checked and calibrated once a year in order to comply with the existing standards.

## 6.4.1 Positioning of the instrument during operation

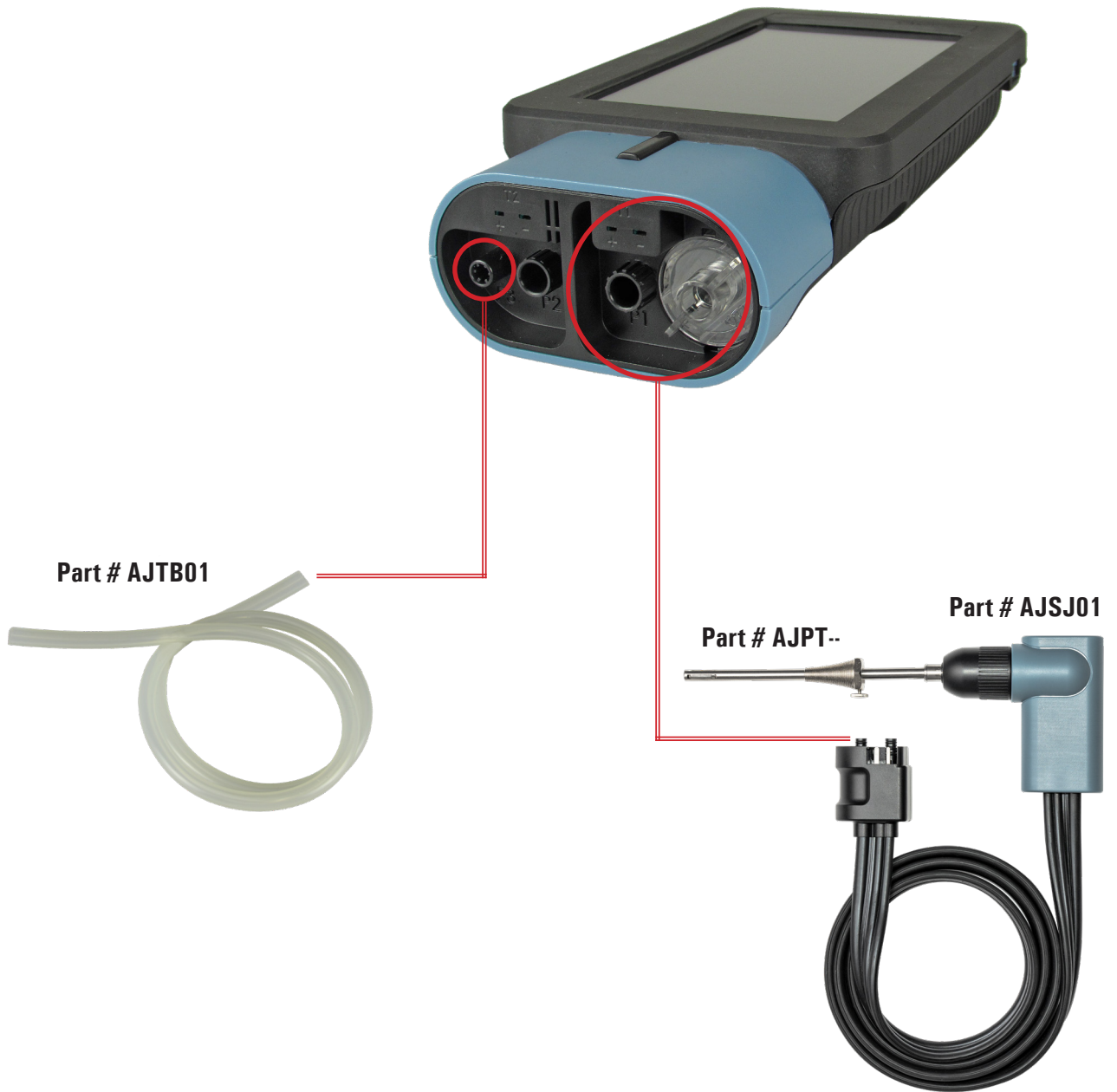


## 7.0 CONNECTION DIAGRAM

### 7.1 Smoke probe and combustion air temperature probe connection diagram



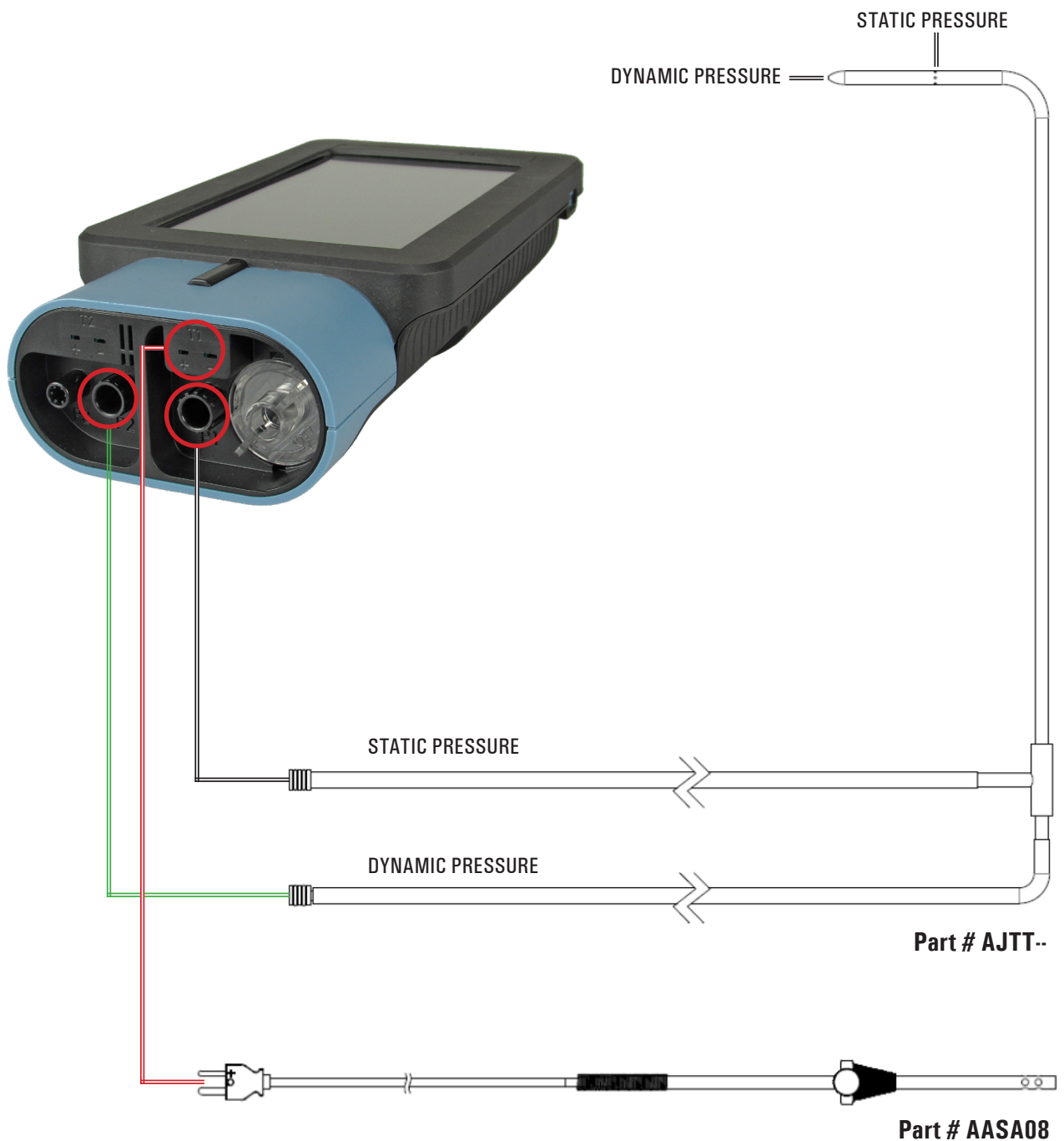
**7.2 Probe connection for simultaneous pressure, O2, pollutants measurement and efficiency calculation**



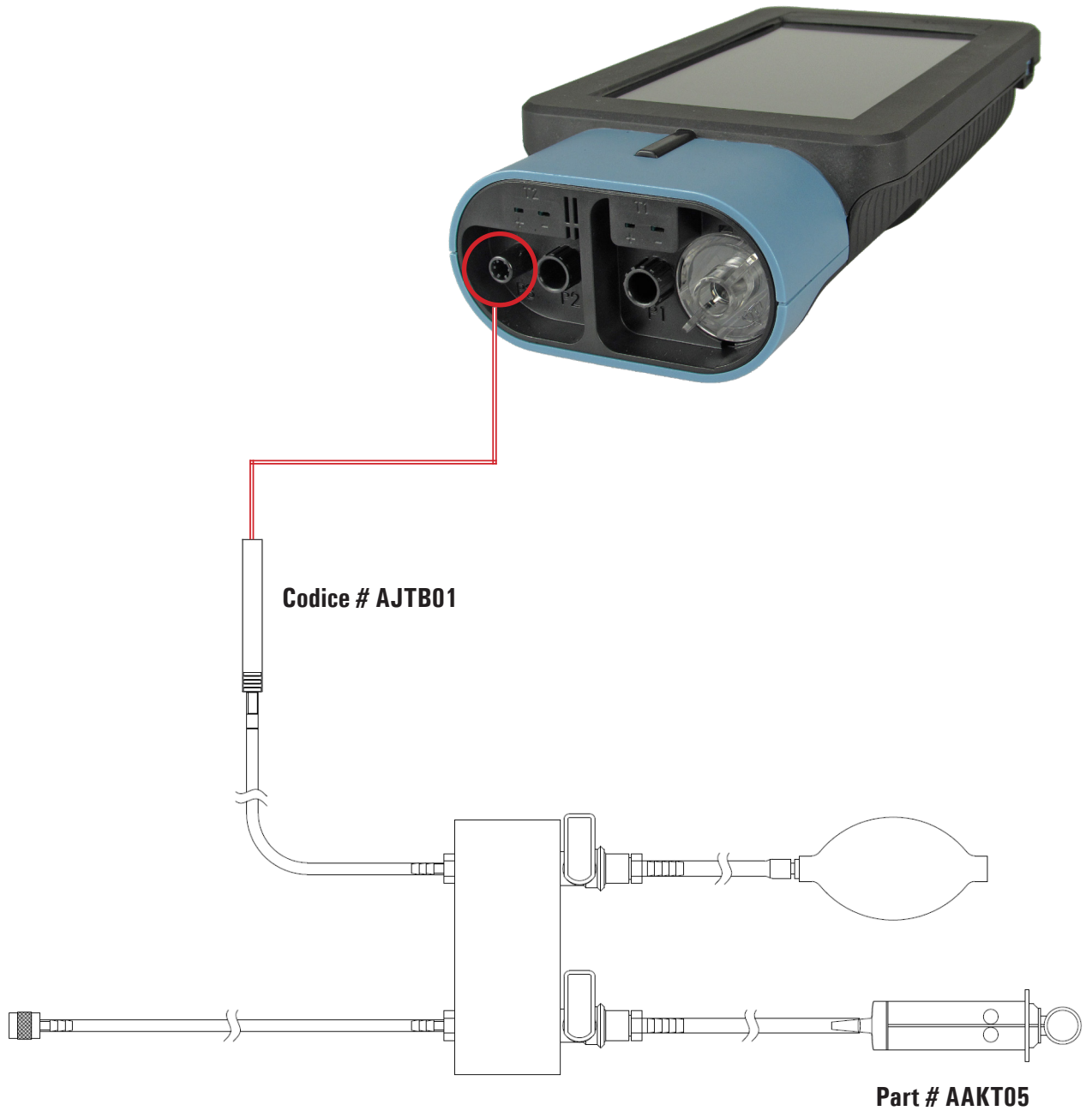
### 7.3 Pitot tube connection

- Connect the Pitot tube (accessory) to the two ports P1 and P2 that are typically used for differential pressure measurement.
- Connect the combustion air probe to the T1 port of the instrument.

**⚠ WARNING!**  
When a Pitot tube integrated to a Tc-K thermocouple is used, remember to connect the thermocouple connector to T1 input at instrument side. In this case the flue gas probe must not be connected.  
The tubes associated to static and dynamic pressure can be connected either to the inputs P1 or P2.

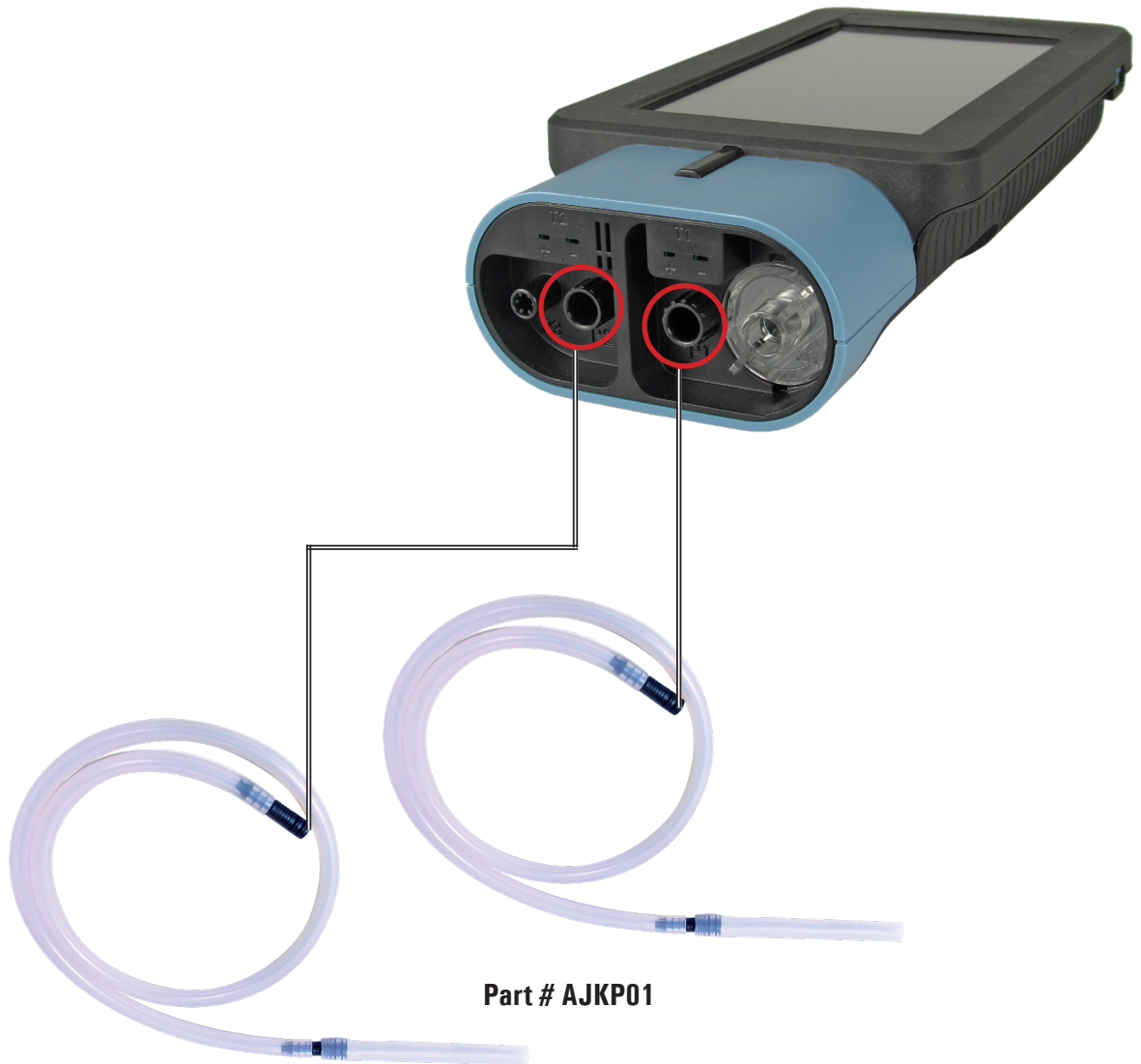


## 7.4 Instrument tightness test kit connection



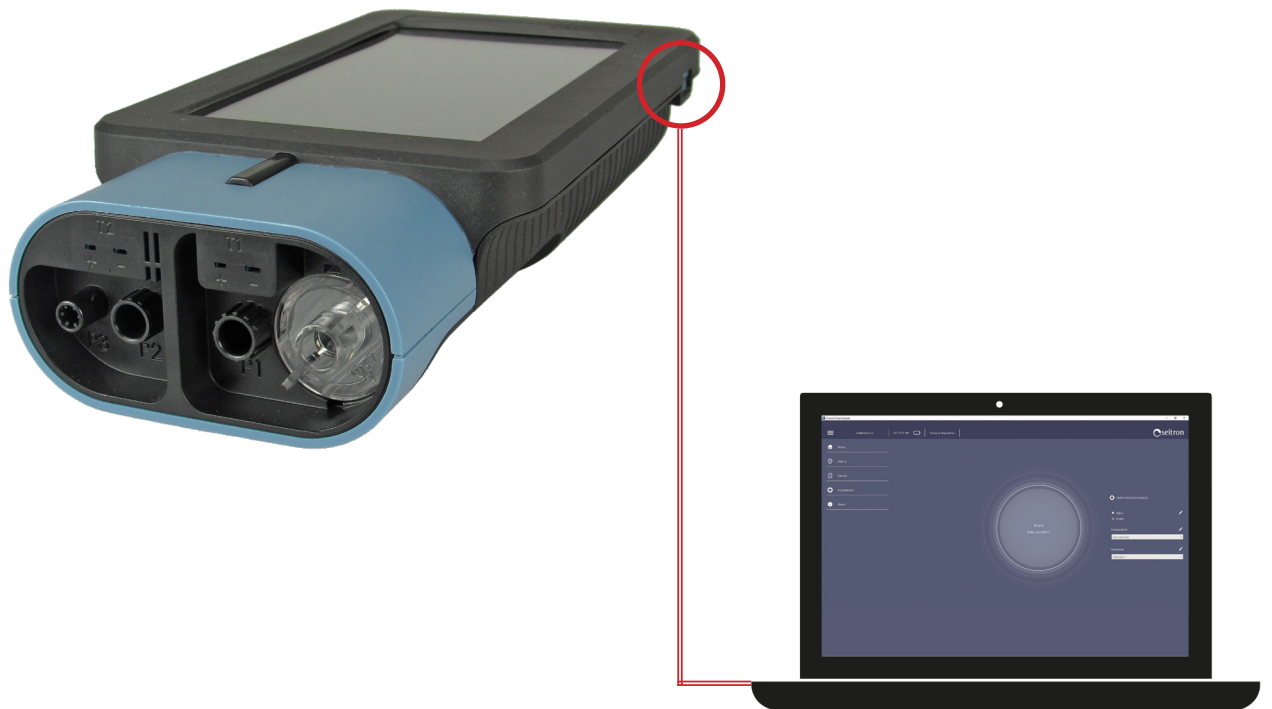


## 7.5 Connection of the instrument differential pressure measurement kit



**This page is blank on purpose**


## 7.7 PC connection



## 8.0 FLUE GAS ANALYSIS

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

### 8.1 Warnings



**WARNING!**

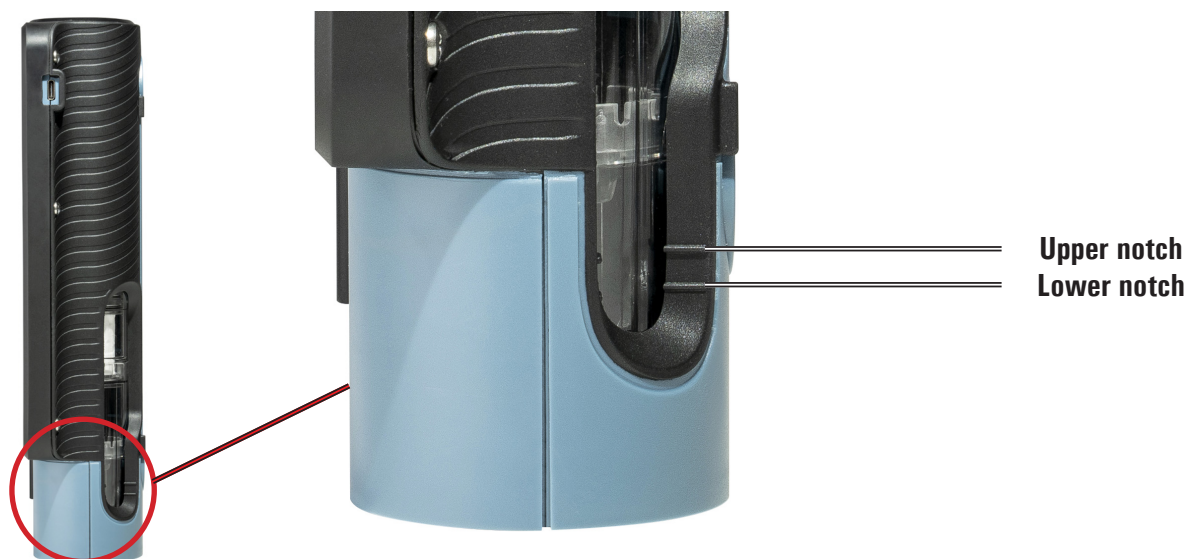
**FOR A CORRECT ANALYSIS NO AIR MUST FLOW INTO THE PIPE FROM OUTSIDE DUE TO A BAD TIGHTENING OF THE CONE OR A LEAK IN THE PIPELINE. THE GAS PIPE MUST BE CHECKED IN ORDER TO AVOID ANY LEAKAGES OR OBSTRUCTIONS ALONG THE PATH.**

**CHECK THE WATER TRAP / SMOKE FILTER UNIT IS SET UP CORRECTLY ON THE INSTRUMENT. THE SMOKE PROBE CONNECTORS MUST BE TIGHTLY CONNECTED TO THE ANALYZER.**

**DO NOT PERFORM ANY MEASUREMENT WHEN THE FILTER IS REMOVED OR DIRTY IN ORDER TO AVOID ANY RISK OF IRREVERSIBLE DAMAGES ON SENSORS.**

**DO NOT PERFORM ANY MEASUREMENT WHEN THE FILTER IS REMOVED OR DIRTY IN ORDER TO AVOID ANY RISK OF IRREVERSIBLE DAMAGES ON SENSORS.**


**DO NOT USE THE INSTRUMENT WITH THE FILTERS CLOGGED OR IMPREGNATED WITH MOISTURE AND WITH THE LEVEL OF CONDENSATION BETWEEN THE TWO NOTCHES (SEE FIGURE BELOW).**



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

By pressing the on / off button, the instrument turns on and displays the initial splash screen.

