seitron
Innovation Technology

USE AND MAINTENANCE

CHEMIST 900 RACK

Gas Analyzer

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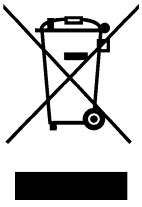
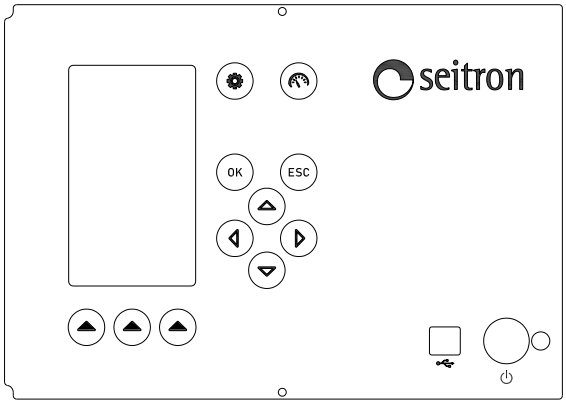
1.0 IMPORTANT INFORMATION

1.1 Information about this manual

- This manual describes the operation and the characteristics and the maintenance of the Combustion Analyzer Chemist 900 RACK.
- Read this operation and maintenance manual before using the device. The operator must be familiar with the manual and follow the instructions carefully.
- This use and maintenance manual is *subject to change due to technical improvements - the manufacturer assumes no responsibility for any mistakes or misprints.*

1.2 Danger levels and other symbols

Symbol	Meaning	Comments
		Read information carefully and prepare safety appropriate action! To prevent any danger from personnel or other goods. Disobey of this manual may cause danger to personnel, the plant or the environment and may lead to liability loss.
	Information on LCD	
	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.
		Touch keyboard with main control functions.

2.0 SAFETY

2.1 Proper use of the product

This chapter describes the areas of application for which the CHEMIST 900 RACK is intended.
All products of the series CHEMIST 900 RACK are stationary measuring devices, in a 19” metal case, for rack mounting; these instruments are capable of measuring gas in the following plants:

- Boilers (fuel oil, gas, wood, coal)
- Low-temperature condensing boilers
- Gas heaters
- Emissions control measurements
- Installations compliance tests
- Gas turbines
- Gas engines
- Furnaces and boilers technical assistance
- Technical assistance in industrial heating systems
- Process control

2.2 Improper use of the product

The use of CHEMIST 900 RACK 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.

CHEMIST 900 RACK should not be used:

- as an alarm device for safety purposes
- in classified zones with explosion risk (ATEX or equivalent)

3.0 GENERAL FEATURES

3.1 General overview of the Analyzer

The CHEMIST 900 RACK is an industrial tool for measuring polluting gases.

The instrument is featured with:

- Rack mounting 19" with 4 HE for the mounting of adjustable frames, racks with or without telescopic guides. Alternatively, the instrument features four rubber feet on the lower surface, so that it can stand horizontally on a flat surface.
- Pneumatic circuit which can accommodate up to 3 sensors of the FLEX-sensors series.
- Housing for fitting an NDIR (infrared) bench. Depending on the instrument configuration, it is able to measure one or more of the following gases: CO - CO2 - CH_4.
- Female pneumatic connectors with 1/8 GAS BSPP thread.
- The gas autozero cycle can be performed with the probe inserted in the stack.
- The autozero of the pressure sensor (piezoresistive, temperature compensated) can also be performed with the gas probe inserted in the stack.
- Up to 4 alarms with visual and acoustic signals are programmable for each measurement parameter.
- Intuitive user interface: the instrument can be used without the support of the user manual.
- Wide (55x95 mm) and bright TFT color display which delivers great readability thanks to the zoom function and an efficient backlight.
- Serial communication port type RS485 according to protocol MODBUS® RTU in order to connect to the PC for the analysis reading.
- USB communication port type A, for PC communication with the dedicated software provided with the instrument, to archive the analysis and the configuration of the main parameters for the combustion analysis. The CHEMIST 900 RACK allows to memorize and archive the analysis data exclusively from remote, using a PC with the software **Chemist Smart Analysis** previously installed.
- 4 .. 20 mA isolated output (4 configurable channels - Active loop)
- Four alarm relays outputs SPDT, AC/DC 24V 1A.

Main functions:

- Gas analysis:
  - Comes with 15 most common fuel parameters (such as natural gas, LPG, gas oil and fuel oil).
  - Possibility to store in memory the parameters for 32 further fuels, once their chemical composition is known.
- Monitoring of pollutants (combustion)

Measurable gases:

- O_2
- CO/H_2
- CO
- NO
- NO_2
- SO_2
- H_2S
- NH_3
- H_2
- CO_2
- CH_4

Measurements:

- Draft in the stack
- Combustion air temperature
- Smoke temperature
- Air speed for air or flue gas leaving the stack with the use of Pitot tube

Maintenance:

- The sensors can be replaced by the user without sending back the instrument to the technical assistance center for the sensors are provided pre-calibrated, while the NDIR bench can't be replaced directly by the user, but only in an authorized Seitron assistance center.
- To get an accurate measure, the instruments needs an annual calibration, which can be performed on the field through the procedure "Calibration On Site" and the use of gas mixtures special samples.

Certificate of calibration

The instruments comes with an ISO 9001 calibration certificate.

4.0 DESCRIPTION OF THE PRODUCT

4.1 Working principle

The gas sample is taken in through the gas probe, by a diaphragm suction pump inside the instrument and it is cleaned of humidity and impurities by the Cooler and the filter located inside the instrument.
The sample is then analyzed in its components by electrochemical and infrared sensors.
The electrochemical sensor guarantees high precision in a time interval of about 60 minutes during which the instrument can be considered very stable. When measurement is going to take a long time, we suggest auto-zeroing the instrument again after flushing the inside of the pneumatic circuit for three minutes with clean air.
During the zero calibrating phase, the instrument aspirates clean air from the environment and detects the cells' drifts from zero (20.95% for the O2 cell), then compares them with the programmed values and compensates them. The pressure sensor autozero must, in all cases, be done manually prior to measuring pressure.
The values measured and calculated by the microprocessor are viewed on the LCD display which is backlit to ensure easy reading even when lighting is poor.

4.2 CO dilution

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 CO sensor is therefore protected in this instrument 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.

4.3 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 fuels and their coefficients in order to define up to a maximum of 32 fuels, other than the default ones.
For more details see Annex B.

4.4 Peltier module condensation assembly (Cooler)

The gas sample needs to be suitably dehumidified and purified of solid combustion residues before being analyzed ("dry analysis").
For this purpose, the **CHEMIST 900 RACK** is equipped with a Peltier condensation assembly; this has the goal of quickly cooling the gas sample down to a temperature of 5° C.
The cooler causes the moisture contained in the gas to condensate thus allowing the gas to reach the sensors without undergoing significant changes in its composition.
This system is particularly useful when water-soluble components have to be analyzed (eg. SO2, NO2, etc.).
In order to raise the efficiency of the Peltier module condensation assembly, it is advisable to use, for the sampling of gas, a special probe with heated head and/or heated hose.
This probe includes in its interior a thermo-resistance for the automatic control of the temperature, which must be maintained above the dew point, always above 90°C to prevent unwanted condensation at the probe level. The heated hose allows the gas to reach the Peltier module condensation assembly unchanged in its chemical characteristics.
In conditions of extreme ambient temperature (+45° C) it is possible that the internal temperature of the cooler is not maintained at +5° C but tends to move up to +10° C /+15° C, this temperature is still sufficient to obtain the drying of the gas, with a loss of efficiency up to 10% of drying.

4.5 Remote condensate sink

On the back of the instrument is located the output of the condensation water.
By properly connecting an appropriate silicone hose it is possible to move the output point of the condensation water.

4.6 External dust filters

Two dust filters protect the pneumatic circuit and the gas sensors.
These two filters are in series with each other: the first is the lowest one, the second is at the top.
Consisting of a cylinder in transparent polycarbonate, these are located on the left side of the analyzer.
A replaceable, low-porosity filter is positioned within each cylinder with the purpose of retaining solid particles suspended in the flue gas. The filter has an efficiency of 95% for 20um solid particles.
It is recommended to replace the filters any time they are significantly dirty (see section '**MAINTENANCE**').

4.7 Dust filter for the NDIR bench protection

For further protection of the NDIR bench, an additional dust filter has been inserted into the analyzer, replaceable by the user.
Placed on the back of the instrument, it consists of a cylinder in transparent polycarbonate with a filter inside, having an efficiency of 99% with 20um solid particles, with the purpose of retaining solid particles suspended in the flue gas.
We recommend to check the filter once a year during periodic maintenance.

4.8 Remote air intake

On the back of the analyzer there is a pneumatic connector '**ZERO CAL**'. This connector is the air intake used to perform the auto-zero for the gas sensors.
To this connector, it is necessary to joint the special anti-dust filter, provided with the instrument (for the assembly diagram, see chapter 9.2.1 Wiring diagram - Back panel - Remote air intake filter assembly).
On special conditions, if the instrument is placed in a closed and polluted environment, it is possible to move the instrument air intake in a lean air environment, using a small tube to be put after the anti-dust filter.

4.9 Pressure sensor, piezoelectric, temperature compensated

The instrument is equipped with a piezoresistive differential pressure sensor, temperature compensated, for measuring pressure or draft.
This sensor is differential type thus, thanks to the second measurement port, can be used for measuring the draft (negative pressure) in the stack, for differential pressure measurement, for measuring the velocity of the flue gas using a Pitot tube, for flow measurement.
The measurement range is -1,000 Pa .. +20,000 Pa.
Any potential drift of the sensor are nulled thanks to the autozeroing system which in this instrument can be operated with the flue gas probe inserted in the chimney, because the instrument is equipped with a solenoid valve that switches the pressure measurement to the ambient, thus allowing to zero the sensor in air.

WARNING
ANY PRESSURE APPLIED TO THE SENSOR GREATER THAN ±300 hPa MAY CAUSE A PERMANENT DEFORMATION OF THE MEMBRANE, THUS DAMAGING THE SENSOR IRREVERSIBLY.

4.10 Smoke suction pump

This diaphragm pump, located inside the instrument, is operated with a DC engine powered by the instrument in order to obtain the optimal suction flow rate of the flue gas for the ongoing analysis; an internal sensor measuring the flow allows to:
- Maintain a constant flow rate of the pump
- Check the state of efficiency of the pump
- Check the level of filter clogging

4.11 Condensate sink pump

The membrane pump has the purpose to automatically empty the condensation water, and it is controlled directly by the microprocessor with alternating turning on/off.
The time interval between one turn on/turn off cannot be modified by the user and it is set to 30 seconds.
When the system is functioning correctly it is monitored by an internal pressure sensor which measures these time intervals. In case of anomalies, an error message will appear on the display.

4.12 Draft measurement with sensor automatic autozero

The CHEMIST 900 RACK performs the draft pressure measurement
The auto-calibration of the sensor is carried out through the switching of an internal valve that allows to perform the zeroing procedure without removing the probe from the stack.
This feature is particularly useful when the analysis in taken in 'data logger' mode.

4.13 Temperature measurements

The **CHEMIST 900 RACK** performs temperature measurements using Tc-K probes, to be connected to input T1 or T2 placed on the back of the instrument.

4.14 Bluetooth® connection

The **CHEMIST 900 RACK** analyzer features an internal **Bluetooth®** module, allowing the communications with the following remote devices:

- PCs running Microsoft Windows 7 or later and Bluetooth® interface upon installation of the specific software ‘SmartFlue’ supplied together with the instrument.

The maximum transmission range in open field is 100 meters (Class 1 Bluetooth® module), provided that also the communication companion is also equipped with a Class1 Bluetooth® interface.
This solution allows greater freedom of movement for the operator who is no longer bound directly to the instrument for acquisition and analysis, with significant advantages for many applications.

4.15 Available software

Chemist Smart Analysis
PC software, downloadable from the web site www.seitron.com, with the following features:

- Displays the plate data of the instrument.
- Sets the instrument parameters.
- Sets the emission analysis mode.
- Starts the analysis and remotely shows the data coming from the instrument.
- Stores the data in .csv files.

5.0 CONNECTIONS

5.1 Warnings

WARNING

- **CONNECT THE DEVICE TO MAINS POWER THROUGH A BI-POLAR SWITCH COMPLYING WITH CURRENT STANDARDS AND WITH CONTACTS APERTURE DISTANCE OF AT LEAST 3 MM IN EACH POLE.**
- **THE INSTALLATION AND THE ELECTRICAL WIRING OF THE DEVICE MUST BE PERFORMED BY QUALIFIED TECHNICIAN AND IN CONFORMITY WITH CURRENT STANDARDS.**
- **THE MINIMUM CROSS SECTION OF THE POWER CABLE SINGLE CONDUCTORS MUST BE 1 mm^2. THE CROSS SECTION OF THE PE CONDUCTOR MUST NOT BE SMALLER THAN CONDUCTORS L AND N CROSS SECTION. THE CABLE MUST BE SUITABLE FOR A MINIMUM TEMPERTURE OF 70 °C (158 °F) AND MUST BE HOMOLOGATED FOR THE COUNTRY AND PLACE OF USAGE.**
- **BEFORE PERFORMING ANY CONNECTION MAKE SURE THAT MAINS POWER IS OFF.**
- **INSTALL THE MAINS POWER LINE SEPARATELY FROM THE SIGNALS LINES.**

WARNING

CONDENSATE INSIDE THE DEVICE

THE DEVICE COULD BE DAMAGED BY CONDENSATE IF THE GAP BETWEEN THE TRANSPORTATION OR STOCK TEMPERATURE AND THE INSTALLATION SITE IS HIGHER THAN 20 °C (68°F).

- **BEFORE OPERATING THE DEVICE MAKE SURE THAT IT IS PLACED ON THE NEW OPERATION SITE FOR A FEW HOURS SO THAT IT CAN ADAPT TO THE NEW CONDITIONS.**

WARNING

MISSING GROUND/PE CONNECTION

ELECTRIC SHOCK DANGER

DEPENDING ON THE MODEL OF THE DEVICE, CONNECT THE POWER SUPPLY AS FOLLOWS:

- **POWER PLUG: MAKE SURE THAT THE PLUG HAS A CONNECTION FOR THE PE/GROUND CONDUCTOR. CHECK THAT THE CONNECTION FOR THE GROUND/PE CONDUCTOR AND THE POWER PLUG ARE COMPATIBLE.**
- **TERMINALS CONNECTION: CONNECT THE TERMINALS AS ILLUSTRATED IN THE WIRING DIAGRAM. CONNECT FIRST THE GROUND/PE CONDUCTOR.**

WARNING

DANGEROUS CONTACT VOLTAGE

ELECTRIC SHOCKS MAY HAPPEN IF THE WIRING HAS NOT BEEN PERFORMED PROPERLY.

- **FOR INFORMATION ABOUT THE WIRING TECHNICAL SPECIFICATIONS SEE THE CHAPTER "CONNECTION TO MAINS POWER (PAGE 74)".**
- **ON THE INSTALLATION SITE OF THE DEVICE RESPECT THE DIRECTIVES AND LAWS IN FORCE ABOUT ELECTRICS SYSTEMS WITH NOMINAL VOLTAGES BELOW 1000 V.**

5.2 Wiring the signal lines

WARNING

UNSUITABLE POWER VOLTAGE
THE POWER VOLTAGE AT 24 V/1A MUST BE A SAFETY LOW VOLTAGE AT LIMITED POWER WITH SAFE ELECTRICAL SEPARATION (SELV).
CONNECT THE SIGNAL LINES ONLY TO DEVICES THAT ARE FEATURED WITH A SAFE ELECTRICAL SEPARATION ON THEIR POWER SUPPLY.

- The connection lines to the relays outputs, to the binary inputs and to the analog outputs must be shielded.
- Connect the signal lines to D-sub connectors on the back of the instrument.
- In order to suppress the formation of sparks through the relay contacts (e.g. limiter relay) some RC elements are to be connected as shown on the figure below. About this topic, it is a good rule to remember that an RC element delays the switch off of an inductive component (e.g. A solenoid valve). So the element C should be calculated on the basis of the following empiric rule:
  - R = RL/2; C = 4L/R2L.
  Normally these values are sufficient R = 100 Ω and C = 200 nF.
  - For the RC element it is recommended to use a non-polarized capacitor.
- When operating with DC it is also possible to install a spark extinguishing diode instead of the RC element.

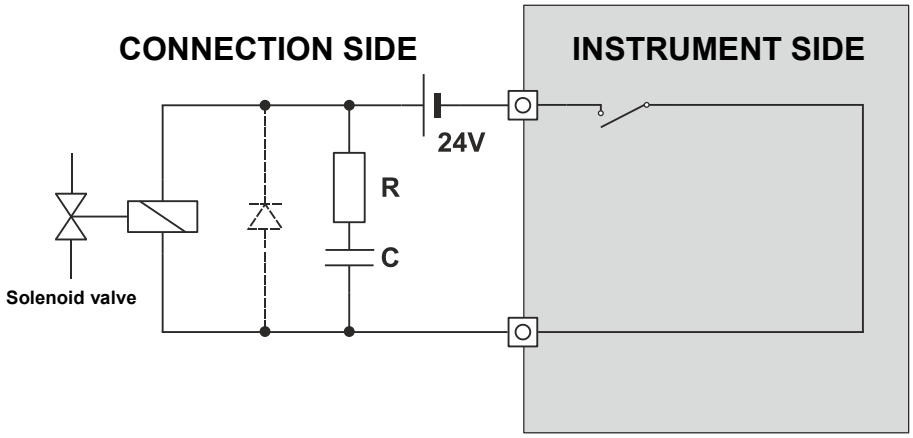


Figure: Sparks suppression on a relay contact

- Analog outputs

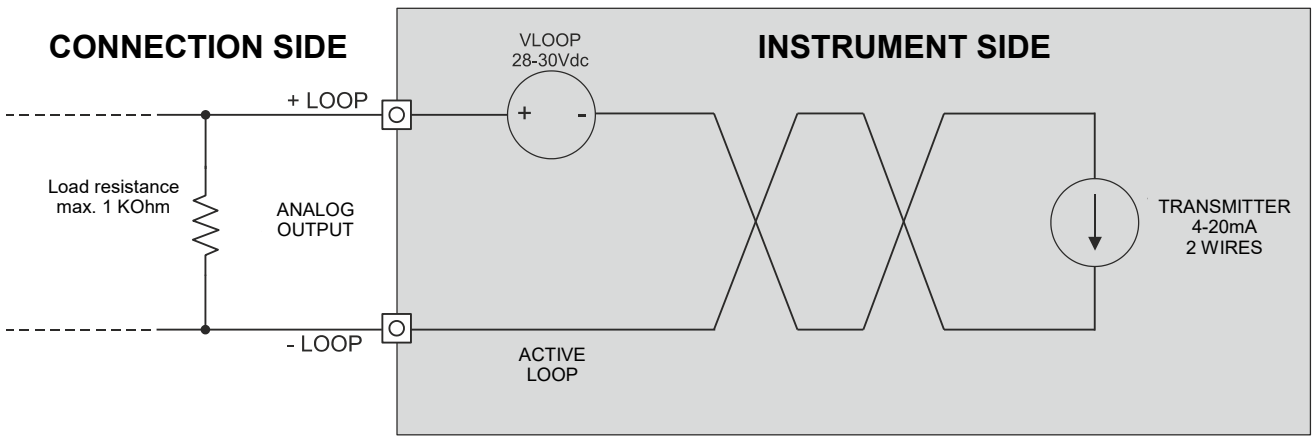


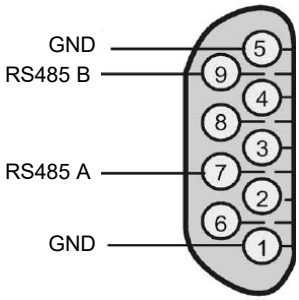
Figure: Connection of the load resistance to the analog output.

5.3 Connection of the serial port RS485 half duplex according to MODBUS® RTU protocol

The **CHEMIST 900 RACK** features a serial output RS485 half duplex, which can be used to connect the instrument to a PC, through the communication protocol MODBUS® RTU.

For further information about the available register table ask the local dealer.

Connection diagram:



WARNING

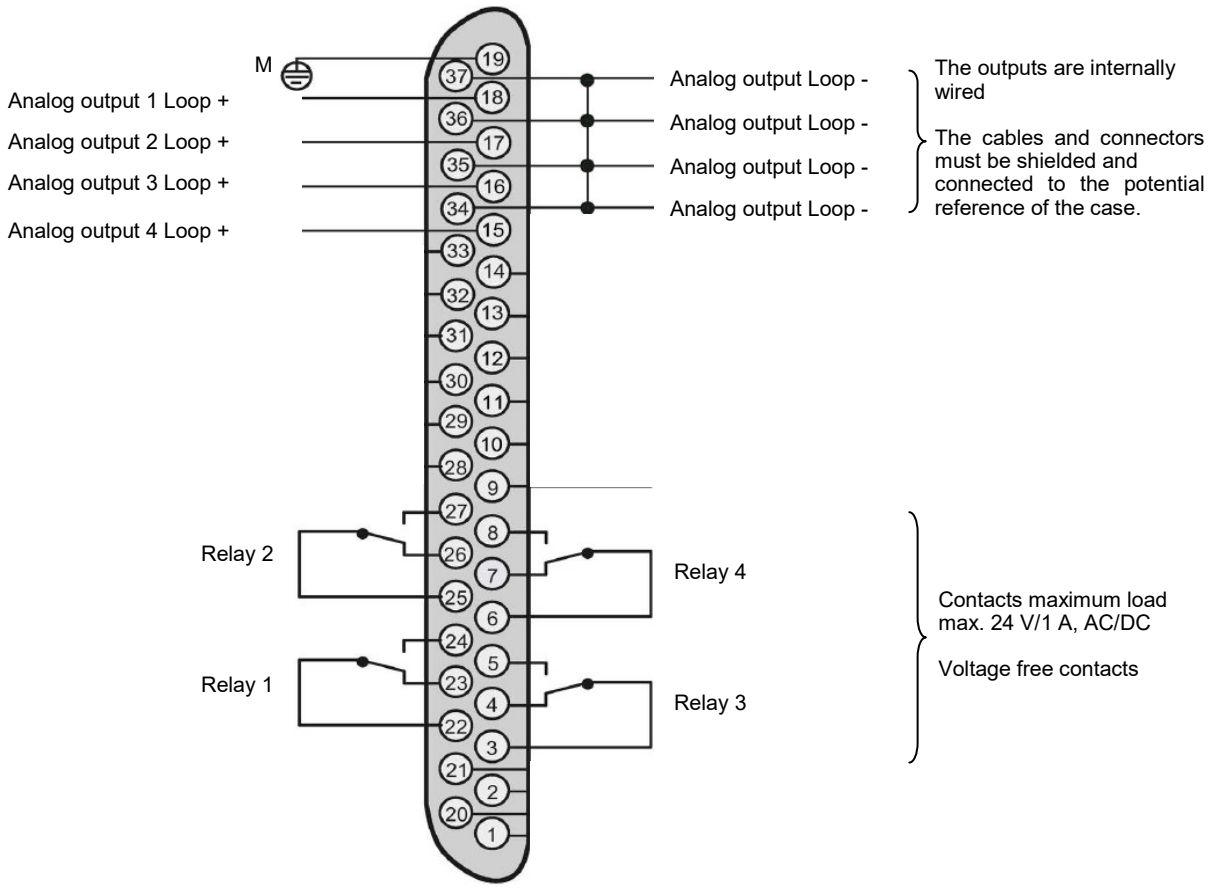
- **THE RS485 NETWORK SUPPORTS UP TO 32 CONNECTED DEVICES.**
- **IF THERE ARE MORE INSTRUMENTS CONNECTED TO THE SAME RS485 NETWORK, IT IS ADVISED TO SET THE SAME COMMUNICATION SPEED.**

5.4 Analog outputs through 37 poles connector (4 outputs 4..20mA and 4 relay outputs)

The **CHEMIST 900 RACK** features:

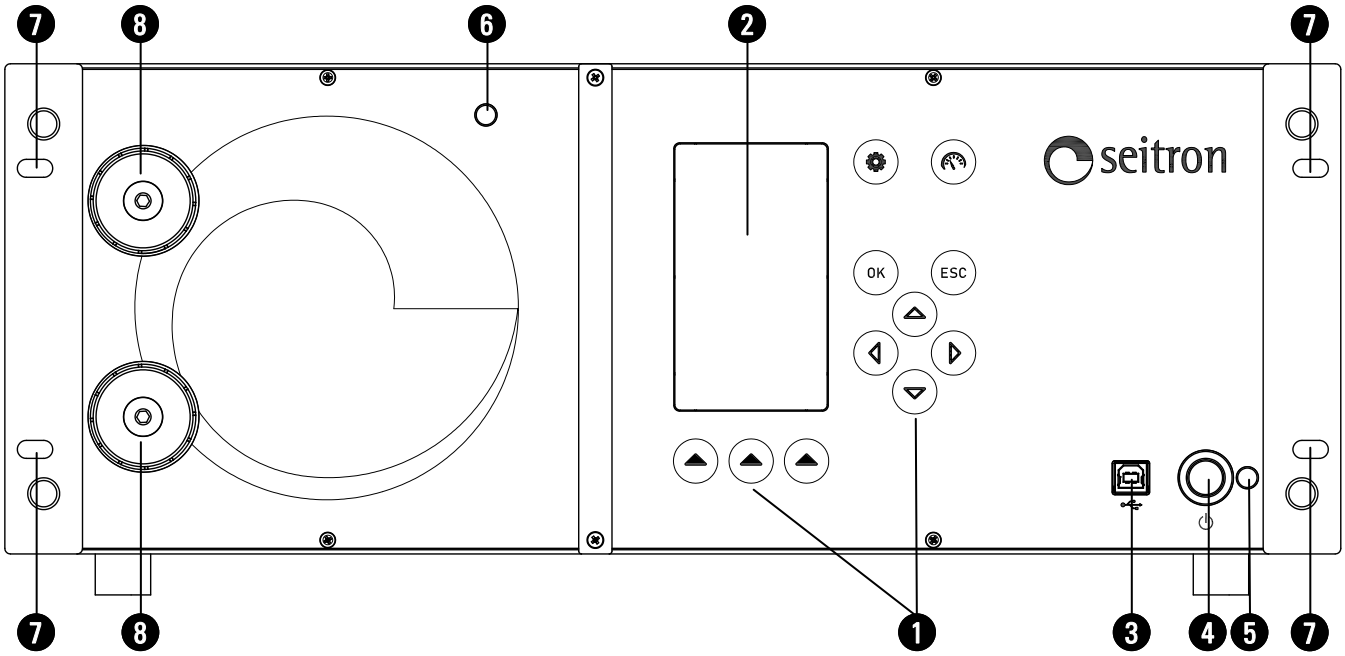
- Four outputs 4..20mA, each one associated to a measurement, customizable through the parameter "Configuration 4..20mA" in order to translate a measure in a current value available on output.
- Four relay outputs, with potential free change over contact:
  - Relay outputs 1 and 2 are always associated to the first two alarms, having correctly set the special parameter "Alarms".
    Relay outputs 3 and 4 change their function depending on the configuration of the parameter "Sample selection":
    - If the parameter "Sample selection" is set to OFF, the relay outputs can be associate to the alarms 3 and 4, having previously set appropriately the special parameter "Alarms".
    - On the contrary, if the parameter "Sample selection" is set to L1, L2 or Auto the relay outputs will be available for the smoke suction on two different points. In this case, the relay 3 commands the smoke suction line called "**L1**", while the relay 4 commands the smoke suction line called "**L2**".
      For further details see chapter "**11.2.8 Configuration→Analysis→Other configs**".

Wiring diagram:



6.0 COMPONENTS DESCRIPTION

6.1 Front cover



LEGEND:

❶ Polycarbonate touch keypad and relevant main functions:

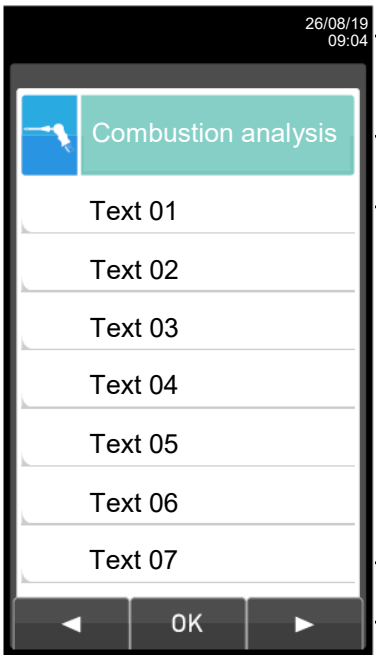
KEY	FUNCTION
▲ ▲ ▲	Activates the context keys shown on the display
⚙	Access to the Configuration menu
◔	Access to the Measurements menu
OK	Confirm settings
ESC	Quits the current screen

KEY	FUNCTION
▲ ◀ ▶ ▼	Select and/or Modify

❷ Display

LCD 128 x 64 pixel backlit color display with 21 characters available and 8 lines. Allows the user to view the measured parameters in the most comfortable format; a Zoom function displays the measured values in magnified form.

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



Date and time.

Selected menu.

Parameters relative to the selected menu.

Context keys. In the various menus the functions vary depending on the type of operation being carried out.

❸ USB connector (type B)

Used to connect the instrument to a personal computer running Microsoft Windows 7 or later upon installation of the specific software 'SmartFlue', supplied with the instrument.

❹ ON / OFF key

To turn on or off the analyzer hold this key down for a few seconds.

❺ Programming LED

This LED provides important information during the firmware update procedure.
For further details please refer to section 15.8 'Firmware Update'.

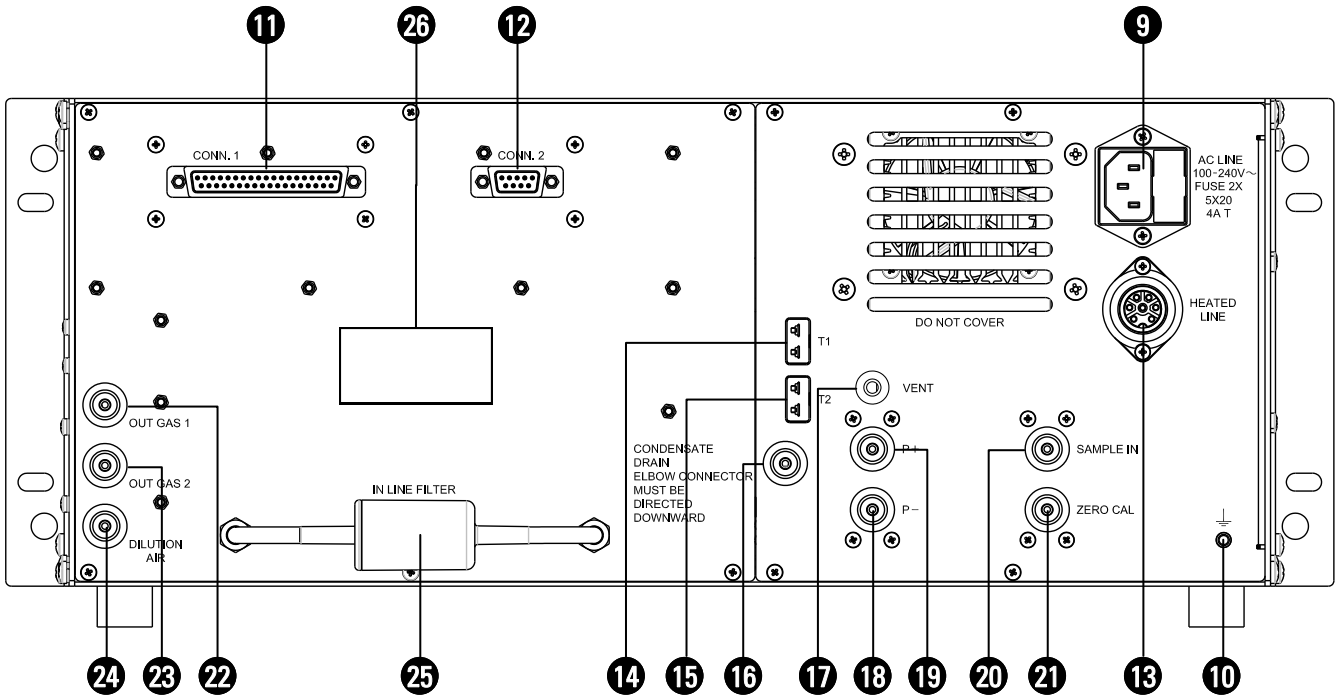
❻ Power Led

When this Led is on, it shows that the power is being delivered to the instrument.

❼ Instruments fixing holes

❽ External dust filters

6.2 Back cover



LEGEND:

9 **Connector 'AC LINE - 100..240V~'**
Plug IEC C14 to connect the power cable to the instrument, provided with the instrument itself. On the plug there is a fuse-holder hidden under a flap, containing 2 fuses 5x20 4A T.

10 **Connection for grounding of the instrument.**

11 **37 poles connector (4 outputs 4..20mA and 4 relay outputs)**
Makes available for the user 4 4..20mA outputs and 4 relay outputs with potential free change over.

12 **Serial connector RS485**
Serial communication port type RS485 according to MODBUS® RTU protocol.

13 **'HEATED LINE' Connector**
Plug for the heated line connection.
See chapter 9.7.

14 **'T1' Connector**
Tc-K connector to plug in the male connector Tc-K of the probe for the measure of the smoke temperature.

15 **'T2' Connector**
Tc-K connector to plug in the male connector Tc-K of the combustion air probe.

16 **Condensation water drain**

17 **'VENT' Connector - Female connector M5**
Air vent used by the pressure sensor to perform the self-zeroing. If the instrument is installed on a rack or in pressurized environments, the air vent must be moved remotely at room temperature.

⑱ Pneumatic connector 'P-' - female connection 1/8 GAS BSPP.
Negative input (P-) to be used for the draft measurement.

⑲ Pneumatic connector 'P+' - female connection 1/8 GAS BSPP.
Positive input (P+) to be used for the measurement of the pressure in general.

The inputs "P+" and "P-" are respectively the positive input and the negative input of the piezoresistive pressure sensor, with temperature compensation, so they are both used at the same time for the measurement of the differential pressure.

⑳ Pneumatic connector 'SAMPLE IN' - female connection 1/8 GAS BSPP.
Input for the connection of the gas sampling probe.

㉑ Pneumatic connector 'ZERO CAL' - female connection 1/8 GAS BSPP.
Input for the line connection to the remote air vent in order to perform the self-zeroing. If the instrument is placed in a closed and polluted environment, it is possible to move the instrument air vent in a room with clean air using the '**ZERO CAL**' connector.

㉒ Connector 'OUT GAS 1' - female connection 1/8 GAS BSPP.
Analyzed gas remote output.

㉓ Connector 'OUT GAS 2' - female connection 1/8 GAS BSPP.
Analyzed gas remote output.

㉔ Connector 'DILUTION AIR' - female connection 1/8 GAS BSPP.
Remote air vent for CO dilution.

THE REMOTE AIR VENT FOR THE CO DILUTION MUST BE PLACED AT LEAST 1 METER AWAY FROM THE REMOTE ANALYZED GAS OUTPUTS.

㉕ Dust filter for NDIR (infrared) bench protection

㉖ Instrument data label

7.0 TECHNICAL FEATURES

7.1 Technical features

Power supply:	100 .. 240V ~, 50 .. 60Hz. With power cable with IEC C14 socket.
Power absorption at 230V:	100 VA
Fuses:	2 x 4A Delayed. Size: 5x20mm.

Display:	TFT 4.3", 272 x 480 pixels graphic color with backlight.

Connectivity:	
Communication port:	USB connector TYPE B CONN. 1: RS485 (half duplex) with communication protocol MODBUS® RTU D-sub 9 poles female. CONN. 2: 4 outputs 4..20mA (active loop) + 4 relay outputs D-sub 34 poles female.
Power LOOP 4-20ma:	28-30 Vdc max resistance load 1 KOhm
Bluetooth:	Class 1 / Communication distance: <100 meters (in open field).

Relay outputs:	4 x 1A 24V AC/DC SPDT Voltage free contacts.

Autozero:	Automatic autozero cycle with the probe inserted in the chimney.
Dilution:	Widens the CO sensor measurement range up to 100,000ppm (10.00%). Programmable as simple protection of the CO sensor with the intervention level set by the user.

Gas measurement sensors:	Up to 3 configurable sensors: electrochemical, NDIR (single cell) and pellistor.
Infrared bench:	NDIR bench - Up to 3 configurable gases: CO, CO2, CH4
Programmed fuels:	15 factory pre-set plus 32 user-programmable.

Self-diagnosis:	Checks all functions and internal sensors and reports any abnormal operation.
Temperature measurement:	Double input for thermocouple K with mini connector (ASTM E 1684-96).
Room temperature measurement:	Using the internal sensor or TCK sensor connected to input T2.

Line filter:	Replaceable cartridge, 95% efficiency with 20um particles.

Suction pump:	2,2 l/min head at the stack up to 300 hPa.
Flow measurement:	Internal sensor.

Sample treatment

Cooler	
Drying system:	Quick moisture condensation with cyclone
Type:	Peltier module

Cooler set-point temperature:	+5° C
Max temp. deviation from the set-point:	+10° C
Condensate drainage:	With diaphragm pump 150ml/min
Duty cycle diaphragm pump:	30s on - 30s off
Warm up time:	~ 15 .. 20 minutes
diaphragm pump:	-5°C to +45°C

Draft test:	With the piezoelectric sensor, the draft can be measured continuously because the system can also perform the self-zeroing of the sensor through an internal valve.

