EN

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Portable Flue Gas Analyser

BOSTON HD

Instruction manual

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IMPORTANT NOTICE
Please read carefully and keep this instruction manual.

NOTE: The present manual is valid for instruments with firmware 3.27 versions and later versions

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1 Introduction

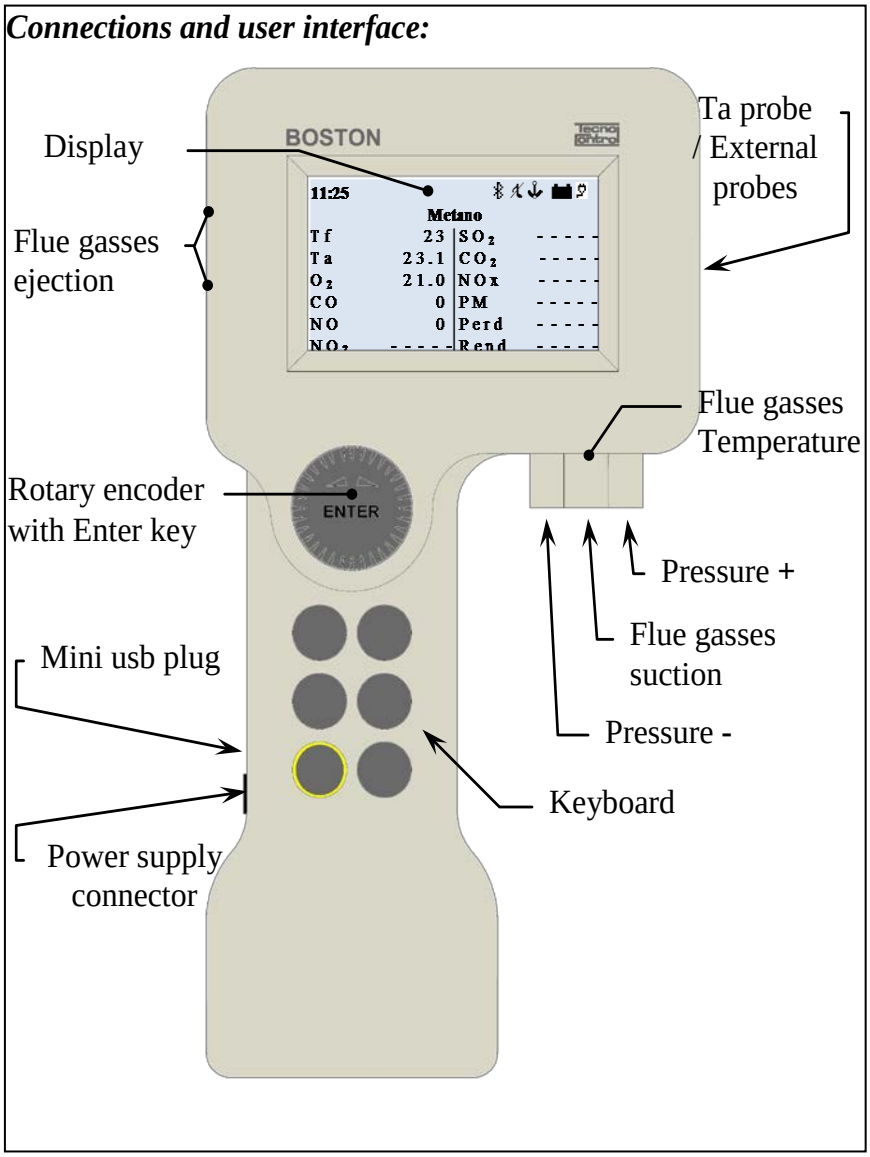
Our products have been designed and realised with the best accuracy in order to give them the highest reliability for their use. A correct use and a regular maintenance of the instrument are necessary for a better reliability and will keep a high value of this important working device.

The instrument must be used only for the application it has been made for, it must not be stored at too low or too high temperatures (see technical specifications), and we suggest to avoid quick temperature changes to avoid condensation inside the instrument.

An accurate annual maintenance from the customer is required.

2 Product description

Connections and user interface:



Ta probe: the plug where to connect the combustion air temperature probe

External probes: the plug where to connect the optional external probes.