After a few moments the instrument automatically proceeds to the autozero phase.



**WARNING!**

**THE INSTRUMENT IS FEATURED WITH A SOLENOID VALVE FOR THE AUTOMATIC AUTOZERO, SO THE AUTOZERO CAN BE PERFORMED WITH THE SMOKE PROBE IN THE STACK.**

**DURING THE AUTOZERO PHASE, THE INSTRUMENT TAKES IN CLEAN AIR FROM THE ENVIRONMENT WHERE IT IS AT THE MOMENT OF THE ANALYSIS AND DETECTS THE BASE LINE OF THE SENSORS (O<sub>2</sub>, CO, NO, ..), THE DATA OF WHICH ARE STORED FOR USE AS REFERENCE DURING THE ANALYSIS. IT IS ALSO IMPORTANT THAT THIS PHASE BE CARRIED OUT IN AN ENVIRONMENT WITH CLEAN AIR. DURING THE AUTOZERO THE ZERO OF THE PRESSURE SENSOR IS ALSO PERFORMED.**

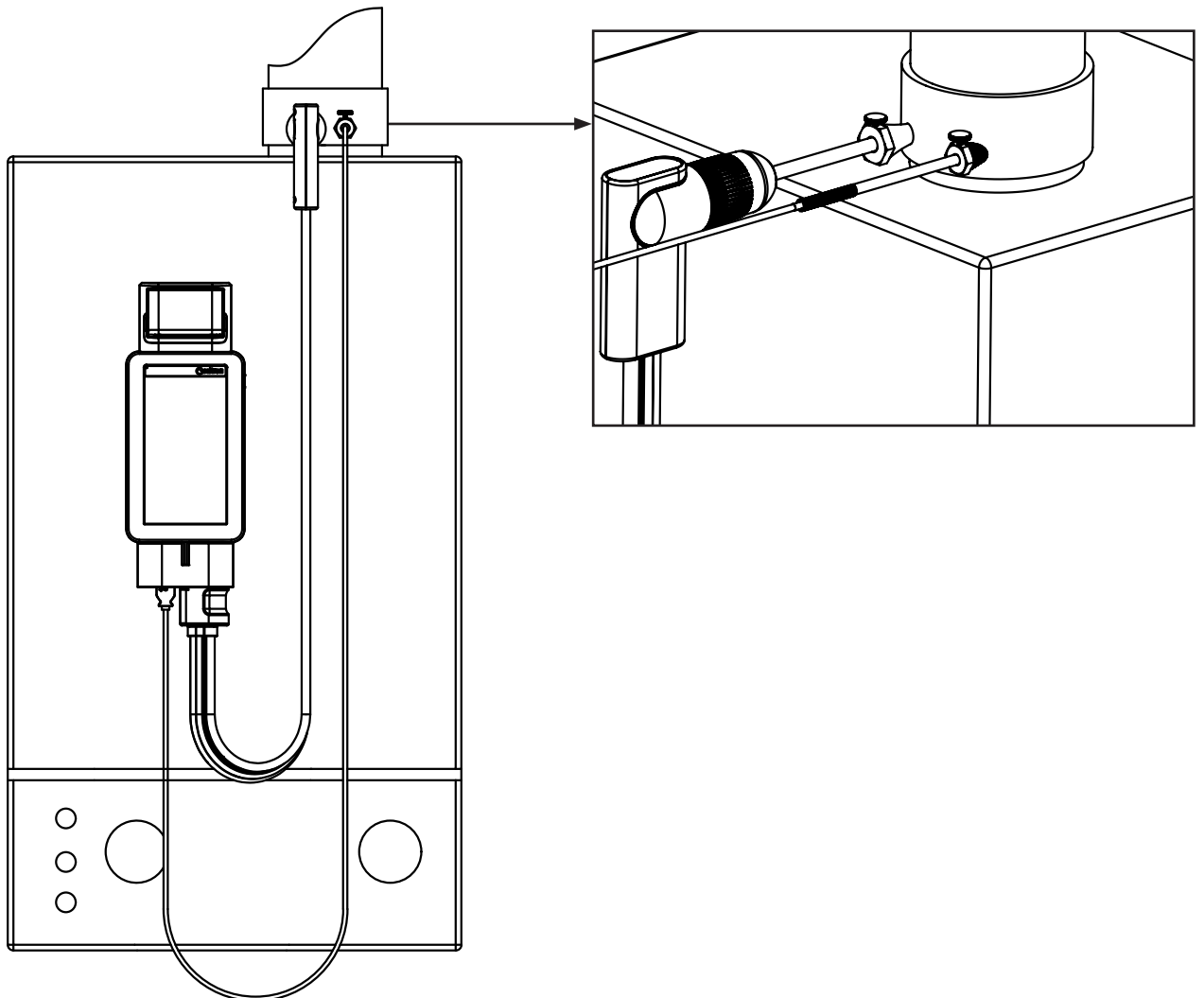
### 8.3 Inserting the smoke probe in the stack

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, a reliable support must be provided by drilling 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.

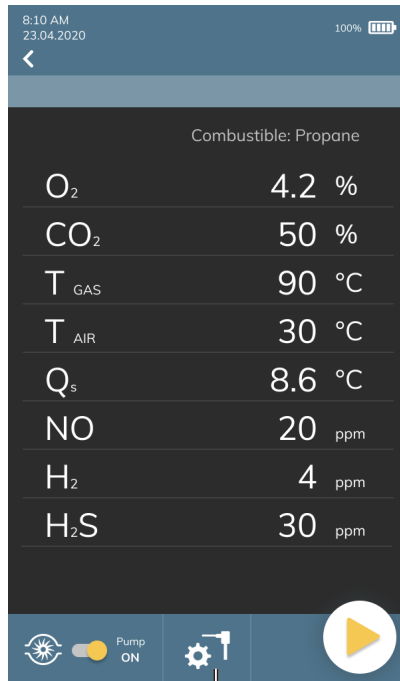
The screw on the cone allows the probe to be stopped at the right measuring depth - this usually corresponds to the centre of the exhaust pipe. For greater positioning accuracy, the user may insert the probe gradually into the pipe until the highest temperature is read.

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.



## 8.4 Setting the main analysis parameters

After inserting the smoke probe in the stack and, if necessary, set up any probe to measure the combustion air temperature in the special pick-up manifold, you can proceed, if not previously done, to the configuration alla configurazione of the analysis mode setting the requested data:



### WARNING.

In case on the instrument are installed sensors that detect the same gas, but with different measuring range, there will also be a letter next to the name of the detected gas indicating the measuring range:

**H: High Range**

**M: Medium Range**

**L: Low range**

**Ex. CO+H<sub>2</sub> H**


In addition, if there were 2 or more sensors of the same type installed on the instrument, the analysis screen will specify the positions where they are placed, such as CO+H<sub>2</sub> S1, CO+H<sub>2</sub> S2, and so on.



### 8.4.1 Analysis parameters

Through this menu the user can configure the available parameters for a proper combustion analysis.

PARAMETER	FUNCTION
Fuel	<p>Lets the user select the type of fuel to be used during analysis.</p> <p>By selecting the sub menu Fuel coefficients the user can view the characteristics of the fuels used in the calculation of performance</p>
Condensation	<p>The burner efficiency figure when condensation takes place is influenced by atmospheric pressure and humidity of the combustion air.</p> <p>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.</p> <p>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.</p>
Analysis mode	<p>This submenu allows the user to define the mode of analysis:</p> <p><b>Automatic analysis mode:</b></p> <p><b>data logger</b></p> <p>This mode is entirely configurable by the user (it is necessary to set the number of samples to be acquired, the duration of acquisition of each sample and the printing mode).</p> <p>When the combustion analysis starts, the instrument automatically acquires the number of samples set on the special parameter, each sample separated by another by the set time.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><b>Warning!</b>  <b>In automatic mode, the smoke test and ambient CO must be carried out before starting the combustion analysis.</b></p> </div> <p><b>Manual analysis mode:</b></p> <p>If the user chooses the manual mode, he will perform the combustion analysis manually; in this case, the settings regarding printing and duration of the automatic analysis will not be considered. At this point the user can start the manual analysis after waiting two minutes so that the displayed values are stable: then he can proceed to save or directly print the test ticket of the analysis, which will be prepared in accordance with the previously configured settings.</p> <p>At the end of the three analyses, the screen with the average can be displayed, which also contains all the data necessary to fill in the booklet of the system or plant.</p>

<p><b>CO Dilution</b></p>	<p>The CO sensor is protected by a pump which, in case of need, can inject clean air in the gas path in order to dilute the gas concentration measured by the sensor. This function can be either triggered by the overcoming of a CO concentration threshold which can be set by the user or, in case it is known that the flue gases contain high CO concentration, kept enabled any time, independently of CO concentration.</p> <div style="border: 1px solid black; padding: 5px; background-color: #f0f0f0;">  <p><b>WARNING!</b>  <b>CO AUTO-DILUTION FEATURE MUST ONLY BE CONSIDERED AS A MEANS OF PROTECTION FOR CO SENSOR, AS ITS ACTIVATION HEAVILY DETERIORATES BOTH ACCURACY AND RESOLUTION OF THE CO MEASUREMENT.</b></p> </div>
<p><b>O<sub>2</sub> reference</b></p>	<p>In this mode the user can set the oxygen percentage level to which pollutant emission values detected during analysis will be referenced.</p>
<p><b>NO/NO<sub>x</sub> ratio</b></p>	<p>NO<sub>x</sub>/NO: all the nitrogen oxides which are present in the flue emissions (Nitrogen oxide = NO, Nitrogen dioxide = NO<sub>2</sub>); total nitrogen oxides = NO<sub>x</sub> (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 NO<sub>x</sub> 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).</p>
<p><b>Measure list</b></p>	<p>In this submenu it is possible to:</p> <ul style="list-style-type: none"> <li>- display the list of measurements made by the instrument</li> <li>- enable or disable a measure</li> <li>- move a selected measure in a different position in the list</li> </ul>
<p><b>Air temperature</b></p>	<p>In this submenu there is a possibility to acquire or manually enter the combustion air temperature.</p>

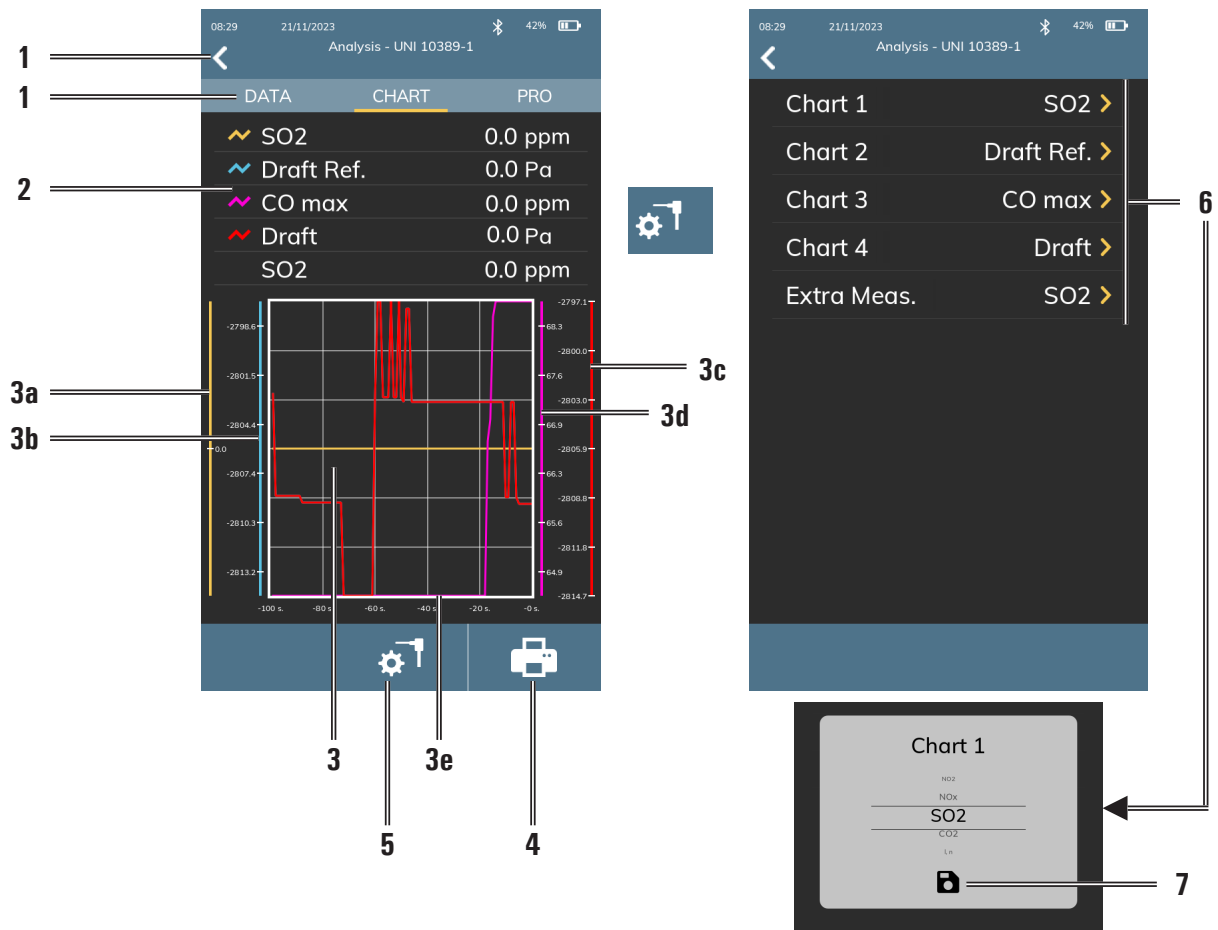



## 8.5 Start and end of the combustion analysis in manual mode



1	Turns on / off the smoke probe. If the pump is switched off, the refresh of the current measures is frozen.
2	Pressed for the first time it starts the analysis; at this time, the first sample is already stored. When it is pressed afterwards, at each press acquires the next measure.
3	<b>TIME ELAPSED:</b> Time passed from the last pressure of the key "2".
4	<b>Running n°:</b> indicates the measure number which will be acquired at the next pressure of the key "2".
5	Stores the acquired memories. The first sample is already stored when pressing the "Play" button.
6	View the QR code relating to the analysis performed on the display.
7	Displays the graph screen, where measurements of O <sub>2</sub> , CO, CO <sub>2</sub> , flue gas temperature, and total efficiency are displayed in a graph in relation to the Low Heating Value (LHV).
8	Opens the print menu.
8a	You can choose which type of printing you want to do: <i>Real time:</i> Real-time printout of the analysis values displayed on the screen at that time. <i>Last Sample:</i> Prints the values for the last sample stored by the instrument. <i>Average:</i> Print the average of the sample values stored up to that point.

### 8.5.1 Details of the Analysis graph screen (Valid for all analysis modes)

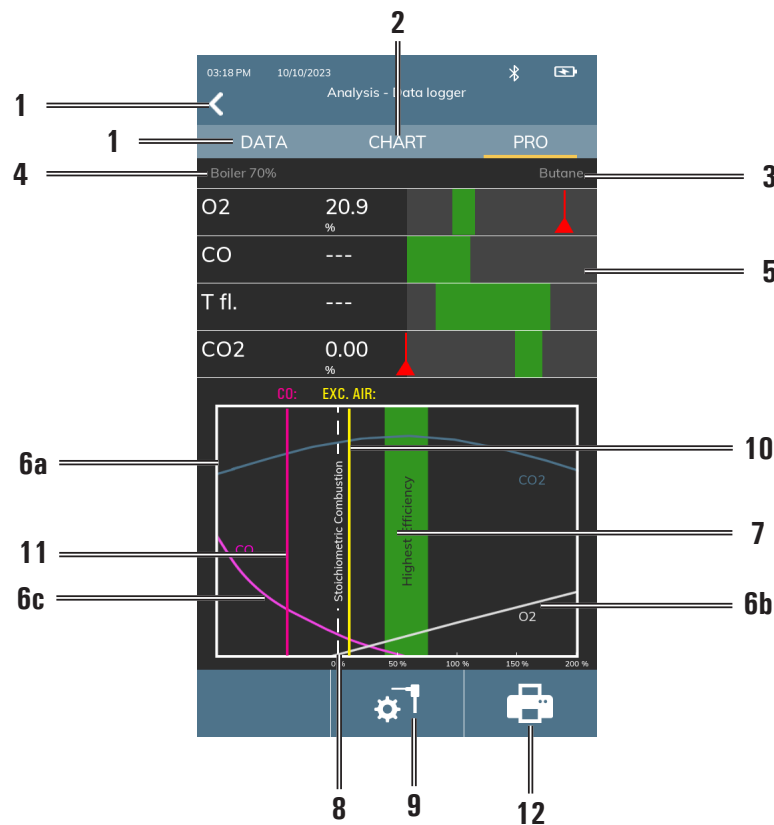


1	Display the "DATA" screen.
2	The measurements present in the graph can be set by the user in the "Settings" screen, accessed by pressing the button  (see point 5).
3	The graph displays real-time value curves.  <b>3a. YELLOW axis related to the measurement set in Chart 1.</b> <b>3b. BLUE axis related to the measurement set in Chart 2.</b> <b>3c. PURPLE axis related to the measurement set in Chart 3.</b> <b>3d. RED axis related to the measurement set in Chart 4.</b> <b>3e. Axis representing time from 0 to 100 seconds.</b>
4	Print real-time analysis data.
5	Access the settings of the "Graph" screen.
6	Set the measurements shown in the graph, along with an additional measurement, the value of which will only be displayed. The graphs are configured in the following order: Chart 1 on the yellow axis, Chart 2 on the blue axis, Chart 3 on the purple axis, and Chart 4 on the red axis.
7	Set the selected measurement for the graph shown in the pop-up.

## 8.5.2 PRO Analysis graphic screen details (Valid for all combustion analysis modes)

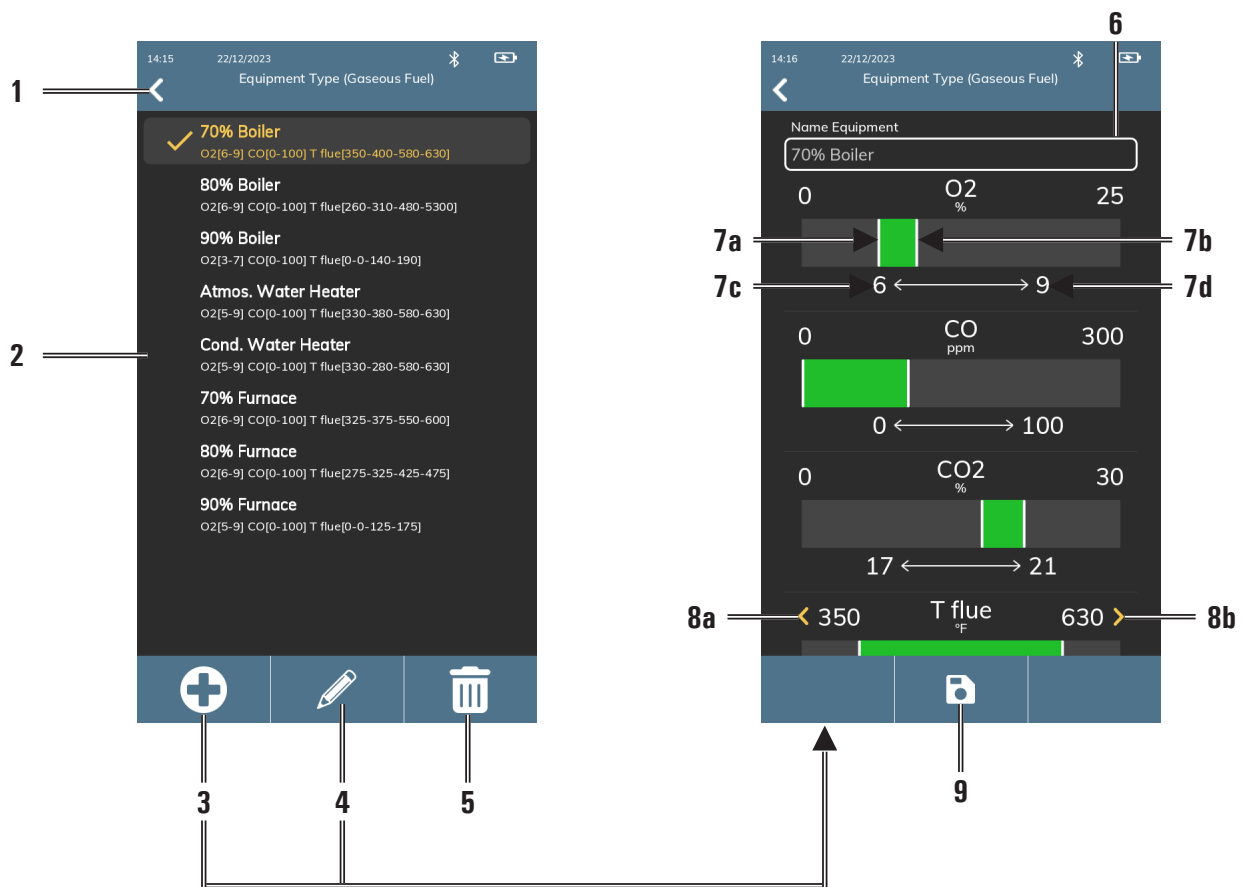
### WARNING!