Operation temperature:	-5°C .. +45°C
Stock temperature:	-20°C .. +50°C
Humidity limit:	20% .. 80% RH
Protection grade:	IP21

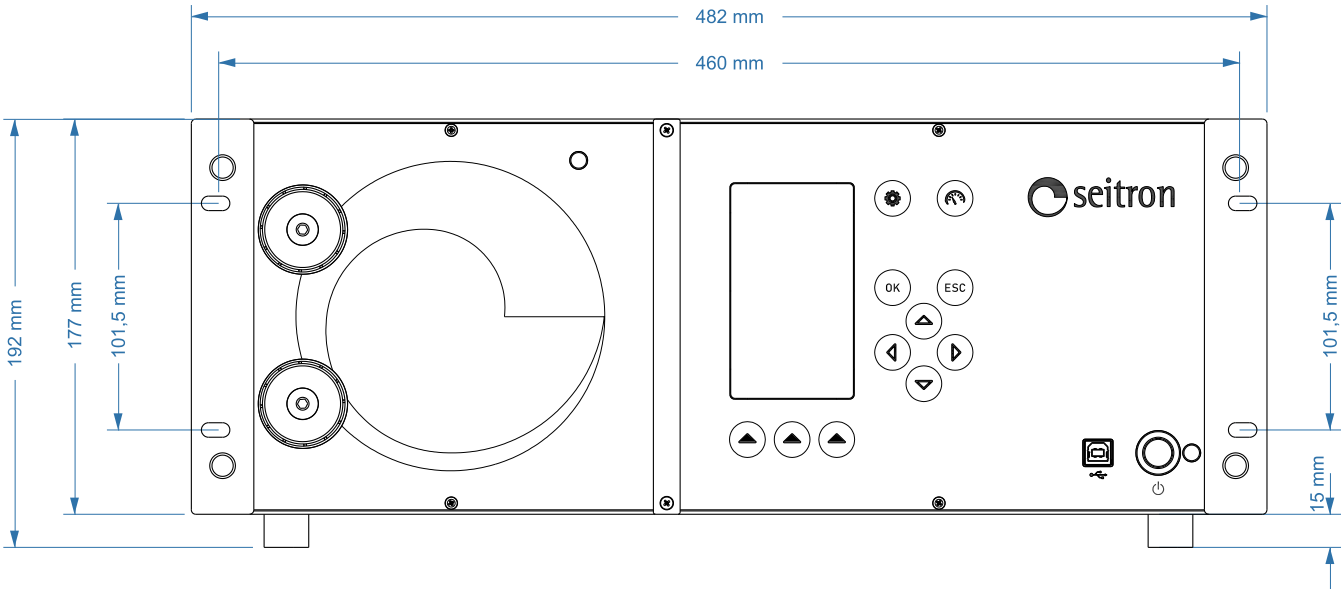
Weight:	**~ 6,8 Kg**

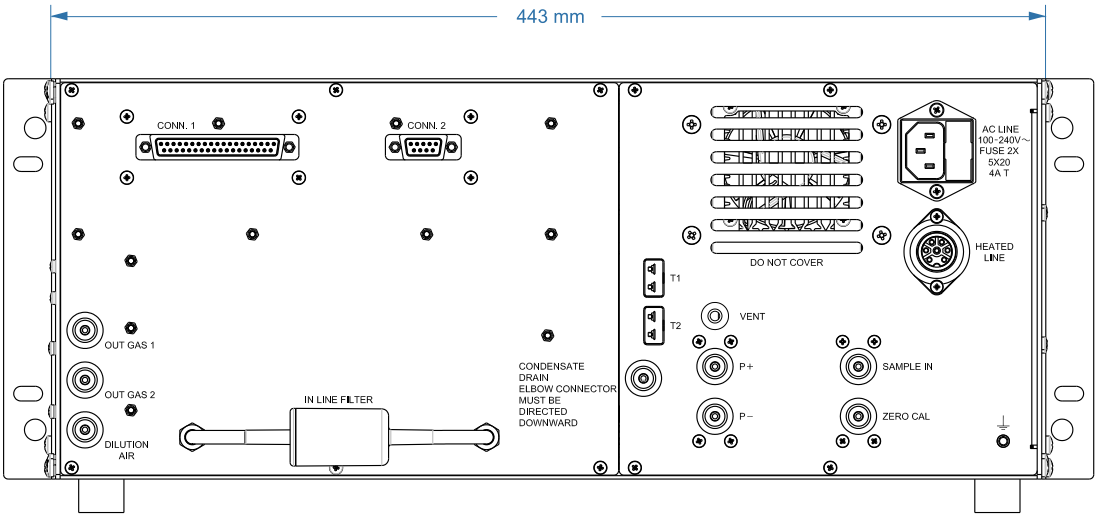
Compliant with European Standards EN 50270, EN 50379-1 and 50379-2:
See the declaration of conformity (ANNEX D).

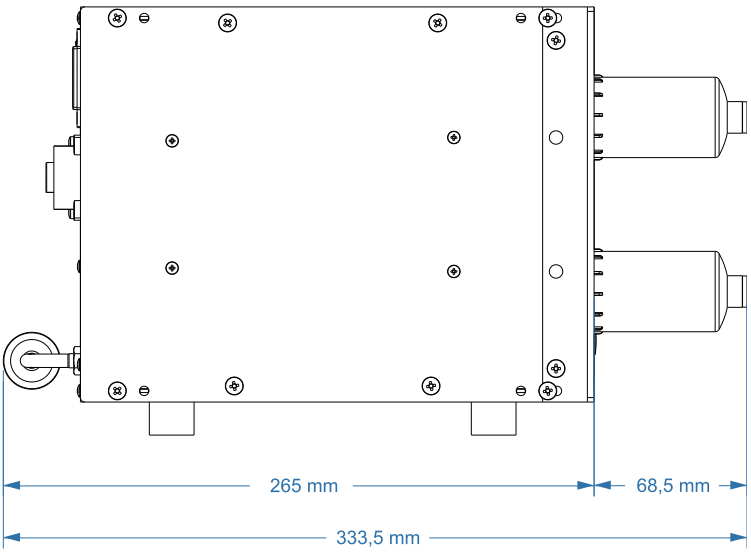
Compliant with USA standard CTM030 and CTM034.

7.2 External size

Size: RACK 19” height 4U







7.3 Measurement and Accuracy Ranges

MEASUREMENT	SENSOR	RANGE	RESOLUTION	ACCURACY
O_2	Electrochemical sensor	0 .. 25.0% vol	0.1% vol	±0.2% vol
CO with H_2 compensation	Electrochemical sensor	0 .. 8000 ppm	1 ppm	±10 ppm 0 .. 200 ppm ±5% measured value 201 .. 2000 ppm ±10% measured value 2001 .. 8000 ppm
diluted	Electrochemical sensor	10.00% vol	0.01% vol	±20% measured value
CO Low range with H_2 compensation	Electrochemical sensor	0 .. 1000 ppm	0.1 ppm	±2 ppm 0 .. 40.0 ppm ±5% measured value 40.1 .. 1000.0 ppm
diluted	Electrochemical sensor	6250 ppm	10 ppm	±20% measured value
CO Mid range	Electrochemical sensor	0 .. 20000 ppm	1 ppm	±100 ppm 0 .. 2000 ppm ±5% measured value 2001 .. 4000 ppm ±10% measured value 4001 .. 20000 ppm
diluted	Electrochemical sensor	25.00% vol	0.01% vol	±20% measured value
CO Hi range	Electrochemical sensor	0 .. 10.00% vol	0.01% vol	±0.02% vol or ±5% m.v. 0 .. 2.00 % ±5% measured value 2.01 .. 10.00 %
NO	Electrochemical sensor	0 .. 5000 ppm	1 ppm	±5 ppm 0 .. 100 ppm ±5% measured value 101 .. 5000 ppm
NO Low range	Electrochemical sensor	0 .. 500 ppm	0.1 ppm	±2 ppm 0 .. 40.0 ppm ±5% measured value 40.1 .. 500.0 ppm
NOx	Calculated			
SO_2	Electrochemical sensor	0 .. 5000 ppm	1 ppm	±5 ppm 0 .. 100 ppm ±5% measured value 101 .. 5000 ppm
SO_2 (J57-2017)	Electrochemical sensor	0 .. 1000 ppm	0,1 ppm (0..200ppm) 1 ppm (201..1000ppm)	±2 ppm 0 .. 40 ppm ±5% measured value 41 .. 1000 ppm
SO_2 Low range	Electrochemical sensor	0 .. 500 ppm	0.1 ppm	±2 ppm 0 .. 40.0 ppm ±5% measured value 40.1 .. 500.0 ppm
NO_2	Electrochemical sensor	0 .. 1000 ppm	1 ppm	±5 ppm 0 .. 100 ppm ±5% measured value 101 .. 1000 ppm
NO_2 Low range	Electrochemical sensor	0 .. 500 ppm	0.1 ppm	±2 ppm 0 .. 40.0 ppm ±5% measured value 40.1 .. 500.0 ppm
CxHy	Pellistor sensor	0 .. 5.00% vol	0.01% vol	±0.25% vol
H_2S	Electrochemical sensor	0 .. 500 ppm	0.1 ppm	±5 ppm 0 .. 100.0 ppm ±5% measured value 100.1 .. 500.0 ppm
NH_3	Electrochemical sensor	0 .. 500 ppm	0.1 ppm	±10 ppm 0 .. 100.0 ppm ±10% measured value 100.1 .. 500.0 ppm
H_2	Electrochemical sensor	0 .. 2000 ppm	1 ppm	±10 ppm 0 .. 100.0 ppm ±10 % measured value 100 .. 2000.0 ppm
CO_2	Calculated	0 .. 99.9% vol	0.1% vol	
CO_2	NDIR sensor	0 .. 20.0% vol	0.01% vol	±0.3% vol 0.00 .. 6.00 % ±5% measured value 6.1 .. 20 %
CO_2 *1	NDIR Bench	0 .. 50.0% vol	0.1% vol	±0.3% vol 0.00 .. 8.00 % ±5% measured value 8.01 .. 40.00 % ±10% measured value 40.01 .. 50.00 %
CO*1	NDIR Bench	250000 ppm (0 .. 25.0% vol)	1 ppm	±50ppm 0.00 .. 2500 ppm
			10 ppm	±3% measured value 2501 .. 100000 ppm
			10 ppm	±5% measured value 100001 .. 250000 ppm
CH4*1	NDIR Bench	0 .. 1000000 ppm (100% vol.)	1 ppm	±50 ppm 0 .. 200 ppm ±2% measured value 201 .. 50000 ppm ±3% measured value 50001 .. 1000000 ppm
CO_2 *2	NDIR Bench	0 .. 50.0% vol	0.1% vol	±0.3% vol 0.00 .. 8.00 % ±5% measured value 8.01 .. 40.00 % ±10% measured value 40.01 .. 50.00 %
CO*2	NDIR Bench	250000 ppm (0 .. 25.0% vol)	1 ppm	±50ppm 0.00 .. 2500 ppm
CO*2			10 ppm	±3% measured value 2501 .. 100000 ppm
CO*2			10 ppm	±5% measured value 100001 .. 250000 ppm
HC*2	NDIR Bench	100000 ppm (0 .. 10.0% vol)	1 ppm	±10% measured value 0 .. 300 ppm ±3% measured value 301 .. 4000 ppm ±5% measured value 4001 .. 100000 ppm

MEASUREMENT	SENSOR	RANGE	RESOLUTION	ACCURACY
Air temperature	TcK sensor	-20.0 .. 1250.0 °C	0.1 °C	±1 °C 0 .. 100 °C ±1% measured value 101 .. 1250 °C
Flue gas temperature	TcK sensor	-20.0 .. 1250.0 °C	0.1 °C	±1 °C 0 .. 100 °C ±1% measured value 101 .. 1250 °C
Pressure (draft and differential)	Piezoelectric	-10.00 .. 200.00 hPa	0.01 hPa	±1% measured value -10.00 .. -2.01 hPa ±0.02 hPa -2.00 .. +2.00 hPa ±1% measured value +2.01 .. +200.00 hPa
Differential temperature	Calculated	0 .. 1250.0 °C	0.1 °C	
Air index	Calculated	0.00 .. 9.50	0.01	
Excess air	Calculated	0 .. 850 %	1 %	
Stack loss	Calculated	0.0 .. 100.0 %	0.1 %	
Efficiency	Calculated	0.0 .. 100.0 %	0.1 %	
Efficiency (condensing)	Calculated	0.0 .. 120.0 %	0.1 %	
PI*3 (CO/CO_2 ratio)	Calculated		0.01%	

Note:

*1: The NDIR bench always measures all 3 gases CO, CO_2 and CH4.
*2: The NDIR bench always measures all 3 gases CO, CO_2 and HC.
*3: 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.

8.0 STARTUP

8.1 Preliminary operations

Remove the instrument from its packing and check it for damage. Make sure that the content corresponds to the items ordered. If signs of tampering or damage are noticed, notify the SEITRON service center or distributor immediately and keep the original packing. A label applied on the instrument carries the model and the serial number.

Both these data should always be stated when requesting technical assistance, spare parts or clarification on the product or its use.

Seitron maintains an updated database for each and every instrument.

8.2 Instrument power supply

The instrument is normally powered with mains power, in the range 100 .. 240 V~, 50 .. 60 Hz, through the featured cable with IEC C14 plug.

THE POWER SUPPLY/BATTERY CHARGER IS SWITCHING TYPE.
THE APPLICABLE INPUT VOLTAGE RANGES BETWEEN 100Vac AND 240Vac.
INPUT FREQUENCY: 50-60Hz.
LINE PROTECTION: 2 FUSES 4A T 5x20 SIZE

8.3 WARNING

WARNING!

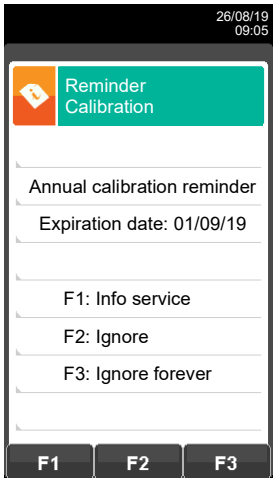
- **USE THE INSTRUMENT WITH AN AMBIENT TEMPERATURE BETWEEN -5° AND +45° C.**
- **IF THE INSTRUMENT HAS BEEN KEPT AT VERY LOW TEMPERATURES (BELOW OPERATING TEMPERATURES) WE SUGGEST WAITING AT LEAST 1 HOUR BEFORE SWITCHING IT ON, IN ORDER TO HELP THE THERMAL BALANCE OF THE SYSTEM AND TO PREVENT CONDENSATE FORMING IN THE PNEUMATIC CIRCUIT.**
- **THE BACKUP BATTERY, WHICH KEEPS THE SENSORS POLARIZED, MAY BE POWER DRAINED IF THE INSTRUMENT IS LEFT UNUSED FOR A LONG PERIOD OF TIME CAUSING THE SENSORS DEPOLARIZATION, PARTICULARLY FOR THE OXIGEN (O2) AND THE NITROGEN OXIDE (NOx) SENSORS.**
  FOR THIS REASON, WHEN USING THE INSTRUMENT FOR THE FIRST TIME AND ANYWAY AFTER A TIME OF INACTIVITY WITHOUT POWER SUPPLY EXCEEDING 3 MONTHS, IT IS NECESSARY TO POWER THE INSTRUMENT FOR 24 HOURS BEFORE PROCEEDING TO ANY MEASURE AND/OR ANALYSIS, IN ORDER TO ALLOW THE BACKUP BATTERY TO RECHARGE AND TO THE SENSORS TO POLARIZE.
  IF THIS PROCEDURE IS NOT PERFORMED, AFTER THE AUTOZERO CYCLE, THE OXIGEN SENSOR AND/OR THE NITROGEN OXIDE SENSOR COULD SHOW A CURRENT ERROR.

- After use and before turning the instrument off remove the probe and let ambient clean air through it for at least 30 seconds in order to purge the pneumatic path from all residues of gas.
- Do not use the instrument if the filters are clogged or damp.
- Before placing the measuring probe back in its case after use, make sure it 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 empty all residues.
- Remember to have the instrument checked and calibrated once a year in order to comply with the existing standards.

STARTING FROM 30 DAYS BEFORE THE ANNUAL CALIBRTATION DEADLINE, THE DISPLAY WILL SHOW A MESSAGE REMINDING THE USER TO SEND THE INSTRUMENT TO THE SERVICE CENTER.

Example:

Press and hold for a few seconds

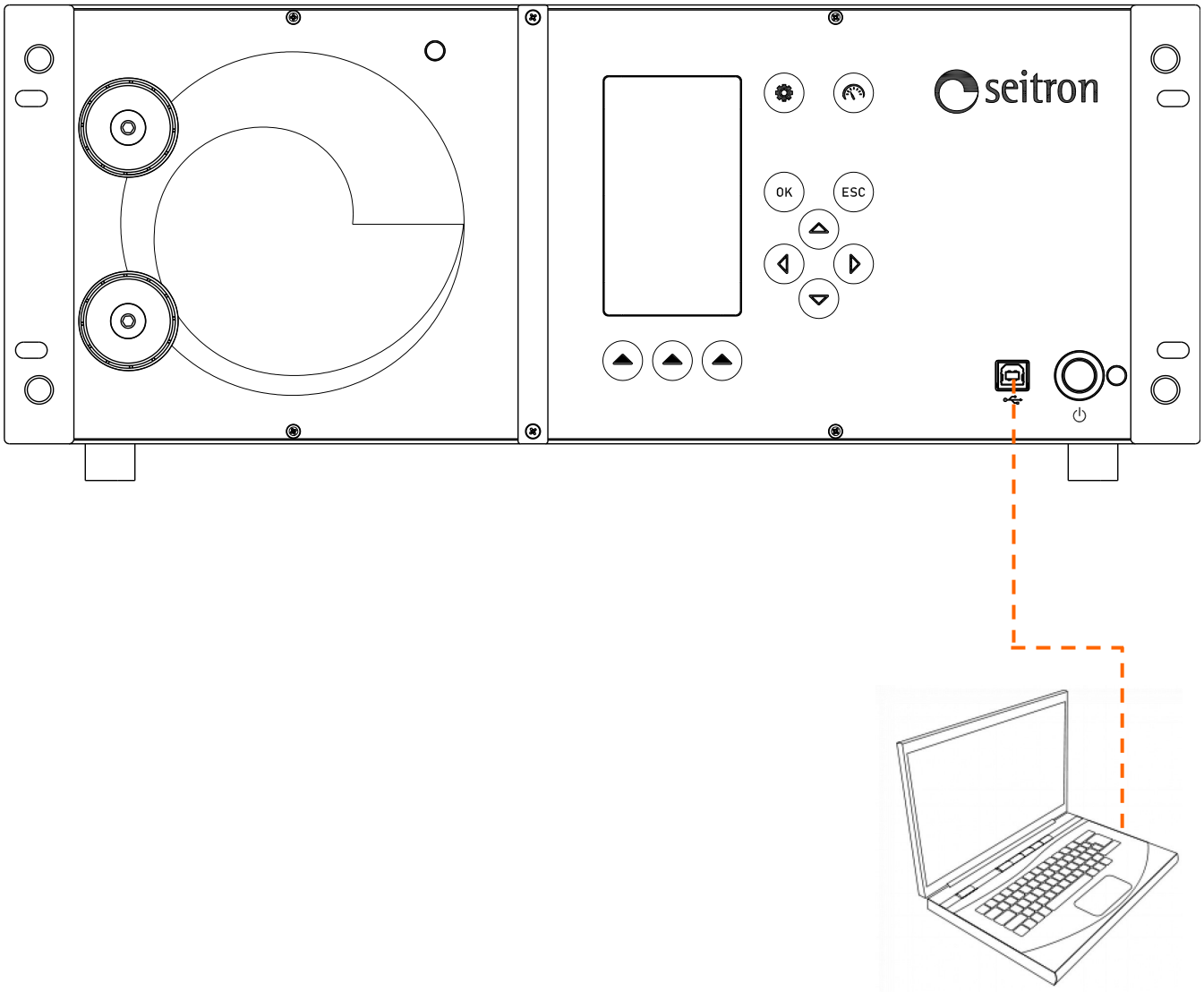


CONTEXT KEY	FUNCTION
F1	**Shows all information relevant to service center.**
F2	**Temporarily ignores the message. At next turn-on of the instrument the reminder will be shown again.**
F3	**Permanently ignores the message.**

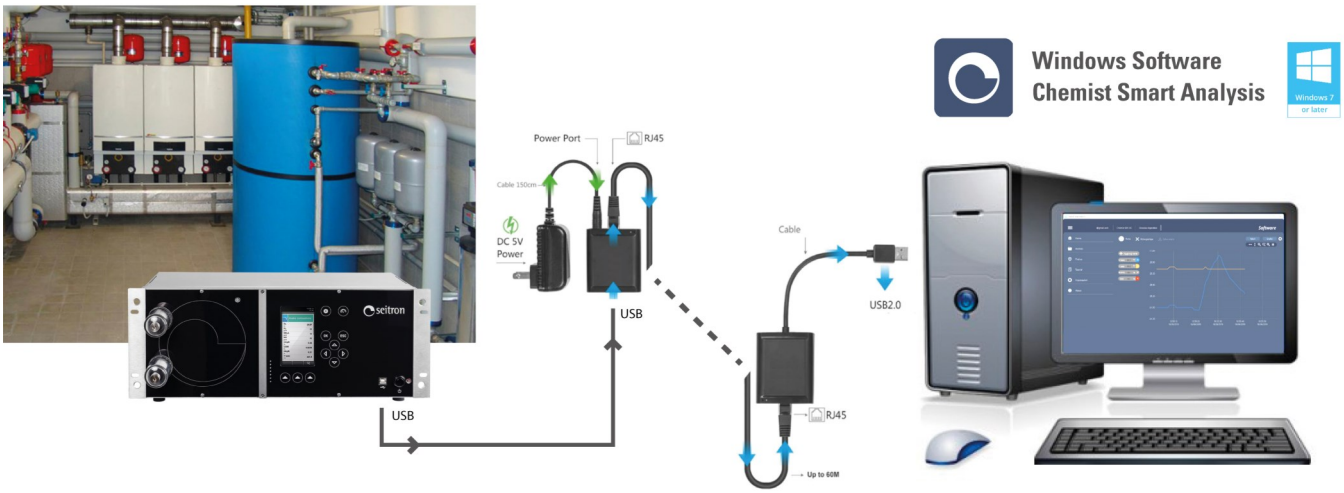
9.0 CONNECTIONS

9.1 Wiring diagram - Front cover

9.1.1 PC connection with the provided USB cable



9.1.2 PC connection with Ethernet cable

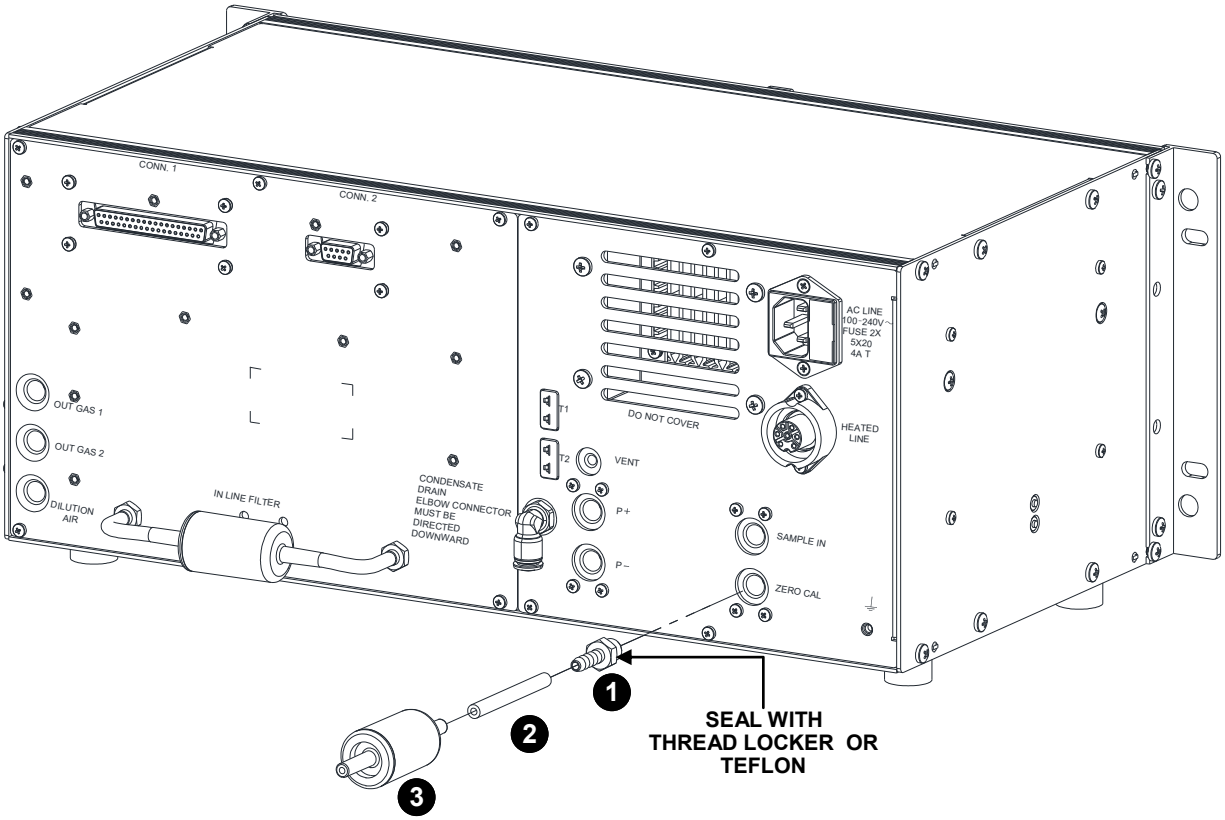


WARNING

- **IN ORDER TO SAVE, STORE ANALYSIS DATA AND MANAGE THE COMBUSTION ANALYSIS MAIN PARAMETRS CONFIGURATION, CAN ONLY HAPPEN VIA THE PC, HAVING PREVIOUSLY INSTALLED THE "CHEMIST SMART ANALYSIS" SOFTWARE PROVIDED WITH THE INSTRUMENT.**
- **IN ORDER TO CONNECT THE CHEMIST 900 RACK TO THE ETHERNET IT IS NECESSARY TO PROPERLY CONNECT TWO USB => ETHERNET CONVERTERS.**
- **ONE OF THE TWO CONVERTERS MUST BE POWERED BY AN EXTERNAL SUPPLY SOURCE, BECAUSE CHEMIST 900 RACK DOES NOT PROVIDE POWER TO THE USB PORT.**

9.2 Wiring diagram - Back Panel

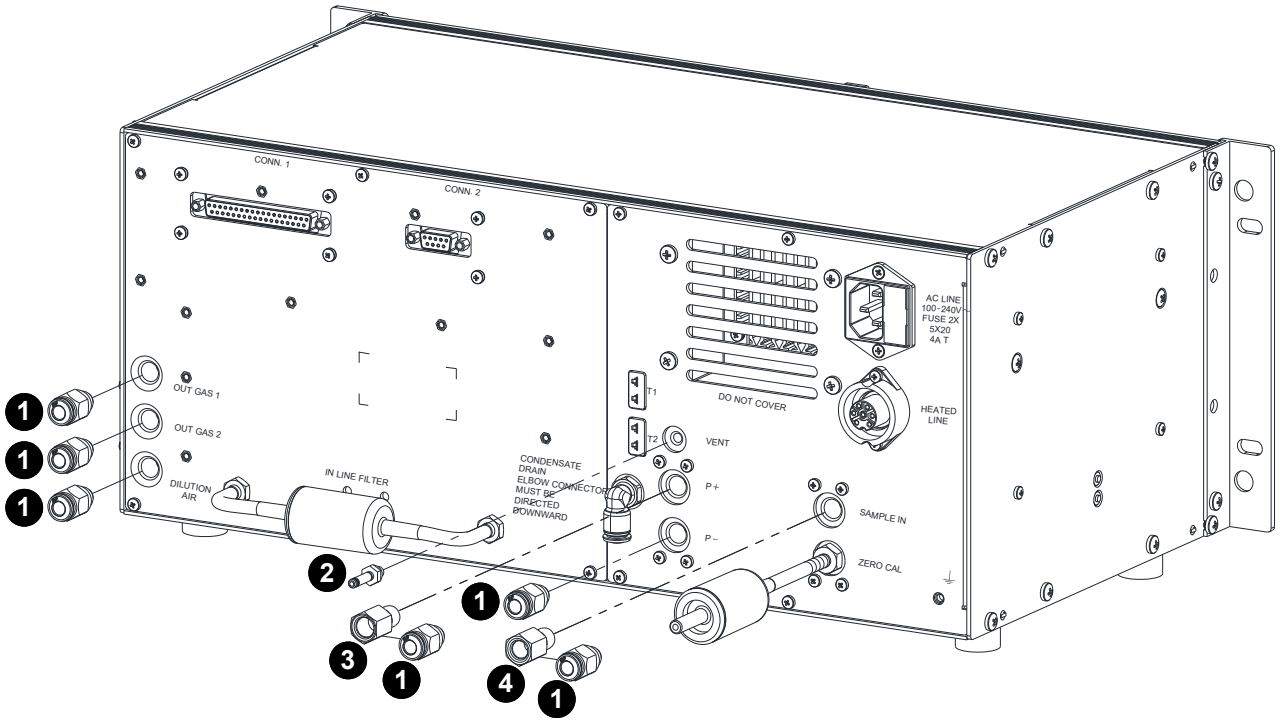
9.2.1 Remote air intake filter assembly



WARNING

- **USING THE DUST FILTER ASSEMBLY IS COMPULSORY TO GRANT THE CORRECT OPERATION OF THE INSTRUMENT.**

9.2.2 Junctions assembly - optional



1. Male junction 1/8” GAS BSPP → hose coupling Ø external 6 mm (6 pieces provided)
2. Male junction M5 → hose coupling Ø external 4 mm (1 piece provided)
3. Male junction 1/8” GAS BSPP → female Ø 9 mm (1 piece provided)
4. Male junction 1/8” GAS BSPP → female Ø 8 mm (1 piece provided)

WARNING

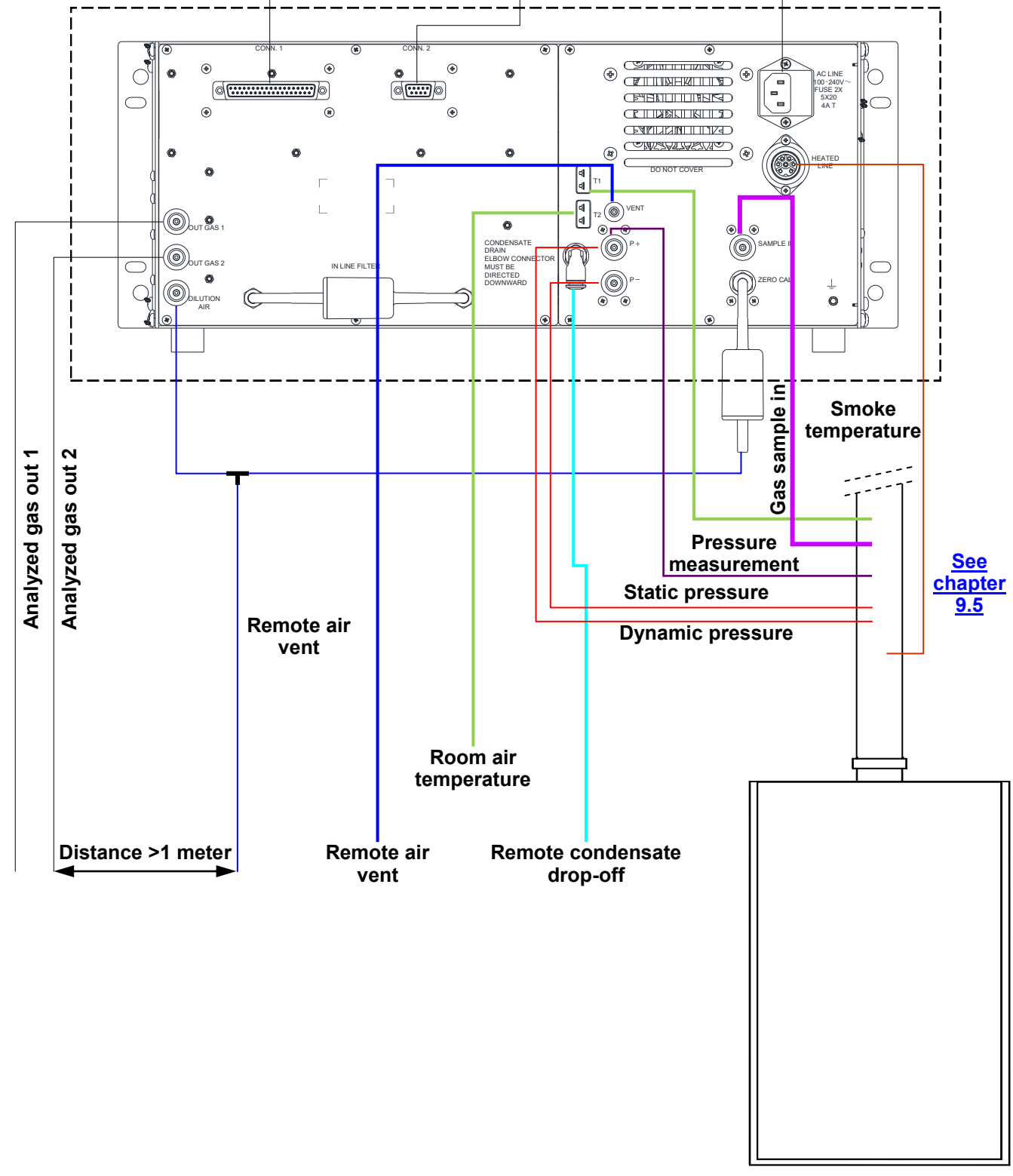
- **WHILE MOUNTING THE JUNCTIONS ON THE INSTRUMENT, SEAL THEM WITH THREAD LOCKER OR TEFLON.**

9.3 Wiring diagram - Back cover

37 poles connector (4 4..20mA outputs and 4 relay outputs)
Make available for the user 4 4..20mA outputs and 4 relay outputs with voltage free changeover contacts.

Power supply
100 .. 240V~, 50 .. 60Hz
With power supply cable and IEC C14 plug

Serial connector RS485
Serial communication port type RS485 half duplex according to MODBUS® RTU protocol



9.4 Pitot tube

By using a Pitot tube and a thermocouple type Tc-K, the instrument can also measure gas flow velocity (air/ smoke).

Connecting the Pitot tube to the instrument

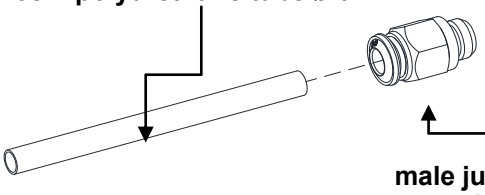
- Connect the Pitot tube (optional) to the inputs P+ and P- which are normally used for measuring the differential pressure.
- Connect the cable related to the thermocouple Tc-K of the smoke temperature probe to the instrument T1 connector.

WARNING

- **If the Pitot tube is used along with the Tc-k thermocouple, connect the related connector to input T1 of the instrument. In this case the smoke temperature probe must NOT be connected.**
- **In order to connect the two pipes it is necessary to perform the following modification:**

1. **Mount on the instrument the two provided junctions with 1/8 M thread for quick connection of the tube ø external 6 mm (to be sealed with thread locker or Teflon).**
2. **Cut two 10 cm pieces of polyurethane tube ø 6mm (provided) and connect one piece in each juction.**

10cm polyurethane tube ø 6mm

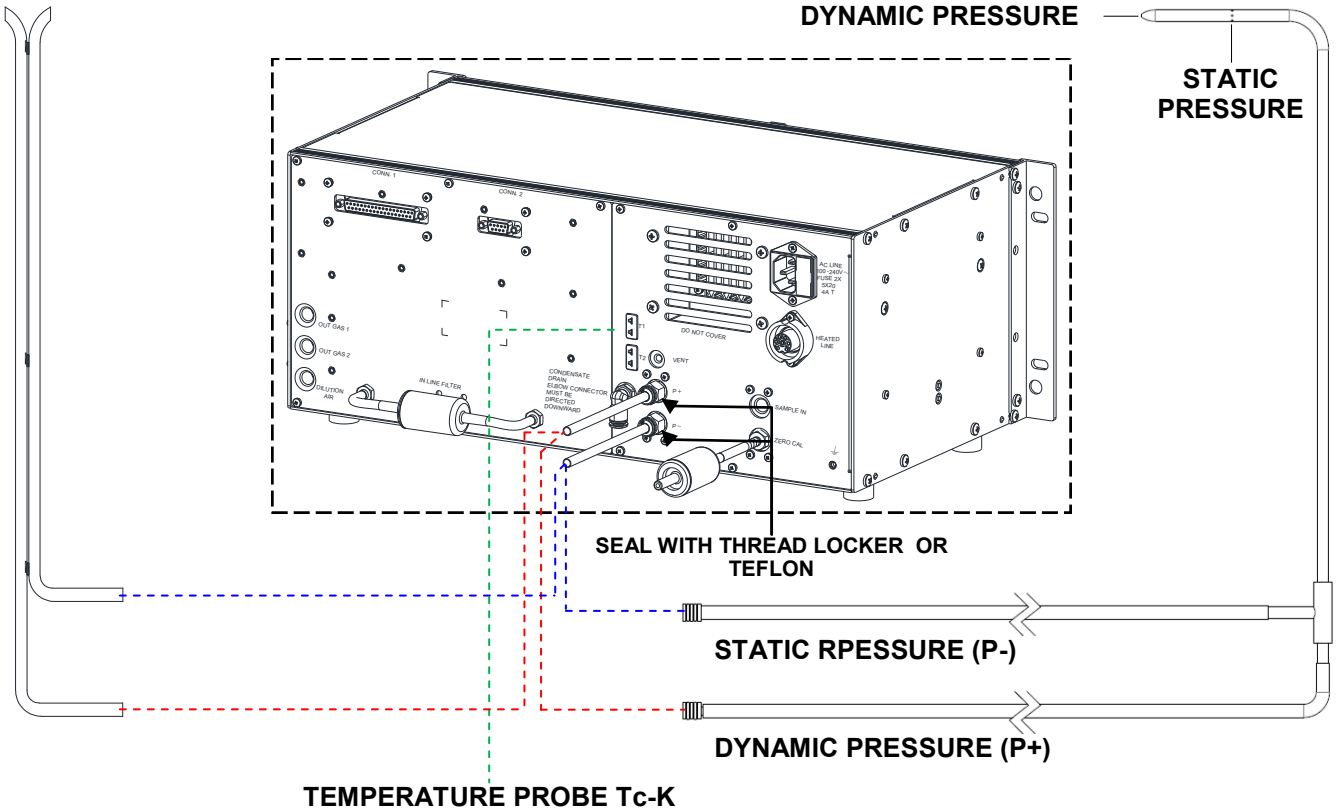


male juction 1/8 GAS BSPP → external tube connection ø 6mm

3. **Remove the quick connection junctions from the Pitot tube.**
4. **Insert on the free end of the polyurethane tube the related pipes of the Pitot tube.**

Alternatively, two male adapters must be mounted on the instrument with 1/8 GAS BSPP thread → FEMALE ø 9mm to be sealed with thread locker or Teflon.

S PITOT TUBE **L PITOT TUBE**



In order to perform the test see chapter 12.0 MEASURES.

9.5 Features of the smoke suction line

General description
The thermocouple type K (Ni-NiCr) provides stable temperature measurements at high temperature.
The instrument is internally equipped with a Pt100 thermistor, allowing to measure the internal temperature; this sensor is also used to measure the temperature of the room where the instrument is placed.
If it is needed to detect the temperature of the combustion air directly from inside the suction duct, the optional remote Tc-K sensor must be used.
It is suggested to make this measure to calculate the system efficiency if the combustion air temperature is different from the room temperature where the instrument is placed.
Two pneumatic connectors are provided with the instrument to allow the connection of the smoke probes (featured with fast connector) to the instrument.