Pressure +: the pressure plug where to connect the flue gas probe or the leak test kit.

Flue gases temperature: the Tc K plug where to connect the flue gas thermocouple probe.

Flue gases suction: the plug where to connect the flue gas probe.

Pressure -: the plug where to connect the auxiliary pressure plug (negative door)

mini usb door: the plug of USB cable for PC PC.

Power supply: the plug where to connect battery charger (from main).

Flue gases Ejection: Where analyzed flue gasses are ejected.

3 Warnings and Preliminary operations

The instrument and the infrared printer (model BST337) are supplied with new batteries that are not fully charged.
The instrument battery pack (Li-ion) reaches its maximum efficiency after a few charging cycles. Its duration could then be initially less than the one stated in the data plate.
The batteries of the printer (Ni-MH technology) must be removed from the battery compartment if not used for a long period of time.
To charge the instrument and the infrared printer batteries, please use the same charger (supplied with the instrument)
Before using the instrument please check the status of the filters (replace them if needed).

3.1 Instrument battery charging

For the first use or after a long period of inactivity it is advisable to charge the batteries by connecting the instrument to the charger supplied, leaving it in charge for at least 8 hours.
Charging process:
a) Connect the charger to the instrument off.
b) Plug the charger into the main (100-240Vca)
c) The instrument is lit and the display shows low battery icon charging
d) At charging end the display shows the end of the charging icon.

3.2 Infrared printer (model BST337) battery charging

For the first use or after a long period of inactivity it is advisable to charge the batteries by connecting the printer (model BST337) to the charger supplied, leaving it in charge for at least 8 hours.
Charging process:
a) Connect the charger to the printer off.
b) Plug the charger into the main (100-240Vca)
c) The "status" led of the printer start blinking, indicating that charging is in progress
d) At charging end the "status" led of printer shuts down.

3.3 Flue gasses probe connection

Before proceeding to the flue gasses analysis, verify that the probe is properly connected to the instrument

Connect the clear tube of the probe to the larger diameter circular plug (the one in the middle)

Connect the black tube of the probe to the circular plug on the right (toward the instrument outside)

Connect the mail plug TcK of the probe (yellow plug) to the female plug TcK of the instrument (always of yellow color)

Verify that the cap of the condense collector (anti condensing trap) is set correctly and that is firmly placed.

3.4 External probes connections

The instrument is designed to operate, with auto identification, various external probes (for the measurement of various parameters)

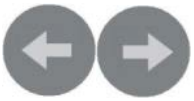
To use the probe, connect it to the instrument (by the plug indicated in the side image) and access to the menu external probe.

See paragraph 4.4.6"06 External probe" *of this manual*

3.5 User interface: keyboard and display

Keyboard

(On/Off): *"on/off" key: instrument switch on/shut off key*



(Left arrow) *and* ***(Right arrow):*** *Arrows Key*
Can have different functions, depending on what is indicated on the display

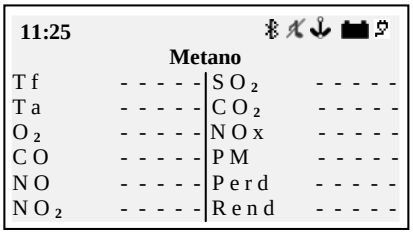
(Enter): *Key "enter / print". Key with function to confirm / print. When pressed on the main screen, it gives access to the menu entries.*

(Menu): *Key "Menu". Key with function to access the main menu (from the main screen). Can have different functions, depending on what is indicated on the display.*

(Esc): *Key "esc". Key with function to exit.*
If pressed twice consecutively and quickly into the main screen it starts printing the current analysis.

Rotary encoder with enter key:
he rotary encoder with enter/print key: key with function of confirm.

Display



Main screen

First line: the clock and the status icons are displayed

Second line: the configured fuel is displayed

The measured and calculated parameters are shown on the display.

Bluetooth icon: it appears when the Bluetooth is active (optional module)

Buzzer icon: a barred note is displayed when the buzzer is off.

Anchor icon: : it appears when the analysis values are stable

Icon exclamation point: appears, instead of Anchor icon, when the instrument is in alarm.