1. The PRO graphic screen is only an *illustrative* example of the combustion data. Please refer to the manufacturer's specifications for correct ranges of all parameters.
2. Be sure to select the fuel used by the appliance *before* entering PRO mode.



1	Display the "DATA" screen.
2	Display the "CHART" screen.
3	Fuel in use by the heat generator, previously selected in the "analysis settings".
4	Heat generator set using button (9) - For details, see the next page.
5	Graphical representation of real-time values. When the cursor (10), the yellow line, moves within the green area, the value is optimal for good combustion. So the operator can visually monitor the 4 values simultaneously. <i>The displayed measurements are fixed and cannot be modified by the user.</i>
6	Graphical area where the ideal curves of CO <sub>2</sub> values (6a), O <sub>2</sub> (6b), and CO (6c) are represented.
7	Area of maximum heat generator efficiency. When the ECC. AIR cursor (10), the yellow line, moves within this area, the ratio between fuel and oxidizer is optimal. If it is not, the technician makes the necessary adjustments to the heat generator to improve this ratio.
8	White line representing stoichiometric (theoretical) ideal combustion.
9	Allows the choice of the heat generator type in use.
10	Yellow line representing the efficiency of the heat generator (Excess of air).
11	Purple line representing the CO level.
12	Prints real-time analysis data.

## Heat generator choice detailed screen

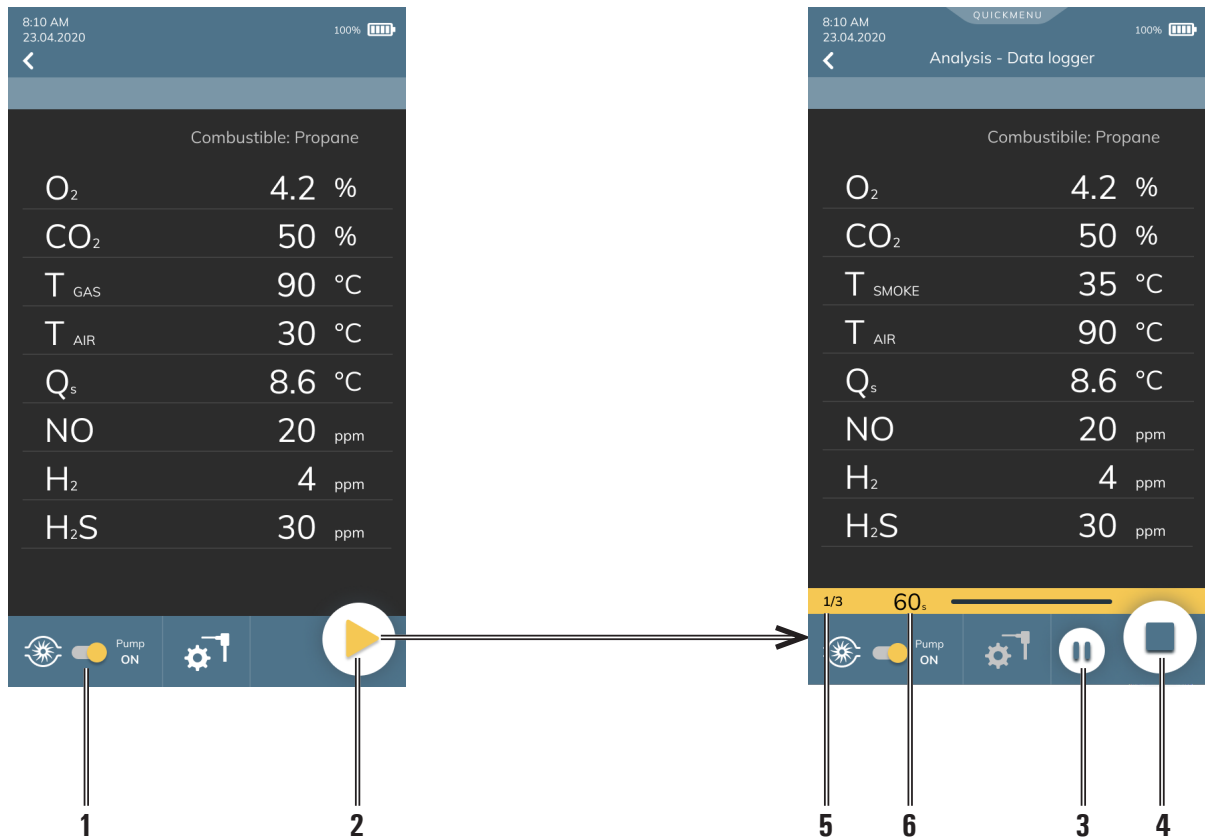


1	Display the "PRO" screen.
2	Choose the heat generator from the presented list - when a generator is selected, it turns yellow. The second row displays the operating parameters of the heat generator.
3	Add a heat generator with custom parameters - Opens the screen on the right.
4	Modify parameters of the selected heat generator - Opens the screen on the right.
5	Delete the selected heat generator.
6	Enter / modify the name of the heat generator.
7	<p>Modify the maximum and minimum values of the heat generator's operating range.</p> <p>7a. By holding down the white bar and dragging it to the left, you can change the minimum value of the measurement.</p> <p>7b. By holding down the white bar and dragging it to the right, you can change the maximum value of the measurement.</p> <p>7c. Minimum limit set through the white bar (8a).</p> <p>7d. Maximum limit set through the white bar (8b).</p>
8	<p>Adjustable minimum and maximum temperature range.</p> <p>8a. Modify the absolute minimum value of the measurement.</p> <p>8b. Modify the absolute maximum value of the measurement.</p>
9	<p>Save the newly created heat generator.</p> <p>Note: The "Save" button only appears when you enter text in the "Name" field (6).</p>

### WARNING.

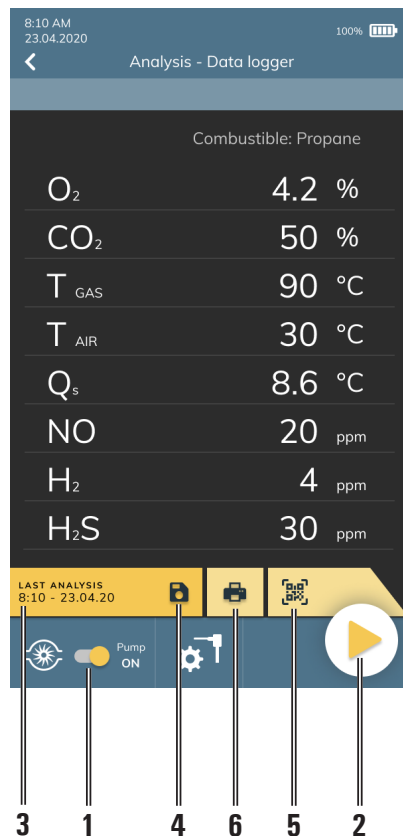
The equipment in the "Equipment Type" menu is automatically filtered according to the phase (gas, liquid or solid) of the selected fuel. In case the user creates a custom Generator via the '+' button, it will be assigned to the current fuel phase.

## 8.6 Starting the combustion analysis on automatic mode (Data Logger)



1	<b>Turns on / off the smoke probe. If the pump is switched off, the refresh of the current measures is frozen.</b>
2	<b>Starts the combustion analysis in accordance with the set analysis parameters.</b>
3	<b>Pause the current analysis.</b>
4	<b>Interrupts the current combustion analysis and goes back the starting page.</b>
5	<b>Current analysis number / Analysis to be acquired.</b>
6	<b>Time left (in sec.) for the acquisition of the current analysis.</b>

### 8.6.1 Ending the combustion analysis on automatic mode (Data Logger)



1	<b>Turns on / off the smoke probe. If the pump is switched off, the refresh of the current measures is frozen.</b>
2	<b>Starts the combustion analysis in accordance with the set analysis parameters.</b>
3	<b>LAST ANALYSIS: Date and time of the last performed analysis.</b>
4	<b>Stores the performed analysis.</b>
5	<b>View the QR code relating to the analysis carried out on the display.</b>
6	<b>Start the printing of the performed analysis, in accordance with the settings made in the appropriate dedicated parameter on the home page.</b>

## 8.7 END OF 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 by pressing the On/Off key.

At this point, if the instrument has detected a high concentration of CO and/or NO, a self-cleaning cycle will be initiated during which the pump will draw fresh outside air until the gas levels drop below acceptable values.

The duration of the cleaning cycle depends on the setting made in the Configuration menu.

**Note: However, it is always advisable to purge the instrument with clean air for at least 5 - 10 minutes, before turning it off and in any case check that the measured value is lower than 20ppm.**



### WARNING!

**WHEN THE SMOKE PROBE IS TAKEN OUT OF THE STACK, THERE COULD FORM SOME CONDENSATION INSIDE THE PROBE HOSE AND INSIDE THE WATER TRAP / SMOKE FILTER UNIT.**

**IT IS ADVISED TO CLEAN ACCURATELY ALL THE DIFFERENT PARTS BEFORE STORING THE INSTRUMENT AND THE PROBE IN THE CASE.**

**TO AVOID DAMAGING THE INSIDE OF THE CASE, MAKE SURE THE METALLIC PART OF THE PROBE IS AT A TEMPERATURE LOWER THAN 140 °F (60 °C).**

### 8.7.1 Checking the water trap / smoke filtering unit

The water trap / smoke filtering unit is integrated with the instrument, but it is removable in order to empty the water in the water trap and the filter replacement operations.

Considering that an analysis lasts on average 20/30 minutes, the autonomy of the water trap can be considered as about 6/8 complete analyses without necessarily having to empty the water trap unit each time.

However, it is a good rule to empty the water trap unit at the end of each complete analysis or at least every 2 - 3 complete analyses.

In this condition, if the instrument is placed in the suitcase, there is no possibility that the water leaks towards the inside.



### WARNING!

**CHECK AND EMPTY, AT THE END OF EVERY ANALYSIS, ANY PRESENCE OF WATER INSIDE THE TANK FOR CONDENSATION DRAINING COLLECTION. STORE THE INSTRUMENT INSIDE THE CASE JUST AFTER EMPTING THE WATER FROM THE WATER TRAP.**

**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 ON SENSORS.**

## 9.0 OPERATOR

In this menu you can enter, edit and select the name of the operator who will use the instrument, which will be saved and printed on the analysis report.

It is possible to store up to a maximum of six operators.

This menu is also accessible from the “Settings” parameter or via PC after installing the special “Seitron Smart Analysis” software downloadable from the website [www.seitron.com](http://www.seitron.com).

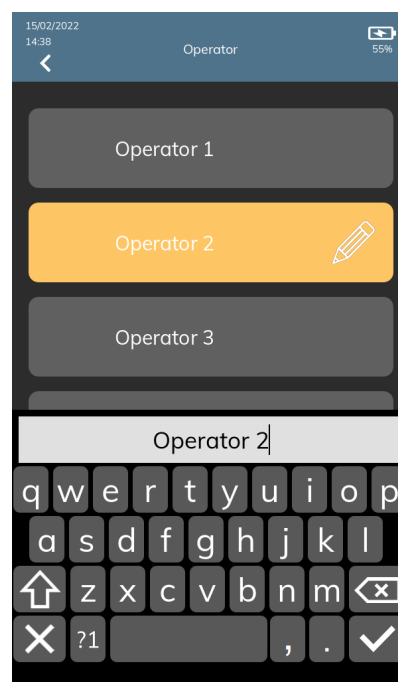
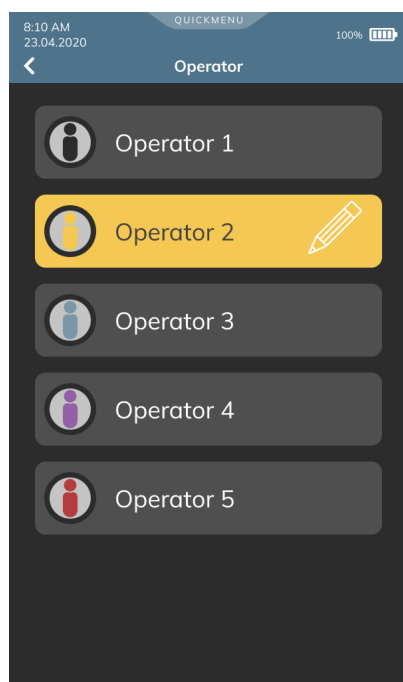


Press on the operator icon in order to select the operator name that will be printed on the instrument; the selected operator is highlighted in yellow.

To edit the text, select the operator and press the “pencil” button; it is possible to write up to a maximum of 40 characters (including spaces).

The “✕” key on the keyboard cancels the modification made and exits the modification mode.

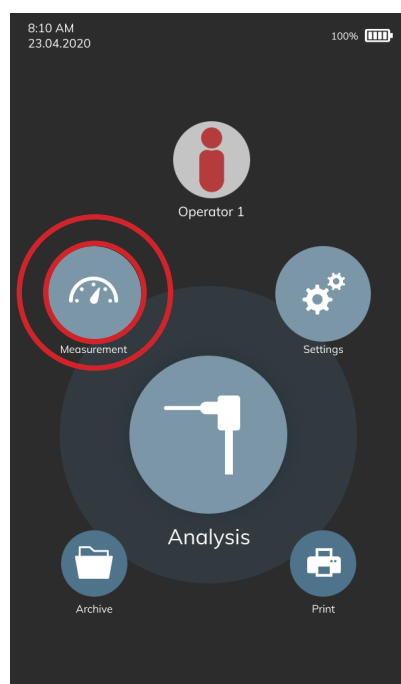
The “✓” key on the keyboard confirms the modification made and exits the modification mode.






## 10.0 MEASUREMENTS

This combustion analyzer is able to perform several other measurements, accessible from the home page of the instrument in the “Measurements” menu.



MEASURE	REFERENCE CHAPTER
Draft	10.1
Black smoke	10.2
Ambient CO	10.3
Temperature	10.4
Pressure	10.5
“P gas” gas network pressure	10.6
Ventilation test	10.7
Tightness test	10.8
Velocity	10.9

## 10.1 Draft measurement

This menu allows you to measure the stack draft. By pressing the  button you can view the real-time graph related to system pressure versus time.



### WARNING!

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.

To measure the draught proceed as follows:

- Connect the smoke probe to the instrument (see chapter "Connection diagrams").
- Perform the zero pressure; it is not necessary to remove the probe from the stack.
- Measure the draft.
- Save the measurement and / or proceed with printing on the report.



### WARNING!

If you want to have the draft measurement in the same combustion analysis report, you must first perform the draft measurement and then, through the guided procedure, proceed with the combustion analysis.

## 10.2 Black smoke measure

It is possible to enter the data concerning one to three CARBON BLACK measurements taken by means of an optional device (BACHARACH PUMP); see the relevant instructions. The method consists in taking a certain quantity of combustion gas from the middle of the flue behind the surfaces of the exchangers at the end of the boiler, and make it pass through a special filter paper. The soot stain obtained is compared with the surfaces blackened in a different way according to a comparison scale; it is thus determined the "soot number", which will be entered in the instrument by hand. The measures can be saved and/or printed on a ticket.

## 10.3 Ambient CO measure

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:

COmax: 30 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).



### WARNING!

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.

## 10.4 Temperature measure

With this menu it is possible to measure the temperature of the supply water, by means of an OPTIONAL thermocouple K-type contact probe to be connected to the input T1.

Also, it is also possible to measure the temperature of the return water, by connecting an OPTIONAL thermocouple K-type contact probe to be connected to the input T2.

With the function  $\Delta T$  it is possible to obtain the relative temperature difference.

## 10.5 Pressure measure

Through the pneumatic inputs P1 and P2 of the instrument it is possible to measure the differential pressure, within the flow limits indicated on P1 in chapter 17 Measuring ranges and accuracies.

## 10.6 "P gas" Measures network gas pressure

It is possible, using an external tube, to connect to P3 input and measure the inlet pressure of the network gas within the range set on P3 at chapter 18 "Measurement and accuracy ranges."

## 10.7 Ventilation measurement


The menu VENTILATION allows to perform the test of the ventilation openings correct operation, through the measurement of the static differential pressure of the boiler room.

**When on verification mode**, the difference between the atmospheric pressure measured at the beginning of the test and the average of the measures performed afterwards **must be  $\leq 4\text{Pa}$** .

The value shown on the display can then be acquired in order to save it in the memory and / or print the ticket.

## 10.8 Tightness test

The analyzer can perform the system tightness test, which system uses combustible gas; the test is divided for New/re-newed plants or Existing plants. The tightness test results, which execution modes are listed below, they can be saved in memory and / or printed.

By pressing the  button you can view the real-time graph related to system pressure versus time.

### 10.8.1 New piping

With this menu it is possible to perform a tightness test on new systems or systems that have been restored after a repair.

Details of the test:

This test requires to charge the piping up to a pressure between 100 hPa and 150 hPa, then wait for a stabilization which must last at least 15 minutes and required in order for the thermal effects caused by the test gas compression to fade out, and finally to test the piping tightness by analysing the decay of pressure over time.

The maximum pressure decay measured, expressed as a function of the piping volume, must be smaller than the values shown in the following table:

Internal piping volume (litters)	Wait time (minutes)	Maximum pressure decay allowed (hPa)
$V \leq 100$	5	0,5
$100 < V \leq 250$	5	0,2
$250 < V \leq 500$	5	0,1

Table 1.

The analyzer allows the user to customize the stabilization phase through the following parameter:

**WAIT TIME:** it is the stabilization time and can be set by the user from 15 to 99 minutes.

**VOLUME SETUP:** An accurate tightness test requires to know the piping volume.

Because this data is often unavailable, the instrument splits the test from the beginning into two different paths:

**< 100l (Default):** valid for systems with a volume under 100 dm<sup>3</sup> (litters), the most frequent, where it is not required to enter the value of the volume since it is assumed that the system has a volume of 100 dm<sup>3</sup>.

**Manual:** in this case it is necessary to set the volume of the system by entering the numeric value if known, or by calculating the amount as the sum of the contributions of the different sections of piping or, even, by assessing the measurement with a simple procedure that requires the injection into the system of a known amount of gas using a syringe.

If you use volume calculation, for each section of piping it is necessary to set the material, the nominal diameter and the length of the same. The instrument calculates the volume of the section ("partial volume") and it adds it up, activating the context key "sum piping", to the calculation of the volume of the system.

To correct any errors or to modify the current calculation, the subtraction operation is also allowed by activating the context key "subtract piping".

When the 'Volume measurement' option is selected instead, the procedure is described in the following steps:

- Close both valves of the piping kit supplied for the test.
- Connect the syringe to the kit opposite to the pump
- Following the indications on the display
- Open the valve on the side where the syringe is connected, take exactly 100 ml (100 cc) of the gas present in the system.
- Wait for the stabilisation of the pressure of the system. After a few seconds, the device displays the measured volume. The suggested value can be accepted and then modified.

It is also possible to repeat the measurement of the volume.

Once the stabilization parameter has been set the user can proceed with the tightness test.

Following the instructions on the display, first the test pressure is indicated, as required by law, then you can access a screen which displays the pressure reading of the inputs of the device.

After zeroing the device and putting the system under a pressure of at least 100 hPa, it is possible to start the tightness test. In the stabilisation screen, the following values are displayed:

- P:** Actual pressure measured by the instrument, in the selected measurement unit.
- ΔP1':** Pressure variation in the last minute, updated every 10 seconds. This value gives a rough indication about the stabilization level reached in the piping system.
- Wait time:** Remaining time before the stabilization phase ends

Once the stabilization phase is terminated the tightness test is started. This test is performed by observing how the pressure decays in time during a fixed 5 minutes interval, as stated in the applied standard.

During the tightness test phase the following values are displayed:

- P1:** Pressure measured at the beginning of the test.
- P2:** Pressure actually measured by the instrument.
- ΔP:** Pressure variation with respect to the initial value. In case the actual pressure is lower than the initial value (pressure is decreasing) this value has a negative sign.
- Wait time:** Remaining time of the tightness test.