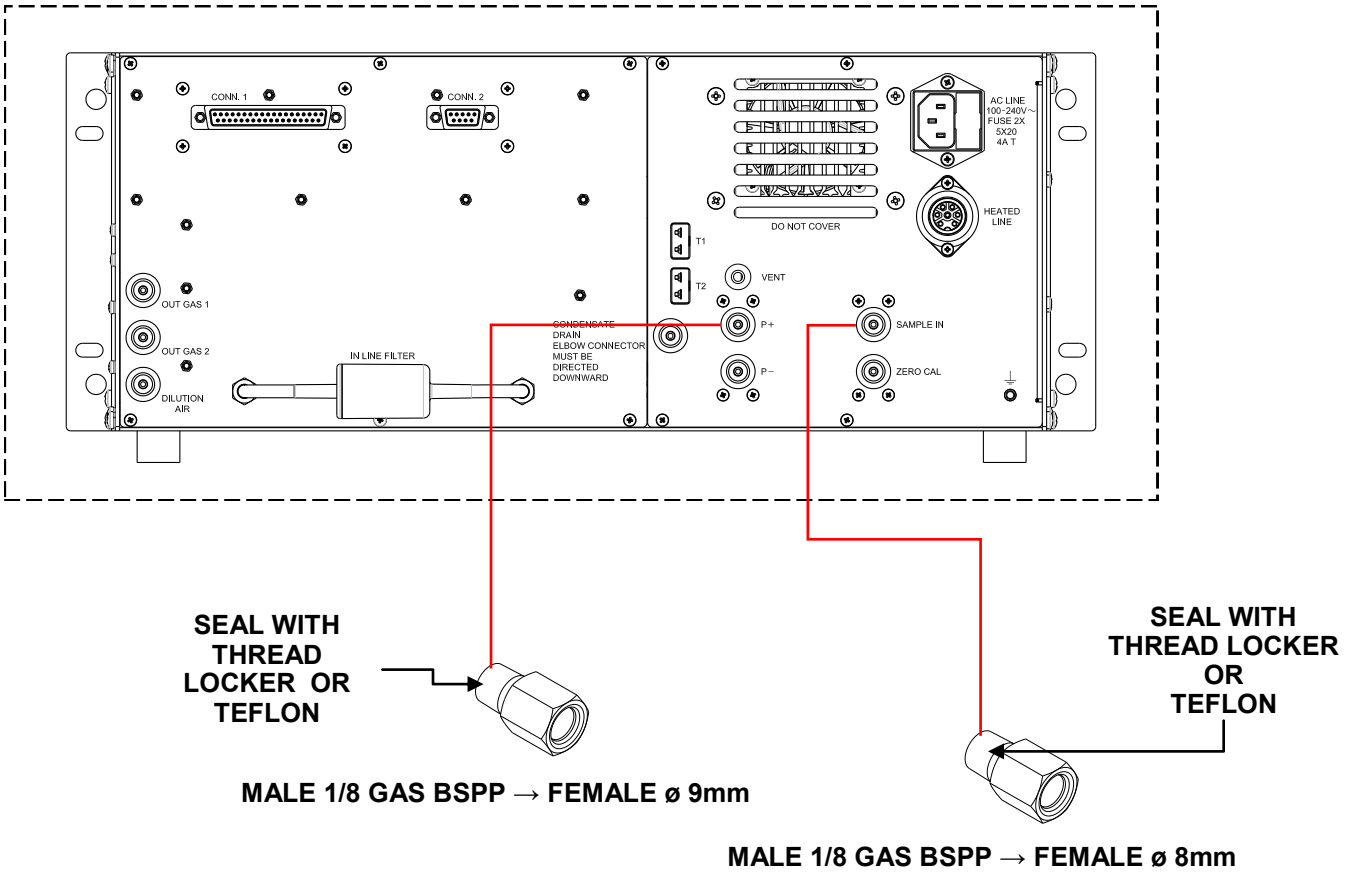
Technical features

Temperature sensor:	Thermocouple type K (Ni-NiCr) - IEC584 - class 1
Pneumatic connector:	Male 1/8 GAS BSPP
Temperature Sensor connector:	TC-K mignon
Pneumatic connectors:	Female 1/8 GAS BSPP => ø 8mm
	Female 1/8 GAS BSPP => ø 9mm

Connection
As shown in chapter 9.2, the gas sensor probe has to be connected to the instrument as follows:

- Male connector Tc-K: connect on input **T1**.
- Pneumatic male connector: connect to the instrument input marked with " **SAMPLE IN** ".
- Pneumatic male connector: connect to the instrument input marked with " **P-** ".

WARNING: **If a smoke probe equipped with fast connectors is being used, it is necessary to plug in the two provided connectors on the instrument, as shown on the image below.**



9.6 Features of the heated smoke suction line (for the measurement of NOx - SOx)

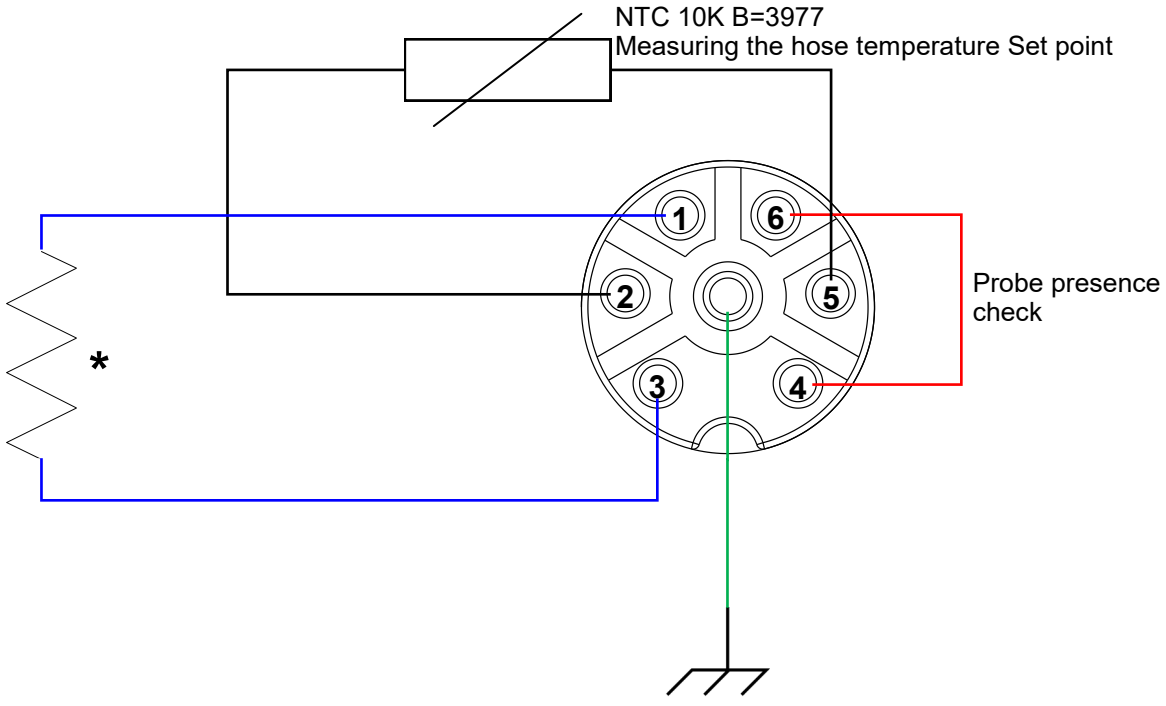
The heated line is used for application where it is needed to perform the measure of NOx/SOx for long time intervals. An heated line maintains the gas temperature above the dew point until the gas gets to the internal cooler. The Peltier cell conditioning unit dries up the sample avoiding the dilution of NO2 and SO2 in the condensation water.
The heated gas sampling line (temperature> 90°) allows to sample the gases to be analyzed and carry them into the analyzer without condensation occurring on the way in order to avoid that gases like NOx and SOx dissolve in the condensate water making them not measurable by the sensors in the measuring chamber.
The gas, kept warm by the heated line, flows in the instrument passing through an efficient Peltier module cooler which reduces very quickly the gas temperature down to 5ºC.
This quick thermal shock creates an immediate condensation of the water in a dedicated tank; the gas, now dried, is therefore carried to the measuring chamber.
The condensation water resulting from the combustion process is then expelled from the instrument through a membrane pump for liquids.

Heated line technical features:

Heated hose:

Material:		Internal measurement hose: Teflon External insulation: water-repellent Megamide
	Length:	3 m
	Bending radius:	140 mm
	Power per meter:	65 Watts
	Power supply:	From the instrument with special R24 connector, 110Vac - 230Vac automatic voltage switching
Temperature control:		NTC 10K
Temperature set-point:		Settable from 90°C to 130°C
HEATED LINE connector:		Female connector compatible with the following male connectors: BINDER 692- 6P+T pn 9902170007 AMPHENOL 6P+T pn C016-30H06-100-12

WARNING
For higher loads it is necessary to use the command of the tube to power a relay or a power SCR, by using the terminals 1 and 3 of the connector to command the relay or the SCR. The command has a voltage of 110 V.
To the “HEATED LINE” connector, it is possible to attach an electrically heated hose.
Follow the diagram below:



*: Heater 110V 195W for 3 meters of hose (65W / m).
It is possible to power up to 500W corresponding to 8 meters of hose.

9.7 Combustion air temperature probe

This probe is used to measure the combustion air temperature, if the pick up point of the latter is in a different area in relation to where the instrument is installed.

Technical features

Temperature sensor: Sensor element: Thermocouple type K (Ni-NiCr) - IEC584 - class 1

Connector: TC-K mignon

Working range: -20.0°C .. +1250.0°C

If the probe is not connected to the instrument, the considered combustion air temperature is the temperature detected by the instrument internal sensor, so the temperature is the one of the room in which the instrument is installed.

Connection:

As shown in chapter 9.2 the probe has to be connected to the instrument as follows:

- The polarized male connector of the thermocouple has to be connected to the **T2** input. The improper insertion of the same is not possible thanks to the different length of the tips.

9.8 Draft measurement

The draft measurement has to be performed using the negative pressure input P-.

If the value of the measurement is negative, it means that the smoke outlet has a negative pressure, while on the contrary if the value is positive the smoke outlet has a positive pressure.

9.9 Remote air suction spots

Use the inputs 'DILUTION AIR' and/or 'ZERO CAL' to move the pick up point for the clean air, in an area free from pollute gases or from the outlet of the instrument itself.

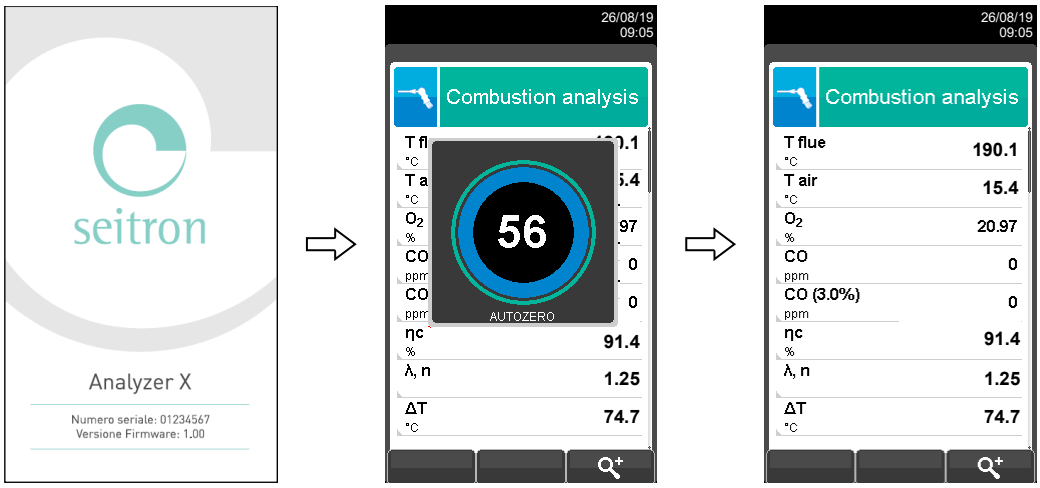
Connection

- The connectors to be used are: Male 1/8 GAS BSPP

10.0 POWER ON - OFF

10.1 Starting the device

As soon as it is powered the Instrument DOES NOT turn on automatically



During autozero, it is possible to use only the menus that do not require autozero.

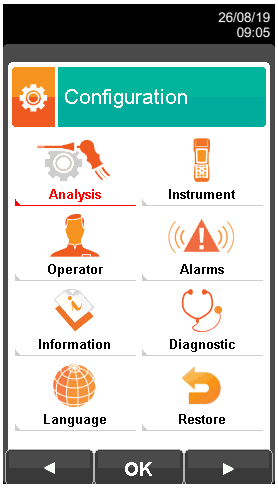
This error message is displayed if the autozero of the device is not successfully completed.

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**Goes through the measurements available.**
OK	**Activates the context key located in the left side of the display.**
ESC	**Returns to the previous screen.**
⏻	**By keeping this button pressed for a few seconds, it turns ON or OFF the analyzer.**

CONTEXT KEY	FUNCTION
F1	**Repeats autozero (is shown in the case of an error).**
F2	**The device will suspend autozero and display the screen "Combustion Analysis"; it is possible to carry out the emission analysis (displayed in case of error).**
F3	**The device displays the screen "Sensor Diagnostics" (displayed in the case of an error).**
🔍+	**Zoom. By pressing this interactive key repeatedly, the device displays the following sequence:** AAA → AAA → AAA → AAA

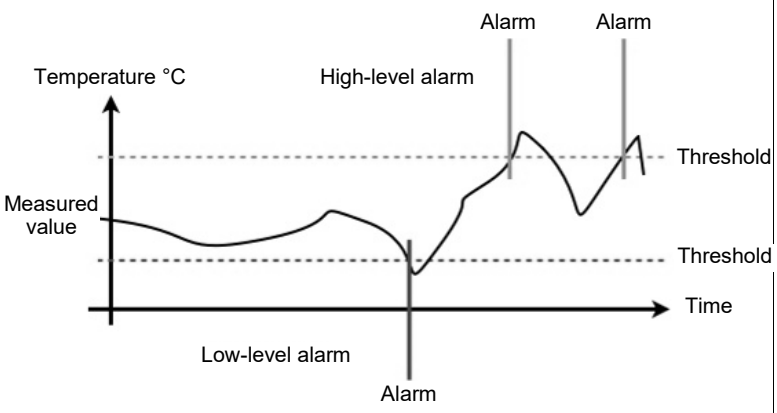
11.0 CONFIGURATION

11.1 Configuration menu

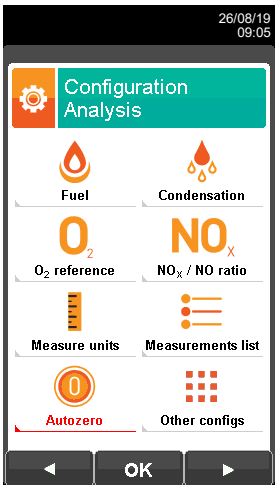


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Selects the available parameters.**
OK	**Enters in the selected parameter setting.**
►	**Selects the available parameters.**

PARAMETER	DESCRIPTION
Analysis	Through this menu the user can configure the available parameters for a proper combustion analysis. SEE SECTION 11.2.
Instrument	This menu is used to configure the instrument's reference parameters. SEE SECTION 11.3.
Operator	In this sub menu you can enter or change the name of the operator that will carry out the analysis. Up to 8 lines are available. Also, you can select the name of the operator that will carry out the analysis and this will be printed on the analysis report. SEE SECTION 11.4.
Alarms	This submenu allows the user to set and memorize 10 alarms, defining the monitored parameter for each (gas, pressure, Ta, Tf), the alarm threshold and relevant measurement unit and whether it is a low or high-level alarm. The first four alarms are featured with a special relay output (e.g. Alarm 1 => Relay output 1). Low-level alarms are triggered when the reading drops below the defined threshold, whereas high-level alarms are triggered when the reading rises above the defined threshold. SEE SECTION 11.5. 
Information	This menu provides information regarding instrument status. SEE SECTION 11.6.
Diagnostic	The user, with this menu, can check any anomalies of the device. SEE SECTION 11.7.
Language	Set the desired language for the various menus and the test paper print-out. SEE SECTION 11.14.
Restore	Restore factory settings. SEE SECTION 11.15.

11.2 Configuration→Analysis



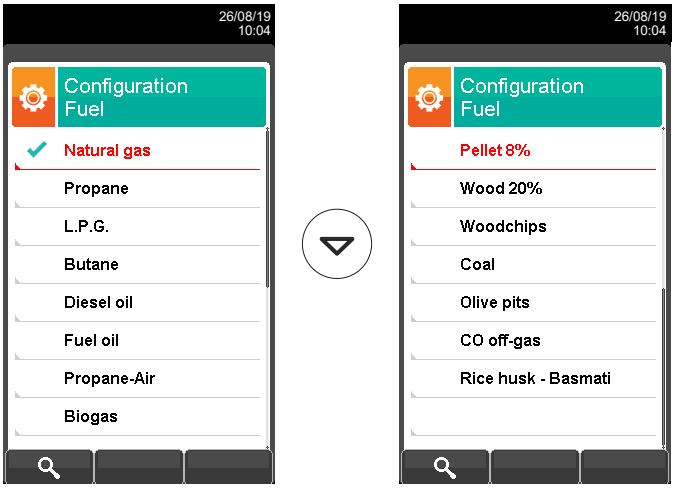
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Selects the available parameters.**
OK	**Enters in the selected parameter setting.**
►	**Selects the available parameters.**

PARAMETER	DESCRIPTION
Fuel	Lets the user select the type of fuel to be used during analysis. Fuel selection can be done either from this menu or during the analysis itself. By selecting the sub menu **Fuel coefficients** the user can view the characteristics of the fuels used in the calculation of performance. SEE SECTION 11.2.1.
Condensation	The burner efficiency figure when condensation takes place is influenced by atmospheric pressure and humidity of the combustion air. As the atmospheric pressure is hardly precisely known, the operator is asked to enter a related parameter, i.e. the altitude of the place above the sea level, from which the pressure is then derived once the dependency from atmospheric conditions is neglected. In calculations the value of 101325 Pa is assumed as atmospheric pressure at sea level. Further the air relative humidity input is allowed, being this calculated at the combustion air temperature as measured from the instrument; in case this value is unknown the operator is recommended to enter 50% for this value. SEE SECTION 11.2.2.
O_2 reference	In this mode the user can set the oxygen percentage level to which pollutant emission values detected during analysis will be referenced. SEE SECTION 11.2.3.
NO_x/NO ratio	NOx/NO: all the nitrogen oxides which are present in the flue emissions (Nitrogen oxide = NO, Nitrogen dioxide = NO_2); total nitrogen oxides = NOx (NO + NO_2). In the combustion processes, it is found out that the NO_2 percentage contained in the gas is not far from very low values (3% or above); hence it is possible to obtain the NOx value by a simple calculation without using a direct measurement with a further NO_2 sensor. The NO_2 percentage value contained in the gas can be however set at a value other than 3% (default value). This menu is only available when the NO_2 sensor is not installed. VEDERE CAPITOLO 11.2.4.

PARAMETER	DESCRIPTION
Measure units	Through this submenu the user can modify the measurement units for all the analysis parameters, depending on how they are used. SEE SECTION 11.2.5.
Measures list	In this sub menu the user can see the list of measurements that the device can perform. With the interactive keys, the user can add, delete or move a selected measurement. SEE SECTION 11.2.6.
Autozero	In this sub menu it is possible to modify the length of the autozero cycle, set the time related to the automatic cleaning cycle of the pneumatic circuit and configure the automatic autozero mode . SEE SECTION 11.2.7.
Other configs	In this sub menu it is possible to set the part related to the sample treatment and the section of the pick up point of the sample to be analyzed. SEE SECTION 11.2.8.

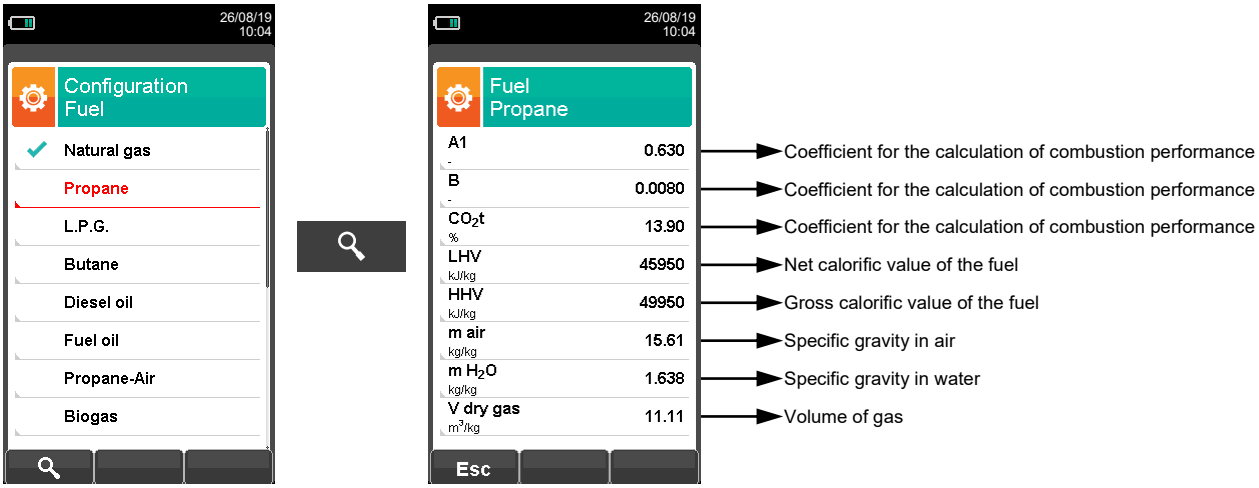
11.2.1 Configuration→Analysis→Fuel



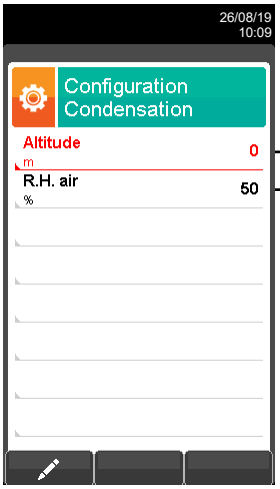
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**The arrows select each line displayed.**
OK	**Confirms the choice of fuel to be used during the analysis.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
🔍	**Shows the details of the selected fuel (see example below).**
Esc	**Returns to the previous screen.**

Example:



11.2.2 Configuration→Analysis→Condensation



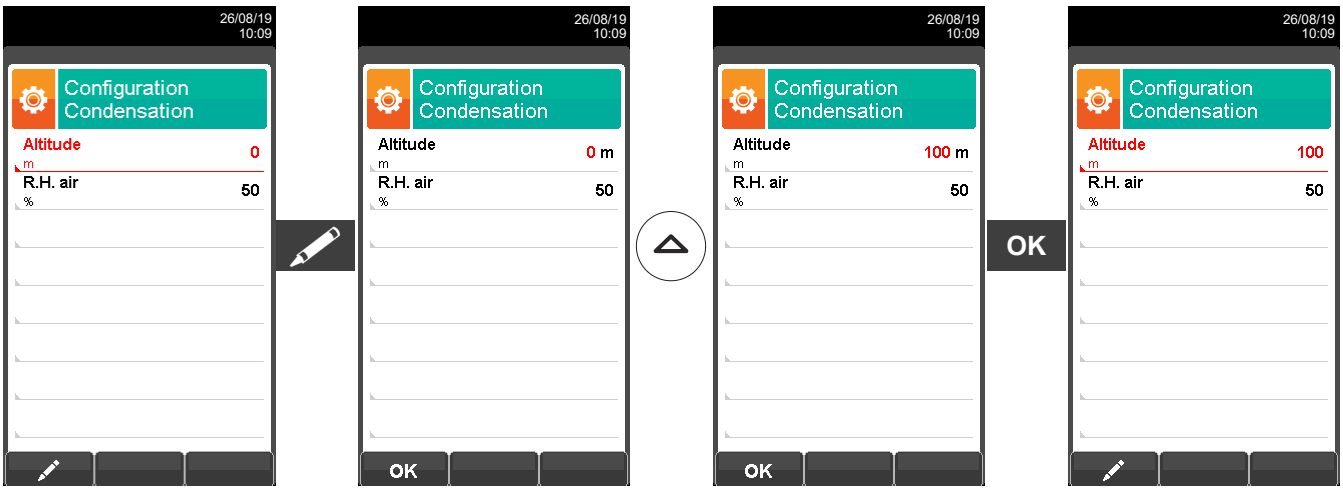
→ Altitude above sea level

→ Relative humidity of air

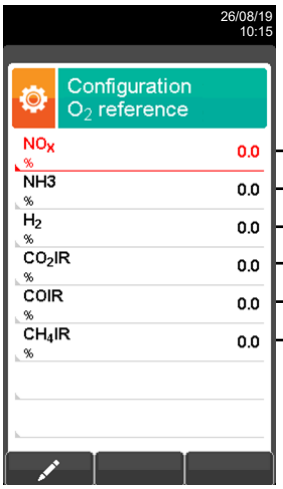
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**The arrows select each line displayed (the selected line is red).** **In edit mode, it scrolls through the suggested values.**
OK	**Enters the modify mode for the selected parameter, then confirms the modification.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters the modification mode for the selected parameter.**
OK	**Confirms the modification.**

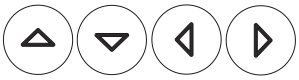
Example:



11.2.3 Configuration→Analysis→Reference O_2

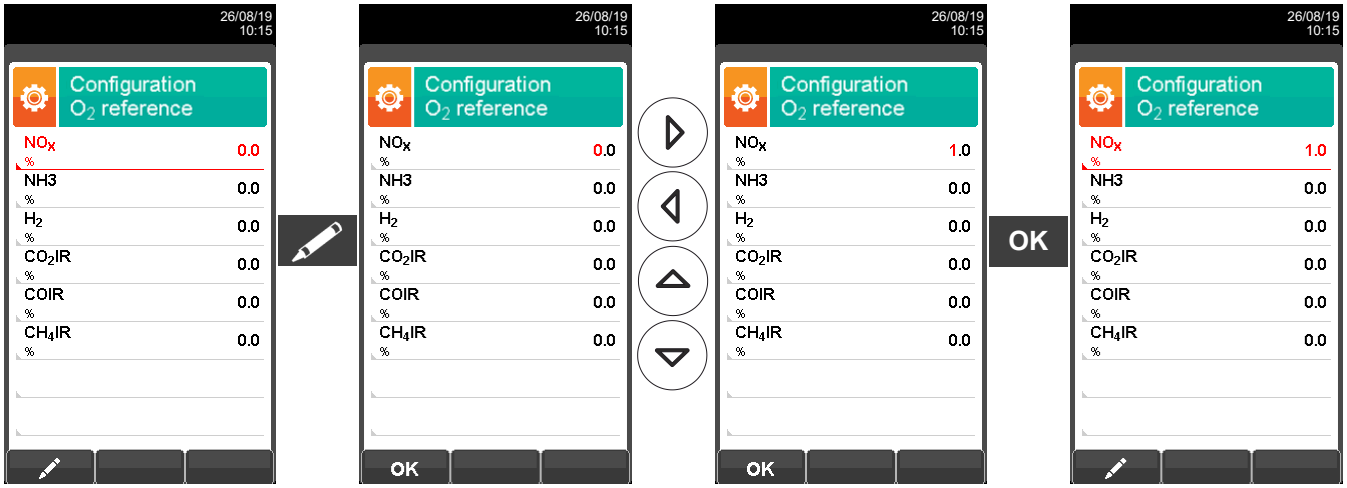


→ Oxygen rate on NO_X measurement
→ Oxygen rate on NH_3 measurement
→ Oxygen rate on H_2 measurement
→ Oxygen rate on CO_2 measurement
→ Oxygen rate on CO measurement
→ Oxygen rate on CH_4 measurement

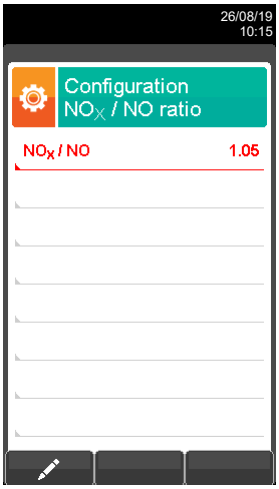
KEY	FUNCTION
	Activate the context keys shown on the display.
	**Keys '▲' and '▼' select any line shown on the display (the selected line is displayed in red).** **When in modify mode, sets the desired value.**
OK	**Enters the modify mode for the selected parameter, then confirms the modification.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

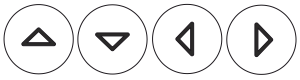
CONTEXT KEY	FUNCTION
	Enters the modify menu for the selected parameter.
OK	**Confirms the modification.**

Example:



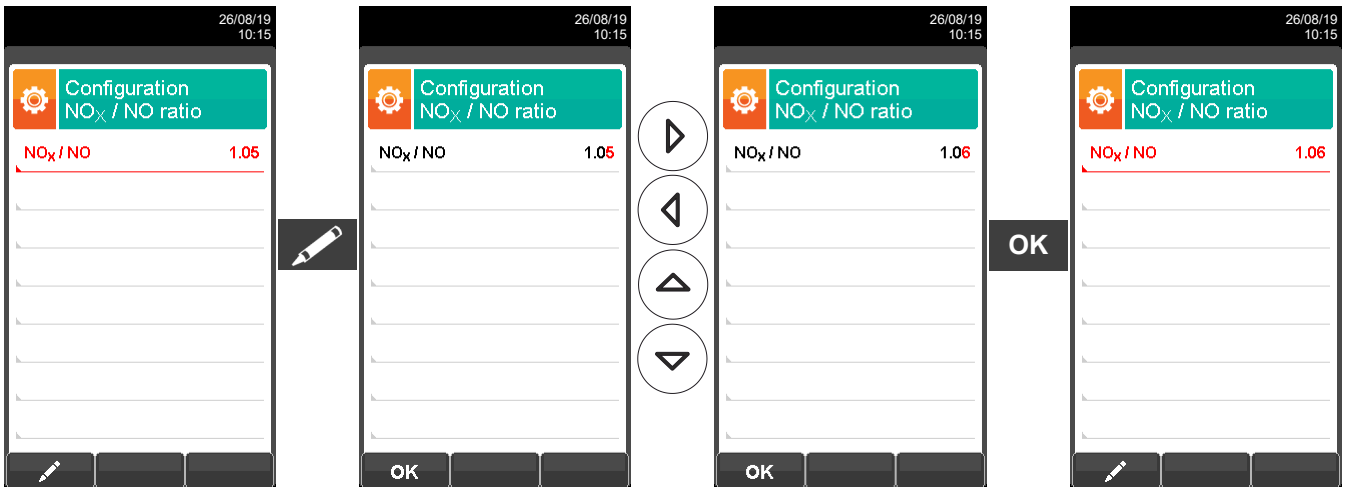
11.2.4 Configuration→Analysis→NO_X/NO ratio



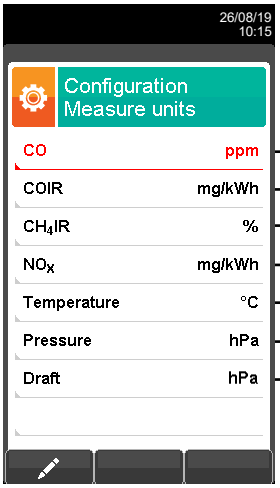
KEY	FUNCTION
	Activate the context keys shown on the display.
	**When in modify mode, sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
	Enters edit mode.
OK	**Confirms the modification.**

Example:



11.2.5 Configuration→Analysis→Measurement units



Measurement unit can be set as: ppm - mg/m^3 - mg/kWh - g/GJ - g/m^3 - g/kWh - % - ng/J

Measurement unit can be set as: ppm - mg/m^3 - mg/kWh - g/GJ - g/m^3 - g/kWh - % - ng/J

Measurement unit can be set as: ppm - mg/m^3 - mg/kWh - g/GJ - g/m^3 - g/kWh - % - ng/J

Measurement unit can be set as: ppm - mg/m^3 - mg/kWh - g/GJ - g/m^3 - g/kWh - % - ng/J

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

Measurement unit can be set as: hPa - Pa - mbar - mmH_2O - mmHg - inH_2O - psi

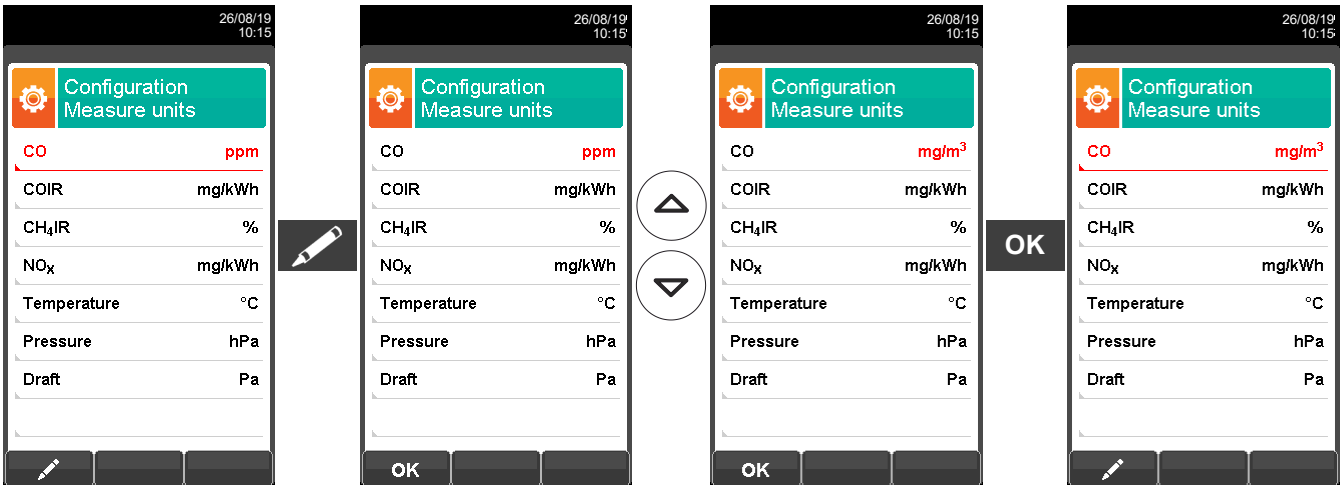
Measurement unit can be set as: hPa - Pa - mbar - mmH_2O - mmHg - inH_2O - psi

The measurement units mg/m^3 and g/m^3 are referred to Normal pressure and temperature conditions, P = 101325 Pa and T = 0 °C.

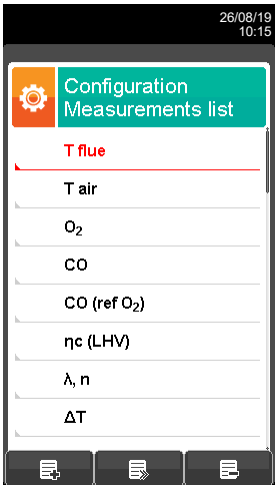
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼	**Keys '▲' and '▼' select any line shown on the display (the selected line is displayed in red).** **When in modify mode, sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters the modification mode for the selected parameter.**
OK	**Confirms the modification.**

Example:



11.2.6 Configuration→Analysis→Measures list



FOR FURTHER DETAILS SEE THE ANNEX C

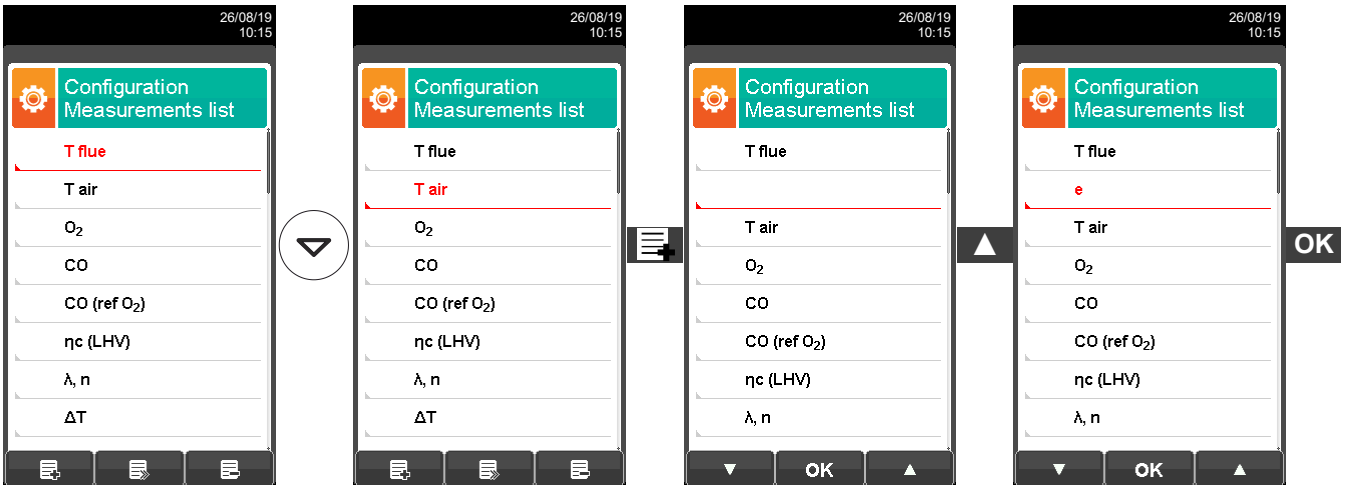
KEY	FUNCTION
▲ ▲ ▲	Activate the context keys shown on the display.
△ ▽	Select each line displayed (the line selected is red). In edit mode, it sets the desired value.
ESC	When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.

CONTEXT KEY	FUNCTION
	Adds a line to the list of available measurements.
	Activates the movement of a measurement from its current position.
	Deletes a measurement from the list of available measurements.
▼ ▲	After the activation of the function ' '. It scrolls through the available measurements. After the activation of the function ' '. It moves the element from its current position.
OK	Confirms the operation.
Esc	Cancels the operation.

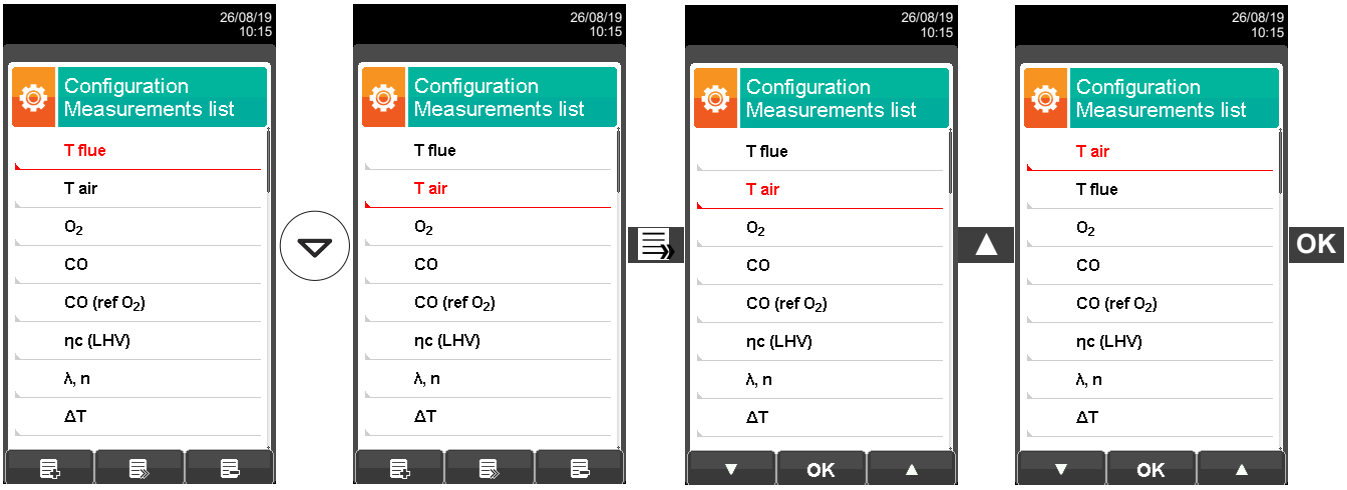
OTHER THAN THE MEASUREMENT LIST ABOVE, IT IS POSSIBLE TO VISUALIZE THE MEASURE OF THE DETECTED GAS ALSO IN PPM, DEPENDING ON THE KIND OF MEASUREMENT CELL IN THE INSTRUMENT. IF IT IS NECESSARY TO MEASURE THE VALUE OF GAS WITH TWO DIFFERENT MEASUREMENT UNITS, SELECT IN THE MEASUREMENTS LIST THE DESIRED 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).