Bell icon: appears when the 'CO alarm is set

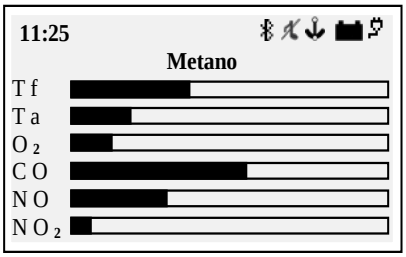
Solenoid icon: appears if solenoid valve is installed.

When the 'solenoid valve is closed (CO exclusion) icon becomes: 

Battery icon: it appears when the instrument is powered by battery only and it shows the battery charge level

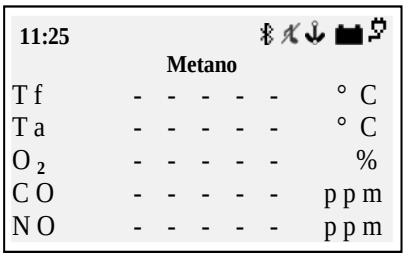
Main icon: it appears in place of the battery icon when the instrument is connected to the battery charger/main power supply

End of charging icon: it appears at the end of the battery charging. Indicates the end of charge.



Bar chart display screen

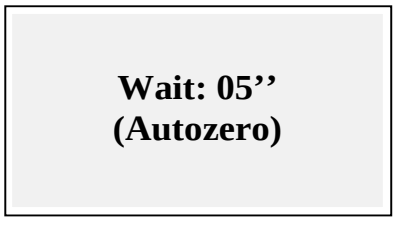
*Pressing the key **(Left arrow)** from the main screen, the access the graphical display of parameters of the analysis is granted*
*Pressing the button **(Right arrow)** to return to the main screen*



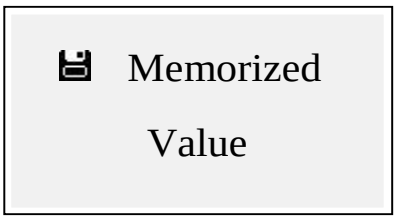
Zoom displaying screen

*Pressing the key **(Right arrow)** from the main screen, the access to the zoom displaying of the analysis parameters is granted.*
*Pressing the key **(Left arrow)** to return to the main screen.*

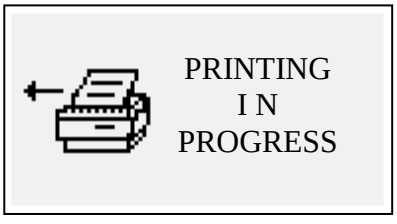
Display: Common messages



Autozero screen
Message displayed during the autozero countdown of the pressure measurements



Memorization screen
Message displayed as confirmation of memorizing a parameter

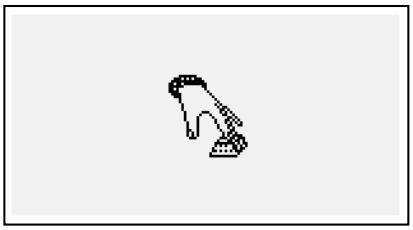


Printing screen
Message displayed during printing

4 Use of the instrument

4.1 Turning on and off

*The instrument is turned on pressing the key **(On/Off)***

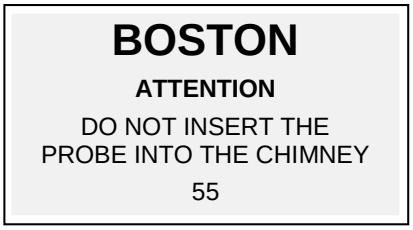


*To prevent the accidental turning on of the instrument the key **(On/Off)** must be pressed for at least 2 seconds otherwise it will not turn on.*
This icon indicates to hold down the power key. Keep the key pressed until the icon disappear.

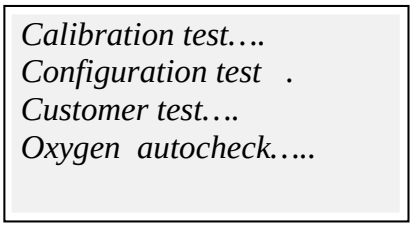
Releasing the key, the instrument is turned off. In case of a high concentration of CO within the chamber of analysis, during the turn off process, the instrument provides to an auto washing, and then it turn off automatically.