After the tightness test, the results are displayed: the data displayed is as follows:

- P1:** Pressure measured at the beginning of the test.
- P2:** Pressure measured by the device.
- ΔP:** Pressure variation between the last instant and the first instant of the test. If the pressure decreased, it presents a negative value.

**Result:** Reports the test result:

- Tight:** when the pressure is within the limit of table 1.
- Leak:** when the pressure is outside the limit of table 1.  
Positive pressure changes are symptom of a temperature change meanwhile the test is performed. Should this happen it is advisable to repeat the entire test.

- Operator:** if the Δ pressure is higher than +3 hPa it is operator's discretion whether repeat the test or not because the pressure and/or temperature conditions may have changed during the test.

## 10.8.2 Existing piping

With this menu it is possible to perform a tightness test on existing systems (to be activated, to be reactivated or in service) powered with fuel gases of the II family (natural gas) or III family (LPG).

Details of the test:

This test requires to charge the piping up to the test pressure, then wait for an unspecified stabilization time until the thermal effects caused by the test gas compression are nulled, and then calculate the amount of the possible leakage from the measure of the pressure decays in 1 minute time.

If the preliminary test is performed using LPG test gas and combustible test gas, the evaluation of the leakage entity, performed through the pressure decay measurement, occurs within 2 minutes and 30 seconds.

The test pressure should be as close as possible as the reference conditions following explained.

**REFERENCE CONDITIONS:** According to the combustible gas to be used in the piping, the tightness test must be performed in one of the following reference conditions:

Methane:	Reference pressure for test with supply gas 2200 Pa Test pressure with air 2200 Pa
L.P.G.:	Reference pressure for test with supply gas 3000 Pa. Test pressure with air 3000 Pa

The tightness test requires the input of some data regarding the piping system and the test conditions, as described in the following.

**PLANT:** Performing the tightness test requires to set the system part which it is intended to verify: Internal or External to the building.

**SYSTEM:** The test further differentiates between the "Home 7th" or "Not home 6th" systems.  
"Home 7th" system is a system in a domestic environment with a maximum service pressure of less than 40mbar, for systems powered by Natural Gas and less than 70mbar for systems powered by LPG.  
"Not home 6th" system we mean a system in a non-domestic environment with a service pressure included in the following values:

Natural Gas	40mbar < Service pressure < 500mbar
L.P.G.	70mbar < Service pressure < 500 mbar

**SERV. PRESS.:** This data is requested only if the "Not home 6th" system has been selected and it is required to enter the system service pressure.

**STABIL.:** the stabilization phase duration can be set in the 1 .. 99 minutes range.  
The stabilization can still be interrupted even if the interval is not over.

**FUEL:** Consider that the amount of the leakage is strictly related to the nature of the gas under pressure. When the tightness of a piping has to be evaluated it is mandatory to specify the family to which the gas belongs: Methane or L.P.G.

**GAS TEST:** Again the amount of the leakage is related to the nature of the gas under pressure, therefore it is mandatory to specify the type of the gas used: Natural Gas, L.P.G. or air.  
Please note that the gas used for the test could also be different from the gas to be used in the plant and could even be a not flammable gas.

**VOLUME SETUP:** An accurate tightness test requires to know the piping volume.  
Because this data is often unavailable, the analyzer splits the test from the beginning into two different paths:

**< 18 l:** valid for systems with a volume under 18 dm<sup>3</sup> (liters), the most frequent, where it is not required to enter the value of the volume since it is assumed that the system has a volume of 18 dm<sup>3</sup>.

**Manual:** in this case it is necessary to set the volume of the system by entering the numeric value if known, or by calculating the amount as the sum of the contributions of the different sections of piping or, even, by assessing the measurement with a simple procedure that requires the injection into the system of a known amount of gas using a syringe.

**Volume:** if known, enter the numerical value of the system volume in this parameter.

**Calculate Volume:** for each section of piping it is necessary to set the material, the nominal diameter and the length of the same.

The instrument calculates the volume of the section ("partial volume") and it adds it up, activating the context key "sum piping", to the calculation of the volume of the system.

To correct any errors or to modify the current calculation, the subtraction

operation is also allowed by activating the context key “subtract piping”.

- Measure Volume:** the procedure is described in the following steps:
- Close both valves of the piping kit supplied for the test.
  - Connect the syringe to the kit opposite to the pump.
  - Follow the instructions on the display
  - Open the valve on the side where the syringe is connected, take exactly 100 ml (100 cc) of the gas present in the system.
  - Wait for the stabilization of the pressure of the system.  
After a few seconds, the device displays the measured volume.  
The suggested value can be accepted and then modified.
- It is also possible to repeat the measurement.

**Table volumes:**

Examples relating to the various lengths of indoor systems, capacity approximately corresponding to 18dm<sup>3</sup>, depending on the material and the diameter of the fuel gas adduction pipe.

Steel		Copper / Multilayer/ Polyethylene	
Diameter	length (m)	Internal diameter (mm)	length (m)
1/2"	82 (68)	10	228 (190)
3/4"	49 (40)	12	160 (133)
1"	28 (23)	14	116 (97)
1 1/4"	17 (14)	16	90 (75)
		19	64 (53)
		25	37 (31)
		26	34 (28)
		34	20 (17)

Table 2.

**When the measurement group can not be excluded from the test, the indicative length of the plant is given in brackets.**

Once the stabilization mode has been defined and the required data has been entered, you can proceed with the tightness test. By following the indications on the display, first the screen shows the test pressure required by the standard, then you can access a screen where it is shown the pressure at the instrument inputs. After performing the zeroing of the instrument and setting the system to conditions next to the ones indicated as referral, it is possible to start the tightness test, which starts the stabilization phase.

In the stabilization screen, the following values are displayed:

- P diff:** Actual pressure measured by the instrument, in the selected measurement unit.
- ΔP 1 min:** Pressure variation in the last minute, updated every 10 seconds. This value gives a rough indication about the stabilization level reached in the piping system.
- Wait time:** Remaining time before the stabilization phase ends.

When the stabilization phase is over, the system tightness test evaluation is performed by measuring the pressure decay in a non-editable time interval of 1 minute for each setting, except when the preliminary test with LPG and combustible gas is performed; in this case the time interval is 2 minutes and 30 seconds, as required by the standard.

During the tightness test phase the following values are displayed:

- P1:** Pressure measured at the beginning of the test.
- P2:** Pressure actually measured by the instrument.
- ΔP:** Pressure variation with respect to the initial value. In case the actual pressure is lower than the initial value (pressure is decreasing) this value has a negative sign.
- Wait time:** Remaining time before the Test phase ends.

Once the test has finished, the results are displayed; the data displayed is as follows:

- P1:** Pressure measured at the beginning of the test.
- P2:** Pressure measured by the device.

- ΔP:** Pressure variation between the last instant and the first instant of the test. If the pressure decreased, it presents a negative value.
- Q<sub>test</sub>:** Is the calculated leakage measured in dm<sup>3</sup>/h according to the conditions under which the test has been performed, i.e. the gas used for the test as well as the final pressure measured during the test.
- Q<sub>ref</sub>:** is the calculated leakage measured in dm<sup>3</sup>/h according to the reference conditions described in the standard, it is related to the gas to be used in the piping as well as to the reference pressure.
- Result:** is the result of the tightness test.

**Compliant (piping suitable for operation):** the plant is authorized to operate without restrictions or intervention.

**Compl. 30 DD (piping temporarily suitable for operation):** : the system is authorized to operate only for the time needed for the maintenance of the pipe in order to fix the leakage problem, and in any case for no more than 30 days after the testing day. Once the fixing has been completed the piping must be tested again for its tightness according to the new plant procedure.

**Non compliant (not suitable for operation):** in this situation the measured leakage is such that the piping is not suitable for operation and must immediately be placed out of order. Once the leakage problem has been fixed the piping must be tested again for its tightness according to the new plant procedure.

**Operator:** if the Δ pressure is higher than +3 hPa it is operator's choice if repeat the test or not because the pressure and/or temperature conditions might have changed during the test.

On the table below are shown the leakage limits:

RESULT	LEAKAGE POSITION	METHANE LIMIT	LPG LIMIT.
<b>Compliant</b>	Inside and outside of the building	Up to 1 dm <sup>3</sup> /h	Up to 0.4 dm <sup>3</sup> /h
<b>Compliant 30 days</b>	Inside the building	1 dm <sup>3</sup> /h < Q <sub>ref</sub> ≤ 5 dm <sup>3</sup> /h	0,4 dm <sup>3</sup> /h < Q <sub>ref</sub> ≤ 2 dm <sup>3</sup> /h
	Outside the building	1 dm <sup>3</sup> /h < Q <sub>ref</sub> ≤ 10 dm <sup>3</sup> /h	0,4 dm <sup>3</sup> /h < Q <sub>ref</sub> ≤ 4 dm <sup>3</sup> /h
<b>Non compliant</b>	Inside the building	≥ 5 dm <sup>3</sup> /h	≥ 2 dm <sup>3</sup> /h
	Outside the building	≥ 10 dm <sup>3</sup> /h	≥ 4 dm <sup>3</sup> /h

## 10.9 Velocity

The measurement of gas velocity in a combustion analysis is important for optimizing boiler settings in various applications. In this chapter, the “Velocity” screen within the NoVO measurements is described.

The measurement of gas velocity can be performed by connecting the Pitot tube and the combustion air temperature probe (optional) or the flue gas sampling probe to the instrument.

For Pitot tube connections, refer to Chapter 7.3.

Before conducting the test, it is necessary to configure the following instrument parameters:

1. **Gas:** Select “Air” or “Flue” depending on the flow.  
**IMPORTANT:** If “Flue” is selected, correctly set the type of fuel in Analysis > Options > Fuel.
2. **K Pitot (Pitot Constant):** Set the Pitot constant provided by the tube manufacturer in use.
3. **U. vel. (Velocity Measurement Unit):** Set the unit of velocity measurement.
4. **Altitud. (Altitude):** The measurement considers the altitude value set in the “Analysis - Analysis Settings - Condensation - Altitude” menu.

Execution of the test:

1. Press the “> >” button in the bottom right corner of the screen.
2. The display shows the temperature of T gas (fluid temperature):

**Press one of these buttons to start the measurement:**



Capture the temperature measured by the thermocouple connected to input T1 and start the measurement.



Manually enter a temperature. After entering it, press “OK” to start the measurement.



Start the measurement using the temperature detected by the thermocouple connected to input T1 in real-time for the entire test duration.

3. On the test results screen, you will find real-time measurements of velocity, density, and the flow temperature used.
4. Using the buttons in the bottom bar of the screen, you can save the test, zero the sensor, or print real-time results. If you need to zero the pressure sensor, you can do so without disconnecting the tubes from the instrument, thanks to the presence of an internal solenoid valve in the instrument.

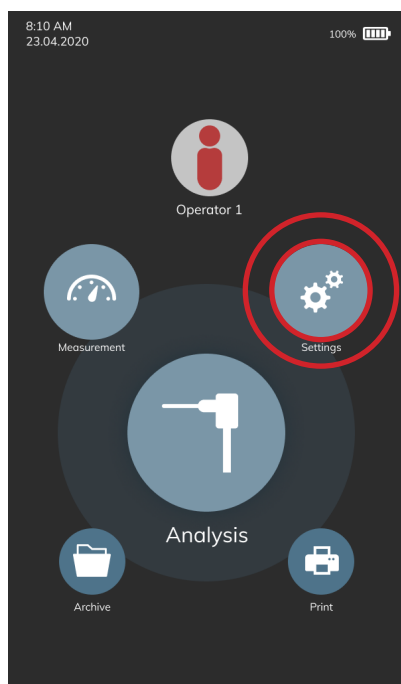
### WARNING!

**DISCONNECT THE INSTRUMENT ONLY AFTER THE MEASUREMENT SAVING PROCESS IS COMPLETE.**



## 11.0 SETTINGS

The configuration menu is featured with all the reference parameters of the instrument, the information about the instrument status and the diagnostic, in order to check any anomalies.



PARAMETER	REFERENCE CHAPTER
Instrument	11.1
Operator	11.2
Information	11.3
Diagnostic	11.4
Autozero	11.5

## 11.1 Instrument configuration

### 11.1.1 Bluetooth®

Through this sub menu the user can turn on and off the instrument Bluetooth® wireless and visualization of the MAC address of the instrument.

When Bluetooth® is on, the icon “” appears on the screen.



**WARNING!**

**WHEN THE INSTRUMENT BLUETOOTH INTERFACE IS TURNED ON, THE BATTERY LIFE IS REDUCED DOWN TO 10 HOURS.**

### 11.1.2 Time/Date

This allows the current time and date to be set. The user can select the date and hour format.

### 11.1.3 Brightness

This submenu allows to adjust the brightness of the display.

### 11.1.4 Language

Sets the instrument language.

### 11.1.5 Country

Selecting a different country from the one selected at the first startup of the instrument, will automatically change the time format and language.

### 11.1.6 Restore

Through this parameter it is possible to restore the instrument default settings.



**WARNING !**

**BY SETTING THE INSTRUMENT TO DEFAULT, ALL THE STORED MEASURES WILL BE ERASED.**

### 11.1.7 Grid

With this parameter it is possible to modify the power grid frequency: 50 Hz / 60 Hz.

The power grid frequency is automatically set at first boot of the instrument depending on the set country.

### 11.1.8 Water trap LED

Anti-condensation trap LED, is an instrument parameter that allows you to turn on or off the three white LEDs on the sides of the anti-condensation trap.

With the LEDs on, the level of condensation present inside the anti-condensation trap is more visible.

### 11.1.9 Beep

Each touch of the screen can be indicated by the instrument with a beep.

With this parameter it is possible to enable or disable the acoustic signal each time the screen is touched.

### 11.1.10 Battery

With this parameter it is possible to update the current value, in mAh, of the battery inside the instrument by choosing one proposed value. The current value of the battery is written on the battery itself expressed in Ah or mAh.

If the data is in Ah it must be translated in mAh using this formula:  $Ah \times 1000 = mAh$  (es.  $5,2Ah \times 1000 = 5200mAh$ )

This parameter is used when the battery inside the instrument is replaced.

**WARNING!**

**If the battery drops below 3000 millivolts, the instrument will rapidly activate and deactivate the pump three times before shutting down automatically. In this case, recharge the instrument completely.**

## 11.2 Operator

This menu is also accessible directly from the home page of the instrument. For all the details see chapter “9.0 Operator”

## 11.3 Information

View information about the help center.

### 11.3.1 Infoservice

This submenu contains details regarding the nearest Service Centre to be contacted in the event of instrument fault or ordinary maintenance. The instrument model, serial number and firmware version are also displayed, thus allowing for a quick product identification. In addition, the status of the memories and calibration of the instrument is displayed.

### 11.3.2 Reminder

This menu is not accessible by the user because it is strictly reserved for the assistance centers.

## 11.4 Diagnostic

The user, through this menu, can check any instrument anomalies.

### 11.4.1 FW update

This menu is not accessible by the user because it is strictly reserved for the assistance centers.

### 11.4.2 Maintenance

The parameters in this menu are not accessible to the user as they are for the exclusive use of the assistance centers.

### 11.4.3 Pump

In this submenu the user can temporarily turn the gas suction pump on or off. It will not be possible to turn off the pump during an autozero cycle.

### 11.4.4 On site calibration

The parameters in this menu are not accessible to the user as they are for the exclusive use of the assistance centers.

### 11.4.5 Sensors

This menu shows the four positions of the sensors. On each position is shown the kind of installed sensor, any error and the symbol “

For example, if the instrument shows “S1: CO” it means that on position 1 the CO sensor is installed.

For each sensor installed it is possible to access the related identification data:

DATA	DESCRIPTION
Gas	Gas detected by the sensor.
Type	Sensor revision index.
Measure range	Sensor measuring range.
Serial	Serial number of the sensor.
Is	'Is' sensor current.
Ia	'Ia' sensor current (present only for the CO sensor).

In addition, any errors on the status and calibration of the electrochemical sensors installed on the instrument are displayed:

ERROR	DESCRIPTION	ACTION
Unkn. sens.	The instrument does not recognize the newly installed sensor.	It is necessary to update the FW of the instrument.
Wrong position	The sensor has been installed on a wrong position or the sensor detected is different from the one previously installed.	Install the sensor in the correct position.
Generic error	Gas sensor error.	Contact the service center.
Not allowed	The installed sensor has not been approved by a service center.	Contact the service center.

---

### 11.4.6 Gas probe

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Tests the tightness of the gas probe pneumatic path.

To proceed with the leak test of the smoke probe, proceed as indicated in the following points:

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



3. Follow the directions on the display.
4. At the end of the procedure the instrument shows the **test results**:
  - Tight:** The system is OK.
  - Error:** The system has a leak or the smoke extraction pump is dirty or damaged.  
Check that the probe is tightly connected to the instrument, check the gaskets of the pneumatic connectors and/or the gaskets of the water trap / smoke filtering and check that the special black cap is well inserted on the probe.  
**WARNING:** the tip of the probe, if damaged, might distort the test.

---

## 11.5 Autozero

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In this submenu you can change the duration of the analyzer autozero cycle and the duration of the automatic cleaning cycle.

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### 11.5.1 Autozero

---

In this submenu you can change the duration of the analyzer autozero cycle, expressed in seconds.

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### 11.5.2 Cleaning

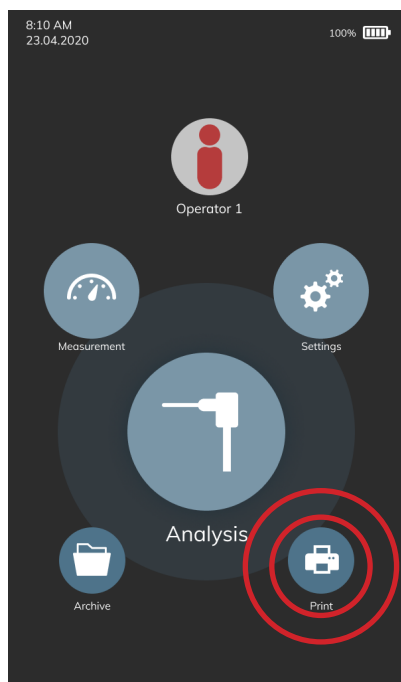
---

In this submenu you can change the duration of the pneumatic circuit automatic cleaning cycle, expressed in seconds.

According with the duration set in this parameter, when the instrument is switched off, the cleaning cycle is performed during which the instrument sucks in clean air until the concentration of toxic gases is reduced.

## 12.0 PRINT

The analyzer can print a report ticket with the results of all the preformed measures, according to the settings made in this menu. The printing is carried out with the internal printer module, if the instrument is provided with it, or using an external printer with Bluetooth® communication.



PARAMETER	REFERENCE CHAPTER
Printer	12.1
Configuration	12.2
Measurements list	12.3
Print test	12.4
Paper feed	12.5

## 12.1 Printer

Allows to choose the kind of printer, internal (Int) or external (Ext) with Bluetooth® communication.

If you choose the external printer will be necessary to perform the pairing procedure to pair the Bluetooth® printer to the instrument.

### 12.1.1 Pairing BT

Through this sub menu, the user can access to the association procedure between the instrument and a Bluetooth® printer.

The pairing procedure has to be done only once.

1. Enter the menu Pairing BT, turn on the printer which you want to connect to the instrument.
2. Select the line corresponding to the desired Bluetooth® printer.
3. The instrument automatically associates the selected printer.
4. The display shows the MAC address code of the paired printer; the operation is completed.
5. Return to the previous screen.



#### WARNING!

- It is possible to associate multiple Bluetooth® printers to the instrument, following the procedure described above.
- If more than one Bluetooth® printer has been associated with the instrument, it is necessary to select the printer that will be used for printing the tickets.

## 12.2 Configuration

The user, by means of this menu, can configure the test report format.

### 12.2.1 Copies\*

Allows you to define the number of copies that will be printed.

### 12.2.2 Report\*

The paper print-out layout selection is only valid for combustion analysis.

Paper print-outs for draft, smoke, ambient gas concentration and tightness test only allow a specific layout.

Layouts options for combustion analysis are specified as described in the following:

**Average:** (Default) reports only the average of the various measurements made, in addition to the header with the company and operator data.

**Synthetic:** it is composed of the synthetic model of the average analysis, without the header.

**Full:** includes the header with the company and operator data previously entered in the configuration menu and the combustion analysis measurements (average and single).

**Column:** includes the header with the company and operator data previously stored in the configuration menu and the combustion analysis measurements (average and single). Single analyses are printed paginated in columns.

### 12.2.3 Date/Time\*

It allows you to define whether or not to print the date and time at which the combustion analysis was performed:

**Manual:** The date and time are not printed in the header of the analysis report. It is the responsibility of the operator to enter the data manually.

**Auto:** The date and time are printed in the header of the analysis report.

### 12.2.4 Header

It allows the user to enter, in eight lines of 24 characters the name of the Company or owner of the device or the information regarding the latter (e.g. address, telephone number), which will be printed in the header of the analysis report.

### 12.2.5 Contrast

Allows to set the print quality of the tickets (minimum 1 - maximum 7).