Example:

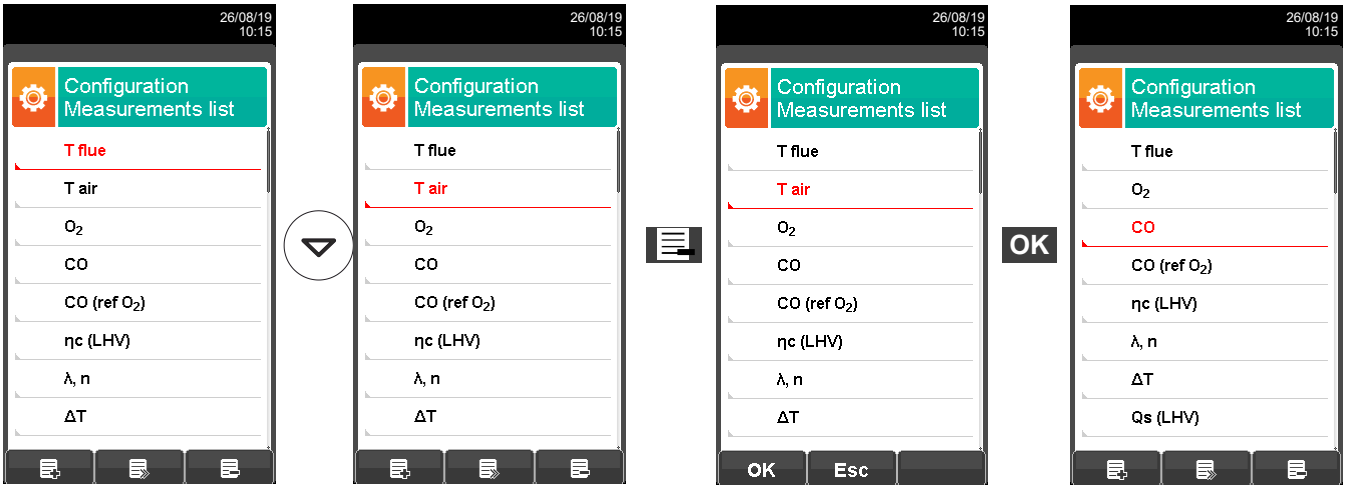
1. Add a measurement to the list - example



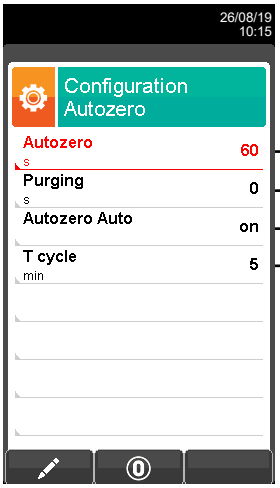
2. Change the position of a measurement - example



3. Delete a measurement from the list - example



11.2.7 Configuration→Analysis→Autozero



→ Duration of autozero, expressed in seconds.

→ Duration of the cleaning cycle, expressed in seconds.

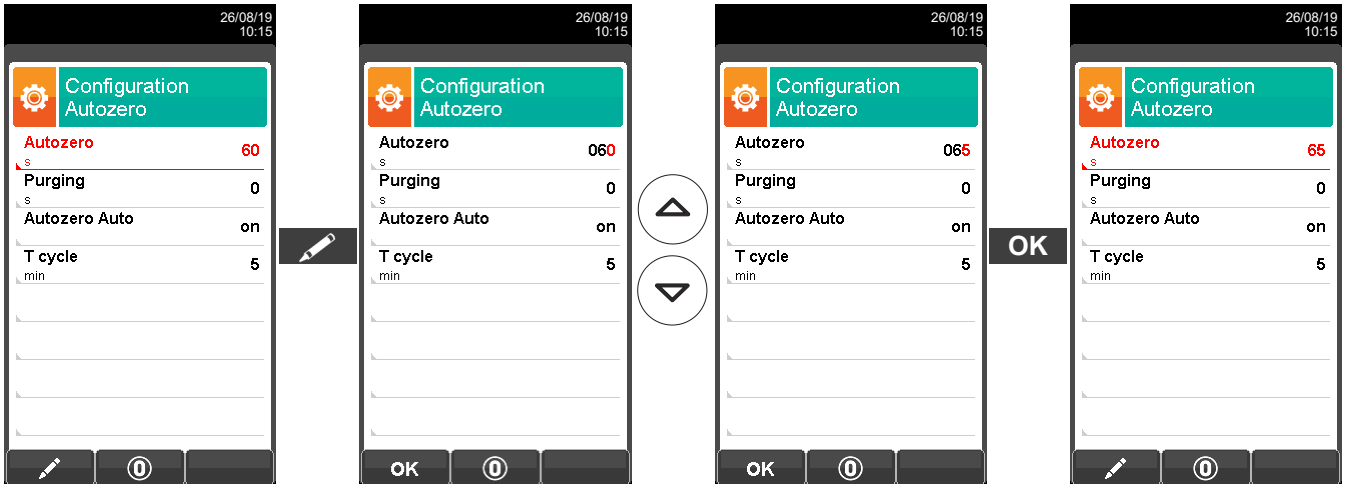
→ Turns On / Off the automatic autozero of the instrument.

→ Setting of the time interval between an autozero and the next, expressed in minutes:
0 .. 1440 min.
This parameter is only visible if the option “Autozero Auto” is set to “On”.

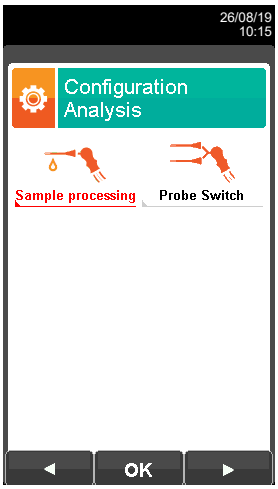
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼ ◀ ▶	**The arrows '▲' and '▼' select each line displayed (the selected line is highlighted in red).** **When in modify mode, sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters the modify menu for the selected parameter.**
OK	**Confirms the modification.**
⏻	**Starts autozero for the selected duration.**

Example:



11.2.8 Configuration→Analysis→Other configs

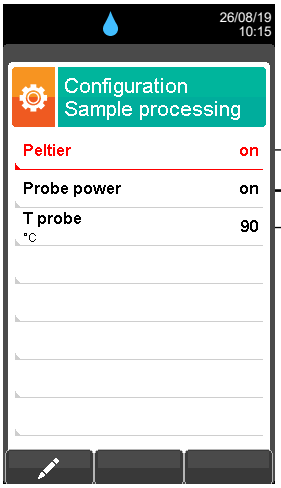


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Selects the available parameters.**
OK	**Enters the selected parameter.**
►	**Selects the available parameters.**

PARAMETER	DESCRIPTION
Sample processing	In this parameter it is possible to activate/deactivate the cooler. Furthermore, it is possible to set the temperature of the heated hose. **The activation of the Cooler is shown on the display with the icon " ".** SEE SECTION 11.2.9.
Probe switch	This parameter has to be set if it is needed to analyze the smoke from two different spots, using two smoke suction lines which are controlled by the relay outputs 3 and 4. Relay number 3 controls the smoke suction line called "**L1**", while relay number 4 controls the smoke suction line called "**L2**". If it is not needed, leave the parameter set to off. SEE SECTION 11.2.10.

11.2.9 Configuration→Analysis→Sample processing



Available settings: on (Cooler is switched on) or off (Cooler is switched off).

Available settings: on (Heated Tube switched on) or off (Heated Tube switched off).

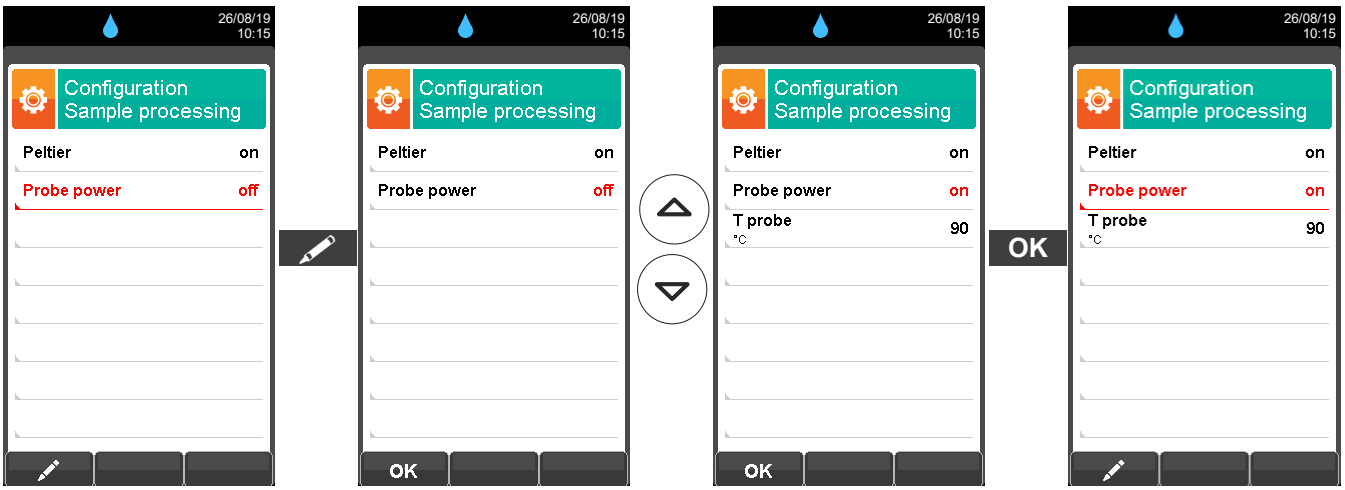
Heated tube temperature: 90°C .. 130°C.

WARNING
The activation of the Cooler system is indicated on the display with the icon "💧"

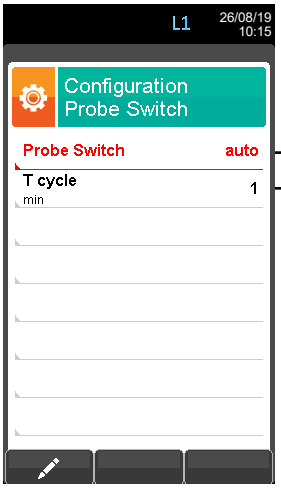
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼ ◀ ▶	**The arrows '▲' and '▼' select each line displayed (the selected line is highlighted in red).** **When in modify mode, sets the desired value.**
OK	**Enters the modify mode, then confirms the modification.**
ESC	**When pressed in modify mode, it cancels the selection made or returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters the modification mode for the selected parameter.**
OK	**Confirms the modification.**

Example:



11.2.10 Configuration→Analysis→Probe Switch



Available options:

off (standard mode, the smoke is taken from one point only)
L1 (the smoke is taken from line 1 driven by relay number 3)
L2 (the smoke is taken from line 2 driven by relay number 4)
auto (smoke is drawn in automatic mode, meaning that the instrument automatically switches between line L1 and L2 alternately, in cyclical mode, staying on each line for the time defined in T cycle).

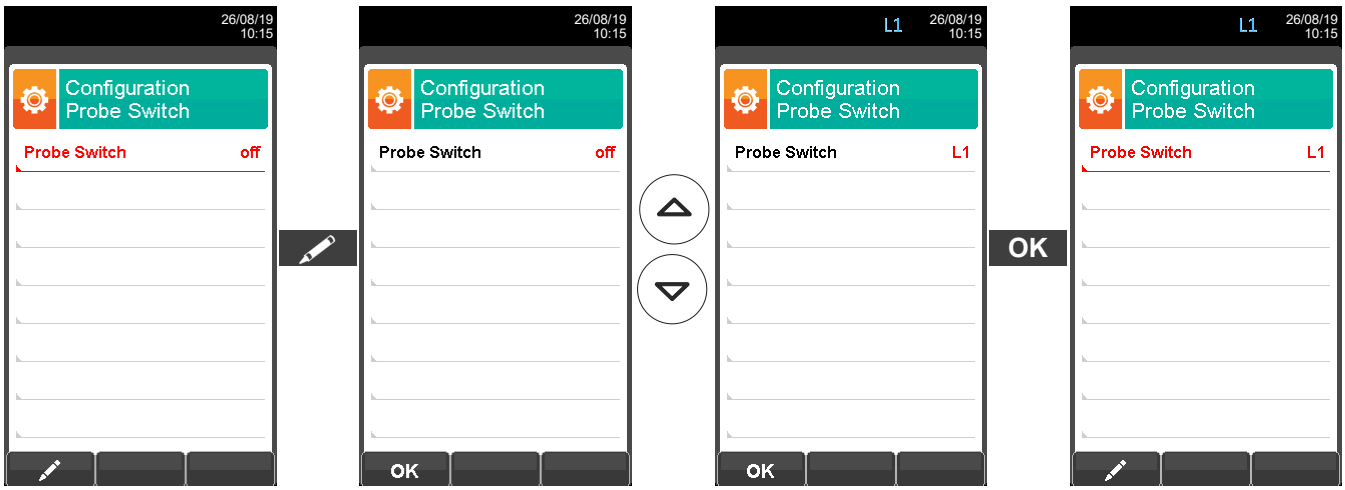
Expressed in minutes, it is the time that the instrument operates on each sampling line.

WARNING!
The data "T cycle" is visible only if the parameter "Probe Switch" is set to auto.

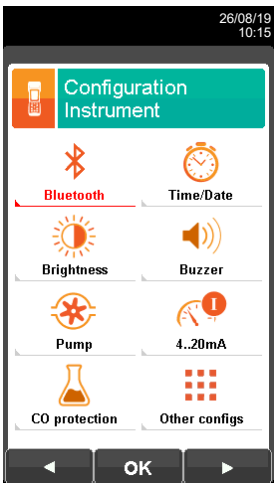
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼ ◀ ▶	**The arrows '▲' and '▼' select each line displayed (the selected line is highlighted in red).** **When in modify mode, sets the desired value.**
OK	**Enters the modify mode, then confirms the modification.**
ESC	**When pressed in modify mode, it cancels the selection made or returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters the modification mode for the selected parameter.**
OK	**Confirms the modification.**

Example:



11.3 Configuration→Instrument

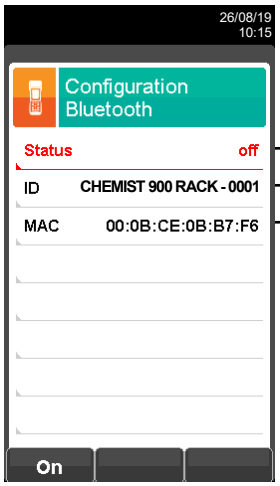


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Selects the available parameters.**
OK	**Enters in the selected parameter setting.**
►	**Selects the available parameters.**

PARAMETER	DESCRIPTION
Bluetooth	Through this sub menu the user can turn on and off the instrument Bluetooth® wireless communication with a PC or PDA. **SEE SECTION 11.3.1.**
Time/Date	This allows the current time and date to be set. The user can select the date and hour format either in EU (European) or USA (American) mode. **SEE SECTION 11.3.2.**
Brightness	The display brightness may be increased or decreased by acting on cursor keys. This operation may be performed even when the introductory screen is active. **SEE SECTION 11.3.3.**
Buzzer	The instrument is fitted with an internal buzzer which is mainly used to signal any faults and/or alarms. In this submenu you can enable or disable the buzzer or enable it and mute the key tones. **SEE SECTION 11.3.4.**
Pump	In this submenu it is possible turn on/off the smoke suction pump. Moreover, if the pump is on, the gas flow of the pump measured in liters per minute will be visible. It is not possible to turn off the pump while the autozero cycle is being performed. **SEE SECTION 11.3.5.**
4..20mA	The instrument features four 4..20mA output channels. In this submenu it is possible to associate to each channel one measure among the ones that the instrument is able to provide, aiming to translate a measure in a current value available as an output. Moreover, it is possible to adjust the measurement field and by doing so, heighten the output resolution. **SEE SECTION 11.3.6.**
CO protection	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 either be 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 at all times, independently of CO concentration. **The activation of the dilution pump is shown on the display by the icon " ".** **THE MAIN PURPOSE CO AUTO-DILUTION FEATURE IS FOR PROTECTION OF THE CO SENSOR AGAINST OVER-SATURATION. THE ACCURACY AND RESOLUTION OF THE CO MEASUREMENT IS NOT AS GREAT WHEN THIS FEATURE IS ENABLED.** **SEE SECTION 11.3.7.**
Other configs	In this submenu it is possible to configure the settings about NDIR bench and the MODBUS® module. **SEE SECTION 11.3.8.**

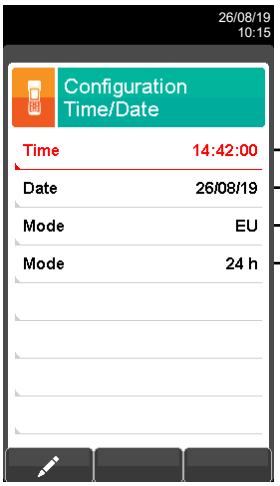
11.3.1 Configuration→Instrument→Bluetooth®



KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
OK	**Also activates the context key shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
on	**Turns on Bluetooth® communication.**
off	**Turns off Bluetooth® communication.**

11.3.2 Configuration→Instrument→Time/Date

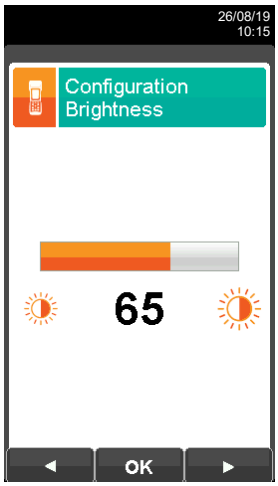


→ Time, in the chosen format
→ Date, in the chosen format
→ Date format: EU (Europe) or USA (America)
→ Time format: 24h or 12h

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽ ◁ ▷	**The arrows '▲' and '▼' select each line displayed (the selected line is highlighted in red).** **When in modify mode, sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters edit mode of the selected parameter.**
OK	**Confirms the modification.**

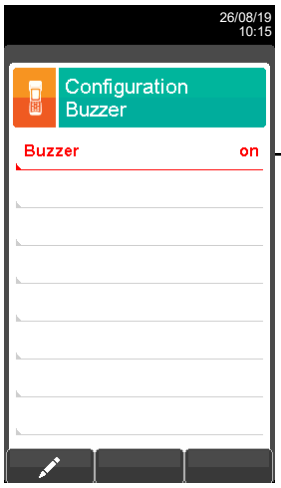
11.3.3 Configuration→Instrument→Brightness



KEY	FUNCTION
▲ ▲ ▲	Activate the context keys shown on the display.
△ ▽ ◁ ▷	Increases or decreases the brightness of the display.
OK	Confirms the modification.
ESC	When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.

CONTEXT KEY	FUNCTION
◄	Decreases the brightness of the display.
OK	Confirms the setting.
►	Increases the brightness of the display.

11.3.4 Configuration→Instrument→Buzzer



Available settings:

on: the buzzer is enabled (key tones and signaling of faults/alarms are enabled).

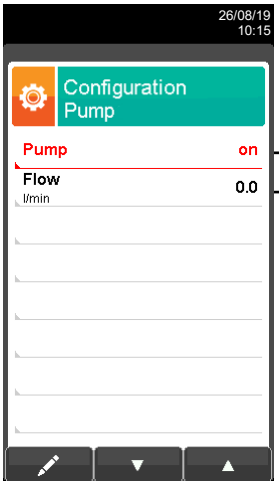
limited: the buzzer is enabled in a limited mode (key tones are disabled, while signaling of faults/alarms is enabled).

off: the buzzer is disabled.

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**When in modify mode, sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters edit mode of the selected parameter.**
OK	**Confirms the modification.**

11.3.5 Configuration→Instrument→Pump



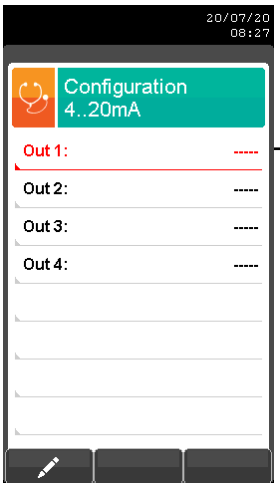
→ Available settings: on (pump on) or off (pump off).

→ Pump flow display, expressed in Liters per minute.

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**When in modify mode, sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Activates edit mode: it is possible to turn on / off the fumes suction pump.**
OK	**Confirm the option selected.**
▼	**Holding down the key, decreases the pump flow.**
▲	**Holding down the key, increases the pump flow.**

11.3.6 Configuration→Instrument→4..20mA

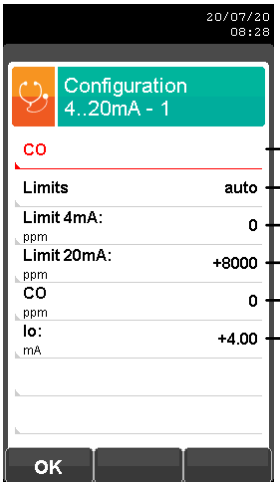


"----": Channel NOT configured (default setting).
"OK": Channel configured.

WARNING

- **If the measurement unit of the observed parameter is changed, it is necessary to reconfigure the set limits.**
- **If the parameter "Limits" is set to manual, the suggested values are the ones related to the automatic setting.**
- **If an output is set to manual and it is needed to set it back to default values, it is necessary to set the "Limits" parameter to auto.**

Example related to output 1:



Select the measure that the instrument can perform.

Limits settings: **auto** - the lower limit (4mA) and the upper limit (20mA) are automatically set by the instrument depending on the observed parameter and it is not settable by the user or **manual** - the lower limit (4mA) and the upper limit (20mA) are settable by the user inside the range of the observed parameter.

Lower limit (4mA) settable only if the parameter limit is set to "manual".

Upper limit (20mA) settable only if the parameter limit is set to "manual".

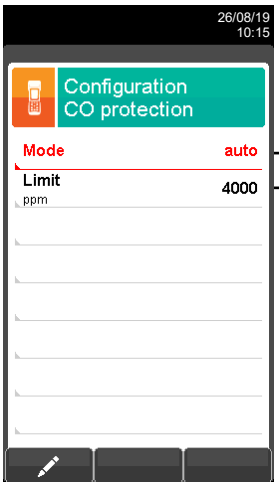
This row shows the measure value in real time.

This row shows the output current value in real time (inside the range 4..20mA).

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼ ◀ ▶	**Keys '▲' and '▼' select any line shown on the display (the selected line is displayed in red).** **When in modify mode, sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters edit mode of the selected parameter.**
OK	**Confirms the modification.**

11.3.7 Configuration→Instrument→CO Protection



→ Available settings: auto, on or off

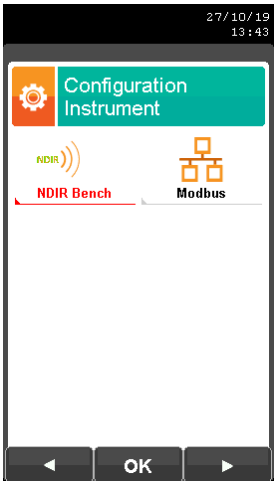
→ Threshold that activates the CO sensor protection (available only if the parameter "Mode" is set to "auto").

WARNING!
The activation of the CO sensor protection is shown on the display with the icon " ".

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**Select each line displayed (the line selected is red).** **In edit mode, it sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters edit mode of the selected parameter.**
OK	**Confirms the modification.**

11.3.8 Configuration→Instrument

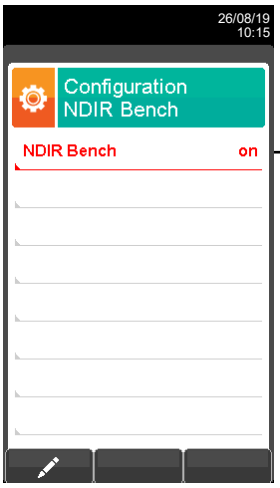


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Select the available parameters.**
OK	**Enters the selected parameter.**
►	**Select the available parameters.**

PARAMETER	DESCRIPTION
NDIR Bench	Allows to turn on or off the NDIR bench. **SEE CHAPTER 11.3.9.**
Modbus	The instrument is featured with the serial output RS485 which is used to connect the instrument to the PC, through the communication protocol MODBUS® RTU. This submenu allows to set the data related to the MODBUS® communication. For further information on the available register table it is necessary to ask the local dealer. **SEE CHAPTER 11.3.10.**

11.3.9 Configuration→Instrument→NDIR Bench



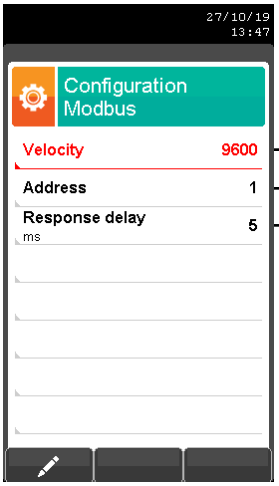
Available settings: **on**: NDIR bench is enabled - **off**: NDIR bench is disabled.

WARNING
In order to make effective the new configuration, please turn the instrument off and then on again.

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**In edit mode, it sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters edit mode of the selected parameter.**
OK	**Confirms the modification.**

11.3.10 Configuration→Instrument→Modbus



→ Communication speed (Available options: **4800 - 9600 - 19200 - 38400**).

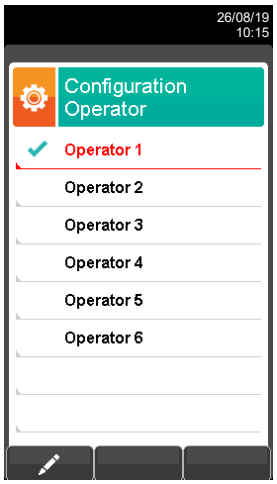
→ Address that identifies the instrument in the MODBUS® protocol.

→ Answer delay to the slave device call.

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**In edit mode, it sets the desired value.**
OK	**Enters edit mode of the selected element and then confirms the change.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters edit mode of the selected parameter.**
OK	**Confirms the modification.**

11.4 Configuration→Operator

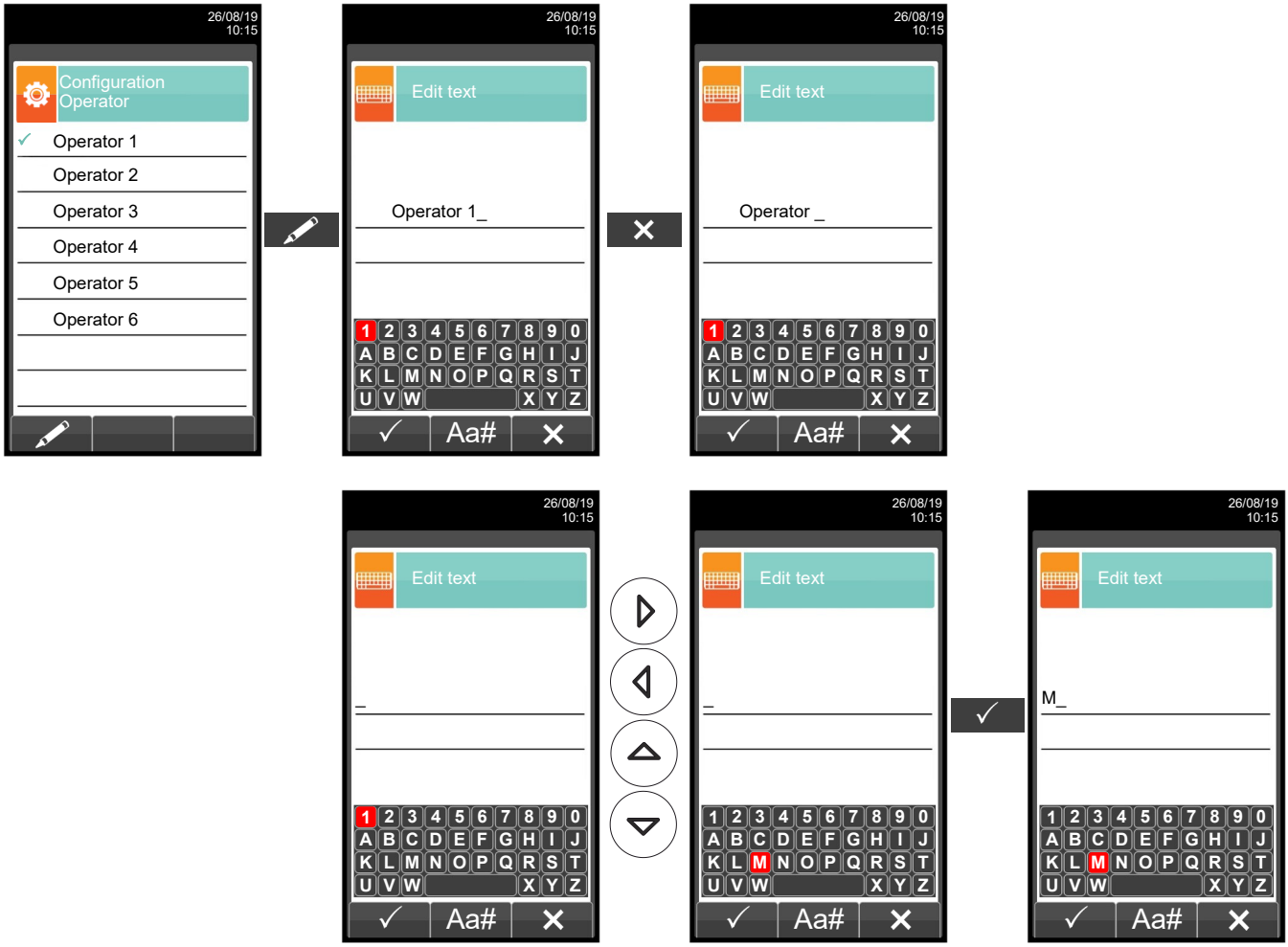


KEY	FUNCTION
▲ ▲ ▲	Activate the context keys shown on the display.
▲ ▼ ◀ ▶	In "edit text": Moves the cursor on the box corresponding to the letter or number required to form the word.
▲ ▼	In "Operator Configuration": Scrolls through the available operators.
OK	In "edit text": Confirms text input. In "Operator Configuration": selects the operator who will carry out the analysis; the operator is highlighted with the symbol "✓".
ESC	Returns to the previous screen. In "edit text" mode returns to the previous screen without saving the changes.

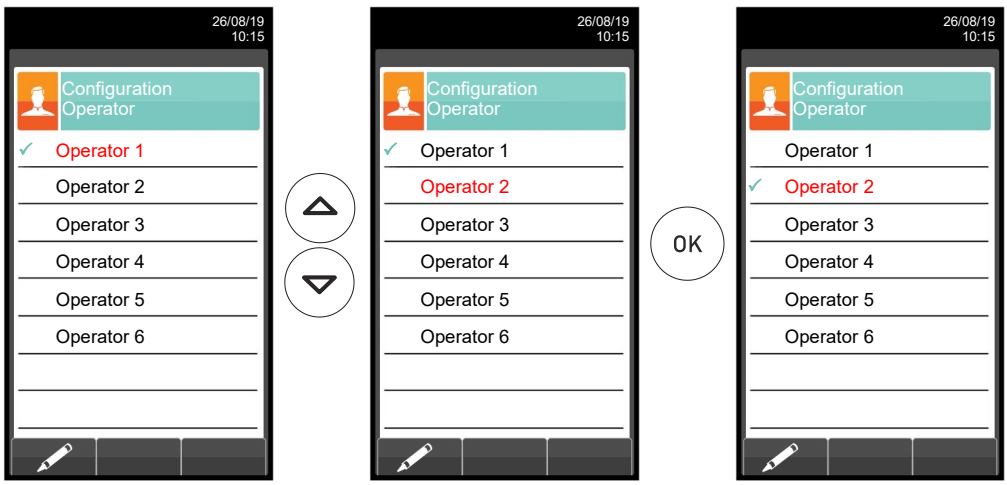
CONTEXT KEY	FUNCTION
✎	Enters edit mode of the selected line: it is possible to enter the name of the operator (24 characters available).
✓	Confirms the selected letter or digit.
✕	Cancels the letter or digit before the cursor.
Aa#	Cycles through uppercase, lowercase, symbols and special characters.

Example:

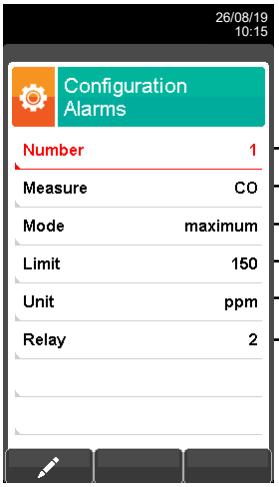
1. Edit text



2. Select the operator who will carry out the analysis



11.5 Configuration→Alarms



→ Number of the set alarm

→ Monitored parameter: O_2 - CO - NO - NO_2 - P diff - Plow - P ext - T1 - T2

→ Type of alarm set: maximum - minimum - off

→ Threshold setting for the previously set alarm: ±999999.999

→ Measurement unit for the threshold set: ppm, mg/m^3, mg/kWh, g/GJ, g/m^3, g/kWh, %, ng/J

Relay output related to the number of the set alarm:
1: Relay output 1 / 2: Relay output 2 / 3: Relay output 3 / 4: Relay output 4

→ Note: the instrument is featured with four relay outputs associated with the first four alarms set (Number 1-4). The other configurable alarms do not have an associated relay output.

WARNING!
In case the function "Probe Switching" is activated, the relay outputs number 3 and 4 will not be associated with alarms 3 and 4, but they will be associated with the two smoke drawing lines "L1" (associated with relay 3) and "L2" (associated with relay 4).
In this case, even on the screens related to alarms 3 and 4 will not appear the "Relay" line.

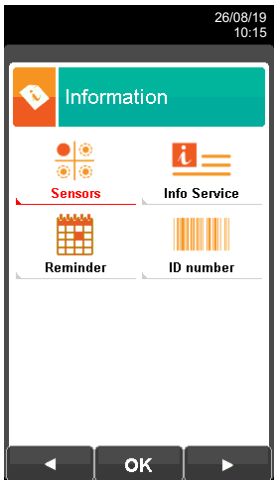
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼ ◀ ▶	**Keys '▲' and '▼' select any line shown on the display (the selected line is displayed in red).** **When in modify mode, sets the desired value.**
OK	**Enters the modify mode for the selected parameter, then confirms the modification.**
ESC	**When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.**

CONTEXT KEY	FUNCTION
✎	**Enters the modify menu for the selected parameter.**
OK	**Confirms the modification.**

Alarm activation flow chart and suggested correctional actions

Type MAX. alarm activation	Type MIN. alarm activation
⇩	⇩
• Buzzer activation. • The measure blinks on the display. • Relay activation.	• Buzzer activation. • The measure blinks on the display. • Relay activation.
⇩	⇩
• Regulate the boiler correctly. • The alarm is switched off automatically, if the gas concentration goes back below the set alarm threshold minus the hysteresis value.	• Regulate the boiler correctly. • The alarm is switched off automatically, if the gas concentration is higher than the set alarm threshold plus the hysteresis value.

11.6 Configuration→Information

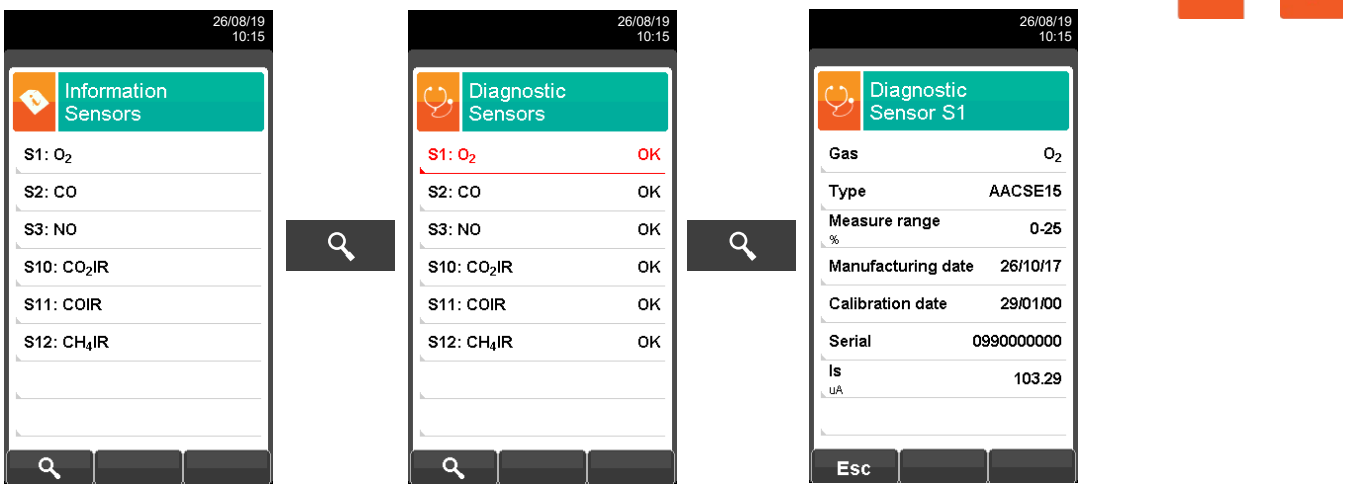


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Selects the available parameters.**
OK	**Enters in the selected parameter setting.**
►	**Selects the available parameters.**

PARAMETER	DESCRIPTION
Sensors	Allows to check which sensors are installed on the instrument, and in which position they are installed on. The instrument automatically detects whether a sensor has been either added or removed. The screen page allows whether to accept the new configuration or ignore the change performed. **SEE SECTION 11.6.1.**
Info Service	This submenu contains details regarding the nearest Service Center 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. **SEE SECTION 11.6.2.**
Reminder	In this menu the user can see the reminder of the instrument annual calibration that was entered in the factory or in the service center. **The menu is protected by the following password: " 2908 ".** **SEE SECTION 11.6.3.**
ID number	Not available.

11.6.1 Configuration→Information→Sensors



For further information see section 11.7.

KEY	FUNCTION
▲ ▲ ▲	Activate the context keys shown on the display.
ESC	Returns to the previous screen.

CONTEXT KEY	FUNCTION
🔍	Displays the details of the main features of the sensors installed.
Esc	Returns to the previous screen.

This screen displays, for each position, the following messages:

MESSAGE	DESCRIPTION
OK	Sensor configured OK (normal operation).
-----	Sensor is not communicating or has been removed. For sensors in positions 10, 11 and 12: NDIR bench is not installed or has been disabled or measure not enabled.
The name of the detected gas is flashing	New sensor detected.
Pos err	Detected sensor in wrong position.
Volt err	Detected voltage is out of the normal operating range; repeat the autozero.
Curr err	Detected current is out of the normal operating range; repeat the autozero.
Err autozero	NDIR bench autozero failed.

Error messages displayed:

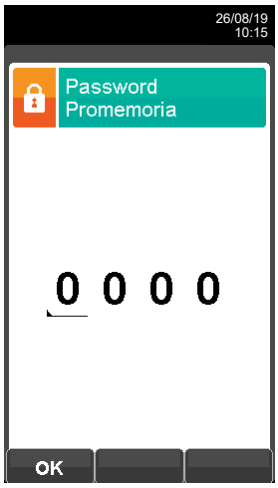
MESSAGE	DESCRIPTION
Cal err	Calibration error.
Data err	Sensor not recognized.
No cal	Sensor not calibrated.