When turning on, the display shows the following screens:

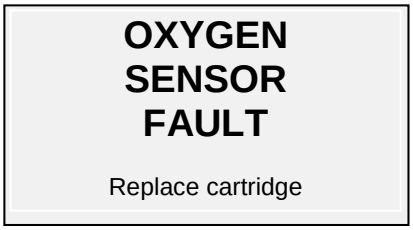
Screen with logo, model (e.g.: BST100), indicating the presence of the Bluetooth module if installed (e.g.: BT), firmware version of the instrument (e.g.: fw 3.0) and serial number of the equipment (e.g.: sn 67295)



Screen signaling washing in progress.
Caution: in this stage, the flue gases probe must be in clean air!
*Note: during the washing stage, the Parameters menu can be accessed by pressing the **(Menu)** key to set the instrument.*



After the washing, the instrument performs a self check of the main functions and of the state of the oxygen sensor



In case of sensor fault, the instrument indicates the problem.

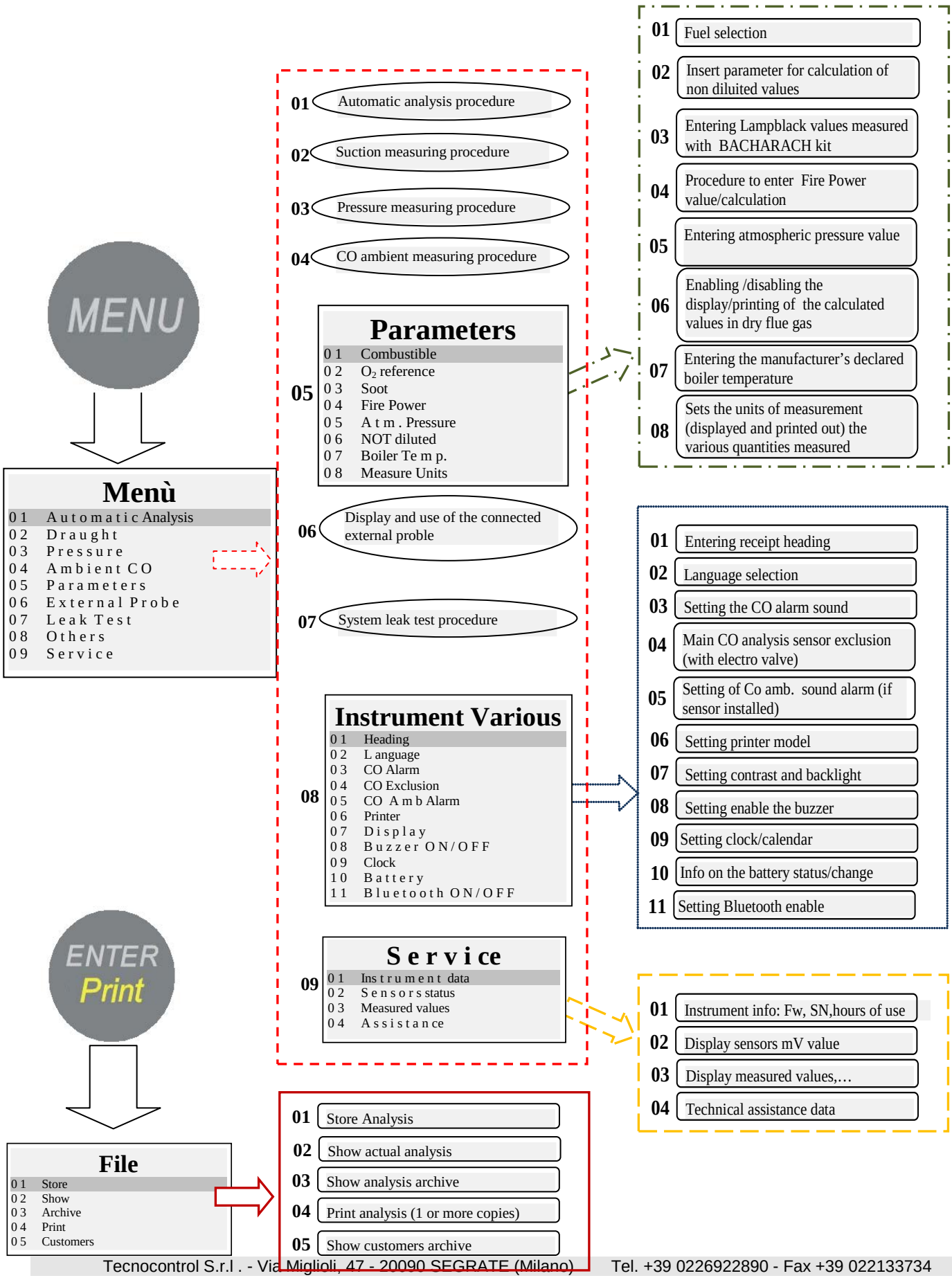
4.2 Fuel selection, type of boiler and start of measuring