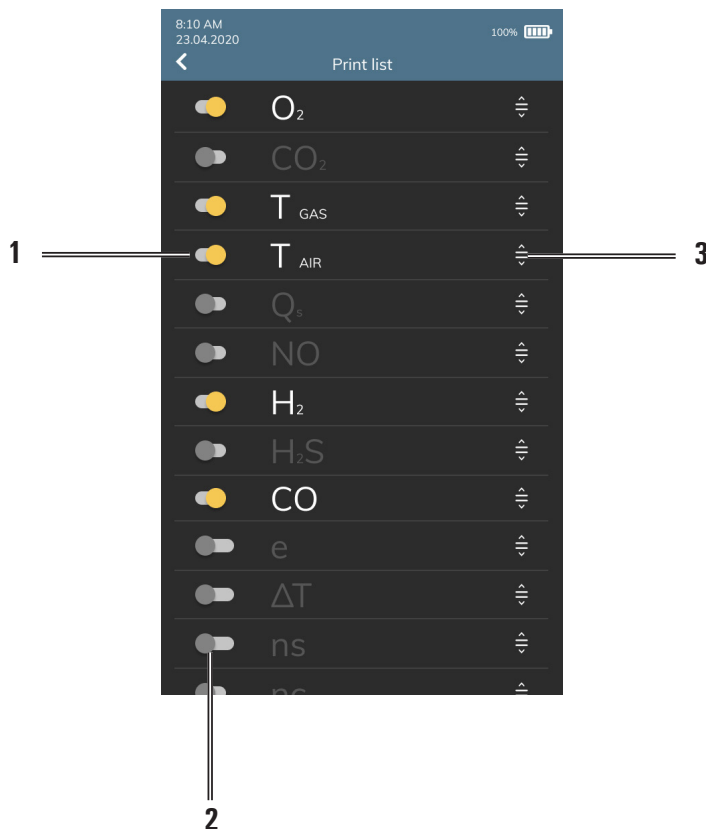
\* Parameter visible only if the version of the instrument provides it.

### 12.3 Measures list

In this submenu it is possible to show the list of the measures which the instrument can perform and which will be printed on the tickets, if enabled.

If a measurement is disabled it will not be printed even if acquired in the combustion analysis phase.

Another important function available in this submenu, is sorting the list of measurements using the appropriate interactive function.



1	Measurement enabled - will be printed on ticket.	2	Measure disabled - it will NOT be printed on ticket.
3	Shifts the measurement position.		

### 12.4 Print test

Prints a graphical/alphanumeric test ticket for a complete check of the printer operation.

### 12.5 Paper feed

Feeds paper in the printer; this function is most useful when replacing the paper roll in the printer.

## 13.0 ARCHIVE

All the performed combustion analyses/measures are saved in the instrument archive.





## 13.1 Archive organization



1	Add new customer folder.	4	Example of viewing the archive by customer name.
2	"Search" function: search by text or by date.	5	Memory Usage: The yellow bar indicates the used memory space.
3	Change the archive view to: <b>CUSTOMER:</b> Folders are displayed per customer. <b>ADDRESS:</b> Folders are displayed by address. <b>DATE:</b> Folders are displayed by date.	6	Print the ticket according to the settings on the "Print" menu.

## 13.2 Rename folders

By keeping pressed on a specific folder a pop-up appears which allows you to choose to rename the folder or to erase it. By choosing "Rename" it is possible to modify the name of the folder. Once the text has been changed, simply press anywhere on the display to save the change.

## 13.3 Delete folders

By keeping pressed on a specific folder a pop-up appears which allows you to choose to rename the folder or to erase it. By choosing "Erase" it is possible to erase all the content of the selected folder, which can no longer be recovered. From this menu it is not possible to delete all the contents of the archive in one time, but it is needed to proceed by deleting one folder at a time. In order to delete all the contents of the archive in one time, it is necessary to restore the instrument to default using the "Configuration-Instrument-Reset" menu; mind that all the instrument settings configured by the operator will be lost.

## 14.0 MAINTENANCE

### 14.1 Preventive maintenance

At least once a year send the instrument to a SERVICE CENTRE for a complete overhaul and thorough internal cleaning. SEITRON's 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 besides being indispensable for users wishing to maintain ISO 9000 status.

### 14.2 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:

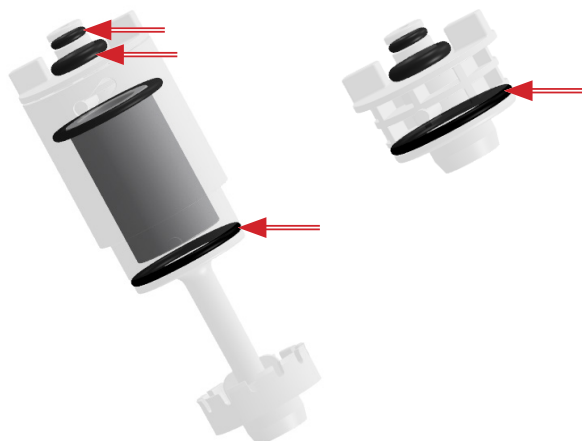
- Do not expose the instrument to substantial thermal shocks before use. If this happens, wait for the temperature to return to normal working values.
- Do not clean the instrument with abrasive cleaners, thinners or other similar detergents.
- Avoid to suck in smokes directly without the filter inserted inside the water trap / smoke filtering unit.
- Do not exceed sensor overload thresholds.
- 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
- It is a good rule to empty the water trap / smoke filtering unit at the end of every complete analysis or at least every 2 - 3 complete analyses.
- Replace the filter of the water trap / smoke filtering unit if visibly dirty and/or impregnated with moisture.
- Clean the smoke probe, unplugging it from the instrument, blowing air through the tubes in order to blow out any condensation left inside.
- In order to avoid any bad friction between the parts and to keep a good tightness and elasticity of the instrument in general, it is advised to periodically lubricate all the sealing parts of the instrument itself and of the provided accessories with a thin layer of silicon like grease.

#### 14.2.1 Periodical seals maintenance

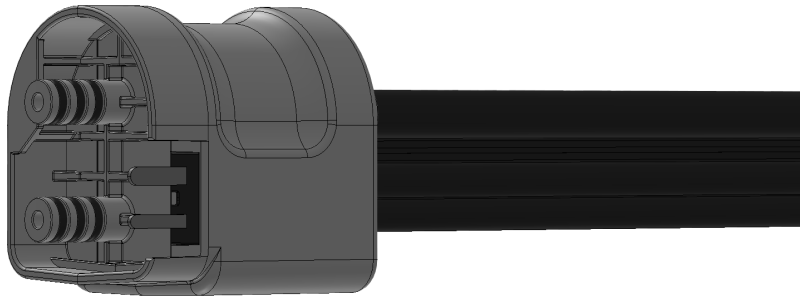
Periodically, it is necessary to check the condition of all the sealing parts of the instrument and of the featured accessories. In particular, check that there are no cuts or damages; in case of damaged parts, it is necessary to replace them immediately because they could cause losses to the pneumatic circuit of the instrument and therefore alter the measurements. In order to avoid damages to the sealing parts, it is necessary **to periodically apply a thin layer of silicon like grease without having to remove the parts from their seats.**

The seals to check are the ones inside the following parts:

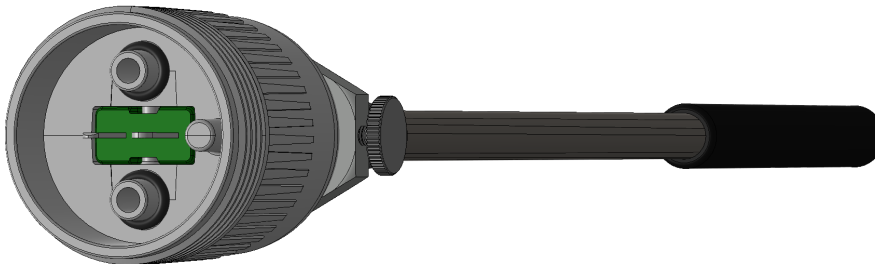
1. Four seals inside the water/smoke filter.



2. Six seals on the connector of the smoke sampling probe and on the connector of the related extension.



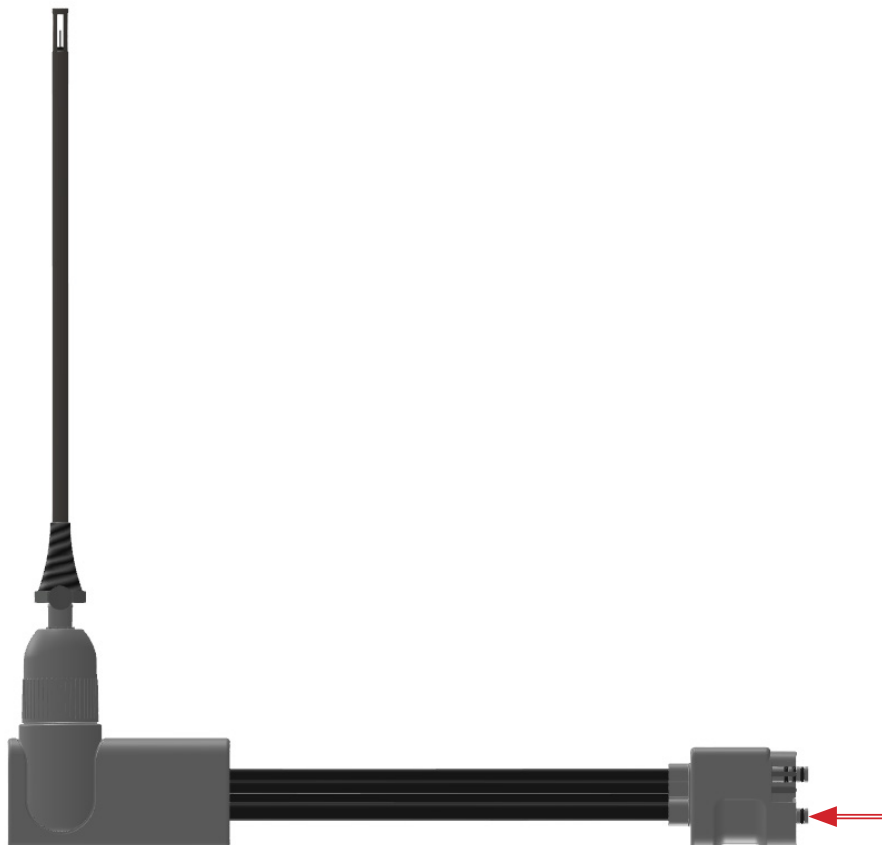
3. Two seals present on the tip attachment of the smoke sampling probe.



### 14.2.2 Cleaning the smoke probe

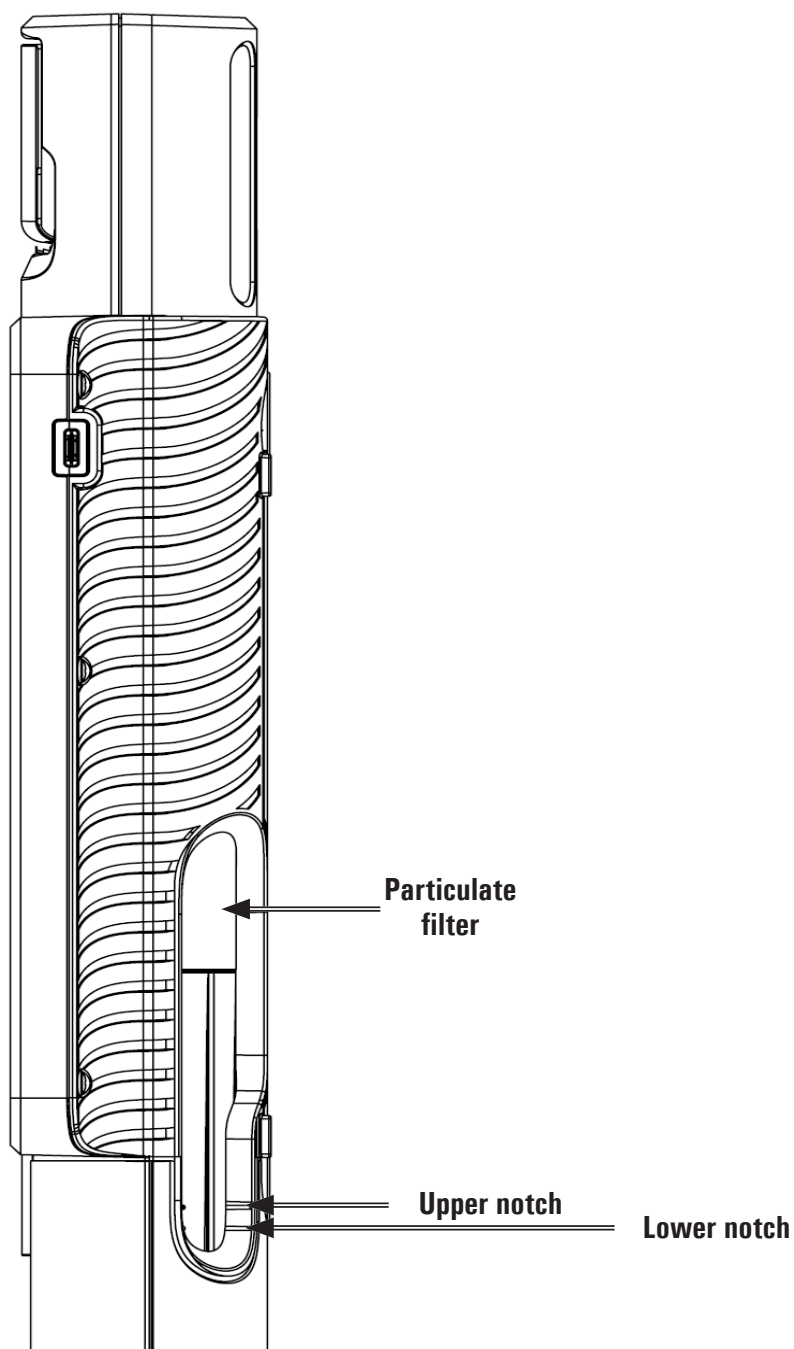
When you have finished using the smoke probe, before storing it inside its case it is a good rule to clean it as described below:

- Unplug the smoke probe.
- Blow clean air inside the tube (through the connector pointed by the arrow) aiming to blow out any condensation residue which might be inside the tube.



### 14.2.3 Maintenance for the water trap / smoke filtering unit

Through the side opening, it is possible to verify the level of the water trap, by checking the notches on the side of the analyzer and the condition of the dust filter.

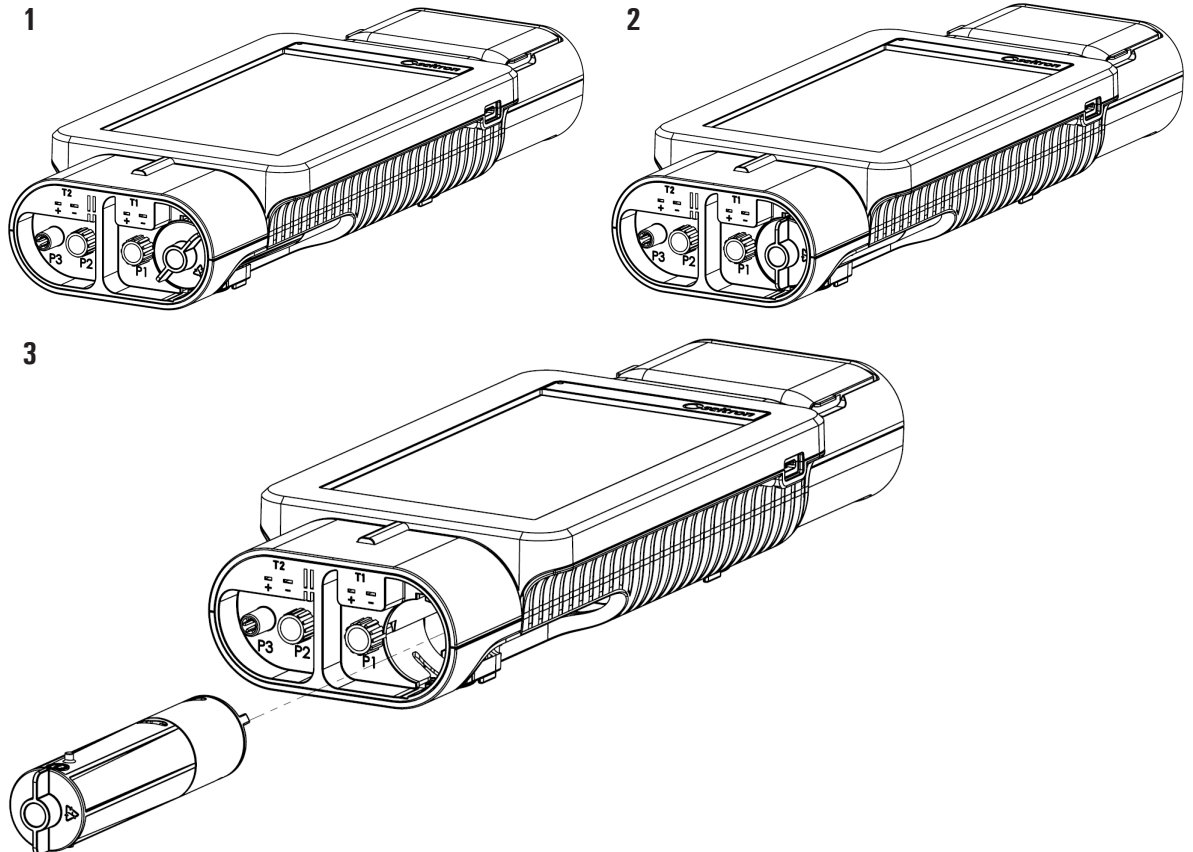


#### **WARNING!**

- To check the condensation level, hold the instrument upright.
- Do not use the instrument with the condensation level between the two notches.
- Do not use the instrument with a blackened filter or clogged with moisture, so as not to obstruct the flow of gas.

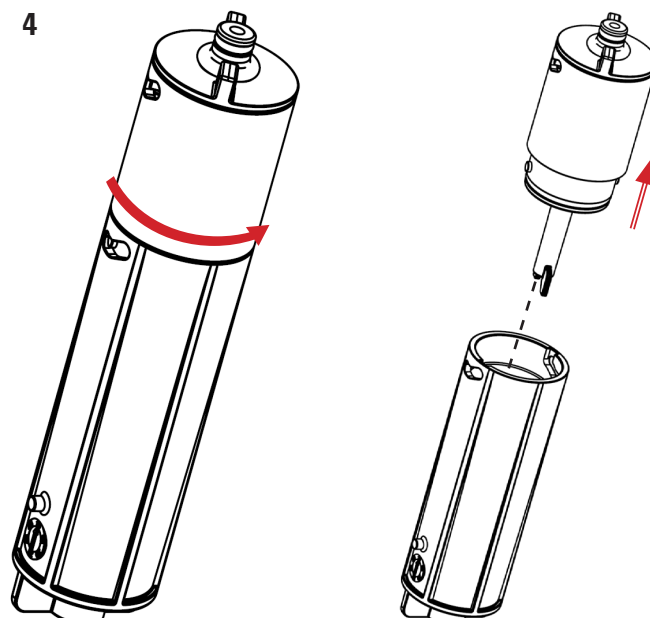
To perform maintenance, it is necessary to remove the entire water trap / smoke filter unit from the instrument, as indicated below:

1. The instrument must be switched off.
2. Using the special flaps, turn left the water trap unit.
3. Pull out the entire unit.



#### Draining the water trap

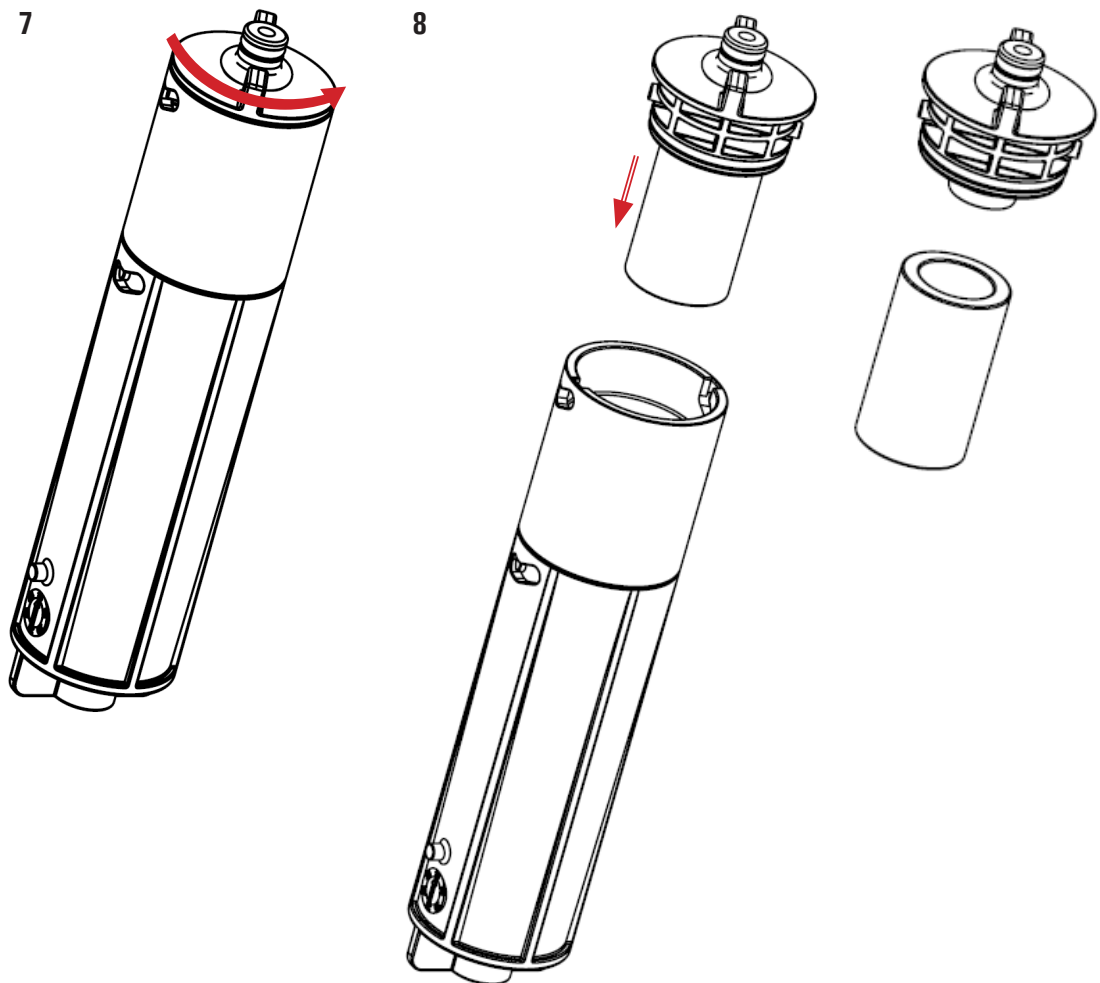
4. Separate the water collector from the entire unit.
5. Empty the water collector and clean it with water.
6. Place back on the water collector by reversing the operations described above.