11.6.2 Configuration→Information→InfoService

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

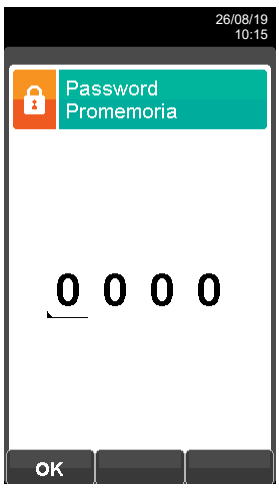
CONTEXT KEY	FUNCTION
Esc	**Returns to the previous screen.**

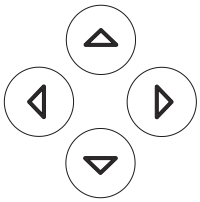
11.6.3 Configuration→Information→Reminder



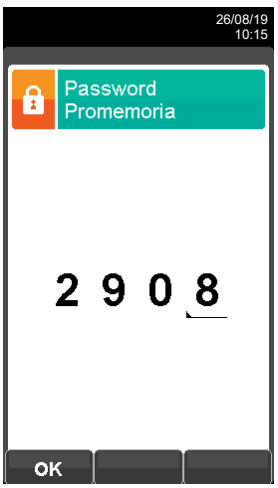
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼ ◀ ▶	**Sets the password to access the remainder menu. The password is: 2908.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
OK	**Shows details about the main features of the sensors installed.**
Esc	**Returns to the previous screen.**
F1	**Shows all information relevant to service center.**
F2	**Temporarily ignores the message. At next turn-on of the instrument the reminder will be shown again.**
F3	**Ignores the message permanently.**

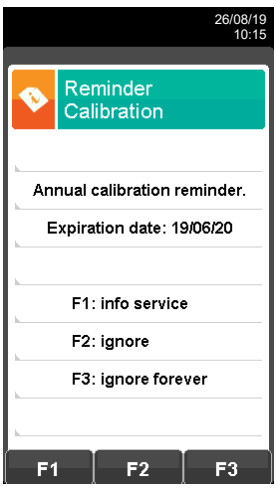




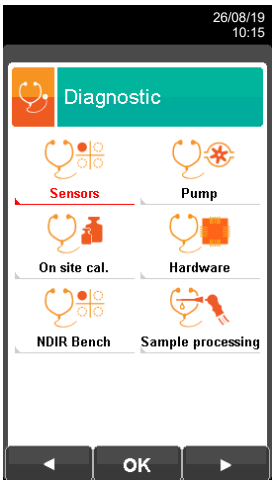
Enter the password for the reminder menu ' **2908** '



OK



11.7 Configuration→Diagnostic

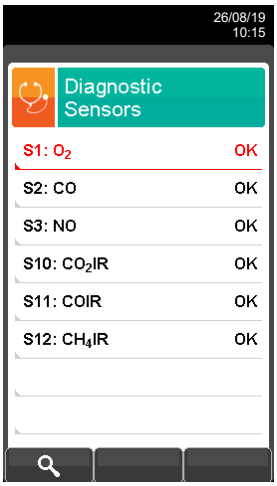


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Selects the available parameters.**
OK	**Enters in the selected parameter setting.**
►	**Selects the available parameters.**

PARAMETER	DESCRIPTION
Sensors	Displays information on the state and calibration of the electrochemical sensors: **Ok** No problem detected **absent** The sensor was not detected **err data** Sensor memory data error **unknown** It is necessary to update the FW of the device **err pos** The sensor has been installed in the wrong position **err cal** Calibration error (sensor not calibrated) **err curr** Currents outside the range **err cfg** Do not use this sensor as it has not been accepted on the screen "types of sensors". Also, from this screen the user can access the identification data of the sensor: type, serial number, date of manufacture and calibration. There are also the measured currents; in this way it is possible to perform a quick diagnosis in the event of a malfunction. **SEE SECTION 11.8.**
Pump	In this submenu it is possible to temporarily turn off the pump for smoke drawing or to switch it back. Furthermore, it is possible to visualize the actual pump flow expressed in liters per minute. It will not be possible to turn off the pump while the autozero cycle is being performed. **SEE SECTION 11.9.**
On site cal.	It is possible to make a recalibration of the instrument gas sensors with suitable known concentration gas cylinders. For the sensors sensible to other gases, called interfering gases (for example NH_3, H_2, H_2S, SO_2, …) it is possible to perform the on site calibration also for the relevant interfering gases. **The sensors recalibration procedure is protected with the password ' 2908 '.** **SEE SECTION 11.10.**
Hardware	At instrument turn on the firmware performs a full check on the physical efficiency of all types of HW memories installed on the instrument, as well as on the integrity of the data stored into them. Any issue is displayed in the screen 'Memories Diagnostics'. Should this happen it is advisable to turn the instrument off and then on again. In case the problem is permanent or frequently recurring, the user should contact the Service Center reporting the error code shown by the instrument. **SEE SECTION 11.11.**
NDIR Bench	The user can check the status of the infrared bench NDIR. **SEE SECTION 11.12.**
Sample processing	Allows the user to check the status of the cooler (Peltier cells). **SEE SECTION 11.13.**

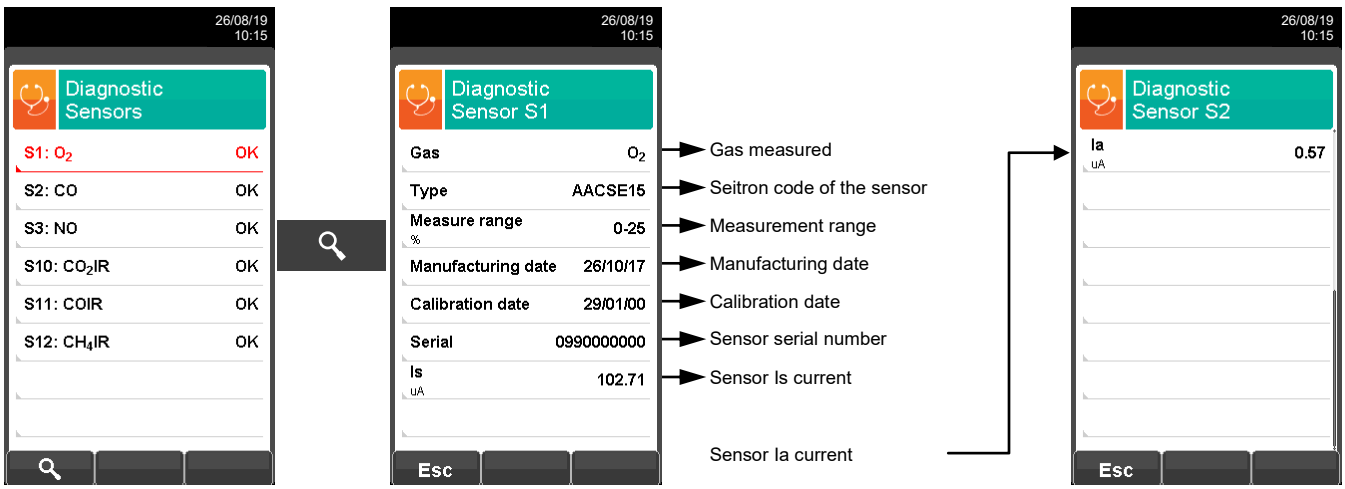
11.8 Configuration→Diagnostic→Sensors



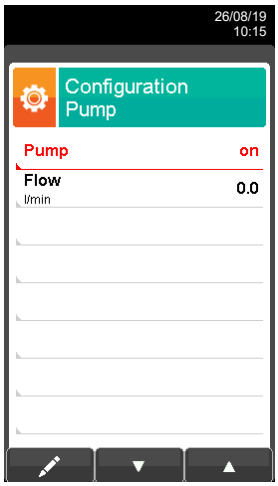
KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**Selects the fuel.**
OK	**Activates the context keys located in the left side of the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
🔍	**Displays the details of the selected sensor (see example below).**
Esc	**Returns to the previous screen.**

Example:



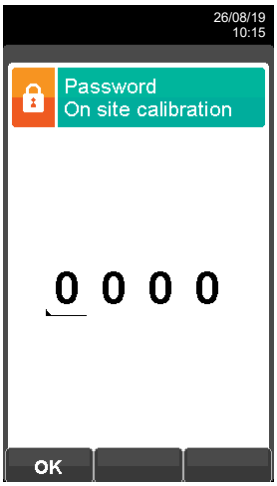
11.9 Configuration→Diagnostic→Pump



KEY	FUNCTION
▲ ▲ ▲	Activate the context keys shown on the display.
△ ▽	When in edit mode, switches between on and off and vice versa.
OK	Enters the modify mode for the selected parameter, then confirms the modification.
ESC	When pressed in modify mode cancels the selection made, otherwise returns to the previous screen.

CONTEXT KEY	FUNCTION
✎	Enters edit mode: it is possible to switch on / off the smoke drawing pump.
OK	Confirms the changes made.

11.10 Configuration→Diagnostic→On site cal.



KEY	FUNCTION
▲ ▲ ▲	Activate the context keys shown on the display.
△ ▽ ◁ ▷	Sets the password.
△ ▽	Selects line; the selected line is displayed in red. In modification sets the value or the desired mode.
OK	Activates the context key located in the left side of the display.
ESC	Returns to the previous screen. When in modify mode cancels the modification just made.

CONTEXT KEY	FUNCTION
OK	Once password is entered, gives access to the 'On site calibration' menu.
🔍	Shows details for the selected sensor.
↻	Zeroes the timer.
✎	Enters the modification mode for the selected parameter.

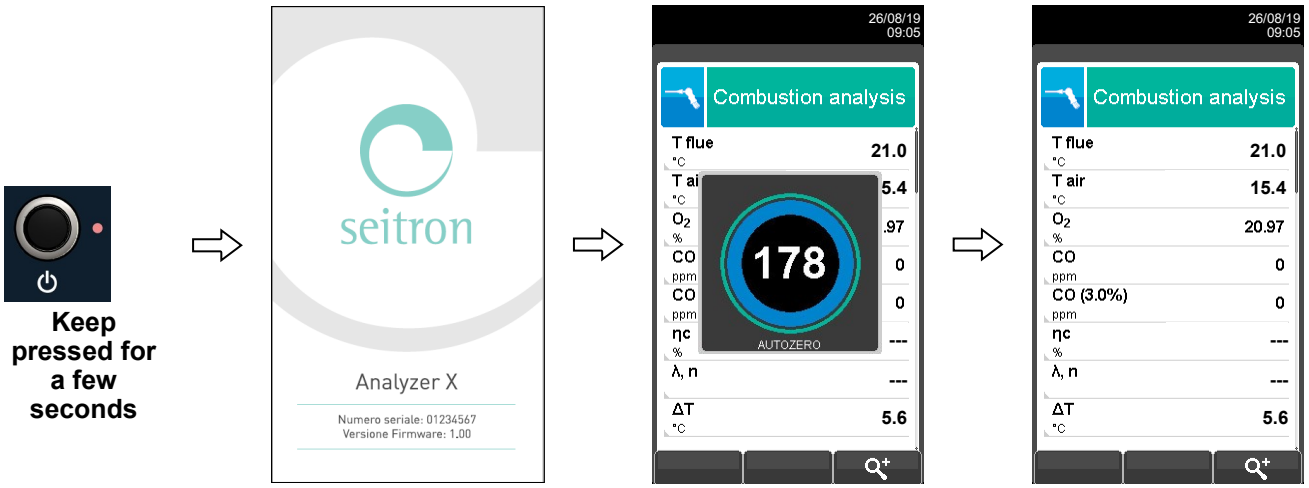
11.10.1 On site Calibration procedure

In order to perform the recalibration of the gas sensors, the following tools are needed:

- Calibration gas cylinder suitable for the sensor with known gas concentration, complete with a pressure regulator
- Flow meter.
- Hose with ' T ' shaped junction, in order to connect the cylinder to the instrument and the flow meter.

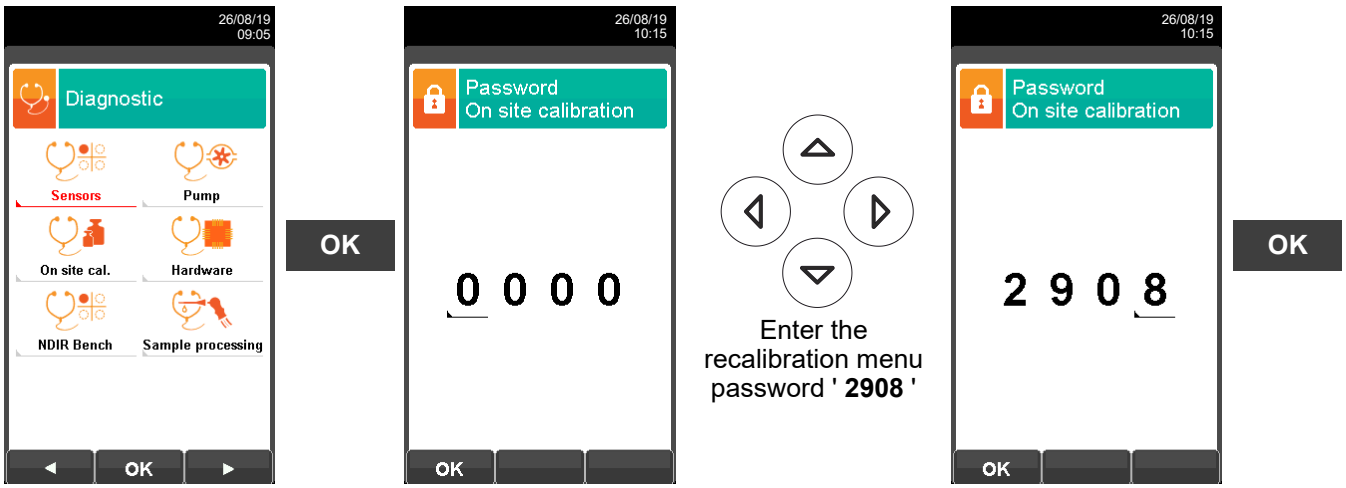
WARNING!
For the oxygen sensor on site calibration, the zero value calibration must be carried out with nitrogen or any other gas mixture which DOES NOT contain oxygen.

1. Start the instrument



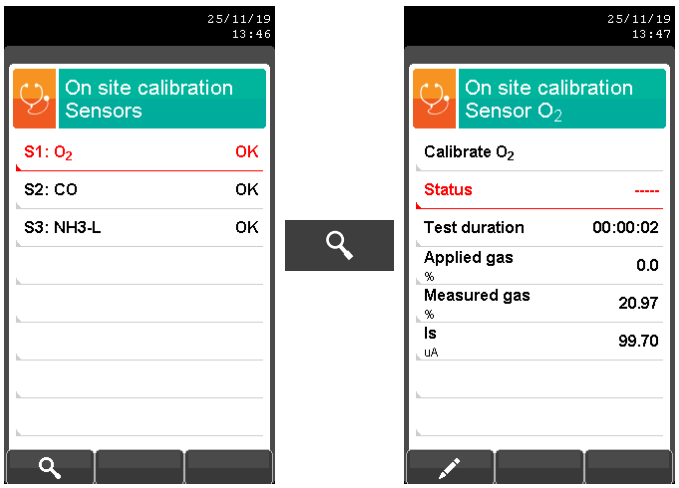
WARNING
Make sure autozero is executed in clean air and terminates correctly.

2. Once autozero is completed press the key and select the diagnostic icon.



3. **Once in the 'On site calibration' menu, the list of the installed sensors for which the recalibration is available is shown.**

   By selecting one sensor, in the recalibration screen all information related to the last performed calibration is shown.



Calibrate: saves new calibration

Status: not active: returns to the factory calibration

active: returns to the last calibration made by the user

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

Test duration: timer

Applied gas: enters the concentration of the applied calibration gas

Measured gas: measures the concentration of the applied gas

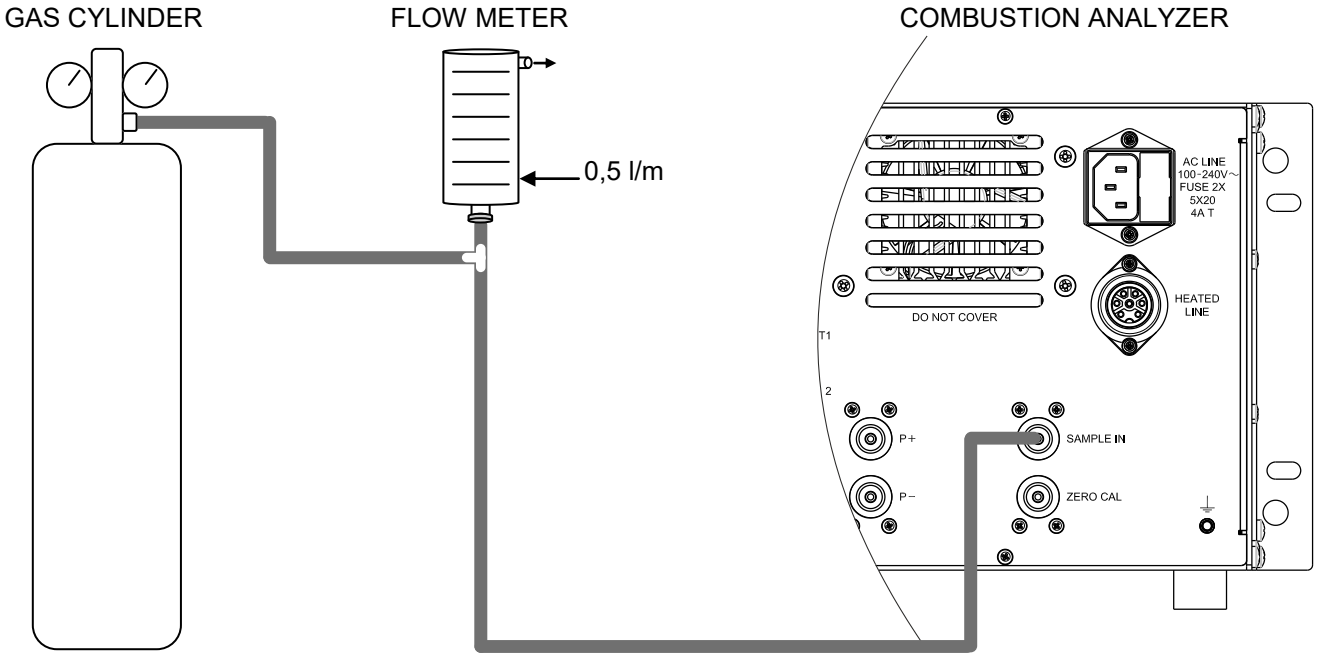
Is: 'Is' current from the sensor

Ia: 'Ia' current from the sensor (CO only)

CHOOSE THE SENSOR TO BE CALIBRATED AND DO AS FOLLOWS

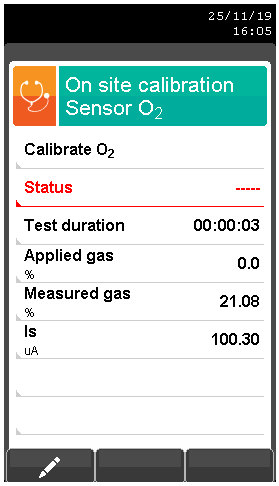
4. Connect the instrument to the gas cylinder suitable for the selected sensor, with known gas concentration, as shown in the following diagram.

WARNING!
Adequate ventilation must be provided when working with toxic gases, particularly the flow meter and instrument outputs must be evacuated by a ventilation system.

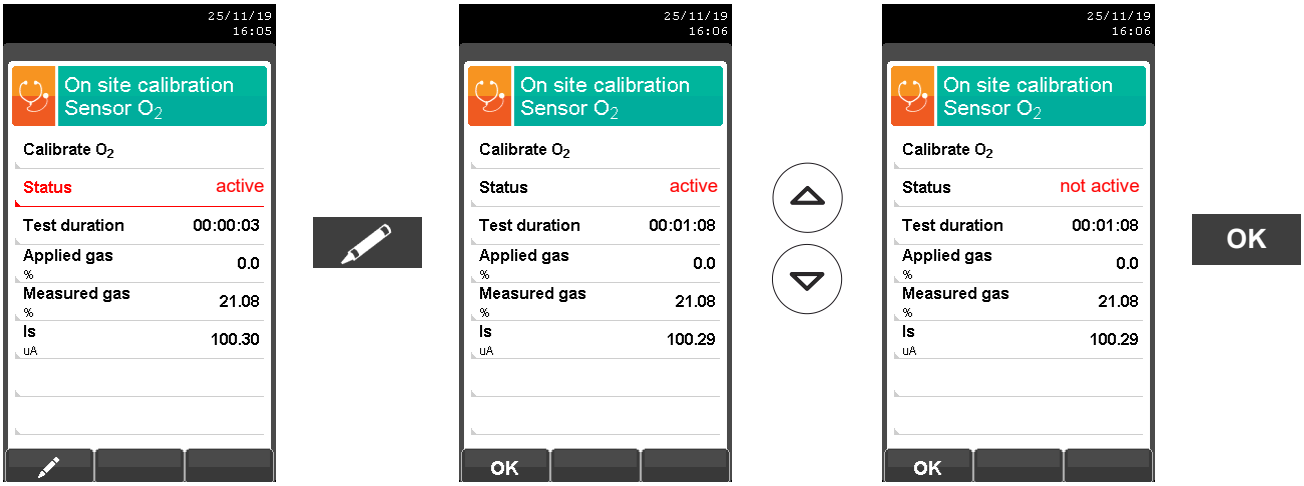


OXYGEN SENSOR (O_2) CALIBRATION DETAIL.

- The calibration will be possible only when the status is set to '----' (cells which never had an on-site calibration) or it is necessary to set the state to '**not active**' (see example).

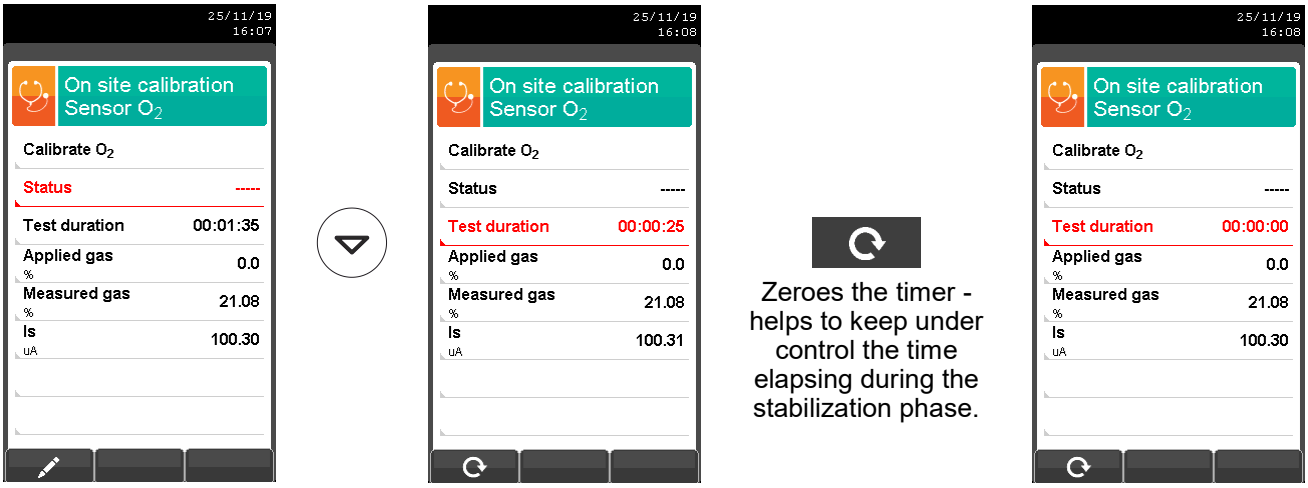


or

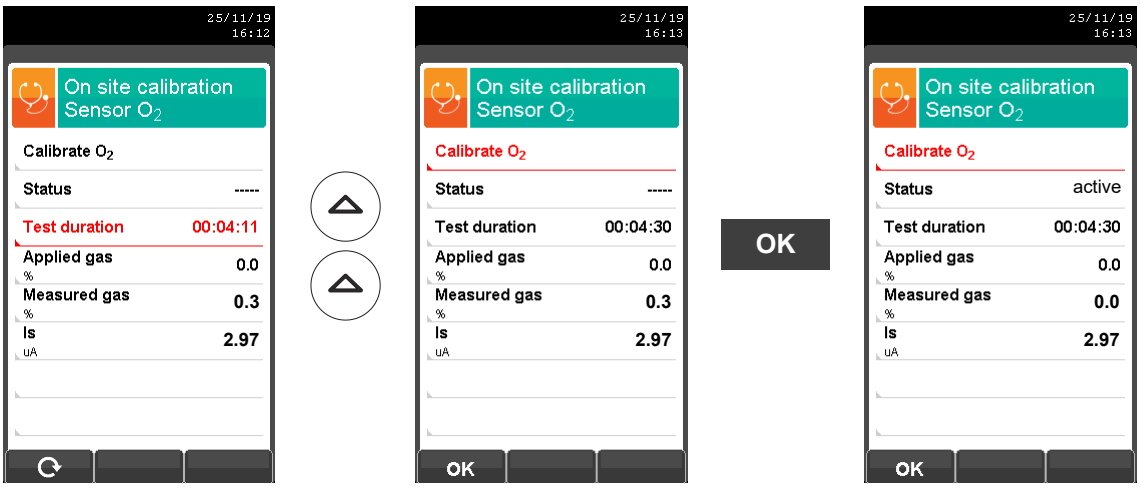


- **Apply gas to the instrument** and adjust the output pressure of the gas from the cylinder so that the flow meter indicates a minimum flow of 0.5 l/m: this guarantees that the instrument is taking the exact amount of gas required by the internal pump.

- The instrument measures the concentration of gas applied; **<u>wait at least 3 minutes to allow the reading to stabilize.</u>** The reading is shown in line 'Gas measured'.



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



Once the new calibration has been stored, the possible temporary messages which can be seen on the row ‘status' are the following:

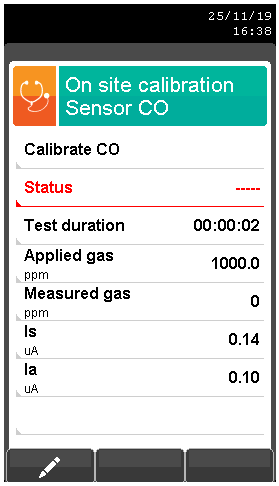
saving: the instrument is saving the performed calibration
error: the sensor has NOT been recalibrated for any of the following reasons:
- The calibration gas cannot properly reach the instrument.
- The user didn’t allow for the stabilization time to properly elapse.
- The sensor could be damaged or exhausted and must therefore be replaced.

WARNING

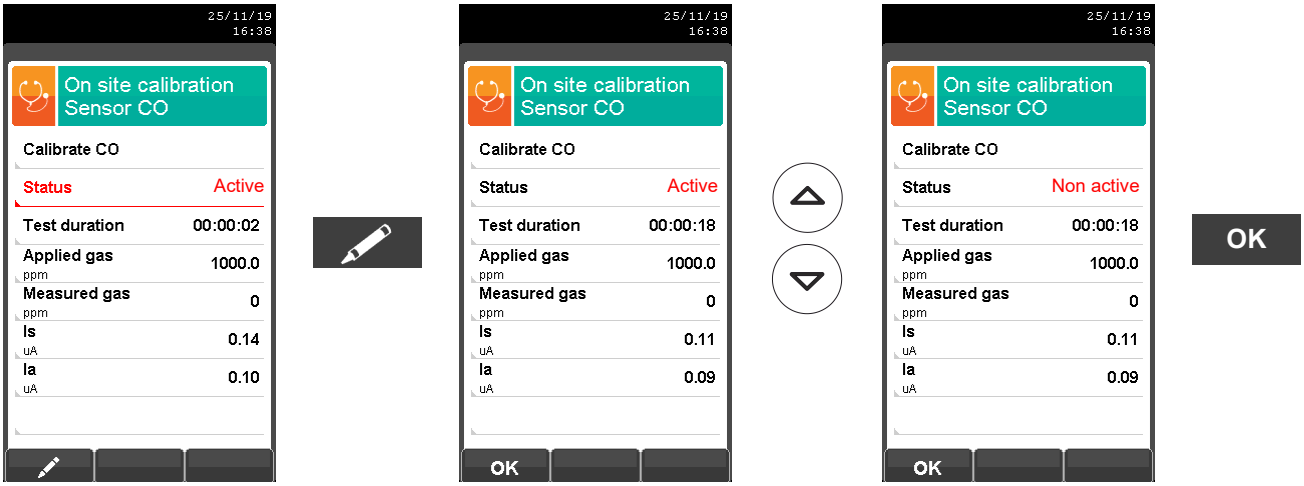
- **At any time the user can restore the factory calibration in the instrument by setting the 'Status' line on 'not active'.**
- **The recommended stabilization time for the on-site calibration of the sensors is 3 minutes. This time can be up to 5 minutes for NO2 and SO2 sensors.**

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

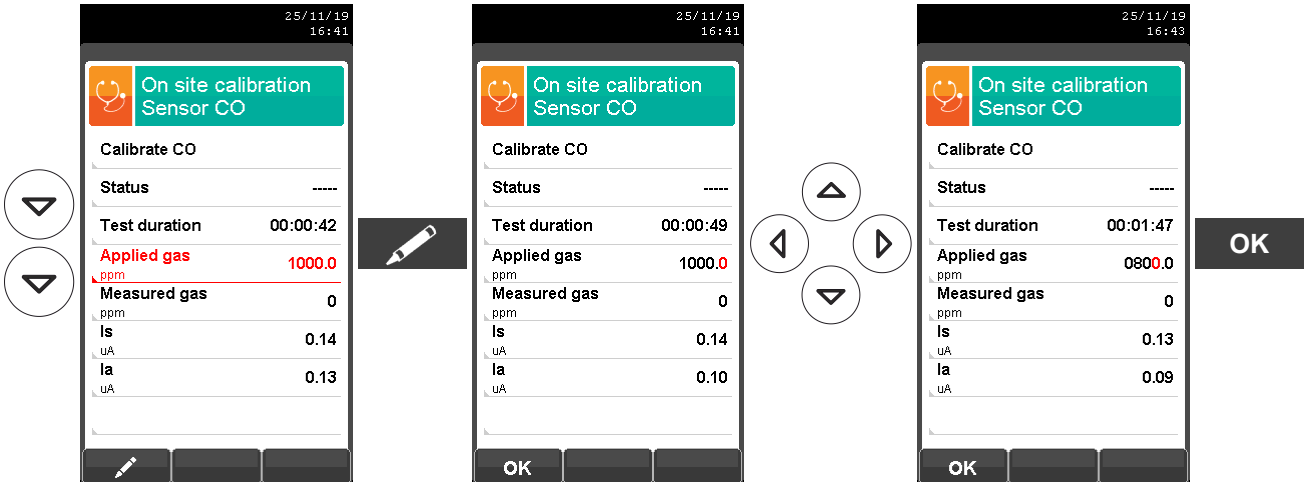
- The calibration will be possible only when the status is set to '----' (cells which never had an on-site calibration) or it is necessary to set the state to '**inactive**' (see example).



or

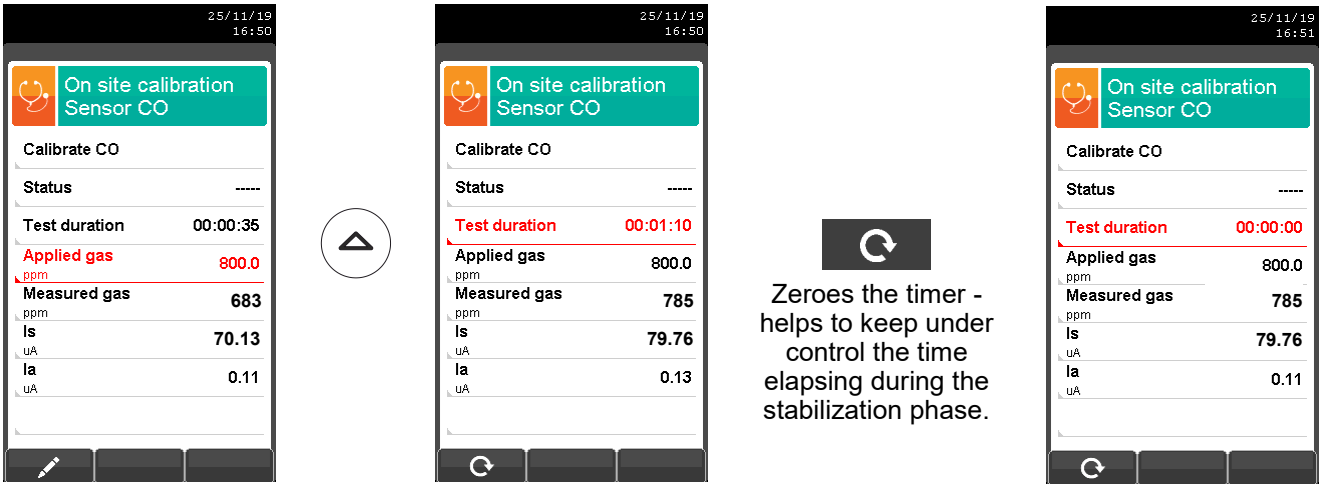


- **Enter the concentration value of the applied gas.**

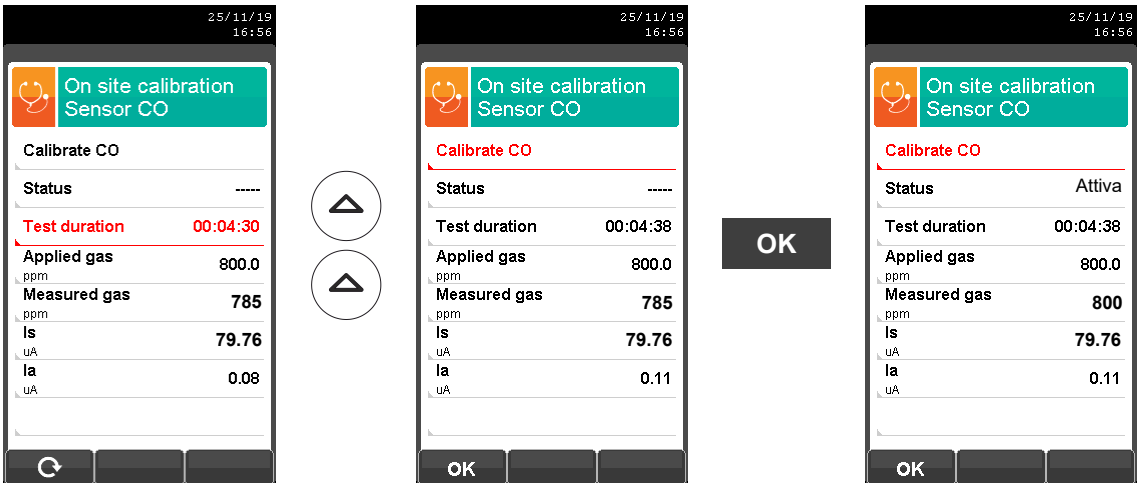


- **Apply gas to the instrument** and adjust the output pressure of the gas from the cylinder so that the flow meter indicates a minimum flow of 0.5 l/m: this guarantees that the instrument is taking the exact amount of gas required by the internal pump.

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



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



Once the new calibration has been stored, the possible temporary messages which can be seen on the row 'status' are the following:

saving: the instrument is saving the performed calibration
error: the sensor has NOT been recalibrated for any of the following reasons:
- The calibration gas cannot properly reach the instrument.
- Concentration for the calibration gas has not been set in the relevant line 'Applied gas'.
- The user didn't allow for the stabilization time to properly elapse.
- The sensor could be damaged or exhausted and must therefore be replaced.

WARNING

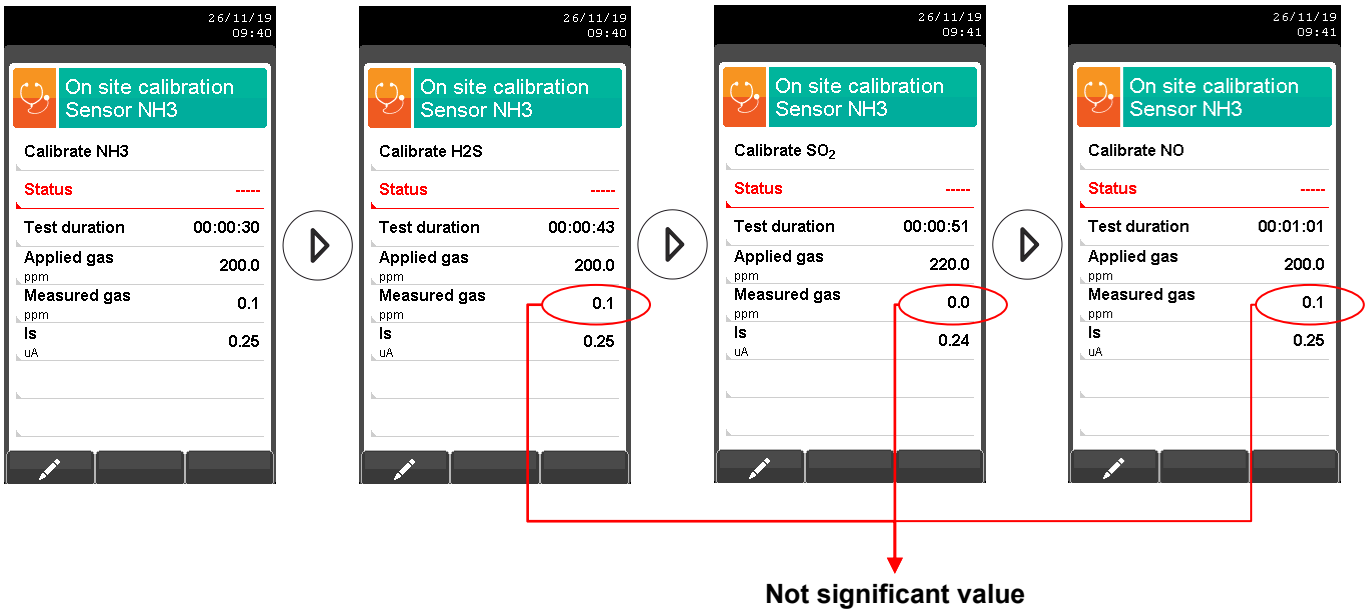
- **At any time the user can restore the factory calibration in the instrument by setting the 'Status' line on 'not active'.**
- **The recommended stabilization time for the on-site calibration of the sensors is 3 minutes. This time can be up to 5 minutes for NO2 and SO2 sensors.**

TOXIC GASES SENSOR CALIBRATION DETAIL WITH INTERFERING GASES

The toxic gases sensors with interfering gases are these sensors sensible to other gases.
The on site calibration for these sensors also allows to calibrate the interfering gases.

The on site calibration procedure for these sensors is the same described in the previous pages regarding the toxic gases sensors and it can be performed for all the gases which interferes with the sensor itself.

On the following is described the mode to access the interfering gases with the sensor which must be calibrated on site (example referred to NH_3 sensor).



SENSOR	INTERFERING GASES		
NH_3	H_2S	SO_2	NO
SO_2	CO	NO	NO_2
H_2S	SO_2	NO	NO_2
H2	CO	NO	NO_2

Tab. 1: Interfering gases table.

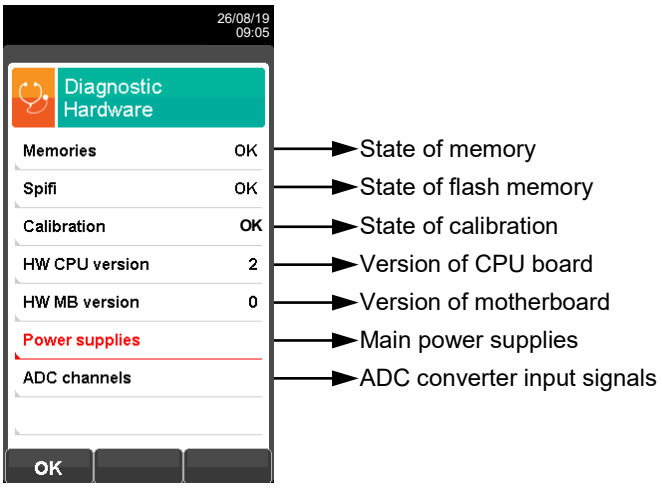
WARNING

The recommended stabilization time for the on-site calibration of these sensors is 5 minutes.

WARNING

During analysis, the influence of interfering gases is compensated only if the correspondent sensor is installed.