Once completed the instrument starting (washing + check), the instrument displays the choice of fuel.
Select the family of the fuel
Note: choosing Special the values of coefficients for a customized fuel can be entered.
Then (only for solid fuels) select the fuel humidity percentage.
In order to select the type of boiler (normal or condensation)
To immediately start the test procedure of the suction select option " _____ + draught"

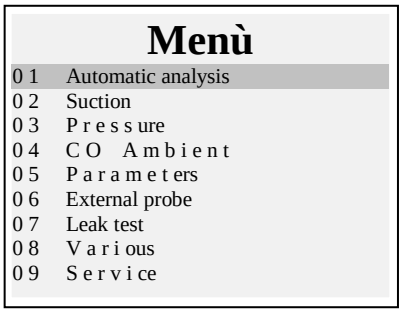
For more details please see section 0 In this menu you can select the type of fuel and the type of boiler, set the O2 reference, enter information about the Lampblack test and calculate the average, enter the power of the fire or calculate it, insert the atmospheric pressure, enable the viewing and printing of the "undiluted" values, enter the nominal value of the boiler temperature and set the units in use.
"Combustible" *of this manual*

For more details on suction measuring please see section 4.4.2 "02 Draught" of this manual.

4.3 Flow chart



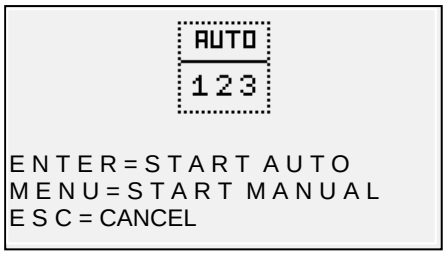
4.4 Menu



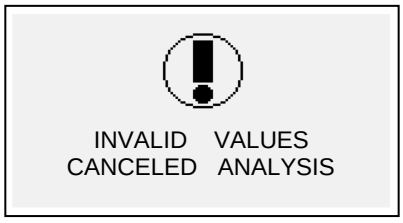
*Pressing the key **(MENU)** from the main screen, enter the main menu of the instrument where to start the following procedures:*
"01 Automatic analysis"**, **"02 Suction"**, **"03 Pressure"**, **"04 CO Ambient"**, **"06 External probe"**, **"07 Leak test ".
*From the main menu the following menus are accessible **"05 Parameters"**, for the configuration of the analysis parameters, **"08 Various"**, for the configuration of the instrument, **"09 Service"** to display the technical information of the instrument*

4.4.1 "01 Automatic analysis"

Procedure of the automatic analysis.



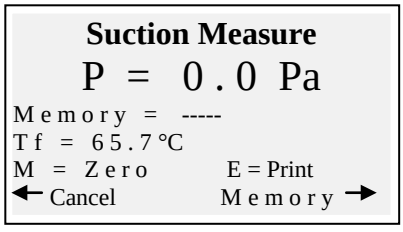
*Pressing the key **(ENTER)** the process that automatically performs 3 consecutive analyzes at intervals of 120 "and calculates the average, starts.*
*Pressing the key **(MENU)** the procedure making 3 consecutive analyzes and calculating the average, acquiring the single analysis data while pressing the key **(ENTER),** giving the possibility to acquire data at time intervals greater than 120", starts. The display shows a stopwatch timer for easy operation.*
*Press the key **(ESC)** to exit the menu*



<u>Warning Screen</u>
The message appears indicating that the analysis is not valid and the value cannot be used for calculating the average. Verify that the instrument is correctly configured and that the boiler under test to work properly.