### Replacing the dust filter

If the dust filter is black or dirty, especially on the outer surface, or clogged with humidity it is necessary to replace it immediately:

7. Turn right the filter holder.
8. Pull off the filter.
9. Clean with just water and dry all the plastic parts of the case holding the filter, separating it before the water collector (see point 4).
10. Insert the new filter.
11. Reassemble the filter holder body by proceeding in the reverse order up to here described.



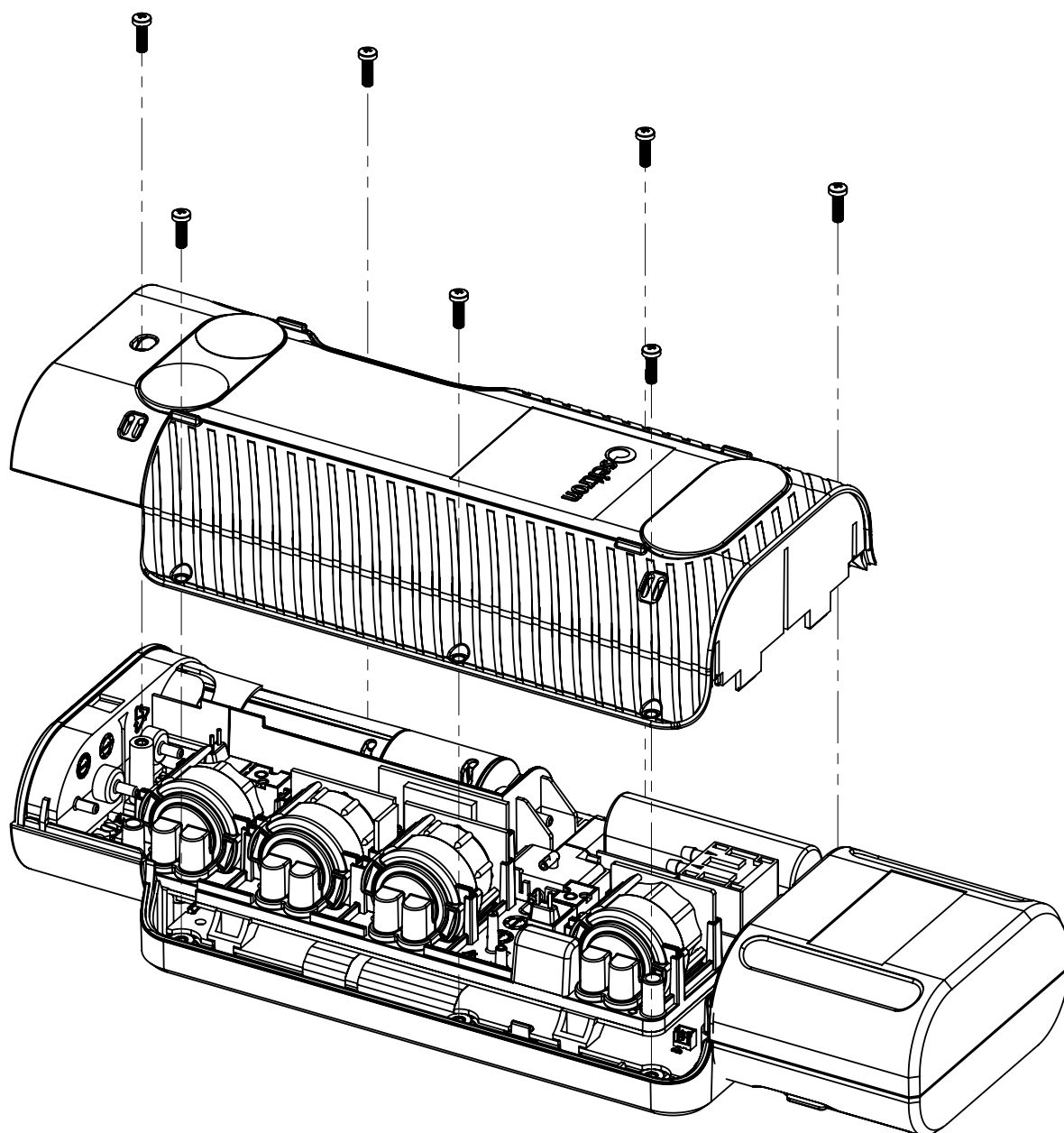
## 14.2.4 Instrument internal parts access

**WARNING!**

**Access the internal parts only if strictly necessary to perform the O<sub>2</sub> gas sensor replacement or battery replacement.**

**Before accessing the internal parts, the instrument must be switched off and must NOT be connected to mains power with the power plug.**

**When managing the instrument without the cover, be sure not to lose the screws.**



## 14.2.5 Sensor replacement

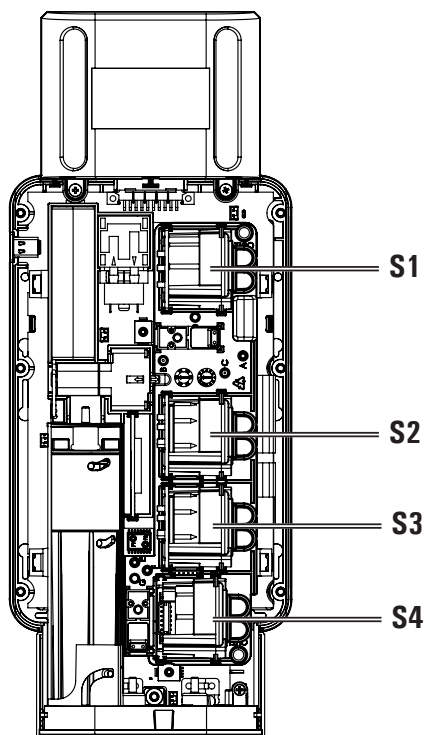
The only sensor which the user can replace on his own is the Oxygen sensor.

In order to replace all the other sensors, it is necessary to send the instrument to an assistance center authorized Seitron.

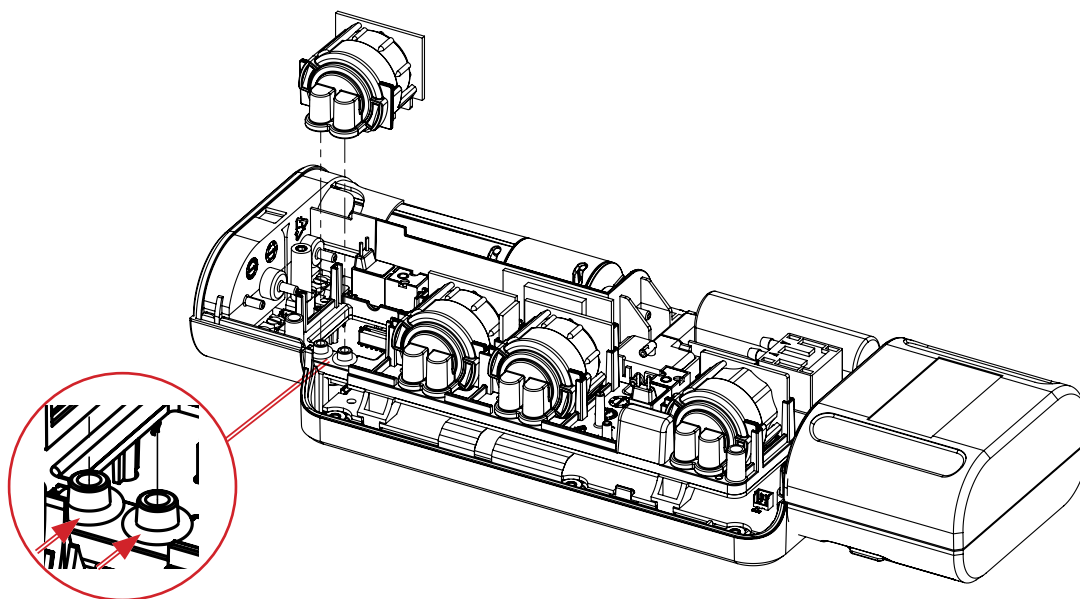
## 14.2.6 Replacing the Oxygen sensor

In order to replace the O<sub>2</sub> sensor proceed as follows:

1. Check the current position of the Oxygen sensor:  
Through the menu "Instrument configuration=> Diagnostic=> Sensors" check the current position of the Oxygen sensor: S4.
2. Locate in the instrument the exact position where the Oxygen sensor is installed:



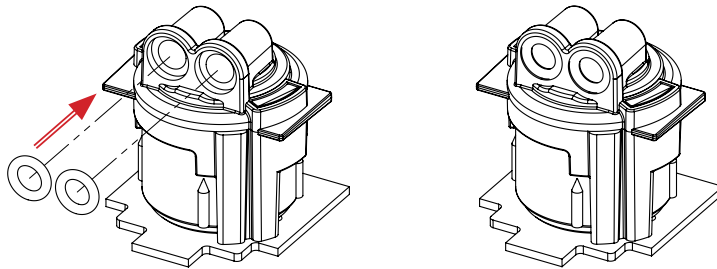
3. Once the position of the Oxygen sensor is located, pull upward the sensor (example referred to the sensor in position S4).



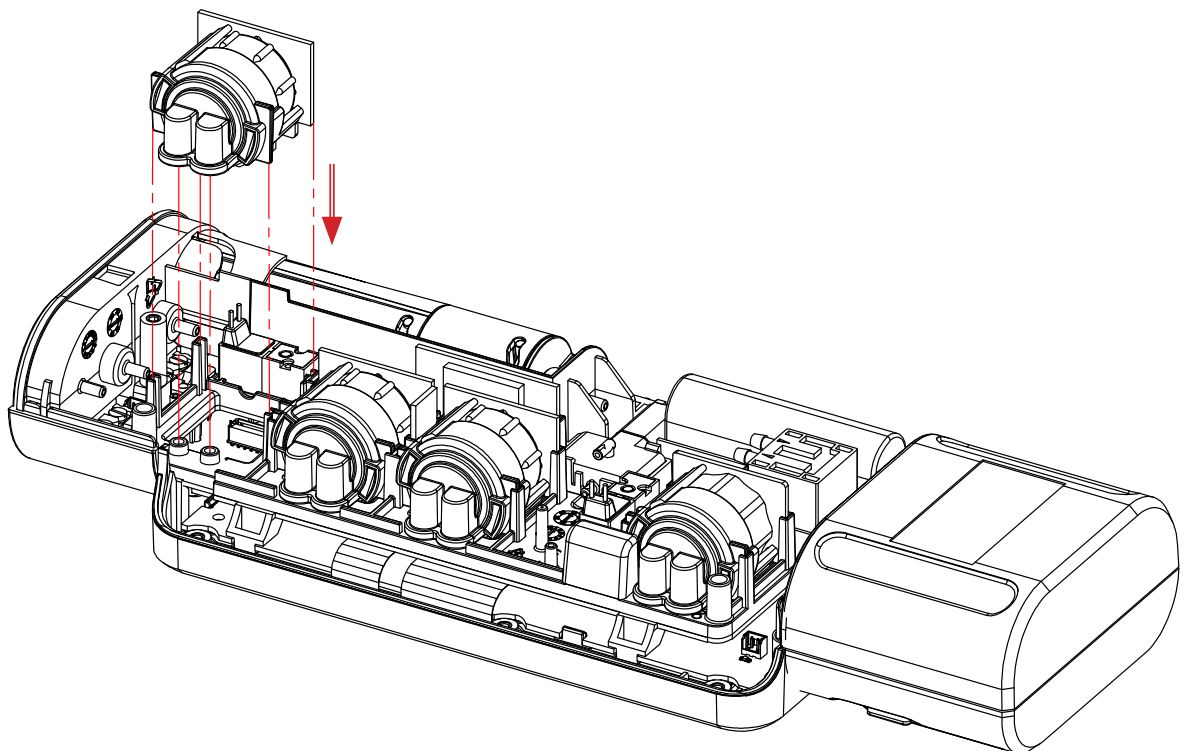
**When the sensor is removed, it is possible that two O-rings of the sensor itself remain stuck in the joints of the instrument (see the example in the picture below); it is necessary to remove them.**



4. Insert the new sensor by doing the reverse operation described up to here.



**The new Oxygen sensor is provided with two O-rings; be sure that these O-rings are well inserted inside the special groove of the sensor (see the example in the picture below).**



**Insert the new sensor into the rails and push down until fully seated.**

5. Close back the instrument.
6. By switching on the instrument it is possible to verify the correct operation of the new sensor, through the menu "Instrument configuration => Diagnostic => Sensors".

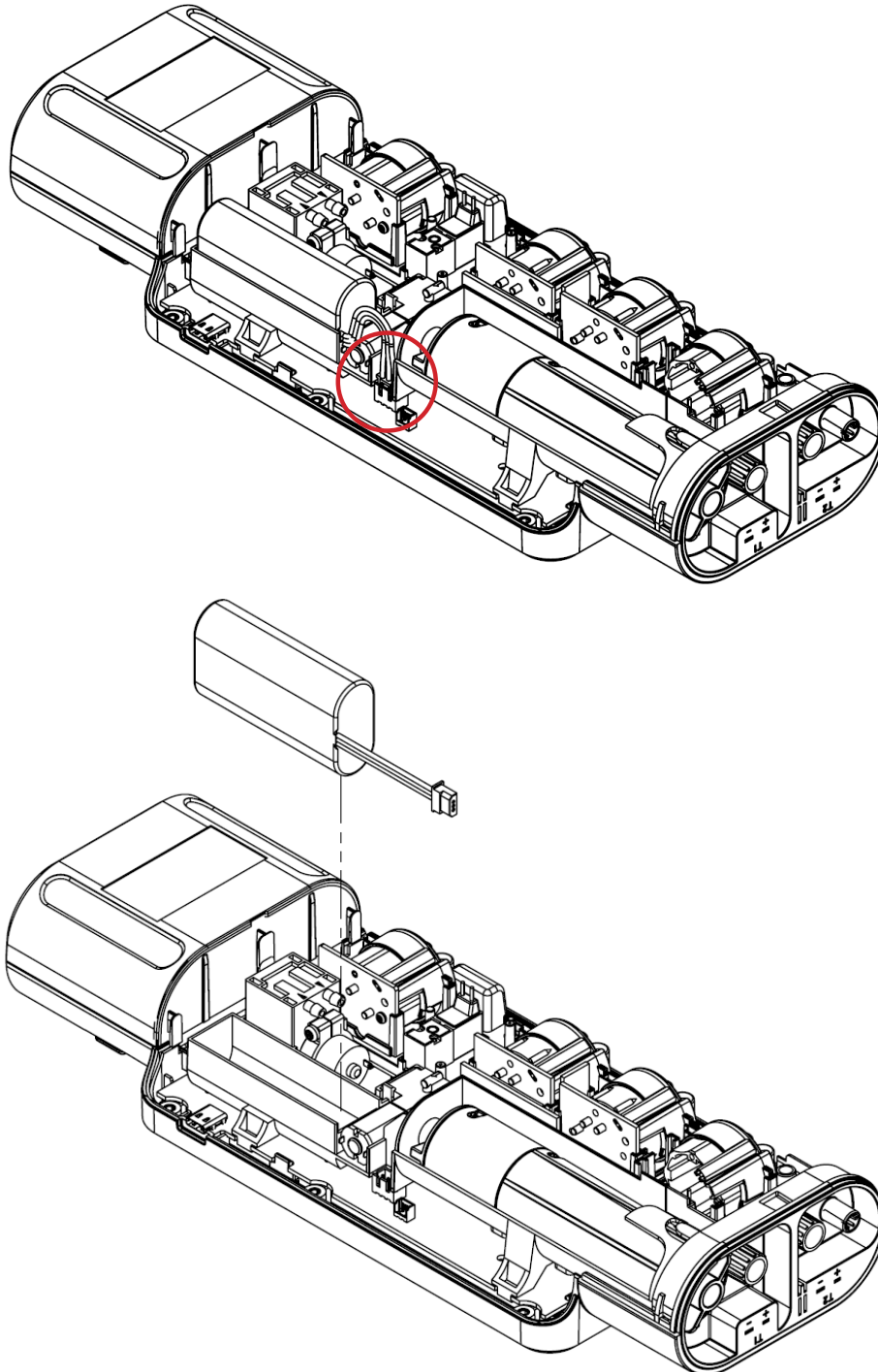
**It is normal if a newly installed sensor gives a 'current error': it is necessary to wait some time, so that the sensor polarization can settle.**

**The Oxygen sensor has a settling time of 24 hours; This means that you have to wait 24 hours before using the instrument.**

## 14.2.7 Battery replacement

In order to replace the battery package proceed as described below:

1. Remove the battery connector.
2. Remove the battery pack.
3. Insert the new battery; in order to close back the instrument, reverse the operations described above.

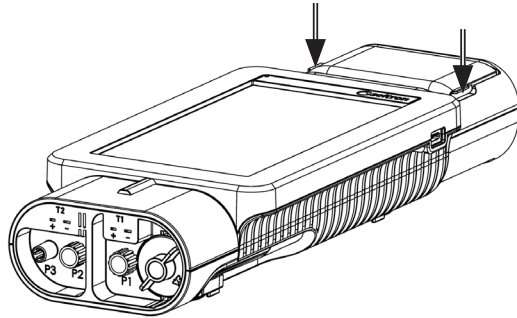


4. Close back the instrument.
5. Turn on the instrument.
6. Check on the Settings=>Instrument=>Battery (see chapter 11.1.9) menu, that the current value set on the instrument is the same as the one written on the new battery.  
If these two values do not match, update the data.
7. If the current value is updated, it is necessary to reboot the instrument.

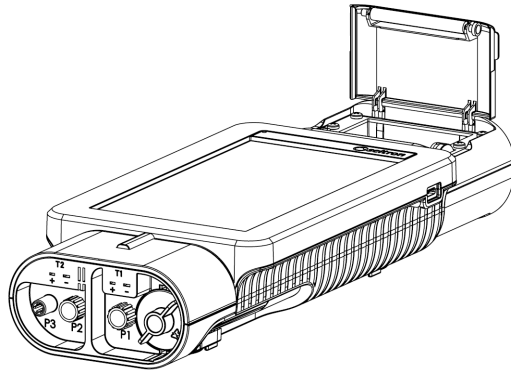
## 14.2.8 Replacing the paper roll of the internal printer (if provided)

To replace the printer paper roll, follow the operations described below.

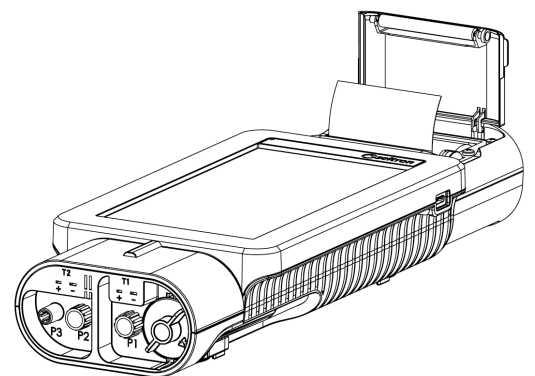
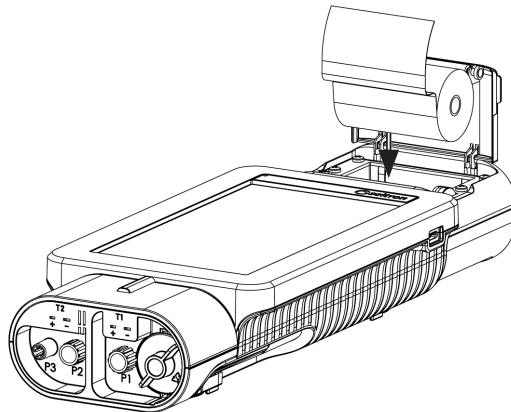
1. Open the paper roll compartment lid, pulling upward the two sockets indicated by the arrows:



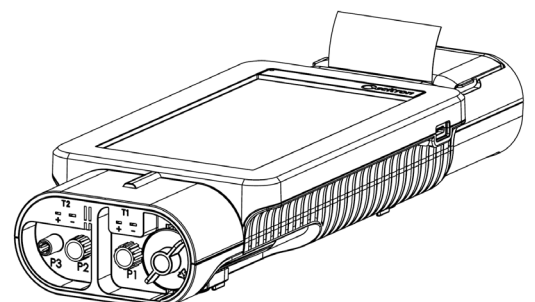
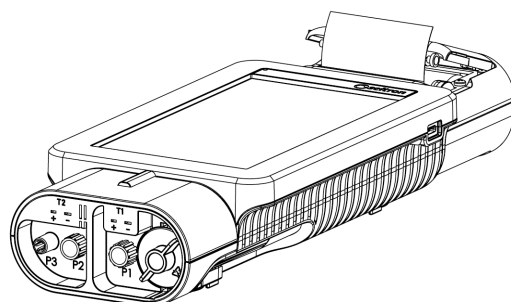
2. Fully raise the entire lid lock.