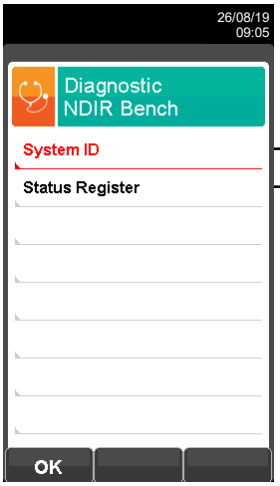
11.11 Configuration→Diagnostic→Hardware



KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
ESC	**Returns to the previous screen.**
mV	**Shows values in mV**
bit	**Shows values in bits**

11.12 Configuration→Diagnostic→NDIR bench



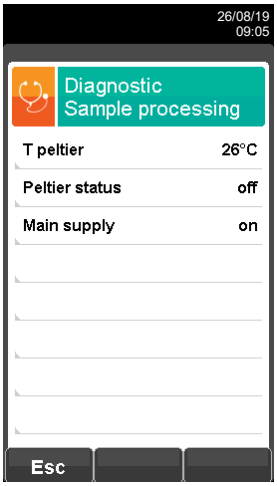
→NDIR bench identification data.

→NDIR bench information about operational status.

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**Selects line; the selected line is displayed in red.**
OK	**Activates the context key located in the left side of the display.**
ESC	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
OK	**Enters in the selected data setting.**
ESC	**Returns to the previous screen.**

11.13 Configuration→Diagnostic→Sample processing



KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
ESC	**Returns to the previous screen.**

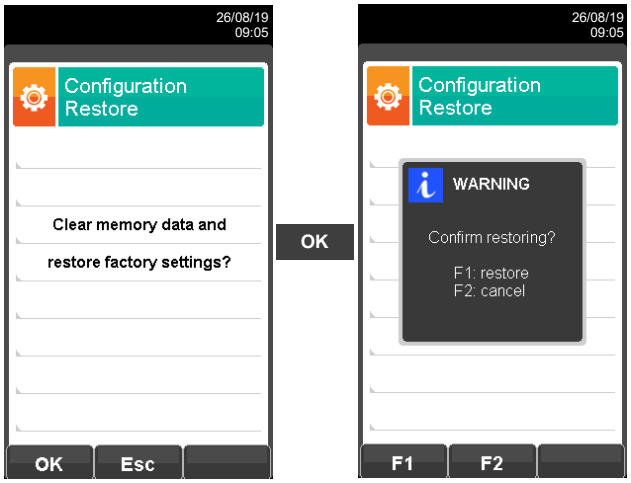
CONTEXT KEY	FUNCTION
ESC	**Returns to the previous screen.**

11.14 Configuration→Language

KEY	FUNCTION
▲ ▲ ▲	Activate the context keys shown on the display.
▲ ▼	Scrolls through the available languages.
OK	Sets the selected language.
ESC	Returns to the previous screen.

CONTEXT KEY	FUNCTION
OK	Sets the selected language.

11.15 Configuration→Restore

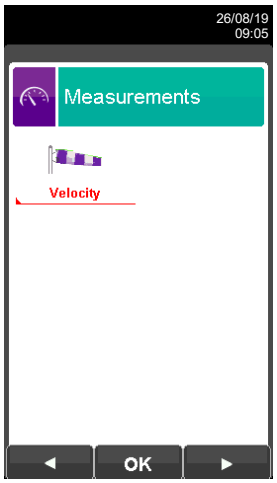


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
OK	**Starts the factory values reset phase.**
ESC	**Exits the current screen without resetting to factory values.**

CONTEXT KEY	FUNCTION
OK	**Starts the factory data reset phase.**
Esc	**Exits the current screen without resetting.**
F1	**Factory reset.**
F2	**Cancels the factory data reset phase and goes back to the previous screen.**

12.0 MEASUREMENTS

12.1 Measurements Menu

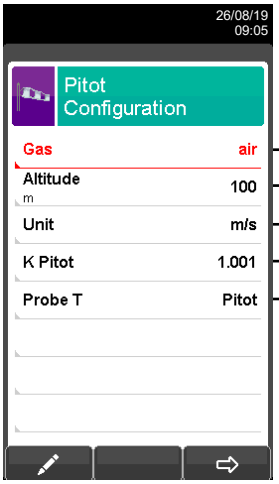


KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
△ ▽	**Returns to the previous screen.**

CONTEXT KEY	FUNCTION
◄	**Selects the available parameters.**
OK	**Enters in the selected parameter setting.**
►	**Selects the available parameters.**

PARAMETER	DESCRIPTION
Velocity	When a Pitot tube and a Tc-K thermocouple are connected, the instrument is capable to measure at the same time both temperature and velocity of a gas (air/flue gas). **SEE SECTION 12.1.2.**

12.1.2 Measurements→Velocity



→ Measurement: air or flue gas.
→ Altitude above sea level.
→ Measurement unit selectable across m/s, km/h, fpm, mph.
→ Insert the K-factor of the Pitot tube stated by the tube manufacturer.
→ Temperature acquisition mode:
Pitot (with Tc-K thermocouple) or Flue gas probe (or external Tc-K thermocouple).

KEY	FUNCTION
▲ ▲ ▲	**Activate the context keys shown on the display.**
▲ ▼	**Selects line; the selected line is displayed in red.** **In edit mode, it sets the desired value.**
OK	**Activates the context key located in the left side of the display.**
ESC	**Returns to the previous screen.** **When in modify mode cancels the modification just made.**

CONTEXT KEY	FUNCTION
✎	**Enters the modification mode for the selected parameter.**
OK	**Confirms the entered value.**
⇨	**Go to next step.**
◎	**Make the zero for the measurement.**
📷	**Saves, in the memory selected in the "Select Memory" menu, the acquired data.**

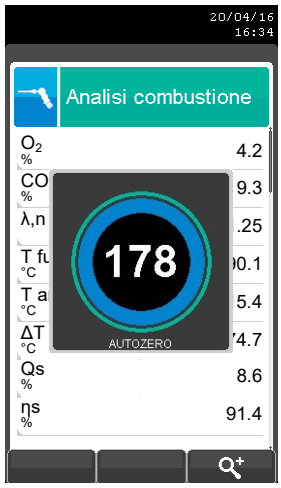
13.0 EMISSION ANALISYS

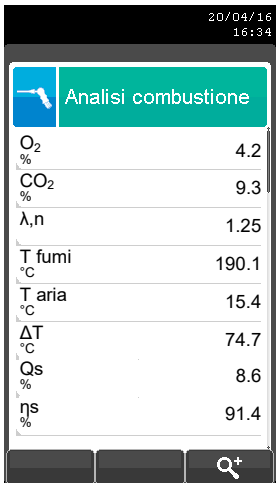
13.1 PRELIMINARY OPERATIONS

Before starting the emission analysis, follow the instructions below.

- By pressing the On/Off button or as soon as it is switched on, the instrument turns on showing the splash screen.
  After a few seconds the instrument automatically performs the autozero phase.
  It is important that this phase is performed in an environment with clean air. During the autozero, it is also performed the zero of the piezoresistive pressure sensor, temperature compensated.

Keep pressed for a few seconds





- The instrument then performs automatically the emission analysis according to the configuration made.

IN ORDER TO GET A CORRECT ANALYSIS IT IS NECESSARY THAT NO EXTERNAL AIR ENTERS THE DUCT BECAUSE OF A BAD LOCKING OF THE CONE OR BECAUSE OF LEAKAGE ON THE PIPING.

THE SMOKE TUBE MUST BE VERIFIED TO AVOID THE PRESENCE OF LEAKAGES OR OBSTRUCTIONS ALONG THE PATH.

THE CONNECTORS OF THE SMOKE PROBE MUST BE TIGHTLY LOCKED TO THE INSTRUMENT.

DO NOT PERFORM MEASURES WITHOUT A FILTER OR WITH A DIRTY FILTER TO AVOID AN IRREVERSIBLE DAMEGE TO THE SENSORS.

IN ANALYSIS MODE, THE HEATED LINE (IF ENABLED) IS ALWAYS ON.

THE ACTIVATION OF THE HEATED LINE STARTS 20 MINUTES BEFORE THE STARTING OF THE ANALYSIS.

BEFORE CONNECTING THE USB CABLE, WAIT FOR THE AUTOZERO OF THE INSTRUMENT TO BE OVER.

ADD TO THE MEASUREMENT LIST ANY ADDITIONAL MEASURES WHICH ARE NEEDED TO BE PERFORMED.

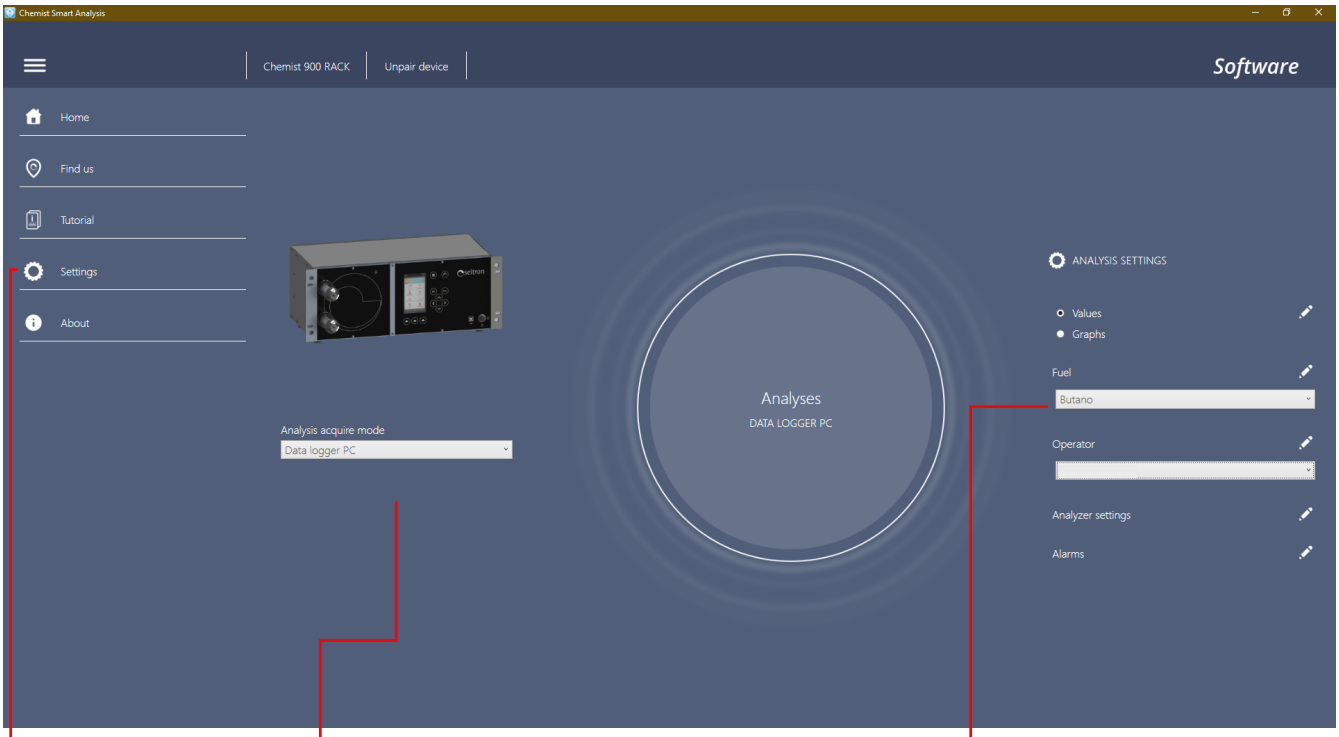
THE SHOWN DATA ABOUT THE POLLUTING ELEMENTS CO / NO / NO_X CAN BE TRANSLATED IN NORMALIZED VALUES (REFERRING TO THE CONCENTRATION OF O_2 PREVIOUSLY SET).

13.1.1 EMISSION ANALYSIS CONFIGURATION MODE

Before turning on the instrument it is important to correctly set the analysis mode, by connecting the instrument to the PC through a USB cable and/or Bluetooth, having previously installed the dedicated PC software "**Chemist Smart Analysis**" provided with the instrument or downloadable at the web site www.seitron.com.

The analysis mode, entirely settable by the user, allows to monitor the emissions of polluting gasses.
The starting point of the emissions analysis can be defined by the user (immediate or programmed by day and time). When the emission analysis starts, the instrument automatically proceeds to acquire and store the number of samples which have been set. During the acquisition, it is possible to follow the progression of the analysis itself. Each real time analyses can be singularly visualized directly by the instrument or transferred to the PC or to other devices for further management.

Detail of settable data
Following, the main screen of the PC software, **Chemist Smart Analysis**, where it is possible to set the analysis mode.



ANALYSIS ACQUISITION MODE
In this menu it is possible to define the analysis mode used by the instrument to monitor the polluting emissions.
It is possible to choose between:
Data logger PC
Periodic

SETTINGS
Advanced settings based on the set analysis acquisition.
For further details see the following pages.

ANALYSIS SETTINGS
Whatever the set analysis mode is, it is necessary to properly set this menu:

Values / Graphs
By clicking on " " it is possible to visualize the list of the measures that the instrument is performing (available measures) and the list of the measures shown when the analysis is being performed (measures to be shown).
Moreover it is possible to add, delete or move by one position a selected measure.

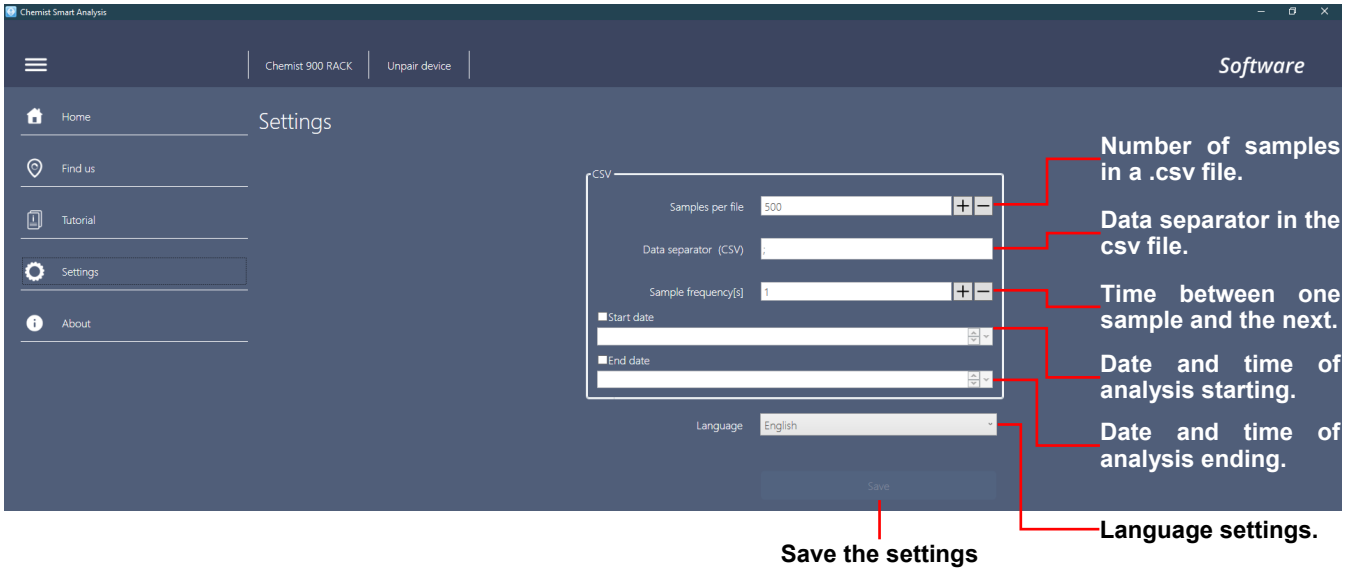
Fuel
It allows the choice of the fuel to be used when the analysis is being performed. By clicking on " " it is possible to visualize the coefficients of the fuels used for calculating combustion efficiency and add a new fuel.

Operator
Allows the choice of the operator performing the analysis. By clicking on " " it is possible to insert or modify the operator's name.

Analyzer settings
This parameter allows to manage the analyzer. The settable data depend on the selected analysis mode.
By clicking on " " it is possible to configure the instrument.

Alarms
By clicking on " " it is possible to set and store 10 alarms. For further details see paragraph 11.1 Menu configuration.

Analysis acquisition mode set to “Data logger PC”
This mode is fully settable by the user.
The starting point and the end of the analysis is defined by the user (immediate or programmed by day and time).
When the emission analysis starts, the instrument automatically proceeds to acquire the set samples.
During the acquisition it is possible to follow along the process.
The specific data to be set are inside the menu “Settings”:

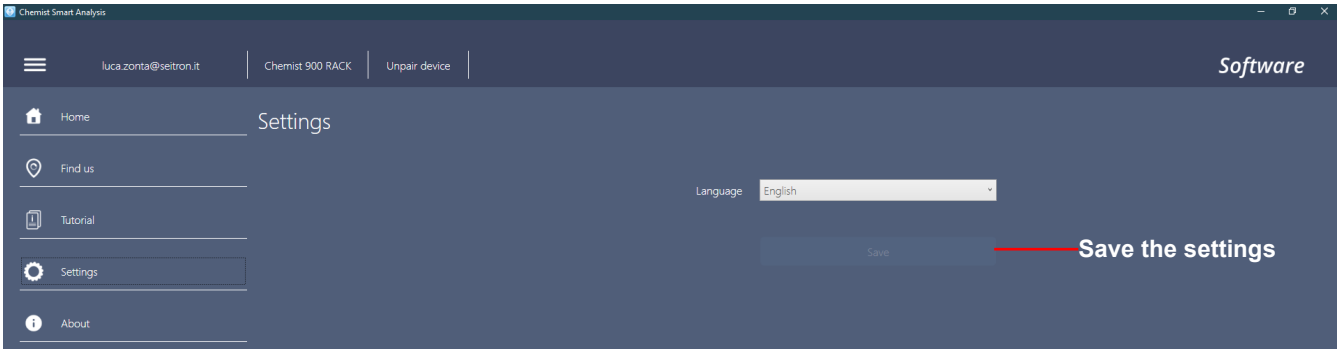


When the emission analysis is over, a pop-up message will be displayed.

Analysis acquisition mode set to "Periodic"
This mode, fully settable by the user, allows to monitor the polluting emissions at defined time intervals.
The start of the emission analysis is defined by the user (immediate or programmed by day and time). When the emission analysis starts, the instrument automatically proceeds to acquire the set samples. During the acquisition it is possible to follow along the process.

WARNING!
THE AUTOZERO OF THE INSTRUMENT IS PERFORMED AT THE BEGINNING OF EACH ANALYSIS CYCLE. AT THE END OF EACH ANALYSIS CYCLE, THE ANALYZER PERFORMS THE CLEANING OF THE PNEUMATIC CIRCUIT AND OF THE SENSORS; THE TIME FOR THIS OPERATION IS DEFINED BY THE USER.

The specific data to be set are found in the "Settings" menu



and by clicking on the symbol " " :

Summary of the settings made:
Duty cycle: Cycle duration
Total time: Total analysis duration
Samples: Number of samples which are being taken
Generated files: Number of the .csv files that are stored in the PC.

A Autozero time length, which is performed at the beginning of each analysis cycle.

This parameter can be set if it is needed to draw smoke from two different points using two different smoke drawing lines which will be controlled by relay outputs 3 and 4. For further details see paragraph 11.2.8.

B Time between one sample and the next.

F Analysis duration (expressed in minutes).

C Cleaning duration, which will be performed at the end of each analysis cycle.

D Time (expressed in minutes) when the instrument turns off the smoke drawing pump and does not perform any analysis.

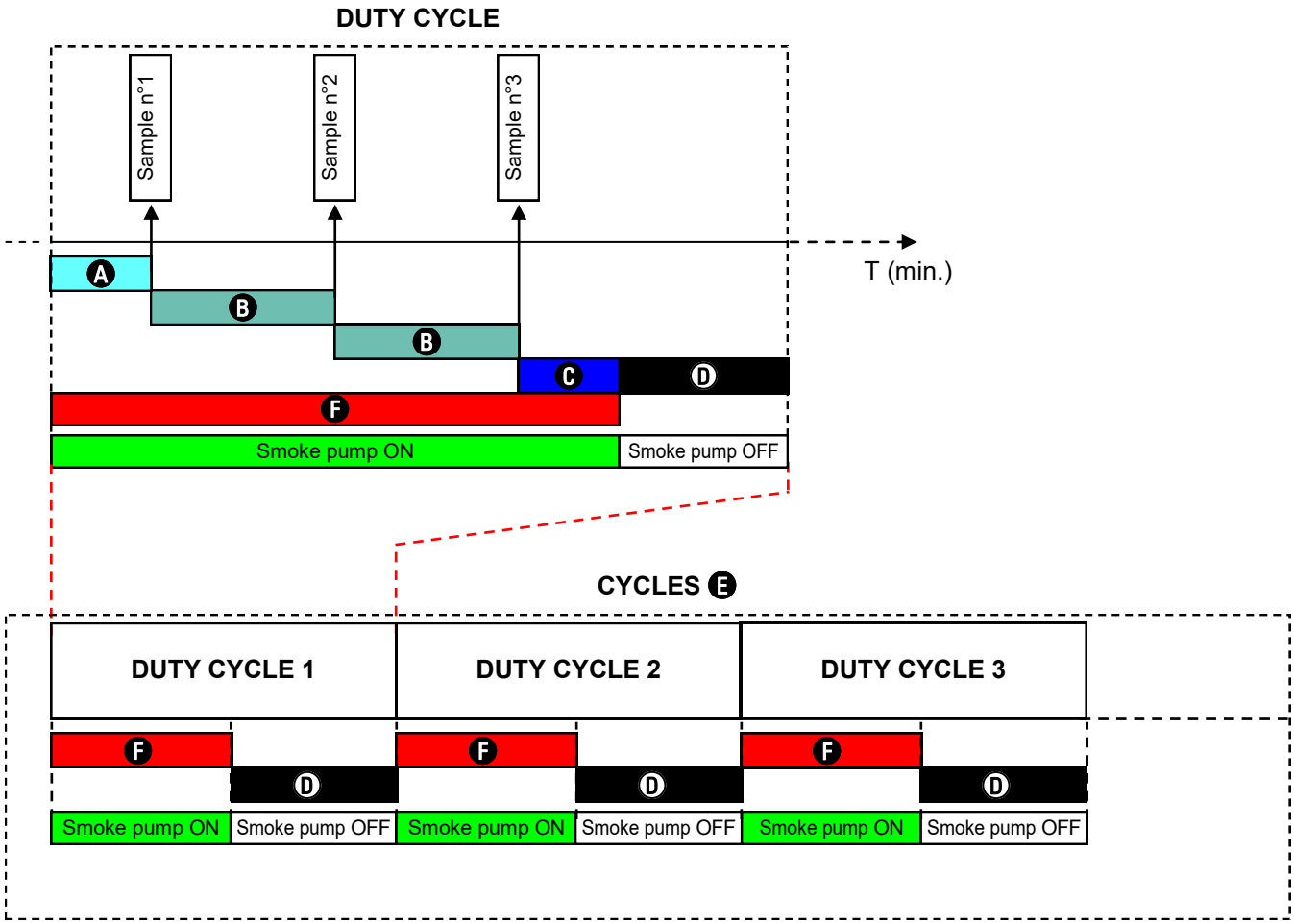
E Number of times that the cycle acquisition is repeated.

Date and time of the emission analysis beginning.

Number of samples contained in a csv file.

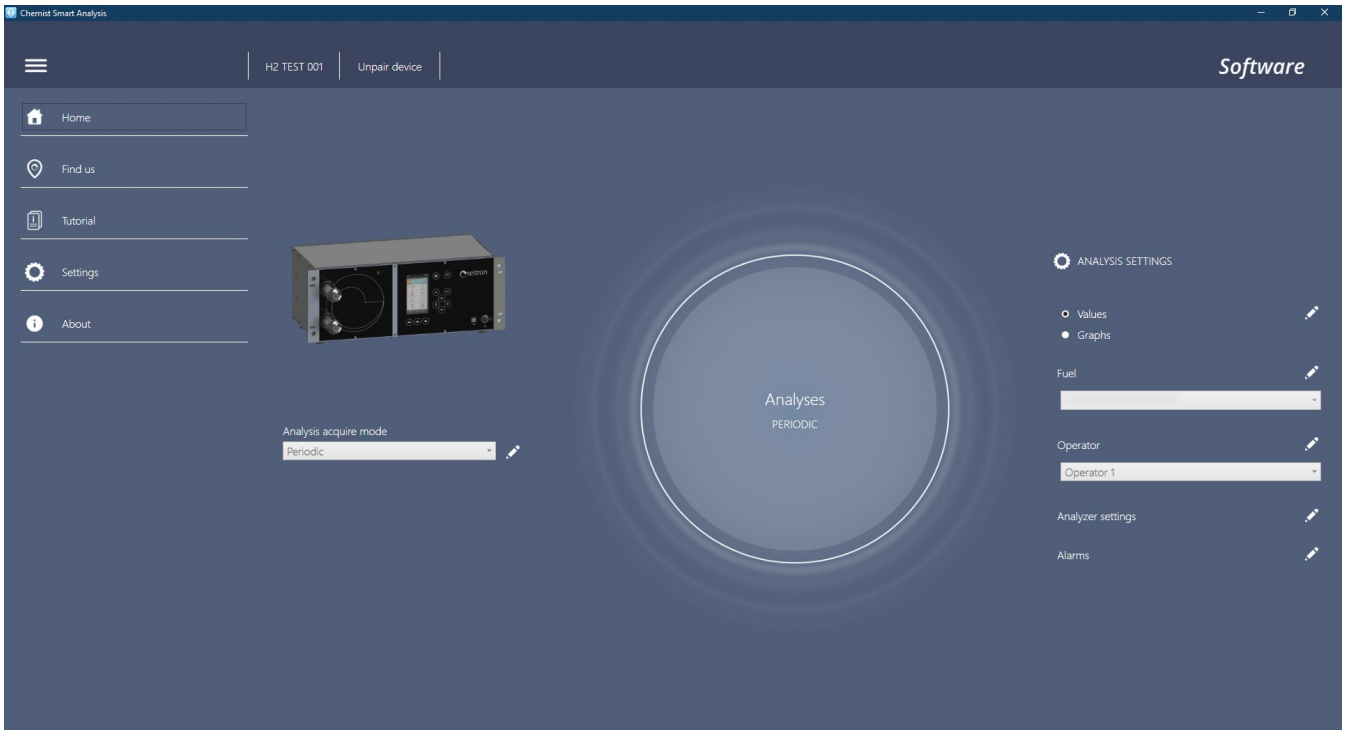
End character in the csv file.

Functioning logic of the “Periodic” analysis mode.



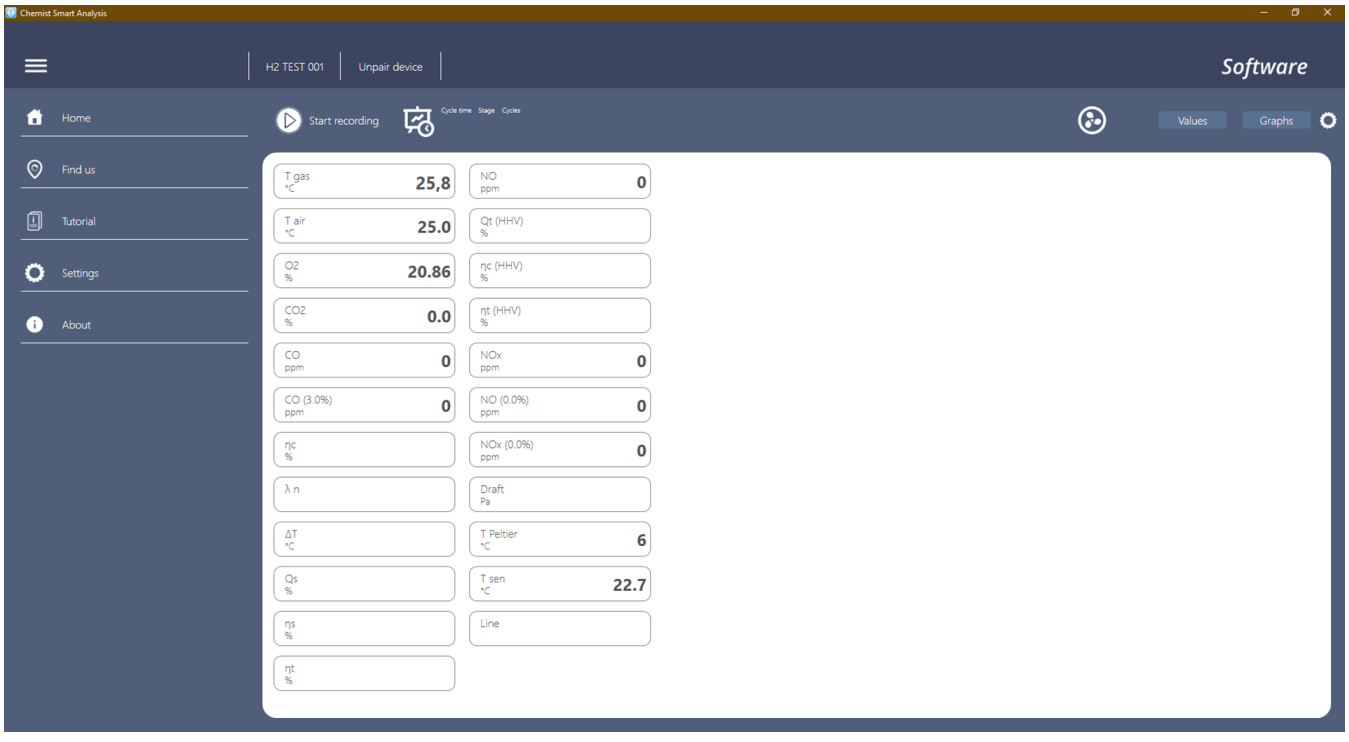
13.1.2 PERFORMING THE EMISSION ANALYSIS

By clicking on “**Analysis**” the instrument shows on real time the emission analysis.



By clicking on the symbol “**Start recording**”, the emission analysis begins according to the settings made; the data of the emission analysis are saved in a csv. file.

The instruments bar on the top of the screen, provides all the information on the analysis phase that the instrument is performing. Furthermore, it is possible to follow the progress of the analysis through a settable graph, by clicking on the icon “Graphs”.



The end of the emission analysis will be shown on video by a message.

14.0 SENSORS

This instrument uses pre-calibrated gas sensors of the Flex-Sensor series.
Sensors do not need special maintenance, but they have to be replaced periodically when exhausted.
The gas measurements are performed with electrochemical sensors which are not subject to natural degrade because they are intrinsically exempt from oxidation processes.
Measurement sensors, of the electrochemical type, are made with an anode, a cathode and an electrolytic solution which depends on the type of gas to be analyzed. The gas goes inside the sensor through a membrane with selective diffusion and generates an electric current proportional to the absorbed gas. The current is measured, converted to digital data, temperature compensated, processed by the microprocessor and shown on the display.
The gas must NOT be at a pressure which could damage or destroy the sensors; for this reason the suction pump is regulated continuously, in order to grant a proper flow to the sensors. The maximum pressure allowed is ±100 hPa.

The response times of the measurement cells used in the analyzer are:
O_2 = 20 sec. at 90% of the measured value
$CO(H_2)$= 50 sec. at 90% of the measured value
CO = 50 sec. at 90% of the measured value
NO = 40 sec. at 90% of the measured value
NO_2 = 50 sec. at 90% of the measured value
SO_2 = 50 sec. at 90% of the measured value
H_2S = 50 sec. at 90% of the measured value
NH_3 = 90 sec. at 90% of the measured value
H_2 = 90 sec. at 90% of the measured value

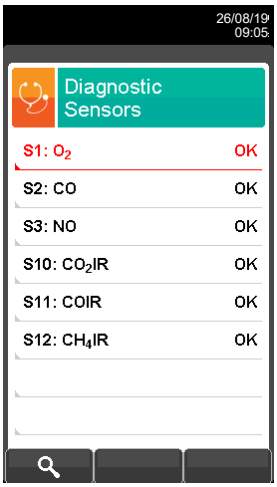
It is therefore suggested to wait 5 minutes (anyway not less than 3 minutes) in order to get reliable analysis data.

If sensors of toxic gases are submitted to concentrations higher than 50% of their measurement range for more than 10 minutes continuously, they can show up to ±2% drift as well as a longer time to return to zero.
In this case, before turning off the analyzer, it is advisable to wait for the measured value be lower than 20ppm by in taking clean air.
Using a solenoid valve, the device performs an automatic cleaning cycle (settable) and it turns off when the sensors return to a value close to zero.
Exhausted cells can be easily replaced by the user without depriving himself of the instrument and without complicated calibration procedures with certified mixtures as they are pre-calibrated before being supplied.
Seitron certifies the accuracy of the measurements only for instruments with a calibration certificate issued by its laboratory or other approved laboratory.

WARNING

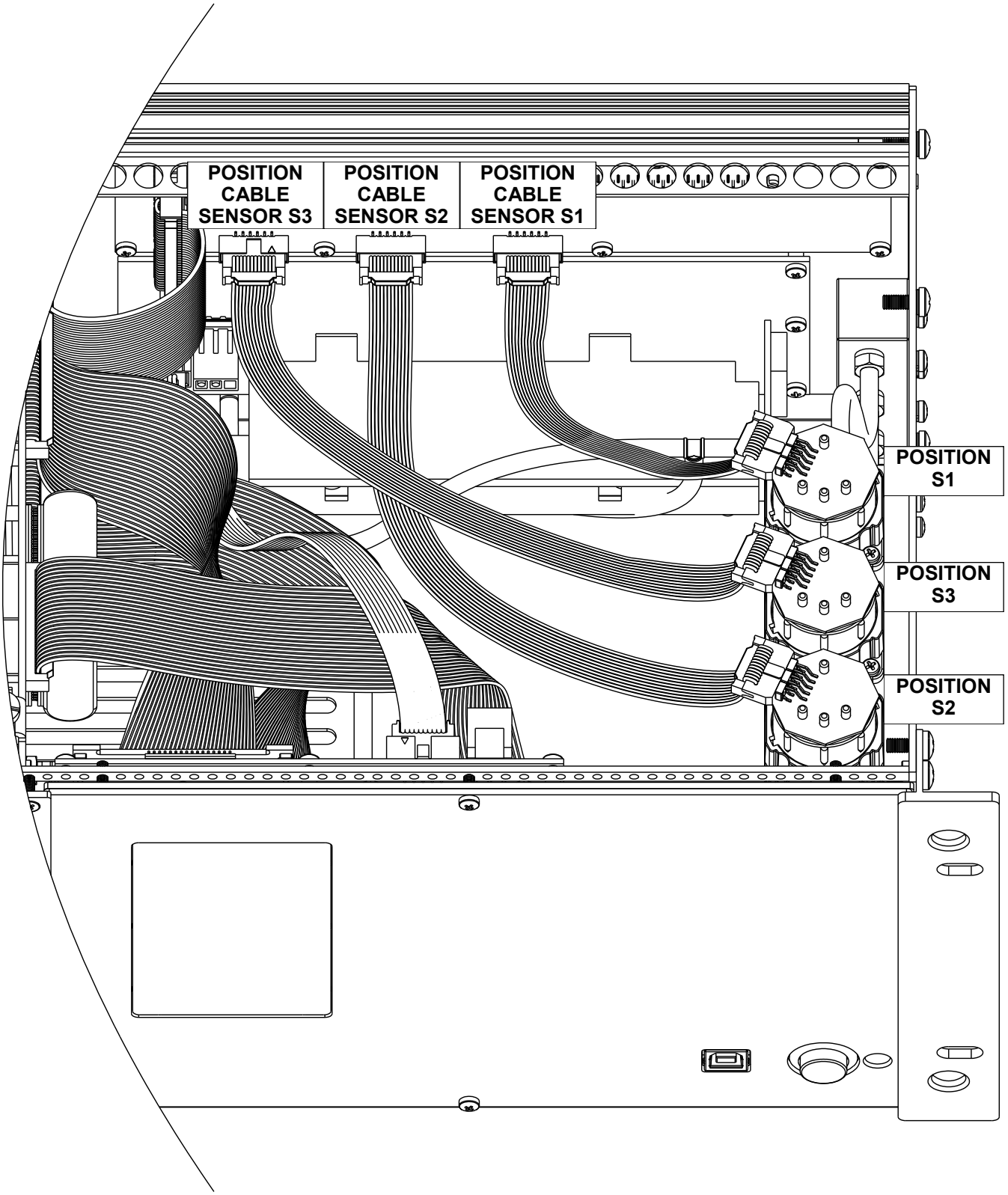
Some sensors (for example NH3, H2, H2S, SO2,…) are sensible to other gases called interfering gases.
On the analysis phase, the influence of interfering gases is compensated only if on the instrument are installed the correspondent sensors.

14.1 Graphical display visualization



Note
- **Positions are S10, S11, S12 are connected to the infrared bench.**
- **If two or more sensors of the same kind are installed, on the display will be shown the measured gas (e.g. NO2, SO2, ..) and the installation position (S2, S3, ..).**

14.2 Positioning of sensors inside the sensor compartment



14.3 Sensor types and relevant positioning

CODE \ POSITION	S1	S2	S3
Flex-Sensor O_2 LL Cod. AACSE43	✓	✓	✓
Flex-Sensor CO+H_2 Cod. AACSE12		✓	
Flex-Sensor NO Cod. AACSE10	✓	✓	✓
Flex-Sensor NO_2 Cod. AACSE14	✓	✓	✓
Flex-Sensor SO_2 Cod. AACSE13	✓	✓	✓
Flex-Sensor SO2 (J57-2017) Cod. AACSE77	✓	✓	✓
Flex-Sensor CO 100.000 ppm Cod. AACSE17	✓	✓	✓
Flex-Sensor CO 20.000 ppm Cod. AACSE18	✓	✓	✓
Flex-Sensor CO_2 0-20% v/v Cod. AACSE41	✓	✓	✓
Flex-Sensor CxHy **0-5.00% vol. ref. to CH4** Cod. AACSE39	✓	✓	✓
Flex-Sensor CO+H_2 low range Cod. AACSE24		✓	
Flex-Sensor NO low range Cod. AACSE25	✓	✓	✓
Flex-Sensor NO_2 low range Cod. AACSE26	✓	✓	✓
Flex-Sensor SO_2 low range Cod. AACSE28	✓	✓	✓
Flex-Sensor CO_2 0-50% v/v Cod. AACSE47	✓	✓	✓
Flex-Sensor H_2S Cod. AACSE35	✓	✓	✓
Flex-Sensor NH_3 Cod. AACSE56	✓	✓	✓
Flex-Sensor H_2 Cod. AACSE57	✓	✓	✓

14.4 Gas sensors life

The gas sensors used in this instrument are electrochemical: thus, when the relative gas is detected, a chemical reaction takes place inside them that generates an electrical current. The electrical current acquired by the instrument is then converted into the corresponding gas concentration. Sensor life is strongly related to the consumption of the reagents within. Sensor characteristics diminish as the reagents are consumed and when these have been used up completely the sensor must be replaced

The sensors must be recalibrated on a regular basis to assure measuring accuracy: recalibration can only be performed by a qualified SEITRON service center.

Chart 14.5 illustrates the characteristics inherent to each sensor.