4.4.2 "02 Draught"

Procedure to measure the suction.
Start the procedure with the probe not inserted into the chimney, and the instrument in a stable position. At the start of the procedure a countdown of 5" is done, during which the instrument performs an autozero. Then the measuring results screen appears.



*Pressing the key **(MENU)** the automatic sensor autozero can be performed*
NOTE: make the sensor zeroing with flue probe out of the chimney and with the instrument in a stable position.

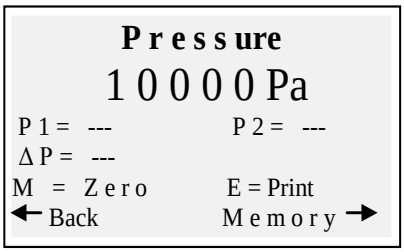
*The key **(Right Arrow)**, allows to memorize the measured pressure value, which will be printed in the analysis slip.*
*The key **(Left Arrow)** allows to cancel the memory of the value just saved.*
*Pressing the key **(ENTER)** the currently measured value is printed. With **(ESC)** to return to main menu.*

4.4.3 "03 Pressure"

By accessing the menu pressure will be possible to select two procedures: the measurement procedure "Pressure" and the measurement procedure "Test 4 Pa"

4.4.3.1 *"01 Manometro"*

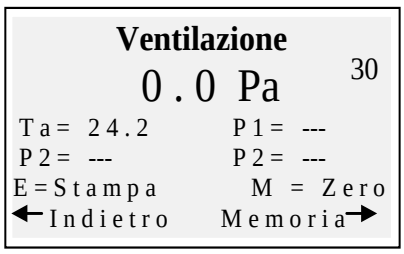
Procedure to measure the pressure
Start the procedure with the probe not inserted into the chimney, and the instrument in a stable position. At the start of the procedure a countdown of 5" is done, during which the instrument performs an autozero. Then the measuring results screen appears.



Press the key **(MENU)**, to set the sensor zero.
The key **(Right Arrow)**, allows to memorize the measured pressure value, it is possible to memorize two values of pressure and to calculate automatically the difference. *The key **(Left Arrow)** allows to cancel the memory of the value just saved. Press the key **(ENTER)** to print the actual measured value. Press **(ESC)** to return to the main menu.*
Using the kit composed of the two tubes (supplied) tool has the function of differential pressure gauge.

4.4.3.2 *"02 Test 4 Pa"*

Measurement procedure of ventilation according to standard UNI10683: 2012.
Start the procedure with the instrument in a stable position.
All 'start of the procedure is performed, a countdown of 9 "during which the instrument performs a' zero procedure. Subsequently appears the measurement screen.

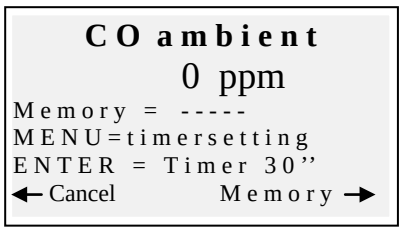


Connect the tube (standard) to the pressure and posizionarne l 'opposite end so as to measure the external pressure.
procedure:
Open the door of the room, waiting for the stabilization of the measure and press (MENU) to make it zero.
Close the door of the room. Press the button (Right Arrow) to start the countdown of 30 seconds (indication count on the high side right of the display). At the end of the count will be stored the measured value.
Repeat for a total of 3 tests.

*Button **(Left Arrow)**, allowing you to cancel the storage of the value you just saved. Pressing the **(ENTER)** values are printed proof. With **(ESC)** to return to the main menu*

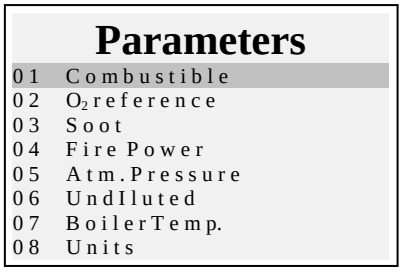
4.4.4 "04 Ambient CO"

Procedure to measure the quantity of CO present in ambient.