3. Insert the printer paper roll as shown in the following pictures.



4. Close the entire printer cover assembly, applying a slight pressure on it in order to hook it to the instrument.



5. Now you can use the printer. See the chapter "Print".

### 14.3 Instrument expandability

If the purchased instrument is expandable, and it is needed to install extra sensors, it is necessary to send the instrument to an **Authorized Assistance Center**.

**Note:** the exact calibration process is only valid if performed using traceable samples.

For your information, the sensors that can be installed in the instrument are listed in the next chapter “15.1 Gas sensors life expectancy and their relative positioning on the instrument”.

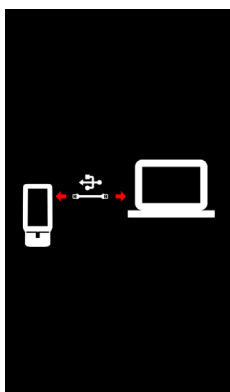
### 13.4 Firmware Update

The manufacturer periodically updates the instruments firmware aiming to correct, improve the instruments performances or add new features.

The update can be performed by the user following the instructions below.

**Instructions for updating the combustion analyzer with a new firmware:**

1. Turn on the instrument and wait for the end of the autozero.
2. Connect the analyzer to the PC with the USB cable.
3. Go to the web site [www.seitron.com](http://www.seitron.com) and download the firmware file which can be found in the “Download - Analyzer firmware” section. This file is in a compressed version with the .zip extension.
4. Open the compressed folder with .zip extension.
5. Double-click on the file novoupdater.exe; the software is started.
6. Click on “Start Update”.
7. The instrument is automatically restarted and displays the following screen:



8. The instrument displays the home page; the analyzer is up to date: it can be turned off and disconnected from the PC.

## 15.0 GAS SENSORS

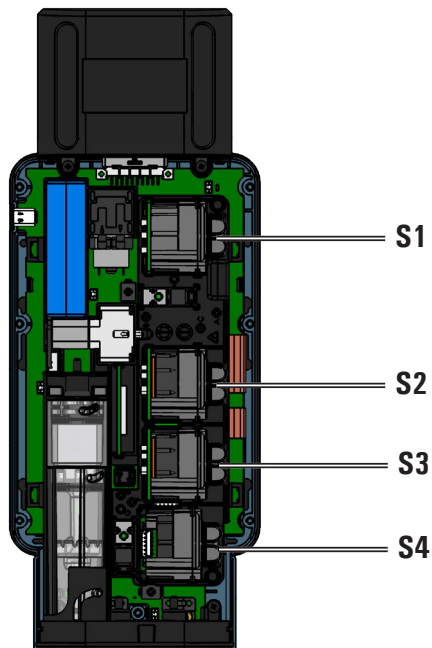
The gas sensors used in this instrument are electrochemical: thus, when the relative gas is detected, a chemical reaction takes place inside them that generates an electrical current.

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 service centre.

### 15.1 Positioning of the gas sensors in the instrument



## 15.2 CxHy sensor for measurement of the unburnt hydrocarbons

The unburnt hydrocarbons are chemicals produced by an incomplete combustion of molecules (hydrocarbons) made of Carbon and Hydrogen.

These are usually named as HC or (better) CxHy: when this is filled with the actual values for the number of C and H atoms, the actual type of fuel is exactly defined. In case of Methane, as an example, the correct formula is CH<sub>4</sub>. In the following table is shown the cross sensitivity of the CxHy sensor when exposed to fuels different from Methane (CH<sub>4</sub>), assumed as 1.00.

GAS / VAPOR	RELATIVE RESPONSE (with respect to Methane)	GAIN ADJUSTMENT
Ethanol	0.75	1.33
Iso-Butane	0.60	1.67
Methane	1.00	1.00
Methanol	1.00	1.00
n-Butane	0.60	1.67
n-Heptane	0.45	2.22
n-Hexane	0.50	2.00
Propane	0.70	1.43

Calculation example:

Type of gas: iso-butane

Relative response: 0.6

Gain adjustment: 1.67

Reading value (related to methane): 1.34

Value = reading value x gain adjustment

Example:  $1.34 \times 1.67 = 2.24$

### WARNING

**Gas vapours which contains silicone compounds (HMDS) can irreversibly damage the sensor.**

**When the CxHy sensor is installed in the instrument, keep the autozero at 180 seconds to allow a good pre-heating of the sensor itself.**

**The instrument battery life, once the CxHy is installed, lasts 10 hours, provided no printing is made.**

## 15.3 CO<sub>2</sub> sensor for Carbon Dioxide measurement in combustion processes

Carbon Dioxide (CO<sub>2</sub>) is the result of combustion of an organic compound in presence of a quantity of oxygen sufficient to complete its oxidation. In nature, it is also produced by aerobic bacteria during the process of alcoholic fermentation and is the by product of respiration.

Many combustion processes are defined with 'mixed fuel' and is therefore difficult to calculate the amount of CO<sub>2</sub> produced. To avoid this drawback, the only way to know the amount of CO<sub>2</sub> produced in a combustion process with 'mixed fuel' is to measure the CO<sub>2</sub> with special NDIR sensors.

### WARNING

**When the CO<sub>2</sub> sensor is installed in the instrument, keep the autozero at 60 seconds to allow adequate pre-heating of the sensor itself.**

## 15.4 Sensor for combustible gas leaks

In order to detect gas leaks in plant, pipes and appliances the instrument requires an internal semiconductor sensor for gas leaks.

This sensor responds to both CH<sub>4</sub> (Methane) and LPG (Iso-Butane and Iso-Propane) as well as several other combustible gases (hydrocarbons).

### WARNING

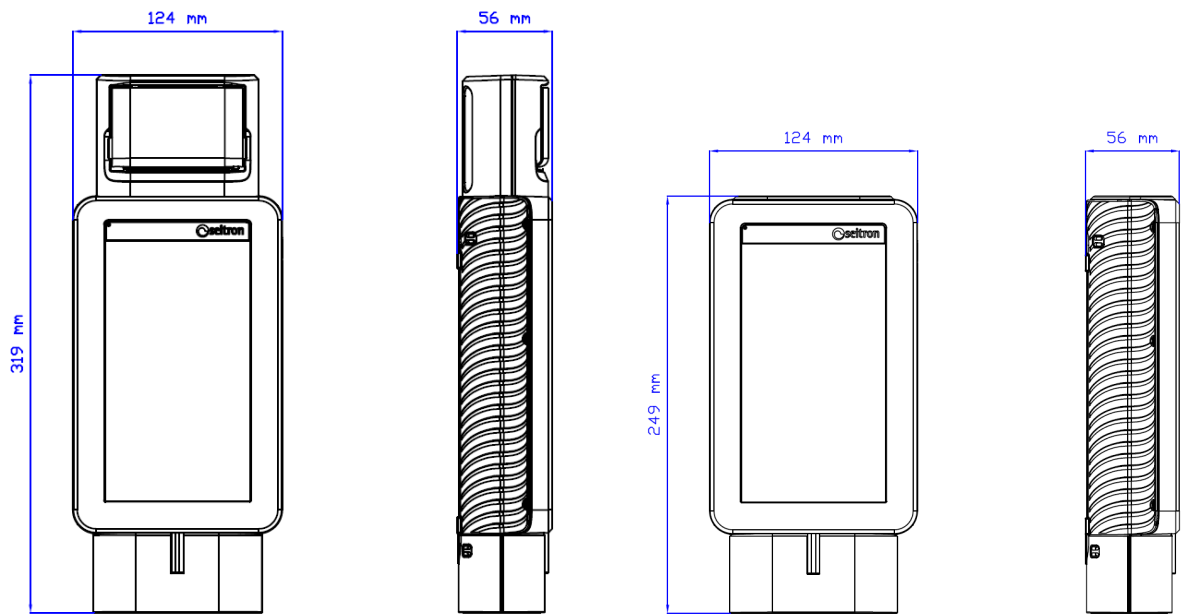
**Gas vapours which contains silicone compounds (HMDS) can irreversibly damage the sensor.**

**When the sensor is installed on the instrument, keep the autozero at 60 seconds to allow adequate pre-heating of the sensor itself.**

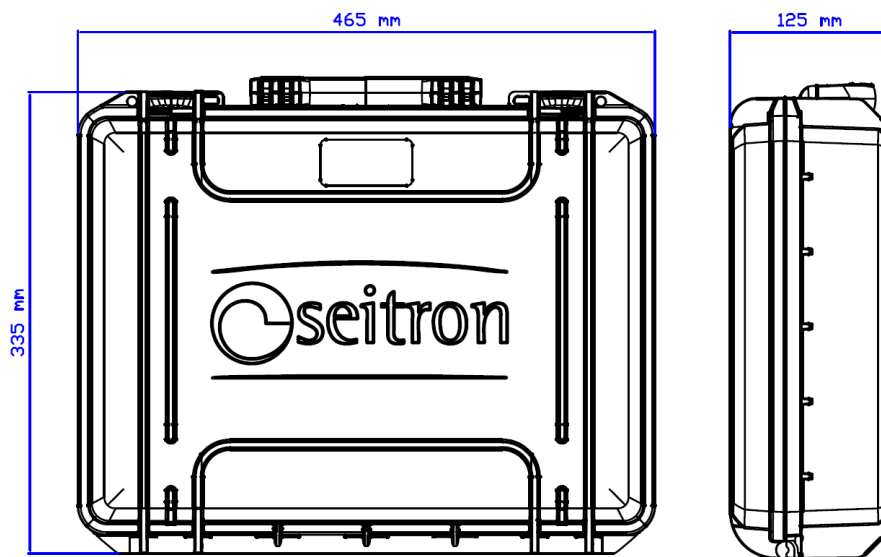
## 16.0 TECHNICAL SPECIFICATIONS

Autozero:	Automatic autozero cycle with probe inserted in the stack.
Dilution (where required):	Measure range expansion system of the CO sensor up to 100.000ppm (10,00%) programmable as simple protection of the CO sensor, user programmable intervention threshold.
Gas measurement sensors:	Up to 4 configurable sensors: electrochemical, NDIR and pellistors.
Probe connection:	Using a solid and robust connector it is possible to measure smokes values, temperature and draft at the same time.
Self-diagnosis:	Check of all functions and internal sensors with anomalies report.
Temperature measurement:	Double input for K thermocouple with mignon connector for measuring the differential pressure (output and input).
Ambient temperature measurement:	Using the internal sensor or the T2 thermocouple input with remote probe.
Gas valve pressure measurement:	Using a pressure sensor and a direct connection to the gas valve with a dedicated tube it is possible to perform this measurement simultaneously with the other combustion control measures (input P3).
Draft measurement:	Internal sensor connected to port P1.
Fuel types:	Factory default and user programmable.
Power supply:	Battery pack Li-Ion.
Battery charger:	External power plug 5Vdc 2A with USB female type connector type A + connection to the instrument with the same serial supplied communication cable.
Charging time:	6 hours to charge from 0% to 90% (8 hours 100%). Charging can also be performed with the instrument connected to the PC (the instrument must be switched off), the charging time, depending on the current that can be supplied by the PC, and it can last up to 12 hours.
Instrument autonomy:	8 hours of continuous operation at an operating temperature of 77 °F (25 °C) (excluding printing).
Printer:	Integrated thermal printer with easy paper roll loading and paper sensor.
Printer power supply:	The printer uses the analyzer batteries.
Printer autonomy:	With batteries completely charged up to 40 analysis reports.
Internal data memory:	100 MB
User data:	8 programmable user names.
Printer header:	8 rows x 24 characters customizable by the user.
Display:	Color TFT 7" with CTP with backlight.
Data communication port and/or power supply:	USB with connector TYPE C.
Bluetooth:	Yes.
Suction pump:	1.0 l/min heads at the flue up to 135mbar.
Flow measurement:	Internal sensor for measuring the pump flow rate (value between 0.7 .. 1.2 l/m).
Water trap / smoke sampling unit:	This is placed inside the instrument, removable by pulling it out, for water emptying and particulate filter replacement.
Line filter:	With replaceable cartridge, 99% efficiency with 20 um particles.
Black smoke:	Using an external hand pump; it is possible to enter and print the black smoke index.
Tightness test:	Performing the tightness test of the gas piping with separate ticket printing, using the accessory AAKT05.
Condensing boiler efficiency:	Condensing boiler automatic detection, with calculation and printing of the efficiency (> 100%) on the P.C.I. according to UNI10389-1 (2019).
Ambient CO measurement:	Separate measurement and printing of ambient CO values.
Operating temperature:	-5°C .. +45°C
Storage temperature:	-20°C .. +50°C
Humidity limit:	20% .. 80% RH
Protection degree:	IP42
Air pressure:	Atmospheric

## 16.1 Analyzer dimensions



## 16.2 Case size





## 17.0 MEASUREMENT AND ACCURACY RANGES

MEASUREMENT	RANGE	RESOLUTION	ACCURACY	RESPONSE TIME t90	RECALIBRATION	AVERAGE LIFE	POSITION
O <sub>2</sub>	0-25% Vol.	0.1% vol	±0.2% vol	20	Yearly <sup>(1)</sup>	48 months	S4
CO compensated H2 extended range	0-500 ppm	0,1 ppm	±2 ppm      0...40 ppm ±5% v.m.    40,1...500 ppm	50	Yearly <sup>(1)</sup>	48 months	S1
	501-8000 ppm	1 ppm	±10% v.m. 501...8000 ppm				
CO	0-20000 ppm	1 ppm	±100 ppm      0...2000 ppm ±5% m.v.    2001...4000 ppm ±10% m.v. 4001...20000 ppm	50	Yearly <sup>(1)</sup>	48 months	S1 - S2 - S3 - S4
CO <sup>(3)</sup>	0-100000 ppm	1 ppm	±100 ppm      0...1000 ppm ±10% m.v.1001...100000 ppm	50	Yearly <sup>(1)</sup>	48 months	S1 - S2 - S3 - S4
NO Extended Range	0-500 ppm	0,1ppm	±2 ppm      0...40 ppm ±5% m.v.    40,1...500,1 ppm	50	Yearly <sup>(1)</sup>	48 months	S2 - S3 - S4
	501-5000 ppm	1 ppm	±10% m.v. 501...5000 ppm				
NO <sub>2</sub> Extended Range	0-100,0ppm	0,1ppm	±2 ppm      0...40 ppm ±5% m.v.    40,1...100,1 ppm	50	Yearly <sup>(1)</sup>	36 months	S2 - S3 - S4
	101-1000ppm	1 ppm	±10% m.v. 101...1000ppm				
SO <sub>2</sub> Extended Range	0-5000 ppm	1 ppm	±5 ppm      0...100 ppm ±5% m.v.    101...5000 ppm	50	Yearly <sup>(1)</sup>	36 months	S2 - S3 - S4
SO <sub>2</sub> (J57-2017) Extended Range	0-500 ppm	0.1 ppm	±2 ppm      0...40 ppm ±5% m.v.    40,1...500,1 ppm	50	Yearly <sup>(1)</sup>	36 months	S2 - S3 - S4
	500-5000 ppm	1 ppm	±10% m.v. 501...5000 ppm				
H <sub>2</sub>	0-2000 ppm	1ppm	±10 ppm      0...100 ppm ±10% m.v.    101...2000 ppm	90	Yearly <sup>(1)</sup>	24 months	S2 - S3 - S4
H <sub>2</sub>	0-4%Vol.			90	Yearly <sup>(1)</sup>	24 months	S2 - S3 - S4
H <sub>2</sub> S	0-500 ppm	0,1ppm	±5 ppm      0...100 ppm ±5% m.v.    101...500,0 ppm	50	Yearly <sup>(1)</sup>	36 months	S2 - S3 - S4
H <sub>2</sub> S	0-5000 ppm	1ppm	±5 ppm      0...100 ppm ±5% m.v.    101...500 ppm ±10% m.v.    501...5000 ppm	50	Yearly <sup>(1)</sup>	36 months	S2 - S3 - S4
NH <sub>3</sub>	0-500 ppm	0,1ppm	±10 ppm      0..100 ppm ±10% m.v. 100,1..500,0 ppm	90	Yearly <sup>(1)</sup>	36 months	S2 - S3 - S4
CO <sub>2</sub>	0-50% Vol.	0,01%	±1 % Vol.      0..10,00% Vol ±2% full scale 10,01%.50,00% Vol	50	Yearly <sup>(1)</sup>	60 months	S2 - S3 - S4
CH <sub>4</sub>	0-100% Vol.	0,01% Vol	±0,5 % Vol.      0..10% Vol ±5% m.v. 10,01%..100,00% Vol	50	Yearly <sup>(1)</sup>	60 months	S2 - S3 - S4
CxHy	0-5% Vol. CH4	0,01% Vol	±0,25 % abs	50	Yearly <sup>(1)</sup>	48 months	S2 - S3 - S4
PI <sup>(2)</sup> (CO/CO2 ratio)		0.01%					
Temperature (T1)	-20.0 .. 1250.0 °C	0.1 °C	±1 °C      -20.0 .. 100.0 °C ± 1% m.v. 100.1 .. 1250.0 °C				
Temperature (T2)	-20.0 .. 1250.0 °C	0.1 °C	±1 °C      -20.0 .. 100.0 °C ± 1% m.v. 100.1 .. 1250.0 °C				
Temperature differential (T1-T2)	0 .. 1250.0 °C	0.1 °C					
Pressure (P1)	-250.0 .. 250.0 Pa	0.1 Pa	±0,5 Pa      -10.0 .. +10.0 Pa ±2 Pa      +10.1 .. +250.0 Pa ±2 Pa      -10.1 .. -250.0 Pa				

MEASUREMENT	RANGE	RESOLUTION	ACCURACY	RESPONSE TIME t <sub>90</sub>	RECALIBRATION	AVERAGE LIFE	POSITION
Pressure (P3)	-100.0 .. 500.0 hPa	0.01 hPa	±1% m.v. -2.01 .. -100.0 hPa ±0.02 hPa -2.00 .. +2.00 hPa ±1% m.v. +2.01 .. +500.00 hPa				
Air index	0.00 .. 9.50	0.01					
Excess air ("e")	0 .. 850 %	1 %					
Stack loss	0.0 .. 100.0 %	0.1 %					
Efficiency	0.0 .. 100.0 %	0.1 %					
Condensation efficiency	0.0 .. 120.0 %	0.1 %					
Smoke index	0 .. 9						

**Note:**

(1) Recommended by the manufacturer.

(2) 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.

(3) If this sensor is mounted on the instrument, the dilutor will be always off.

## 18.0 SPARE PARTS AND SERVICING

### 18.1 Spare parts

CODE	DESCRIPTION
AJ PB01	Li-Ion 3,7V 6000 mAh Battery pack
AJ KA02	Power plug 100-240V~/12 VDC 2A with 2 mt cable + Italian plug + Adapter cable USB-A / USB-C
AJ CR01	Plastic case
AJ TA01	Water trap / smoke filtering unit
AAC FA01	Anti dust filter (1 piece)
AA RC10	Thermal paper roll for integrated printer; size 57x35mm
Novo O2-LL	O <sub>2</sub> sensor, pre-calibrated and interchangeable

### 18.2 Accessories

CODE	DESCRIPTION
AAST04	Bluetooth® printer
AAKT05	Tightness test kit
AARA01	Male connector with 9 mm diameter, gas connection 1/4" with 1/4" to 1/8" adapter (for tightness test kits)
AAPM02	Manual pump kit for smoke measurement
AS0000MF	Black smoke filter
AASU01	Black smoke measuring scale
AASA08	200 mm air temperature probe (cable length 3 mt)
AJSJ01	Smoke probe handle with 1,8 meters cable
AJSJ02	Smoke probe handle with 3 meters cable
AJPT01	180 mm probe tip (maximum working temperature 400°C) for smoke probe handle
AJPT02	300 mm probe tip (maximum working temperature 600°C) for smoke probe handle
AJPT03	750 mm probe tip (maximum working temperature 800°C) for smoke probe handle
AJPT04	1000 mm probe tip (maximum working temperature 1200°C) for smoke probe handle
AJPT05	300 mm flexible probe tip (maximum working temperature 160°C) for smoke probe handle
AJEX01	3 mt extension cable for gas sampling probe
AASP01	Protective screen for gas sampling probe
AAFS02	Inox filter with adapter
AJKP01	Differential pressure measurement kit

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## 18.3 Service Centres

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### **Seitron Service Milano**

Via Leonardo da Vinci, 1

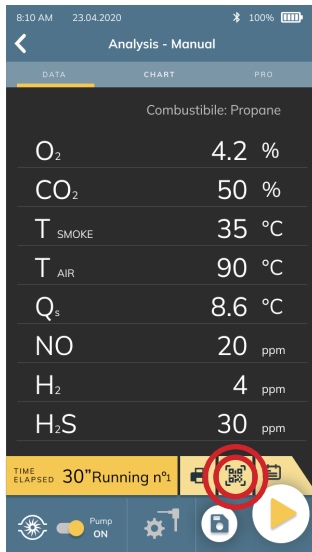
20090 Segrate (MI)

Tel. / Fax: +39.02.836.476.71

E-mail: [service.milano@seitron.it](mailto:service.milano@seitron.it)

## ANNEX A - Seitron Smart Analysis APP

Data Management with “SEITRON SMART ANALYSIS” APP.