14.5 Table gas sensors life

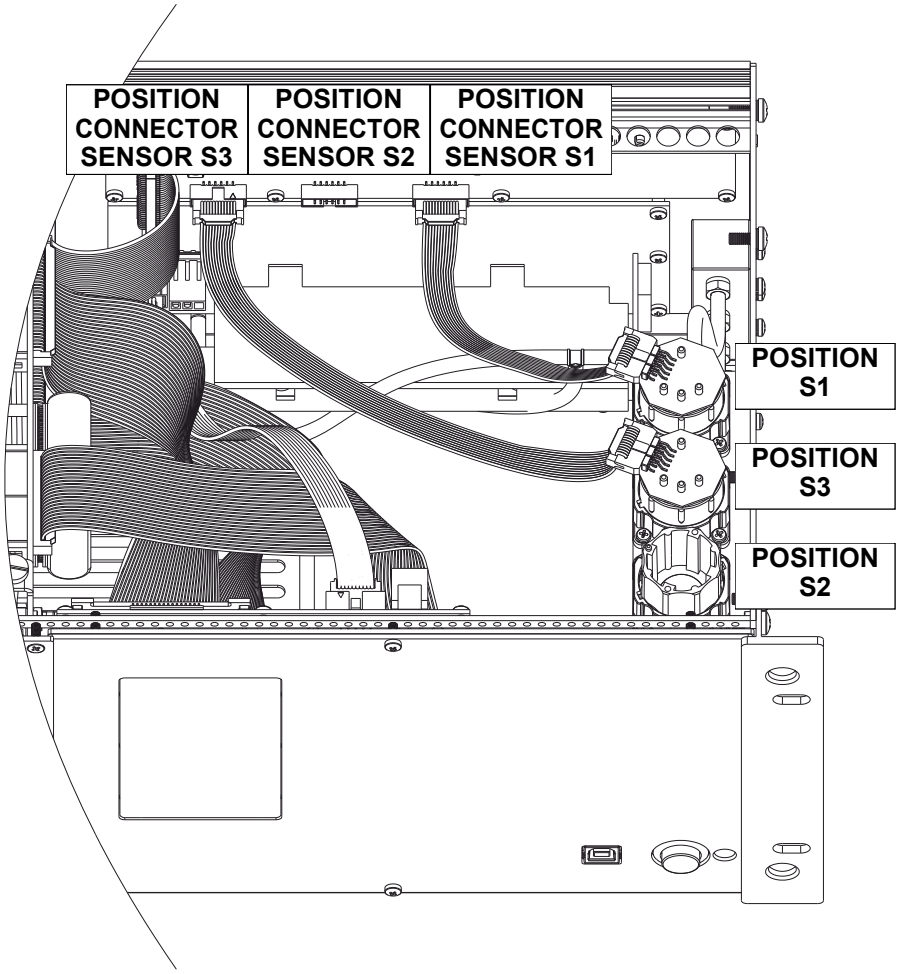
CODE	MEASURED GAS	IDENTIFYING (1) COLOR	AVERAGE LIFE	RECALIBRATION
Flex-Sensor O_2 LL Cod. AACSE43	O_2 Oxygen		48 months	not required
Flex-Sensor CO+H_2 Cod. AACSE12	CO Carbon Monoxide	Red	48 months	yearly (2)
Flex-Sensor CO+H_2 low range Cod. AACSE24	CO Carbon Monoxide	Red	48 months	yearly (2)
Flex-Sensor CO 100.000 ppm Cod. AACSE17	CO Carbon Monoxide	Purple	48 months	yearly (2)
Flex-Sensor CO 20.000 ppm Cod. AACSE18	CO Carbon Monoxide	Blue	48 months	yearly (2)
Flex-Sensor NO Cod. AACSE10	NO Nitrogen Oxide	Orange	48 months	yearly (2)
Flex-Sensor NO low range Cod. AACSE25	NO Nitrogen Oxide	Orange	48 months	yearly (2)
Flex-Sensor NO_2 Cod. AACSE14	NO_2 Nitrogen Dioxide	White	36 months	yearly (2)
Flex-Sensor NO_2 low range Cod. AACSE26	NO_2 Nitrogen Dioxide	White	48 months	yearly (2)
Flex-Sensor SO_2 Cod. AACSE13	SO_2 Sulphur Dioxide	Green	36 months	yearly (2)
Flex-Sensor SO2 (J57-2017) Cod. AACSE77	SO_2 Sulphur Dioxide	Green	36 months	yearly (2)
Flex-Sensor SO_2 low range Cod. AACSE28	SO_2 Sulphur Dioxide	Green	48 months	yearly (2)
Flex-Sensor CxHy 0-5.00% vol. ref. at CH4 Cod. AACSE39	CxHy Unburnt Hydrocarbons		48 months	yearly (2)
Flex-Sensor CO_2 0-20% Cod. AACSE41	CO_2 Carbon Dioxide		>48 months	yearly (2)
Flex-Sensor CO_2 0-50% Cod. AACSE47	CO_2 Carbon Dioxide		>48 months	yearly (2)
Flex-Sensor H_2S Cod. AACSE35	H_2S Hydrogen Sulfide		48 months	yearly (2)
Flex-Sensor NH_3 Cod. AACSE56	NH_3 Ammonia		48 months	yearly (2)
Flex-Sensor H_2 Cod. AACSE57	H_2 Hydrogen		24 months	yearly (2)

Note:

(1) Colored dot on the sensor electronic board.

(2) UNI 10389-1 standard requires for the instrument and the sensors must undergo a calibration process once per year. This task has to be performed in a laboratory authorized to issue calibration certificates.

EXAMPLE OF AN EXPANDABLE 2 SENSORS CHEMIST 900 RACK



14.6 Expandability to 3 sensors

The CHEMIST 900 RACK combustion analyzer can be expanded up to 3 cells.
The upgrading of the number of sensors can be easily done by the user by performing the following directions:

- The expandable instruments are arranged in a way to accept up to a maximum of 3 sensors.
- Identify, with the help of paragraph 14.3 "Sensor types and relevant positioning", the sensor(s) which must be added to the existing configuration (Seitron delivers all FLEX-series sensors already pre-calibrated and ready to use).

THE INSTRUMENT AUTOMATICALLY DETECTS WHEN AN ADDITIONAL SENSOR IS INSTALLED OR HAS BEEN REMOVED. THE SCREEN 'SENSORS CONFIGURATION' ALLOWS TO ACCEPT THE NEW PROPOSED CONFIGURATION OR TO IGNORE THE CHANGE DETECTED. IN THIS SCREEN ARE SHOWN, FOR EACH POSITION, THE FOLLOWING MESSAGES:

EXAMPLE OF AN 'NO' SENSOR IN POSITION 3 REPLACED WITH AN 'NO_2' SENSOR

$NO \rightarrow NO_2$ A SENSOR DIFFERENT FROM THE PREVIOUS ONE HAS BEEN DETECTED.

EXAMPLE OF A NEW SENSOR INSTALLED IN POSITION 2 (PREVIOUSLY NOT PRESENT):

$SO_2 \rightarrow \square$ A NEW SENSOR HAS BEEN DETECTED.

14.7 CxHy sensor for measurement of unburnt hydrocarbons (pellistor)

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 CH4. In the following table is shown the cross sensitivity of the CxHy sensor when exposed to fuels different from Methane (CH4), assumed as 1.00.

GAS / VAPOR	RELATIVE RESPONSE (relatively 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

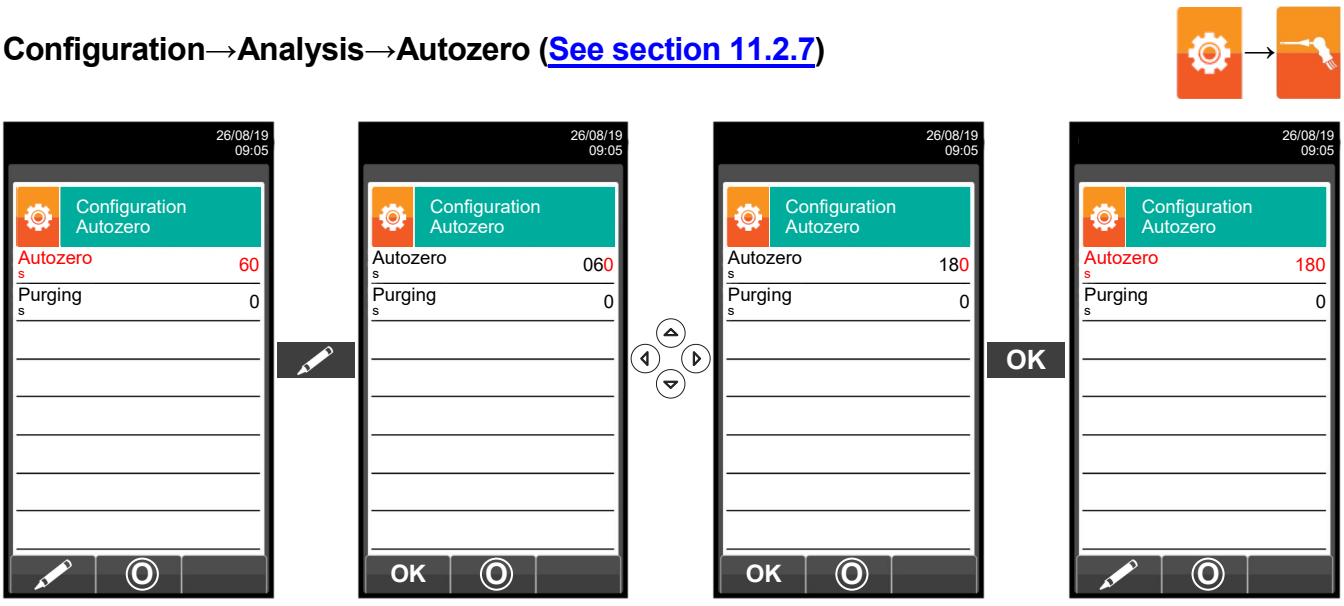
Example: 1.34 x 1.67 = 2.24

WARNING
Gases that contain acidic or silicone compounds (HMDS) can irreversibly damage the sensor.

14.7.1 Installing the CxHy sensor

When the CxHy (position S1, S2 or S3) is installed on the instrument, it is mandatory to set the autozero at 180 seconds, in order to allow a proper pre-heating of the sensor itself.

Configuration→Analysis→Autozero (See section 11.2.7)



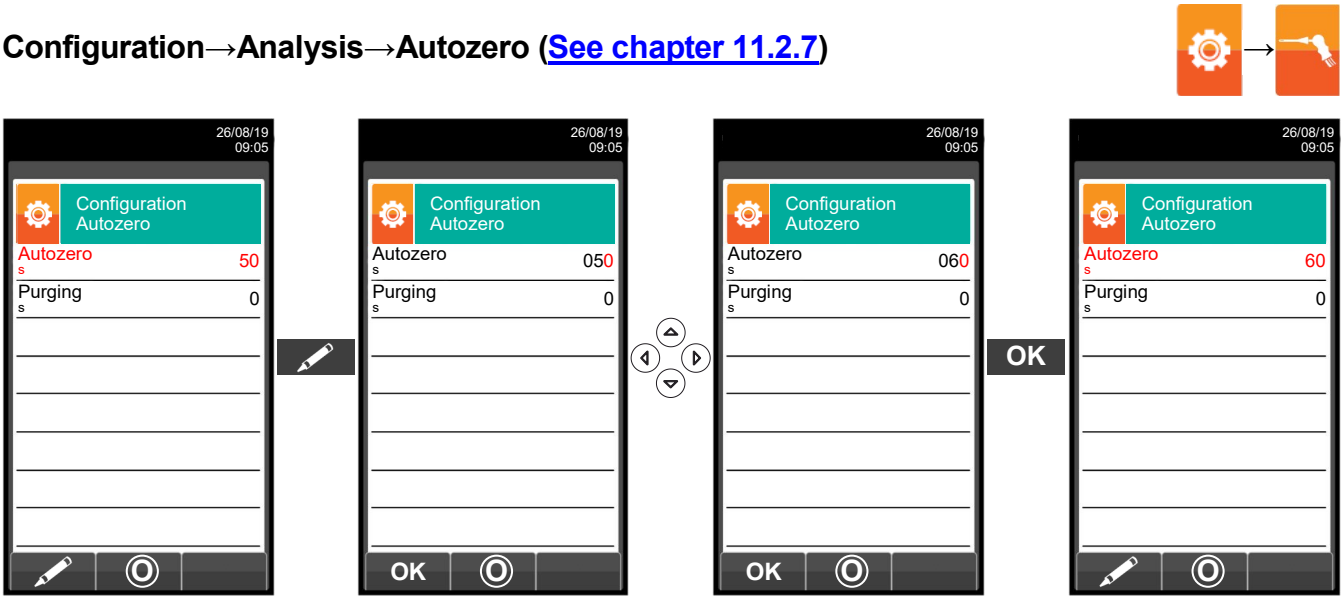
14.8 CO_2 sensor for Carbon Dioxide measurement in combustion processes (NDIR - Single Cell)

Carbon Dioxide (CO_2) 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 byproduct of respiration.
Many combustion processes are defined with 'mixed fuel' and is therefore difficult to calculate the amount of CO_2 produced. To avoid this drawback, the only way to know the amount of CO_2 produced in a combustion process with 'mixed fuel' is to measure the CO_2 with special NDIR sensors.

14.8.1 Installing the CO_2 sensor

When the CO_2 sensor is mounted on the instrument, it is mandatory to configure the CHEMIST 900 RACK the autozero by setting it at 60 seconds, in order to allow for a proper pre-heating of the sensor itself.

Configuration→Analysis→Autozero (See chapter 11.2.7)



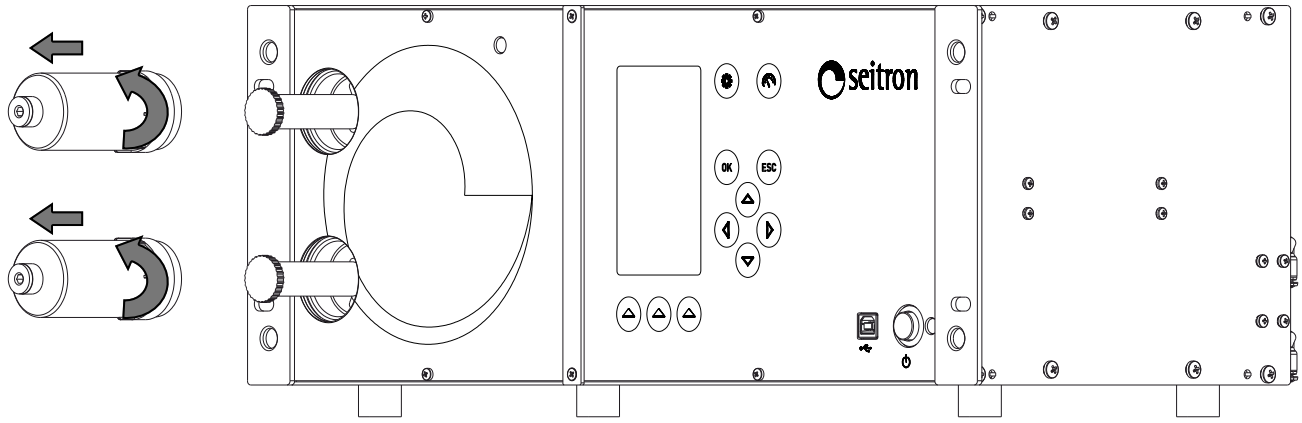
14.9 NH_3 sensor for ammonia gas measurement in combustion processes

USE ONLY WITH THE SMOKE PROBE FOR INDUSTRIAL ENGINES COMPLETE WITH SYNTHERIZED STEEL FILTER ON THE TIP AND FILTERED CARTRIDGE IN HDPE IN THE WATER TRAP.

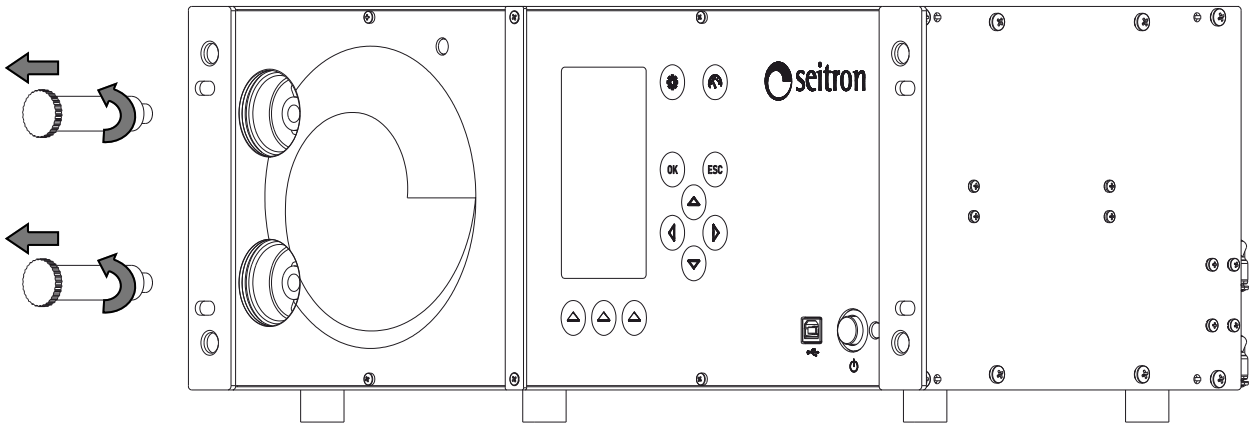
This sensor measures the presence of ammonia (NH_3) in combustion gases and, since this gas is easily soluble in H_2O, some precautions are necessary; the measure must be performed:

- For short periods of time (1-2 hours).
- Using only the flue gas sampling probe for industrial engines as it is equipped with a filter on the tip, suitable to perform this measurement. This filter creates a dry "pre-filtration" in order to retain the humidity that actually cancels the NH_3 content present in the fumes, making it not measurable.
  The filter being inserted inside the chimney is heated by the fumes and kept warm; the gas that passes through the filter does not form condensation and therefore allows an accurate measurement of ammonia. The filter inserted in the chimney is called "hot filter".
- It is necessary to replace the paper filters on the two anti-condensation traps external from the instrument, with two HDPE filters (to be sold separately), which retains the dust particles but not the residual humidity and therefore ammonia.
  The procedure to replace the filters in the anti-condensation trap is described in the following:

1 Unscrew the transparent cap.



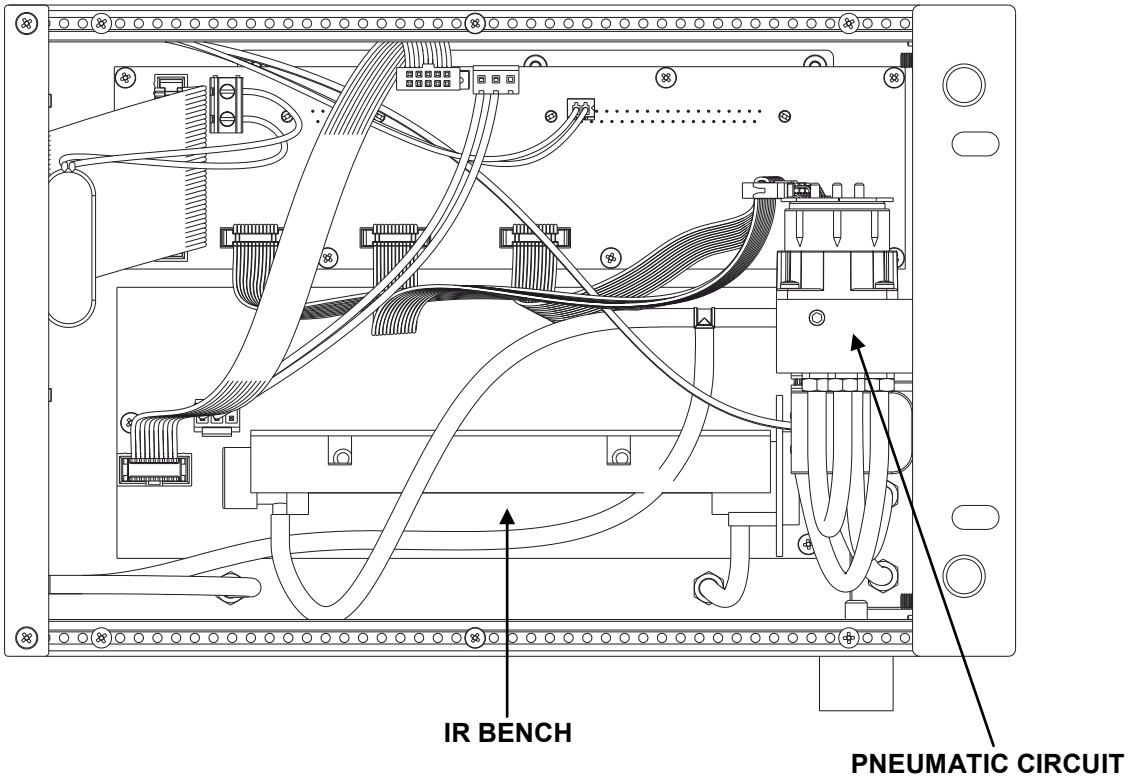
2 Un screw the anti dust filter.



3 Replace the paper filter with the HDPE filter and screw it back on its seat.

4 Place back the filter performing the operations described above in reverse order.

14.10 Infrared bench



An infrared bench for the detection of gases based on (NDIR) infrared spectroscopy can be installed on **CHEMIST 900 RACK**.
By this system it is possible to simultaneously detect one or more of the following gases: CO, CO2 and/or CH_4.
An additional dust filter is fitted along the pneumatic circuit before the IR bench.
The principle is the (NDIR) nondispersive infrared absorption at two wavelengths, stability over time, no interference with other compounds of the process, very fast response and quick return to zero value even after measuring concentrations up to the maximum measurement limit.
Gases absorb light at specific wavelengths, typically in the IR. An NDIR system includes: an IR light source, a chamber which contains the gas sample to be analyzed and a detector equipped with an optical filter. The light goes through the chamber and the gas sample will absorb it at a specific wavelength (i.e. 4.26µm for CO2) or in specific bands.
The filter is the nondispersive optical component which allows the detector to unequivocally identify the gas according to the absorption spectrum pattern. The narrower the filter bandwidth the higher is the specificity of the sensor. The intensity of light (at a specific wavelength) that reaches the detector is inversely proportional to the relevant gas concentration.
The signal picked up by the detector is then processed by the downstream electronics in order to have the concentration of CO, CO2 and/or CH_4 depending on the configuration of the instrument.

15.0 MAINTENANCE

15.1 Ordinary maintenance

This instrument has been designed and made using high quality components. A systematic and proper maintenance shall prevent the occurrence of any malfunctioning and increase the overall life cycle of your device.

The operator is recommended to carry out the following basic operations:

- Avoid any great thermal shock before using the instrument or possibly wait that its temperature is within the operating parameters.
- Do not extract flue gas directly without a dust/condensate trap.
- Do not exceed the sensor overload thresholds.
- When the analysis is completed, disconnect the water trap and hoses and let the analyzer purge with clean fresh air for at least 5 to 10 minutes, or at least until the displayed parameters return to their original values in air.
- Clean the filter unit as necessary, by replacing the dust filter and blowing air inside the tube of the sampling probe to release any condensate.

Do not use abrasive cleaners, solvents or other aggressive detergents to clean the instrument.

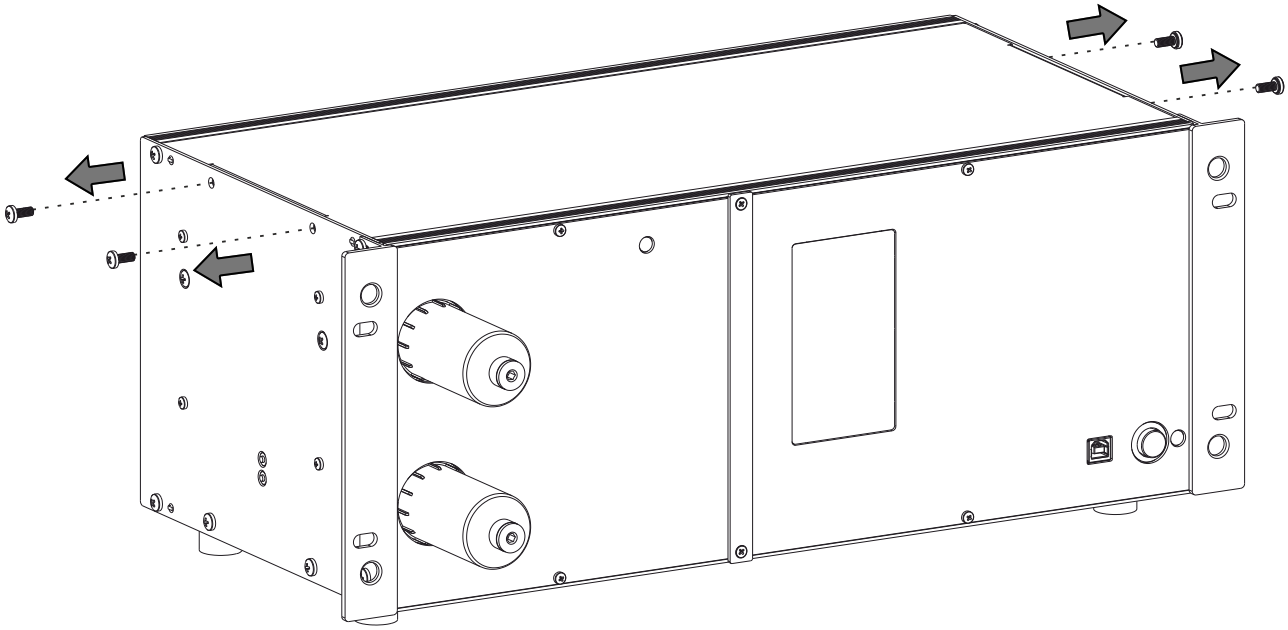
15.2 Scheduled Maintenance

Send the instrument to the SERVICE CENTER to be thoroughly cleaned and checked at least once a year.
SEITRON highly qualified personnel is always at your disposal for any commercial or technical information and implementation or maintenance issues.
The service center is always ready to timely return the instrument like brand new. Calibrations are carried out using gases and instruments in compliance with National and International Sampling standards.
The annual test and certificate of calibration guarantee the proper operation of the instrument as provided by the UNI 10389-1 standard and are mandatory for users who require ISO 9000 certification.

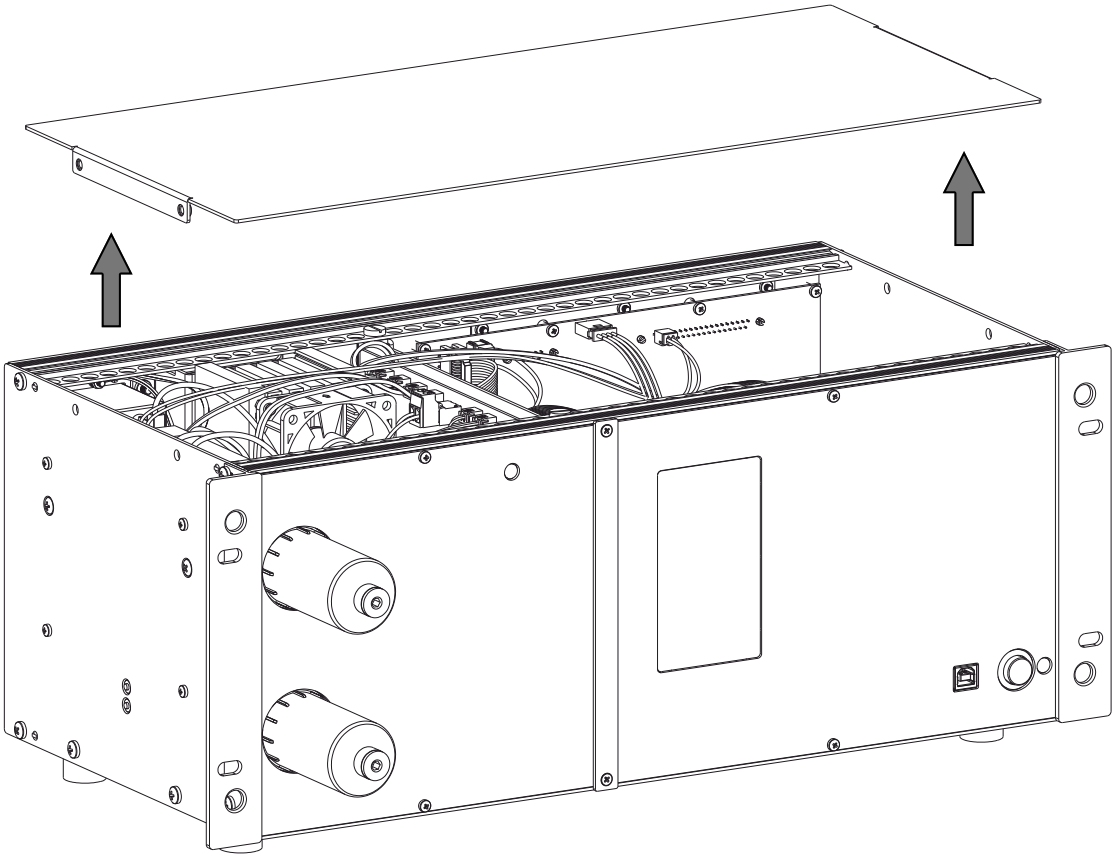
15.3 Access to the internal parts

In order to access the internal parts of the emission analyzer it is necessary to unscrew the top cover of the instrument, as shown on the figures below:

A



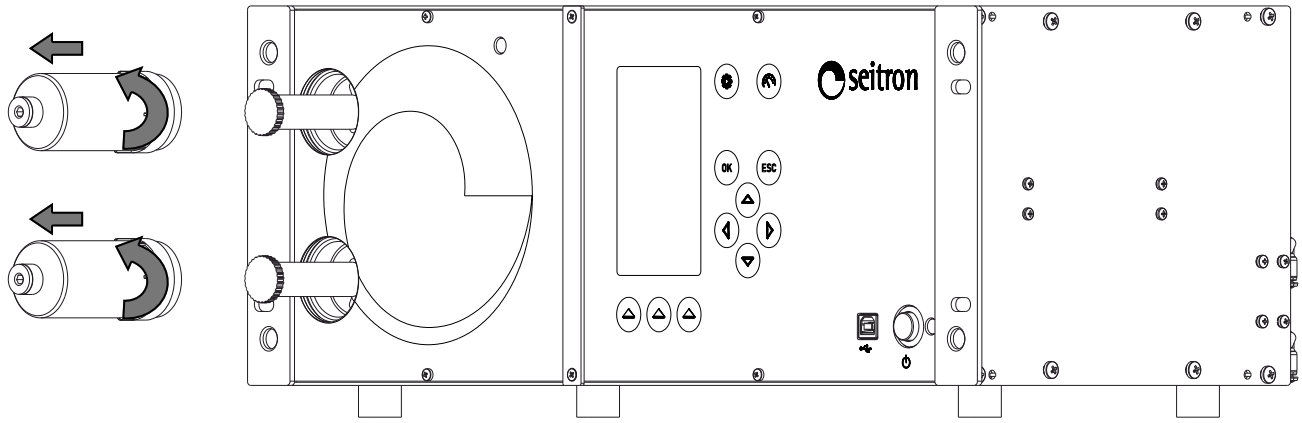
B



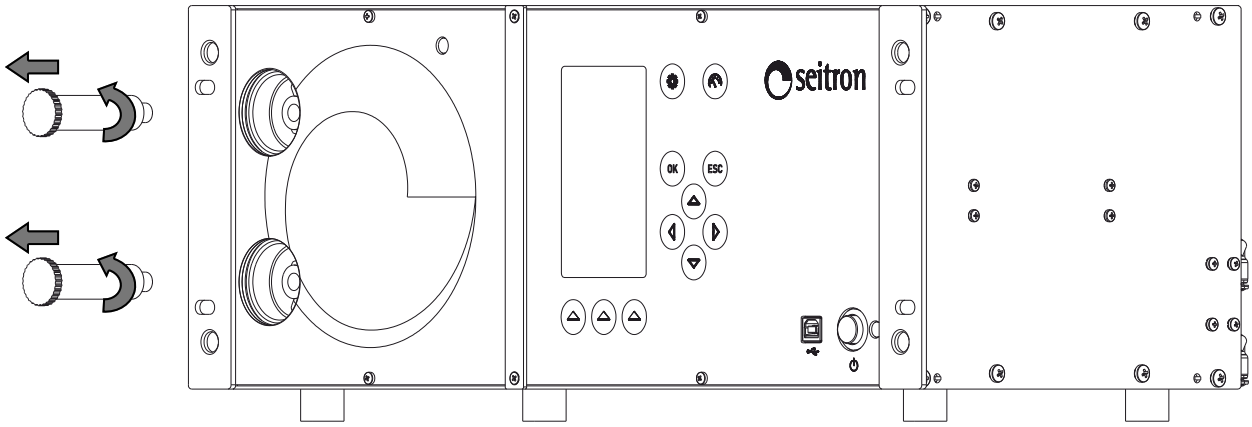
15.4 Cleaning the external dust filters

If the external particulate & dust filters have large accumulations of particulates, ash, & dust and/or have any cracks in them, then replace these filters as shown below.

1. Unscrew the transparent cover



2. Unscrew the dust filter



3. Clean the cover inside by using compressed air, soap and water or ultrasonic cleaner (do not use solvents or thinners as the case/container is made of PVC plastic material).

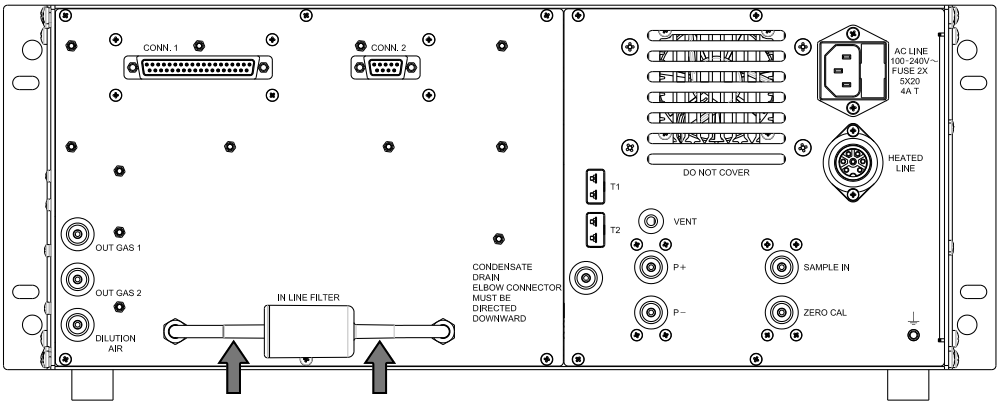
4. Replace the dust filter with a new one.

5. To reassemble the filter logically reversing this procedure.

15.5 External dust filter cleansing on the IR line

If the dust filter positioned on the back of the instrument is blackened, immediate replacement is necessary.

1. Remove the hoses from the filter



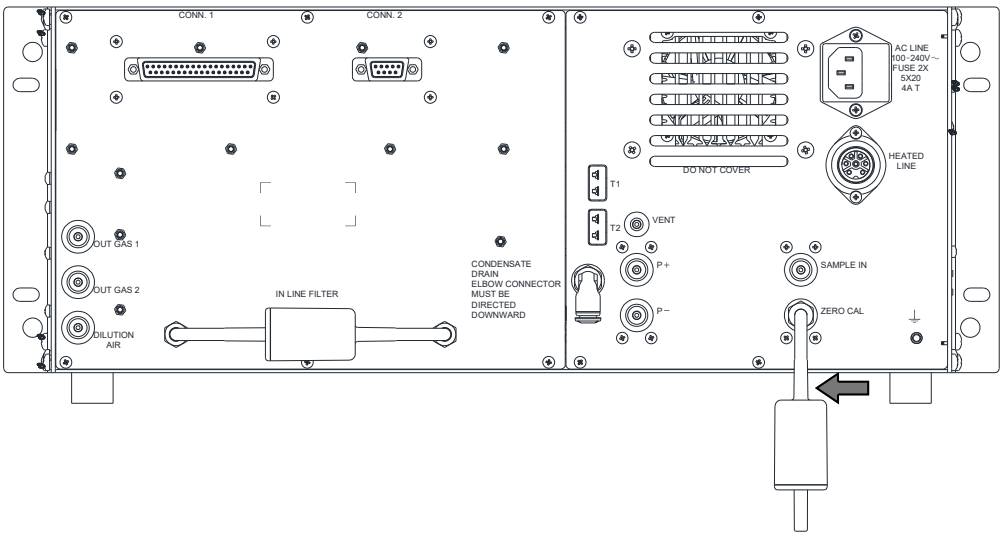
2. Replace the dust filter with a new one. See chapter “Spare parts”

3. To reassemble the filter logically reversing this procedure.

15.6 External anti-dust filter replacement on external air intake

If the dust filter positioned on the back of the instrument is blackened, replace it as soon as possible.

1. Extract the dust filter from the tube.



2. Replace the dust filter with a new one. See chapter “Spare parts”

3. To reassemble the filter logically reversing this procedure.

15.7 Fuse replacement

If it is necessary to replace the fuses of the instrument, proceed as follows.
About the fuses technical features, see chapter “7.0 Technical features”.

1. Turn off the instrument and unplug the power cable from the instrument connector.
Locate the fuse holder ad pull it out.

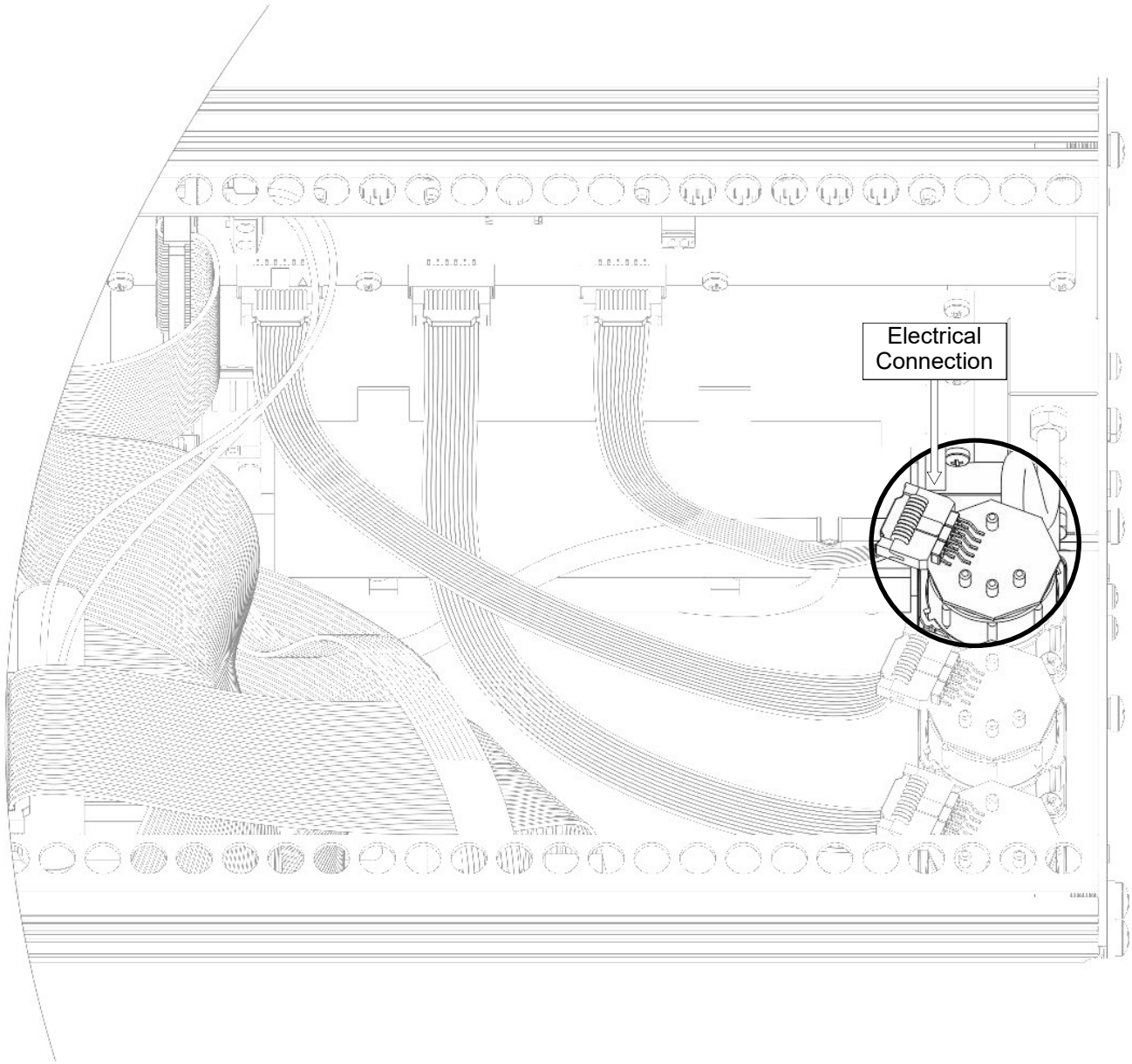
2. Extract the fuses, using a screwdriver, paying attention not to damage the fuse holder and/or the fuses themselves.