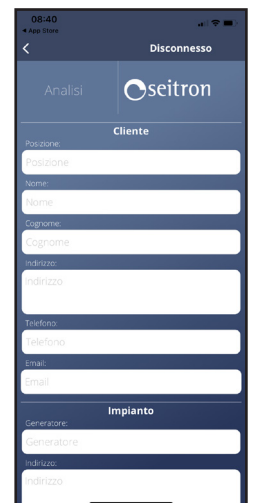
**SCAN THE QR CODE USING SEITRON APP “SEITRON SMART ANALYSIS”, TO DOWNLOAD THE ACQUIRED DATA.**



When the app starts, this screen is presented. Press the “Scan QR code” button and scan the QR code presented by the analyzer.

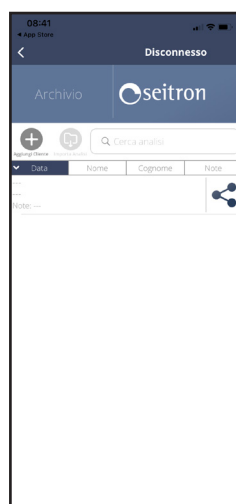


The data for the analysis under consideration are displayed. Press the “Save” button to save the analysis data to the device.



Fill in all fields with the required data. Once the data entry is complete, press the “Save” button at the end of the page.

Salva



When the analysis has been saved, it can also be shared via the button showed below.



By pushing the “☰” button on the Home screen, you access the app settings, where you can set some parameters related to saving data to the device.



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

Novo		
Serial number	00001100	
Date	05/05/2021	
Time	12:00	
Fuel	Natural gas	
Altitud.	0.000000	m
Air humidity	50	%
O2	15.7	%
CO	23	ppm
CO2	2.9	%
T flue	100.6	°C
T air	27.0	°C
Eff. sens	90.0	%
NO	0.000	mV
CO-SEN	258.270	mV
O2	1.131.867	mV
I sen	0.000	uA
I sen	0.000	uA
I sen	100.346	uA
T az	22.5	°C
ΔT	73.6	°C
Loss sens	10.0	%
λ,n	4.01	
Exc. air	4.01	
Eff. cond	0.0	%
Eff. tot	90.0	%
Loss sens	10.0	%
Loss tot	10.0	%
Eff. sens	90.0	%
Eff. cond	0.0	%
Eff. tot	90.0	%
NO	0	ppm
NOx	0	ppm
CO (0.0%)	0	ppm
NO (0.0%)	0	ppm
NOx (0.0%)	0	ppm
Draft	4.5	Pa

## ANNEX B - Report

### Example of Total analysis Full.

COMPANY Ltd.  
 Park Road, 9  
 Tel.02/12345678

Oper.: John Smith  
 Model: Novo  
 Serial: 999989

Sign.: \_\_\_\_\_

Date: 05/05/2021  
 Time: 10.30

Fuel: Natural gas  
 Altitude: 0 m  
 R.H. air: 50 %

Analysis: Average

O2	15.7 %
CO2	2.9 ppm
l,n	4.01
T flue	100.6 °C
T air	27.0 °C
dT	73.6 %
Loss sens	10.0 %
Eff. sens	90.0 %
Eff. cond	0.0 %
Eff. tot	90.0 %
CO	23 ppm
NO	14 ppm
NOX	15 ppm
Ref. O2:	0.0 %
CO ref	92 ppm
Ref. O2:	0.0 %
NO ref	56 ppm
Ref. O2:	0.0 %
NOX ref.:	60 ppm
P gas	0.06 hPa

Note: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Analysis: 1  
 05/05/2021 10.00

O2	15.7 %
CO2	2.9 %
l,n	4.01
T flue	100.4 °C
T air	27.0 °C
dT	73.4 °C
Loss sens	10.0 %
Eff. sens	90.0 %
Eff. cond	0.0 %
Eff. tot	90.0 %
CO	23 ppm
NO	14 ppm
NOX	15 ppm
Ref. O2:	0.0 %
CO ref	92 ppm
Ref. O2:	0.0 %
NO ref	52 ppm
Ref. O2:	0.0 %
NOX ref.:	56 ppm
P gas	0.06 hPa

Analysis: 2  
 05/05/2021 10.15

O2	15.7 %
CO2	2.9 %
l,n	4.01
T flue	100.6 °C
T air	27.0 °C
dT	73.6 °C
Loss sens	10.0 %
Eff. sens	90.0 %
Eff. cond	0.0 %
Eff. tot	90.0 %
CO	23 ppm
NO	14 ppm
NOX	15 ppm
Ref. O2:	0.0 %
CO ref	92 ppm
Ref. O2:	0.0 %
NO ref	56 ppm
Ref. O2:	0.0 %
NOX ref.:	60 ppm
P gas	0.06 hPa

Analysis: 3  
 05/05/2021 10.20

O2	15.7 %
CO2	2.9 %
l,n	4.01
T flue	100.8 °C
T air	27.0 °C
dT	73.8 °C
Loss sens	10.1 %
Eff. sens	90.0 %
Eff. cond	0.0 %
Eff. tot	90.0 %
CO	23 ppm
NO	14 ppm
NOX	15 ppm
Ref. O2:	0.0 %
CO ref	92 ppm
Ref. O2:	0.0 %
NO ref	52 ppm
Ref. O2:	0.0 %
NOX ref.:	56 ppm
P gas	0.06 hPa

**Example of a column print-out.**

COMPANY Ltd.  
 Park Road, 9  
 Tel.02/12345678

Oper.: John Smith  
 Model: Novo  
 Serial: 999989

Sign.: \_\_\_\_\_

Date: 05/05/2021  
 Time: 10.30

Fuel: Natural gas  
 Altitude: 0 m  
 R.H. air: 50 %

Analysis: Average

O2	15.7 %
CO2	2.9 ppm
l,n	4.01
T flue	100.6 °C
T air	27.0 °C
dT	73.6 %
Loss sens	10.0 %
Eff. sens	90.0 %
Eff. cond	0.0 %
Eff. tot	90.0 %
CO	23 ppm
NO	14 ppm
NOX	15 ppm
Ref. O2:	0.0 %
CO ref	92 ppm
Ref. O2:	0.0 %
NO ref	56 ppm
Ref. O2:	0.0 %
NOX ref.:	60 ppm
P gas	0.06 hPa

Note: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Measure	1	2	3
T flue	100.5	100.6	100.7
T air	26.0	27.0	28.0
O2	15.6	15.7	15.8
CO2	2.8	2.9	2.10
Ec	0.0	0.0	0.0
l, n	4.0	4.1	4.2
dT	73.5	73.6	73.7
Loss s	9.0	10.0	11.0
Eff. s	90.0	90.0	90.0
Eff. t	90.0	90.0	90.0
CO	22	23	24
NO	13	14	15
NOx	14	15	16
P gas	0.06	0.07	0.08
Time	08:50	08:53	08:55

Note: \_\_\_\_\_  
 \_\_\_\_\_



### Example of Average analysis report.

COMPANY Ltd.  
 Park Road, 9  
 Tel.02/12345678

Oper.: John Smith  
 Model: Novo  
 Serial: 999989

Sign.: \_\_\_\_\_

Date: 05/05/2021  
 Time: 10.30

Fuel: Natural gas  
 Altitude: 0 m  
 R.H. air: 50 %

Analysis: Average

O2	15.7 %
CO2	2.8 ppm
l,n	4.18
T flue	80.6 °C
T air	26.9 °C
dT	53.7 %
Loss sens	7.6 %
Eff. sens	92.4 %
Eff. cond	0.0 %
Eff. tot	92.4 %
CO	27 ppm
NO	11 ppm
NOX	12 ppm
Ref. O2:	0.0 %
CO ref	113 ppm
Ref. O2:	0.0 %
NO ref	46 ppm
Ref. O2:	0.0 %
NOX ref.:	50 ppm
P gas	0.06 hPa

Note: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

### Example of Synthetic Paper print-out.

Date: 05/05/2021  
 Time: 10.30

Fuel: Natural gas  
 Altitude: 0 m  
 R.H. air: 50 %

O2	15.7 %
CO2	2.9 ppm
l,n	4.01
T flue	95.4 °C
T air	26.9 °C
dT	68.5 %
Loss sens	9.3 %
Eff. sens	90.7 %
Eff. cond	0.0 %
Eff. tot	90.7 %
CO	23 ppm
NO	13 ppm
NOX	14 ppm
Ref. O2:	0.0 %
CO ref	92 ppm
Ref. O2:	0.0 %
NO ref	52 ppm
Ref. O2:	0.0 %
NOX ref.:	56 ppm
P gas	0.06 hPa



## ANNEX C - Optional measures list

MEASURE	DEFINITION
$\lambda$ , n (l,n)	<b>Air index</b> (defined as $\lambda$ , sometimes also indicated as n).
E (Exc. Air)	<b>Air excess.</b> Expressed as a percentage according to the formula in the appendix B, 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> It is the difference between the smoke temperature and the air combustion temperature.
Loss sens LHV	<b>Stack losses in relation to the Lower Heating Value (LHV):</b> It is the percentage of dissipated heat through the stack referred to the lower heating value (LHV).
Loss sens HHV	<b>Stack losses in relation to the Higher Heating Value (HHV):</b> It is the percentage of dissipated heat through the stack referred to the higher heating value (HHV).
Eff. sens LHV	<b>Sensible efficiency in relation to the Lower Heating Value (LHV):</b> It is the burner efficiency calculated according to the UNI 10389-1 (2019) standard, 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%. The sensible efficiency value is to be compared against minimum efficiency stated for the heating system performances.
Eff. sens HHV	<b>Sensible efficiency in relation to the Higher Heating Value (HHV):</b> 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 Higher Heating Value (HHV) of the fuel and cannot exceed 100%. The sensible efficiency value is to be compared against minimum efficiency stated for the heating system performances.
Eff. cond LHV	<b>Condensation efficiency in relation to the Lower Heating Value (LHV):</b> Efficiency deriving from the condensation of water vapor contained in flue gases, calculated according to the UNI 10389-1 (2019) standard, and it is referred to the LHV.
Eff. cond HHV	<b>Condensation efficiency in relation to the Higher Heating Value (HHV):</b> Efficiency deriving from the condensation of water vapor contained in flue gases referred to the HHV.
Eff. tot LHV Eff. tot=Eff. sens+Eff. cond	<b>Total efficiency in relation to the Lower Heating Value (LHV):</b> Total efficiency. It is the sum of sensible efficiency and condensation efficiency. It is referred to LHV (Lower Heating Value) and can exceed 100%.
Eff. tot HHV	<b>Total efficiency in relation to the Higher Heating Value (HHV):</b> Total efficiency. It is the sum of sensible efficiency and condensation efficiency. It is referred to HHV (Higher Heating Value) and can not exceed 100%.
Loss tot HHV	<b>Total stack losses (HHV):</b> It is the total heat percentage dissipated through the stack.
NO <sub>x</sub>	Measure of nitrogen oxides quantity; the measurement unit can be set in the special menu.
NO <sub>x</sub> ppm *	Measure of nitrogen oxides quantity; the measurement unit can not be set but it is fixed in ppm.
NO <sub>x</sub> (ref. O <sub>2</sub> ) *	Measure of nitrogen oxides quantity referring to O <sub>2</sub> ; the measurement unit can be set in the special menu.
NO <sub>x</sub> (ref. O <sub>2</sub> ) ppm	Measure of nitrogen oxides quantity referring to O <sub>2</sub> ; the measurement unit can not be set but it is fixed in ppm.
PI	<b>Poison Index (CO/CO<sub>2</sub> ratio):</b> It is defined as the ratio between CO and CO <sub>2</sub> useful to determine whether the system needs maintenance.
CO	CO quantity measurement. Measurement units: ppm · mg/m <sup>3</sup> · mg/kWh · g/GJ · g/m <sup>3</sup> · mg/kWh · % · ng/J

MISURA	DEFINIZIONE
CO (REF)	CO quantity measurement with O2 reference. Measurement units: ppm - mg/m3 - mg/kWh - g/GJ - g/m3 - g/kWh - % - ng/J
CO amb. ext.	Measure of the outer CO level when using the external CO probe. Measurement unit: ppm. This is the only measurement unit which is possible to set.
T DEW	Value of the temperature at which the water present inside the flue condensate (Dew Point). This value is calculated.

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



**WARNING!**

**OTHER THAN THE MEASUREMENT LIST ABOVE, IT IS POSSIBLE TO VISUALIZE THE MEASURE OF THE DETECTED GAS ALSO IN PPM, DEPENDING ON THE KIND OF MEASUREMENT SENSOR IN THE INSTRUMENT. IF IT IS NECESSARY TO MEASURE THE VALUE OF GAS WITH TWO DIFFERENT MEASUREMENT UNITS, SELECT IN THE MEASUREMENTS LIST THE DESIRED GAS IN PPM AND CHANGE THE MEASUREMENT UNIT FOR THE SAME GAS IN THE "CONFIGURATION->ANALYSIS->MEASUREMENT UNIT" SCREEN. NOW THE INSTRUMENT ACQUIRES THE MEASURE WITH TWO DIFFERENT UNITS (PPM AND THE ONE PREVIOUSLY SET).**



## ANNEX D - Coefficients of the fuels and Formulas

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

Coefficients for calculating combustion efficiency									
Fuel	A1	A2	B	CO <sub>2</sub> t (%)	PCI (KJ/Kg)	PCS (KJ/Kg)	M aria (Kg/Kg)	M H <sub>2</sub> O (Kg/Kg)	V gas dry (m <sup>3</sup> /Kg)
Natural gas	0,660	0,380	0,0100	11,70	50050	55550	17,17	2,250	11,94
Propane	0,630	0,420	0,0080	13,90	45950	49950	15,61	1,638	11,11
L.P.G.	0,630	0,420	0,0080	13,90	45730	49650	15,52	1,602	11,03
Butane	0,630	0,420	0,0080	13,90	45360	49150	15,38	1,548	10,99
Diesel oil	0,680	0,500	0,0070	15,10	42700	45500	14,22	1,143	10,34
Fuel oil	0,680	0,520	0,0070	15,70	41300	43720	13,73	0,990	10,06
Propane air	0,682	0,447	0,0069	13,76	28250	30700	9,13	0,999	6,77
Biogas	0,719	0,576	0,0086	16,81	19200	21250	6,38	0,840	5,82
Pellets (8% RH)	0,740	0,670	0,0071	19,01	18150	19750	6,02	0,660	4,58
Wood (20% RH)	0,761	0,686	0,0089	18,93	15450	17170	5,27	0,700	4,01
Chipped wood	0,8020	0,785	0,0108	20,56	11950	13565	4,20	0,660	3,25
Coal	0,7620	0,691	0,0023	19,06	31400	32300	10,70	0,370	8,14
CO Off gas	0,775	1,164	0,0012	31,55	8610	8735	2,21	0,051	2,14
Olive pits	0,749	0,689	0,0065	19,33	18780	20309	6,290	0,626	4,79
Rice husk	0,777	0,768	0,007	20,738	12558	13633	4,065	0,440	3,152
Petrol	0,692	0,495	0,0058	15	44000	47200	14,73	1,296	10,64
Digester gas	0,695	0,3525	0,0085	10,65	21303	23644	6,93	0,905	7,02

Details of the coefficients of the fuels:

- 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, A2, 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.  
A2 is used when the CO<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.  
- For Germany coefficients A1 and A2 are swapped.

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

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

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

$$q_A = (t_A - t_L) \times \left( \frac{A2}{CO_2} + B \right)$$

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

The user is guaranteed against the product's defects of conformity according to the European Directive 2019/771 as well as the Seitron warranty terms, available online on the website [www.seitron.com](http://www.seitron.com).

We invite the user to visit our website and check the latest version of technical documents, manuals and catalogs.





## TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSES AND REMEDIES
The instrument does not work at all. When the On/Off pushbutton is pressed the instrument does not come on.	<ul style="list-style-type: none"> <li>a. Keep the On/Off key depressed for at least 3 seconds.</li> <li>b. The battery is low; connect the battery charger to the instrument.</li> <li>c. The battery may not be connected to the instrument; Access the internal parts and insert the battery connector into its socket on the printed circuit (see chapter 14.2.3 and 14.2.6).</li> <li>d. The instrument is faulty: Contact the assistance center.</li> </ul>
The batteries last less than 8 hours.	<ul style="list-style-type: none"> <li>a. Battery capacity is limited by low temperatures. To achieve a longer battery life it is recommended to store the instrument at higher temperatures.</li> <li>b. The battery is old. Battery capacity tends to diminish with age. If battery life has become unacceptable, replace the battery.</li> </ul>
The battery, after a complete charging cycle, can't hold a charge.	<p>If the batteries are old tend to reduce their capacity. If the autonomy has become unacceptable it is advisable to replace the battery pack.</p>
After auto-calibration is complete the sensor diagnostics screen appears and gives an error for one or more sensors.	<ul style="list-style-type: none"> <li>a. Auto-calibration took place while the flue gas was being sampled.</li> <li>b. The O<sub>2</sub> sensor is broken, not connected properly, or not connected at all.</li> <li>c. The sensor was not allowed the necessary adjustment time or the instrument was left with a low battery for too long.</li> </ul>
A pressure sensor error is shown in the pressure/draught screen.	<p>There is a calibration problem. Send the instrument to a service centre.</p>
The analysis screen gives a flue gas temperature (Tf) error.	<ul style="list-style-type: none"> <li>a. The thermocouple is not connected; connect the thermocouple to the analyser</li> <li>b. The thermocouple is faulty. Send the complete probe to a service centre.</li> </ul>
The following symbol "----" appears on the analysis screen.	<p>The instrument is not able to calculate a numerical value based on the flue gas analysis conducted. The "----" are replaced by numbers when the analyser detects valid combustion data.</p>
"Max. Lim." or "Min. Lim" appears on the analysis screen.	<p>The relative sensor is detecting a value that is beyond the analyser's measuring range. "Max. Lim" or "Min. Lim." are replaced by numbers when the instrument reveals values that are within the measuring range.</p>
In the analysis screen the indicated values are not reliable.	<p>The causes can be multiple and depend on the sensors, the pump or the smoke gas probe. Contact the Service Center for an accurate analysis.</p>
After the autozero, the pump always remains on.	<p>It's normal. When starting the instrument, there is an autozero procedure during which the pump must suck in room air. After that, the pump remains on to suck in combustion smokes: only with the pump on is it possible to be sure of a correct and real-time measurement of the gases.</p>
The sample pump sounds as though it is running slowly, tends to stop or does not even start.	<ul style="list-style-type: none"> <li>a. The gas flow is obstructed. Check that the dust filter is clean and not clogged with condensation. Also check that the tube connected to the probe is not crushed.</li> <li>b. Sample intake flow is obstructed. Check that the particulate filter is clean.</li> <li>c. Bad electrical connection of the pump. Contact the service center.</li> <li>d. Faulty pump. Contact the service center.</li> </ul>
A sensor is not visible in the sensor diagnostics screen.	<p>The sensor was not detected (not communicating or has been removed). Check that the sensor is inserted correctly. If necessary, try to remove and reinsert the sensor.</p>

The built-in printer of the instrument does not print correctly.	<p>a. Check the type of paper you are using as it should only be thermal paper.</p> <p>b. Check the direction of the paper roll.</p> <p>c. If the paper is not dragged, check the closure of the printer door and the integrity of the feed roller.</p>
The (external) Bluetooth® printer prints too small characters.	<p>It is necessary to set the factory font. Press and hold the "POWER" button for a few seconds; you will hear the following beeps in succession:</p> <p>a. A short beep;</p> <p>b. One long beep;</p> <p>c. Two beeps in quick succession = font set to 12x24.</p>
The values shown in the analysis screen are not reliable.	<p>a. . Sensor/s is/are faulty. Check that the sensors are installed correctly by accessing the sensor diagnostics menu.</p> <p>b. The sample probe connection presents a leak. Check all joints and the conditions of the hose.</p> <p>c. Pump is faulty. Contact the service center.</p> <p>d. The instrument is faulty. Contact the service center.</p>
During the tightness test a "sensor error" is reported.	Check for the correct connection of the hose to the P3 pressure input.
The result of the flue gas probe leak test is "Error".	<p>a. The pneumatic system has a leak; contact Seitron service center.</p> <p>b. The instrument smoke pump is dirty or damaged; Seitron service center.</p>
Print-out printing does not start or does not complete.	The battery charge inside the instrument is less than 5%; connect the battery charger to the instrument.



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