15.8 Replacing the gas sensors

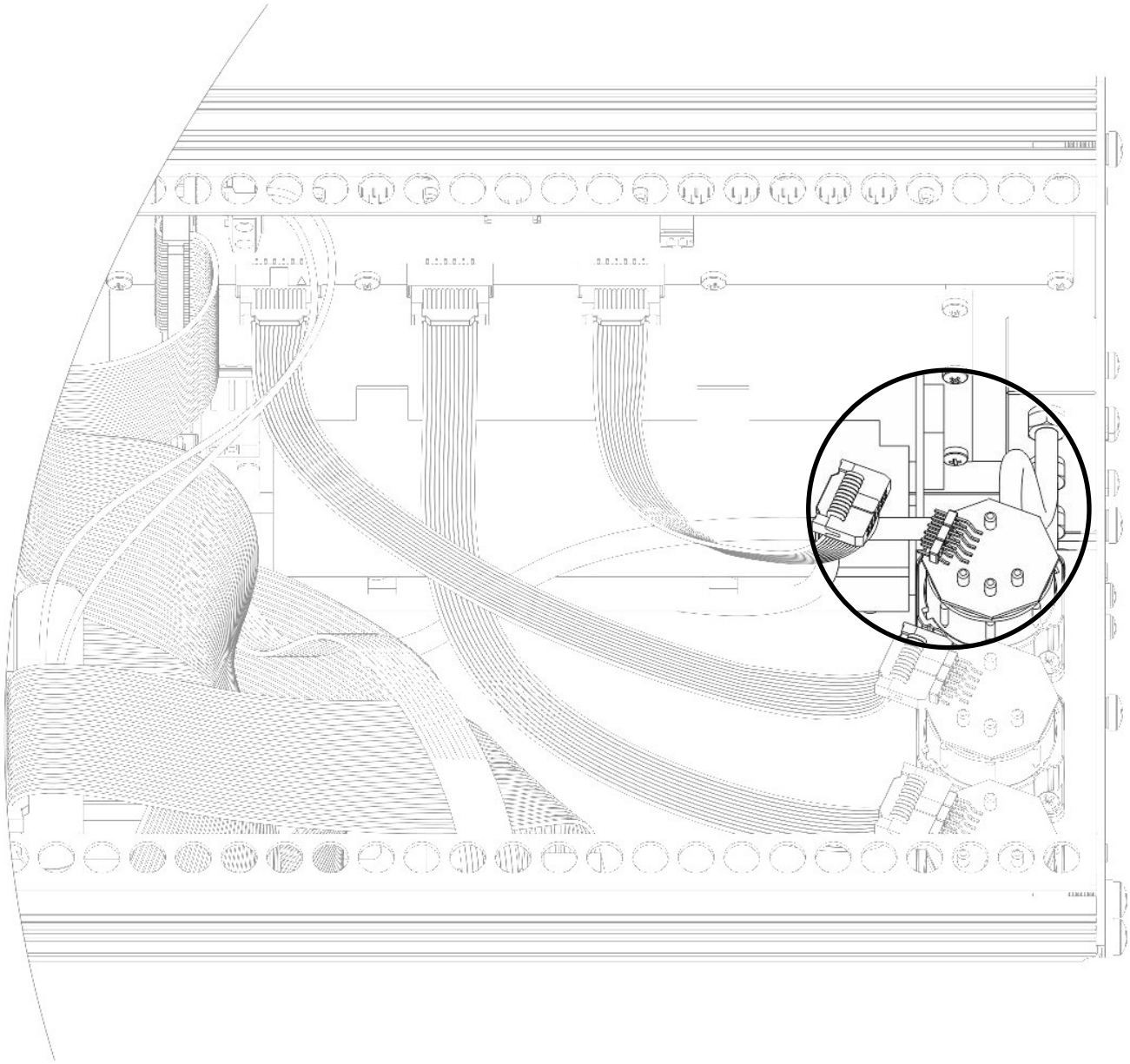
The gas sensors of the instrument shall be periodically replaced (see table 14.5) with new or recalibrated sensors.
The user can easily perform this replacement operation according to the following instructions:

1. Gain access to the internal parts of the instrument, as explained in section 15.3 " Access to internal parts ".

2. Locate the sensor to be replaced; here is an example of a connected sensor to be replaced (with the electrical connector still coupled).

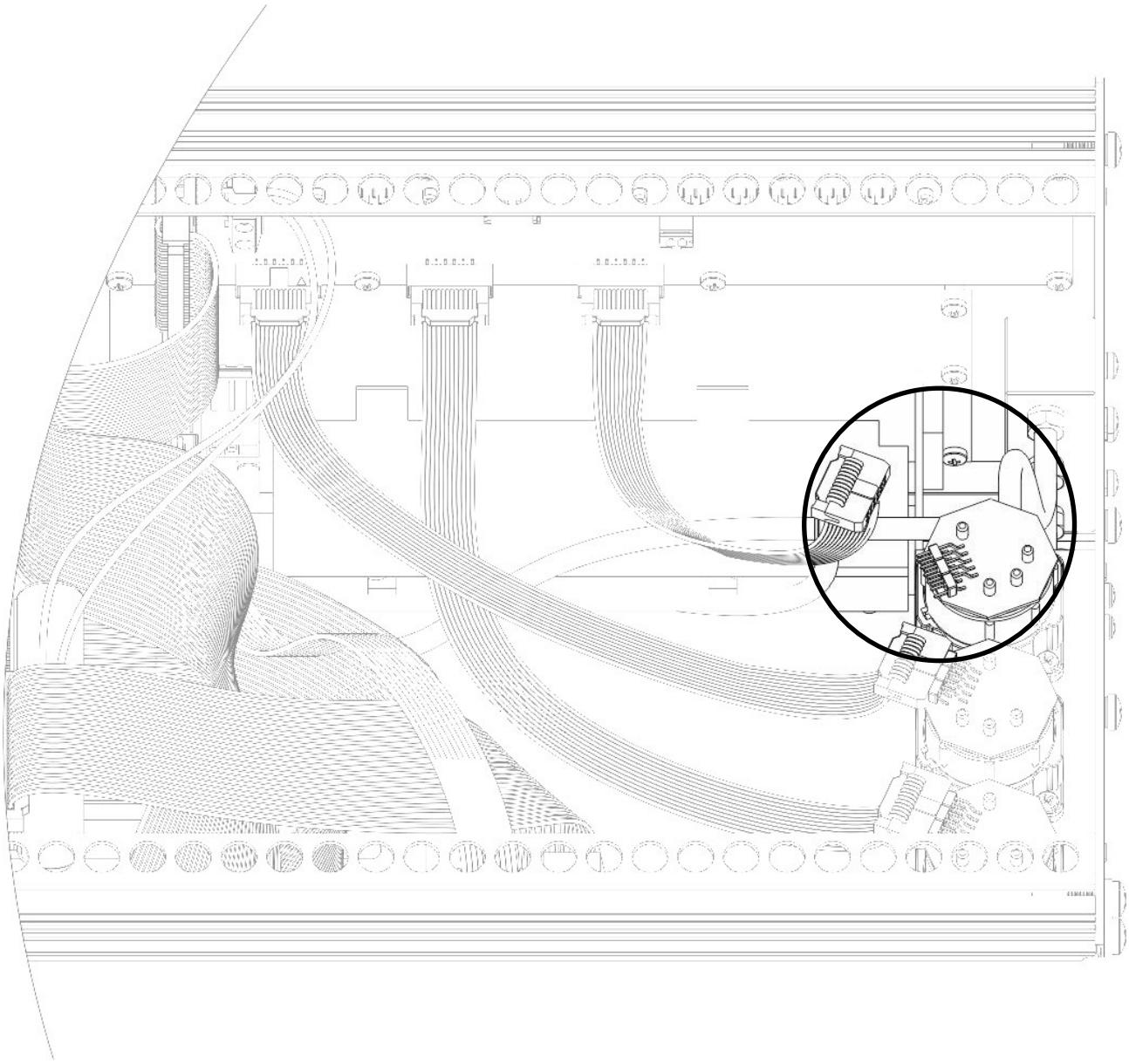


3 Unplug the electrical connection of the sensor to be replaced; in the following there is an example of a sensor to be replaced with the electrical connection unplugged.

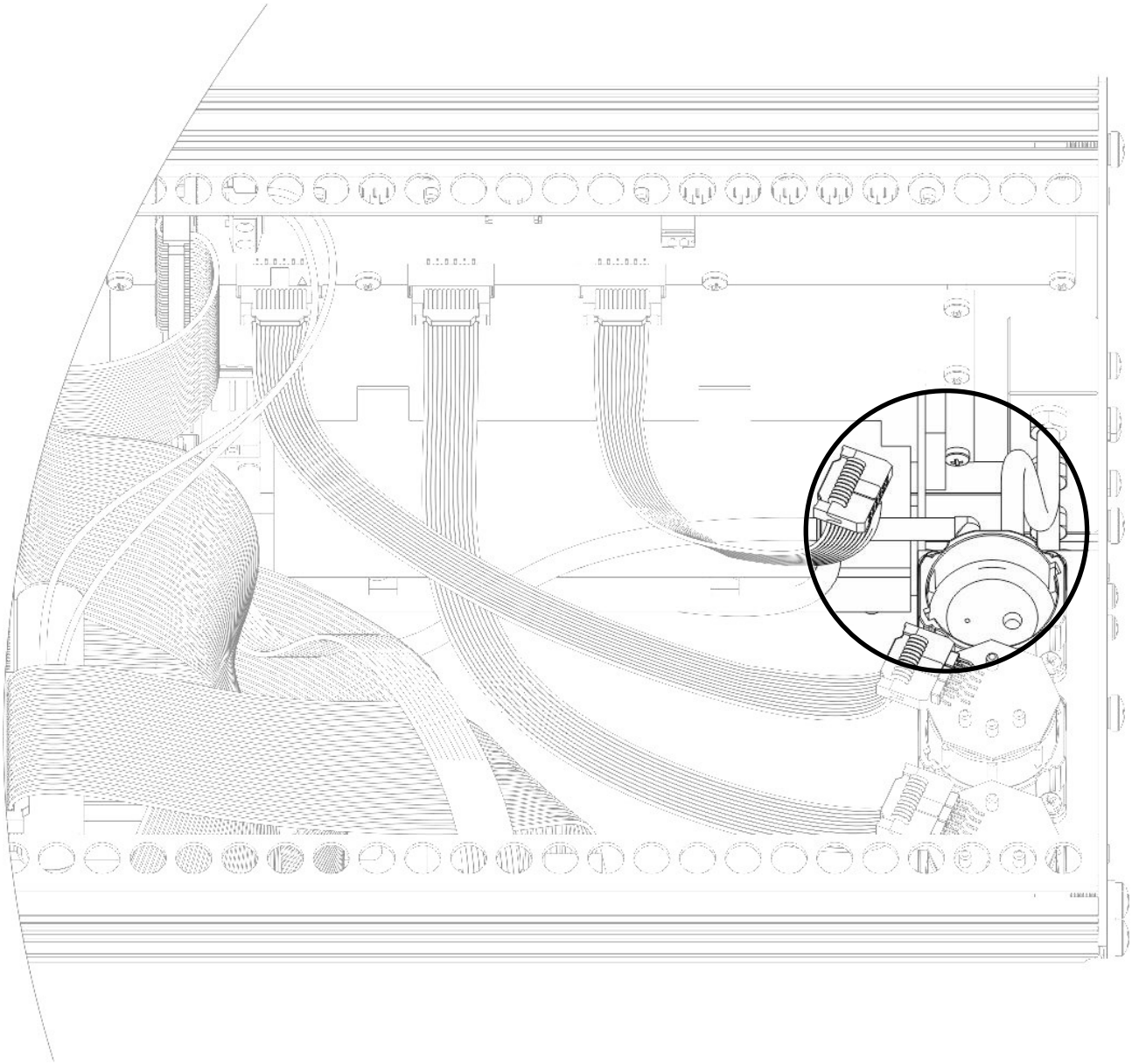


4 The sensor is bayonet-connected to its socket; rotate it counter-clockwise to remove it. Here is an example of a rotated sensor.

While rotating the sensor, take care not to exert any pressure on the printed circuit board mounted on the top of the sensor: exert pressure only onto the plastic body.



5 After rotating the sensor, pull it upward; here is an example of the sensor compartment with a sensor removed.



6 Fit the new sensor again taking care the electric connection is turned to the inside of the instrument, not the outside (See point 4).

7 Rotate the sensor clockwise until hearing a click (See point 3).

While rotating the sensor, take care not to exert any pressure onto the printed circuit above: exert pressure onto the plastic body only.

8 By paying attention to insert the connector correctly, reconnect the sensor (See point 2).

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

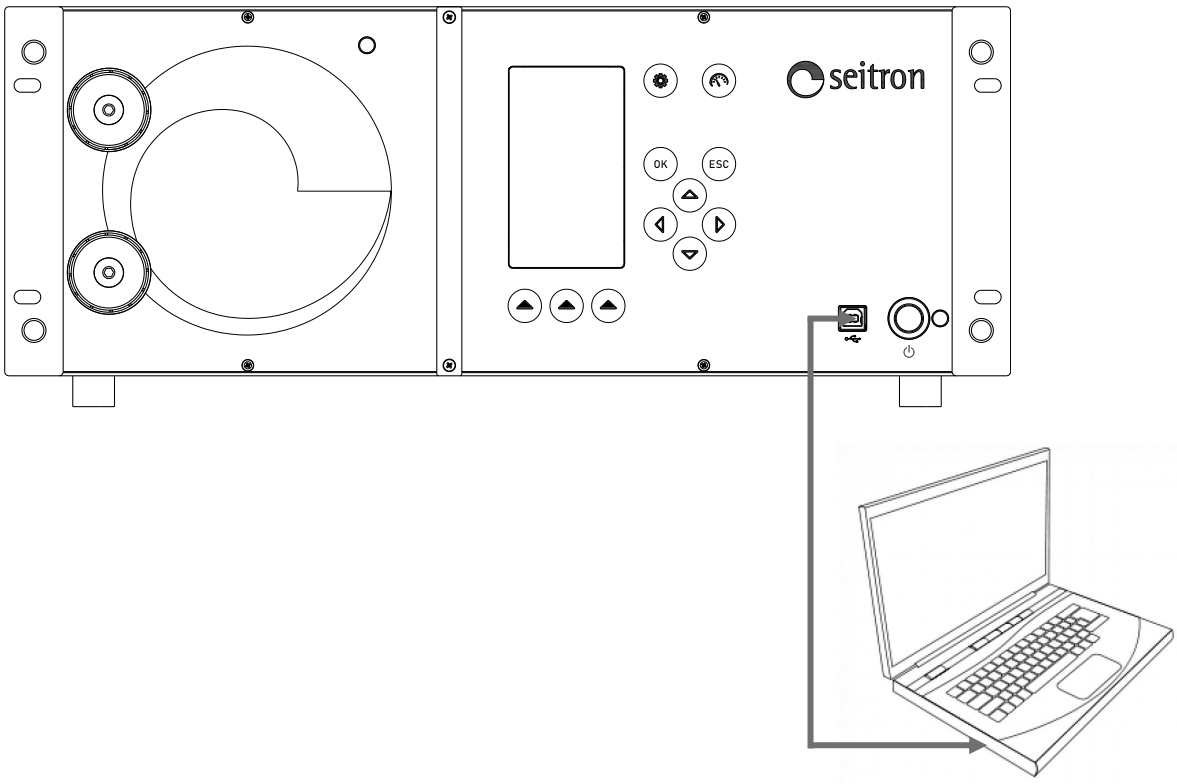
CODE	MEASURED GAS	SETTLING TIME
Flex-Sensor O_2 LL Cod. AACSE43	O_2 Oxygen	24 hours
Flex-Sensor CO+H_2 Cod. AACSE12	CO Carbon Monoxide	2 hours
Flex-Sensor CO+H_2 low range Cod. AACSE24	CO Carbon Monoxide	2 hours
Flex-Sensor CO 100.000 ppm Cod. AACSE17	CO Carbon Monoxide	2 hours
Flex-Sensor CO 20.000 ppm Cod. AACSE18	CO Carbon Monoxide	2 hours
Flex-Sensor NO Cod. AACSE10	NO Nitrogen Oxide	48 hours (1)
Flex-Sensor NO low range Cod. AACSE25	NO Nitrogen Oxide	48 hours (1)
Flex-Sensor NO_2 Cod. AACSE14	NO_2 Nitrogen Dioxide	2 hours
Flex-Sensor NO_2 low range Cod. AACSE26	NO_2 Nitrogen Dioxide	2 hours
Flex-Sensor SO_2 Cod. AACSE13	SO_2 Sulphur Dioxide	2 hours
Flex-Sensor SO2 (J57-2017) Cod. AACSE77	SO_2 Sulphur Dioxide	2 hours
Flex-Sensor SO_2 low range Cod. AACSE28	SO_2 Sulphur Dioxide	2 hours
FLEX-Sensor CxHy **0-5.00% vol. referred to CH4** Cod. AACSE39	CxHy Unburnt Hydrocarbons	1/2 hour
Flex-Sensor CO_2 0 .. 20% vol. Cod. AACSE41	CO_2 Carbon Dioxide	2 hours
Flex-Sensor CO_2 0 .. 50% vol. Cod. AACSE47	CO_2 Carbon Dioxide	2 hours
Flex-Sensor H_2S 500 ppm Cod. AACSE35	H_2S Hydrogen Sulphide	2 hours
Flex-Sensor NH_3 500 ppm Cod. AACSE56	NH_3 Ammonia	24 hours
Flex-Sensor H_2 2000 ppm Cod. AACSE57	H_2 Hydrogen	2 hours

Note:
(1) 48 hours settling time is needed; if the sensor is featured with an external polarization battery the settling time becomes 2 hours.

15.9 Firmware Update

The manufacturer periodically releases firmware updates of the instrument in order to correct unavoidable mistakes or improve the instrument performance or add new functions.
This update can be performed by the user by following the simple instructions below.

Instructions to update the combustion analyzer with a new firmware:



1. Log in to the website www.seitron.it and download the firmware file available in the "combustion analyzers" section. This file is in a compressed version .zip.
2. Unzip the file thus obtaining the contents of the .zip file (extension .srec).
3. Plug in the analyzer to the PC via the USB cable.
4. Connect the analyzer to the mains supply using the cable with the IEC C14 socket supplied
5. Press and hold the ON/OFF key of the combustion analyzer for approx. 10 seconds
6. Release the ON/OFF key; the red led turns on steady
7. Press and hold the ON/OFF key until the red led turns off
8. Release the ON/OFF key; the red led turns on flashing slowly (1 flash/second)
9. The analyzer will be recognized by the operating system as a portable device drive.
10. Copy the firmware file (extension .srec) to the directory of the analyzer.
11. The red led blinks quickly to indicate that the firmware is being updated; wait till the end of the file copy operation.
12. The red led is steady on.
10. The file copy directory will be closed and the analyzer will restart.
11. The analyzer is now updated, it can be powered off and it can be unplugged from the PC.

16.0 TROUBLESHOOTING

16.1 Troubleshooting guide

SYMPTOM	PROBABLE CAUSES AND REMEDIES
The instrument does not work; when pressing the On/ Off key, it does not switch on.	**a.** Press and hold the On/Off key down for longer than 2 seconds. **b.** Check the fuses and replace them, if it is needed. **c.** The instrument is defective: send it to the service center.
After the instrument turns on, the sensor diagnostic screen displays an error in one or more cells.	Sensor communication error (sensor may be broken or not properly connected) or a change in the sensors installed in relation to the configuration is signaled.
After switching on, the instrument fails to perform the autozeroing.	**a.** If the NDIR bench is installed and enabled, check that the autozero time is set at 70 seconds at least. **b.** An error has occurred in one or more sensors, see the sensor Diagnostic screen.
In the pressure / draft screen an error is reported to the piezoresistive pressure sensor, compensated for temperature.	There might be a calibration problem. Send the instruments to the service center.
The analysis screen gives a flue gas temperature (Tf) error.	**a.** The thermocouple is not connected; connect the thermocouple to the analyzer. **b.** The sensor has been exposed to temperatures greater or lower than its operating temperature range. **c.** The thermocouple is faulty. Send the complete probe to a service center.
On the analysis screen is reported an error on the condensate outlet circuit.	Contact the assistance center.
The “----” icon appears in the analysis screen.	The instrument is unable to calculate the numerical value based on the combustion analysis carried out. When the analyzer detects valid combustion data, the “----” icons are replaced with numerical data.
In the analysis screen, the “----” icon appears next to the gases detected by the NDIR bench.	**a.** Check if the NDIR bench is enabled, then switch off and switch the instrument on again. **b.** If in "Diagnostic➞Bench NDIR➞Status Register" the CO2, CO, CH4 indicate "invalid", it means that the inlet gas is out of the measurement range. **c.** If in "Diagnostic➞Bench NDIR➞Status Register" the Sample Temp. indicates "Out of Range", it means that the measurement temperature (detected in the cell /IR tube) is out of the 0-75°C range. **d. Warning: in the "Diagnostic➞Bench NDIR➞ Status Register" ignore the messages relating to "Zero Required" and "Proc. In Progress".** **e.** If the problem persists, contact the service center.
"Max. Lim." or "Min. Lim" appears on the analysis screen.	The relevant sensor is detecting a value that is beyond the analyzer measuring range. "Max. Lim" or "Min. Lim." are replaced by numbers when the instrument reveals values that are within the measuring range.

Troubleshooting guide

SYMPTOM	PROBABLE CAUSES AND REMEDIES
The suction pump does not work or the flow is lower than 1,5l/min.	**a.** The suction flow is blocked. Check that the particulate filter is clean. **b.** Contact the service center.
The instrument is switched on, but the display seems to be off.	**a.** Check the display brightness level (see the configuration menu). **b.** If the problem persists, contact the service center.
The heated line is enabled, but the heated tube status displays ' disab. '.	The probe connector is not properly connected to the 'HEATED LINE' connector of the instrument.
T head indicates ' no probe '.	The heated head connector is not properly connected to the 'HEATED HEAD' connector of the instrument.
T tube indicates ' error '.	**a.** The connector may be damaged. **b.** The cable of the temperature sensor may be damaged. Send it to the service center.
The heated line is enabled, but the tube status and/or the head status and/or Peltier status display ' fault '.	**a.** Check that the T head, T tube and T Peltier temperatures are within the parameters that have been set. **b.** Contact the service center.
The Cooler is enabled, but the Peltier status indicates ' fault '.	**a.** Check that the T Peltier temperature is within the parameter that has been set. **b.** Contact the service center.

17.0 SPARE PARTS AND SERVICING

17.1 Spare parts

CODE	DESCRIPTION
AACADX005	Dummy sensor
AACSE43	Flex-Sensor O_2 long life, pre-calibrated and interchangeable
AACSE12	Flex-Sensor CO+H_2, pre-calibrated and interchangeable
AACSE10	Flex-Sensor NO/NO_x, pre-calibrated and interchangeable
AACSE14	Flex-Sensor NO_2, pre-calibrated and interchangeable
AACSE13	Flex-Sensor SO_2, pre-calibrated and interchangeable
AACSE17	Flex-Sensor CO 100.000ppm, pre-calibrated and interchangeable
AACSE18	Flex-Sensor CO 20.000ppm, pre-calibrated and interchangeable
AACSE39	Flex-Sensor C_xH_y referred to CH_4, pre-calibrated and interchangeable
AACSE24	Flex-Sensor CO+H_2 low range, pre-calibrated and interchangeable
AACSE25	Flex-Sensor NO low range, pre-calibrated and interchangeable
AACSE26	Flex-Sensor NO_2 low range, pre-calibrated and interchangeable
AACSE28	Flex-Sensor SO_2 low range, pre-calibrated and interchangeable
AACSE41	Flex-Sensor CO_2 0-20% v/v, pre-calibrated and interchangeable
AACSE47	Flex-Sensor CO_2 0-50% v/v, pre-calibrated and interchangeable
AACSE35	Flex-Sensor H_2S, pre-calibrated and interchangeable
AACSE56	Flex-Sensor NH_3, pre-calibrated and interchangeable
AACSE57	Flex-Sensor H_2, pre-calibrated and interchangeable
AACSE77	Flex-Sensor SO_2 (J57-2017), pre-calibrated and interchangeable
AACCV01	Power cable and plug type schuko.
AACCV04	European power cable and plug.
AACCV06	US power cable and plug.
WFILX0016	Dust filter for IR bench protection
AAFA02	Filter cartridge, 2 pieces pack
WFUS5X20004R	4A delayed fuse
WRAC0006901	Male connector 1/8” GAS BSPP → female Ø 8 mm
WRAC0007001	Male connector 1/8” GAS BSPP → female Ø 9 mm
WRAC0007201	Male connector 1/8” GAS BSPP → tube connection Ø external 6 mm
WRACO0026	Male connector M5 → tube connection Ø external 4 mm
WRACO0041	Male connector 1/8” → rubber holder Ø 6 mm
WTUB0005301	Polyurethane tube (ø External 6mm - ø Internal 4mm).

17.2 Accessories

CODE	DESCRIPTION
AASW17	Configuration software.
AAUA01	USB-A / USB-B adapter cable.
AAFA04	Filtering cartridge HDPE 100um 12x57mm, 2 pieces pack
AASF31	180 mm flue gas sampling probe with 3 mt cable. Working temperature range: 400°C.
AASF32	300 mm flue gas sampling probe with 3 mt cable. Working temperature range: 600°C.
AASF35	750 mm flue gas sampling probe with 3 mt cable. Working temperature range: 800°C.
AASF36	1000 mm flue gas sampling probe with 3 mt cable. Working temperature range: 1200°C.
AASJ03	Flue gas suction probe handle; without ferrule - length Cable: 3 meters.
AAPT08	180mm rigid tip. Working temperature 400 °C – for AASJ03 handle.
AAPT09	300mm rigid tip. Working temperature 600 °C – for AASJ03 handle.
AAPT10	750mm rigid tip. Working temperature 800 °C – for AASJ03 handle.
AAPT11	1000mm rigid tip. Working temperature 1200 °C – for AASJ03 handle.
AACEX02S	3 m extension cable for gas sampling probe.
AASP01	Heat protection shield for flue gas sampling probes.

17.3 Service Centers

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http://www.seitron.it

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20090 Segrate (MI)
Tel. / Fax: +39.02.836.476.71
E-mail: service.milano@seitron.it

Coefficients of the fuels and Formulas

The following chart, derived from standard UNI 10389-1, lists the coefficients of the memorised fuels, used for calculating losses and efficiencies.

Coefficients for calculating combustion efficiency									
Fuel	**A1**	**A2**	**B**	**CO2t** (%)	**PCI** (KJ/Kg)	**PCS** (KJ/Kg)	**M air** (Kg/Kg)	**M H_2O** (Kg/Kg)	**V dry gas** (m^3/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

Details of the coefficients of the fuels:

- **CO2 t**: The value of CO_2 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_2 measurement is available.
  A2 is used when the CO_2 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_2 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.
- **NOx conv**: Same as CO conv, but for NOx.
- **SO2 conv**: Same as CO conv, but for SO2.
- **PCI**: Potere Calorifico Inferiore. Italian for LHV (Lower Heating Value).
- **PCS**: Potere Calorifico Superiore. Italian for HHV (Higher Heating Value).
- **m H2O**: 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.

ANNEX B

Flue gas analysis according to Italian Law No. 10/1991 and subsequent modifications and supplements, Legislative Decree 192/2005 and the UNI 10389-1 standard

Preamble

It is Seitron intention, by means of this compact guide, to provide boiler installers/service technicians with a quick and easy way to understand whether a boiler conforms to the requirements of Italian Law no. 10 dated January 1991, and subsequent modifications and supplements, and Legislative Decree 192/2005. The contents of this guide have been extremely simplified whereby they are not to be deemed at all comprehensive of the complex phenomenon of combustion.

Flue Gas Analysis: theory

During the combustion process taking place in a boiler, part of the heat evolved by the burner is transferred to the water or air to be heated. The quantity of heat available at the burner is called the input rating (Pf) and is usually declared by the boiler manufacturer. Part of this energy, known as the useful output (Pu), is used by the boiler. The remainder is lost to the flue gas in the stack and is known as Stack loss (Qs).

Thus we can say that: $Pf=Pu+Qs$

THE THERMAL EFFICIENCY OF COMBUSTION is given by:

$$\eta=100-Qs$$

According to the Italian Legislative Decree 192/2005 the MINIMUM thermal efficiency η should respect the values below:

For hot water generators:

Period of installation	Minimum efficiency %	Minimum with Pn < 35 kW
Before 29/10/1993	84 + 2 * log Pn - 2	around 85 %
From 29/10/1993 to 31/12/1997	84 + 2 * log Pn	around 87 %
From 01/01/1998 to 07/10/2005	Standard boilers 84 + 2 * log Pn	around 87 %
	Low temperature boilers 87.5 + 1.5 * log Pn	around 90 %
	Condensing boilers 91 + 1 * log Pn	around 92.5 %
After 08/10/2005	Condensing boilers 90 + 2 * log Pn - 1	around 92 %
	Other boilers 88 + 2 * log Pn - 1	around 90 %

For hot water generators:

Period of installation	Minimum efficiency %	Minimum with Pn < 35 kW
Before 29/10/1993	83 + 2 * log Pn - 6	around 80 %
After 29/10/1993	84 + 2 * log Pn - 3	around 83 %

Stack loss is calculated by applying a simple formula which relates it to other easily measurable parameters:

$$Qs = \frac{A2}{CO_2} + B \quad Tf-Ta$$

Where: A2, B = factor that depends on the fuel used
Tf = flue gas temperature
Ta = combustion air temperature
CO_2 = % carbon dioxide in the flue gas

Thus in order to calculate the stack loss and hence the thermal efficiency of a plant, one must measure the two temperatures (flue gas and air) and the level of carbon dioxide contained in the flue gas (% CO_2). These operations are performed automatically by the flue gas analyzer during testing.

ANNEX C

Optional measures list which the instrument can perform, if properly set:

MEASURE	DEFINITION
λ, n	**Air index** (defined as **λ,** sometimes also indicated as **n**).
e	**Air excess.** 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.
T smoke (T1)	**Smoke temperature**, detected by the probe linked to connector T1.
T air (T2)	**Combustion air temperature**, detected by the probe linked to connector T2.
T Peltier	**Peltier condensation cells temperature.**
T tube	**Heated tube temperature.**
ΔT	**Differential temperature:** It is the difference between the smoke temperature and the air combustion temperature.
Qs (LHV)	**Stack losses in relation to the Lower Heating Value:** It is the percentage of dissipated heat through the stack referred to the lower heating value (LHV)
ηs (LHV)	**Sensible efficiency in relation to the Lower Heating Value:** It is the burner efficiency calculated according to the UNI 10389-1 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.
ηc (LHV)	**Condensation efficiency in relation to the Lower Heating Value:** Efficiency deriving from the condensation of water vapor contained in flue gases, calculated according to the UNI 10389-1 standard, and it is referred to the LHV.
ηt (LHV) **ηt = ηs + ηc**	**Total efficiency in relation to the Lower Heating Value:** Total efficiency. It is the sum of sensible efficiency and condensation efficiency. It is referred to LHV (Lower Heating Value) and can exceed 100%.
Qs (HHV)	**Stack losses in relation to the Higher Heating Value:** It is the percentage of dissipated heat through the stack referred to the higher heating value (HHV)
Qt (HHV)	**Total stack losses:** It is the total heat percentage dissipated through the stack.

MEASURE	DEFINITION
ηs (HHV)	**Sensible efficiency in relation to the Higher Heating Value:** 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.
ηc (HHV)	**Condensation efficiency in relation to the Higher Heating Value:** Efficiency deriving from the condensation of water vapor contained in flue gases referred to the HHV.
ηt (HHV)	**Total efficiency in relation to the Higher Heating Value:** 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%.
Draft	Stack draft measurement.
T sen	Sensor compartment temperature.
Pump capacity	Smoke pump capacity.
PI	**Poison Index (CO/CO2 ratio)**: It is defined as the ratio between CO and CO2 useful to determine whether the system needs maintenance.
Pressure	Pressure measurement through P+ and P-.
Velocity	Gas speed, detected by the Pitot tube.
NOx	Measure of nitrogen oxides quantity; the measurement unit can be set in the special menu.
NOx ppm *	Measure of nitrogen oxides quantity; the measurement unit can not be set but it is fixed in ppm.
NOx (rif. O2)	Measure of nitrogen oxides quantity referring to O2; the measurement unit can be set in the special menu.
NOx (rif. O2) ppm *	Measure of nitrogen oxides quantity referring to O2; the measurement unit can not be set but it is fixed in ppm.
CO	CO quantity measurement. Measurement units: ppm - mg/m^3 - mg/kWh - g/GJ - g/m^3 - mg/kWh - % - ng/J
CO (RIF)	CO quantity measurement with O2 reference. Measurement units: ppm - mg/m^3 - mg/kWh - g/GJ - g/m^3 - g/kWh - % - ng/J

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

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 CELL 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

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Dichiarazione di Conformità UE
Declaration of conformity EU
Déclaration de Conformité UE
EU Konformitätserklärung
Declaración de Conformidad UE

Nr. 032907

Pag. 01 di 01

Nome e indirizzo del fabbricante:
Constructor name and address: / Nom et adresse du fabricant: / Name und Adresse des Herstellers: / Nombre y dirección del fabricante:

Seitron S.p.A. a socio unico
Via del Commercio, 9/11 36065 Mussolente (VI) - ITALY

Dichiara sotto la propria esclusiva responsabilità che il seguente prodotto:
Declares under its sole responsibility that following product: / Déclare sous sa propre responsabilité que le produit suivant : / Der Hersteller erklärt unter der alleinigen Verantwortung, dass folgendes Produkt: / Declara bajo la propia y exclusiva responsabilidad que el siguiente producto:

nome del prodotto: **H2**
product name: / nom du produit: / produktname: / nombre del producto: **(CHEMIST 900 RACK)**

versioni del prodotto: **Tutte**
Product versions: all / Versions du produit : toutes / Produktversion: alle / Versiones del producto: todas /

è conforme alla pertinente normativa di armonizzazione dell'Unione:
is in conformity with the relevant Union harmonisation legislation: / est conforme à la législation d'harmonisation communautaire applicable : / entsprechen den aktuell gültigen Europäischen Normen EN / DIN EN (Harmonisierungsvorschriften der Europäischen Union): / es conforme a las pertinentes normativa de armonización de la Unión:

EMC 2014/30/UE
LVD 2014/35/EU
RoHS2 2011/65/UE & DIRECTIVE 2015/863/UE

Sono state utilizzate le seguenti norme armonizzate e specifiche tecniche:
The following harmonized standards and technical specifications have been applied:/ Voici les normes harmonisées et spécifications techniques qui ont été utilisées: / Folgende harmonisierte Normen und technische Spezifikationen wurden angewendet: / Han sido utilizadas las siguientes normas armonizadas y específicas técnicas:

EN 50270 (2006)

EN 60335-1 (2012) Per le parti citate nella norma di prodotto
For parts mentioned in the Product Standard / Pour les pièces mentionnées dans la norme de produit / Gültig für die genannten Parteien in der Produktnorm bezeichnet / Para las partes mencionadas en la norma del producto.

EN 50581 (2012) Per i sensori di O_2 elettrochimici vale l'esenzione di cui all'Allegato IV, punto 1b.
Electrochemical O_2 sensors are exempted according to Annex IV, point 1b / Pour les capteurs électrochimiques d'O_2, l'exemption prévue à l'annexe IV, point 1b / Die Ausnahme gemäß in der Anhang IV Nummer 1b, ist gültig für CO2-elektrochemischen Sensoren / Para los sensores electroquímicos de O2, se aplica la exención del anexo IV, punto 1b.

Note aggiuntive:
Further notes:
Notes complémentaires :
Wichtiger Hinweis:
Notas adicionales:

Inoltre, si dichiara la conformità alle seguenti norme di prodotto:
Furthermore, the conformity to the following product standars is declared: / De plus, nous déclarons la conformité aux normes de produit suivantes : / Außerdem die Einhaltung der folgenden Produktnormen erklärt wird: / Además, se declara el cumplimiento de las siguientes normas de producto:

EN 50379-1 (2012) Requisiti generali e metodi di prova
General requirements and test methods / Conditions générales et méthodes d'essai / Allgemeinen Anforderungen und Prüfverfahren / Requisitos generales y métodos de prueba.

EN 50379-2[1] (2012) Requisiti prestazionali per apparecchiature impiegate per ispezioni e valutazioni obbligatorie
Performances requirements for apparatus used in statutory inspections and assessment / Conditions de performance pour appareils pour les inspections et évaluation obligatoires / Leistungsanforderungen für Geräte, die für obligatorische Inspektionen und Bewertungen verwendet werden /
Requisitos de rendimiento para equipos utilizados para inspecciones y evaluaciones obligatorias.

Casoni di Mussolente, li 02/08/19

Ing. Vito Feleppa
Amministratore Delegato Seitron S.p.A. a socio unico

seitron spa a socio unico P. IVA 00775330244 ISO 9001 Via del Commercio, 9 36065 Mussolente - VI - ITALY

1 *Valido per le configurazioni che includono uno o più dei seguenti sensori:*
Valid for configurations equipped with one or more of the following sensors:
Valable pour les configurations comprenantes l'un ou plusieurs des capteurs suivant :
Gültig für Konfigurationen die eine oder mehrere der folgenden Sensoren enthalten:
Válido para configuraciones que incluyen uno o más de los siguientes sensores:

O_2:	Qualunque codice / *All codes / N'importe quel code / Jegliche Codes / Cualquier código*
$CO+H_2$:	Cod. AAC SE12 (Low+Mid)
CO:	Cod. AAC SE18 (High)
NO (optional):	Cod. AAC SE10
SO_2 (optional):	Cod. AAC SE13

WARRANTY CERTIFICATE

WARRANTY

Chemist 900 Rack analyzer is guaranteed for 24 months from the date of delivery note, electronic parts and measurement sensors.
Seitron undertakes to repair or replace, free of charge, those parts that, in its opinion, are found to be faulty during the warranty period. The products which are found defective during the above mentioned periods of time have to be delivered to Seitron Laboratories carriage paid. The following cases are not covered by this warranty: accidental breakage due to transport, inappropriate use or use that does not comply with the indications in the product's use and maintenance manual.
Any mistreatment, repairs and modifications to the product not explicitly authorized by Seitron shall invalidate the present warranty.

IMPORTANT

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

Space reserved for user

Name: _____

Company: _____

User's notes:

_____

_____

_____

_____

_____

Date: _____

S.N.:

MODEL:

seitron
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