*Press the key **(MENU)** to set the checking time.*
*Pressing the key **(ENTER)** the countdown for the duration of time set starts, at the end of the countdown the value of COamb is saved*
*The key **(Right Arrow)** allows to memorize the CO amb value measure at present.*
*The key **(Left Arrow)** allows to cancel the memory of the value just saved. Press **(ESC)** to return to the main menu.*
In case of sensor COamb not installed, the instrument gives the possibility to carry out the verification on the suction with the internal sensor, using the flue gas probe. In this case, before the CO ambient screen, a message will appear with a warning, requesting the confirmation of the use of standard CO sensor.

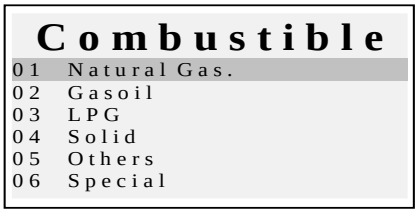
4.4.5 [05 Parameters]



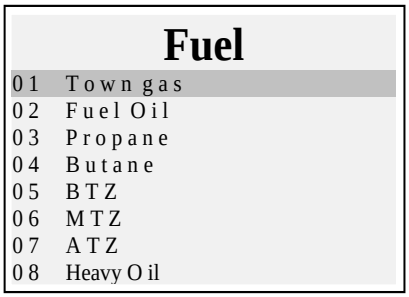
Configuration submenu of the analysis parameters
In this menu you can select the type of fuel and the type of boiler, set the O2 reference, enter information about the Lampblack test and calculate the average, enter the power of the fire or calculate it, insert the atmospheric pressure, enable the viewing and printing of the "undiluted" values, enter the nominal value of the boiler temperature and set the units in use.

4.4.5.1 *"Combustible"*

Configuration of the fuel and type of boiler of the analysis

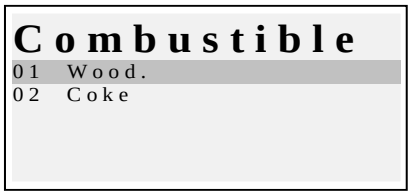


By accessing the main fuel menu screen, it is possible to select the most commonly used fuels (natural gas, diesel, LPG), enter the submenu of solid fuels ("Solid"), enter the submenu of the other fuel liquids / gases ("Other") or enter the known parameters of a fuel not listed, by accessing the sub-menu ("Special").



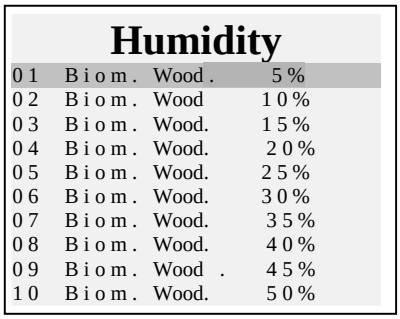
Other:

Select "Other" to go to the selection menu of fuel (e.g. methane, LPG .....)



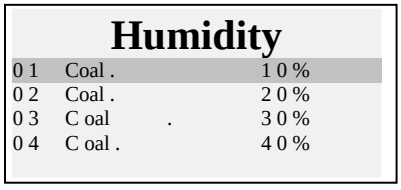
Solid

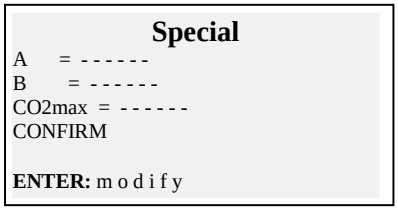
Select "Solid" to go to the fuel selection menu. Solid fuels are identified according to two types: woody biomass (e.g. pellets, chips ...) and coal.



Humidity (only for solid fuels)

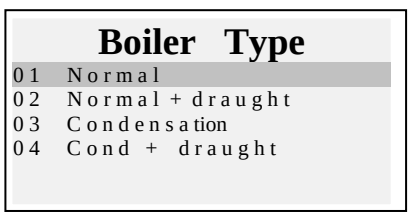
For solid fuels it is necessary to indicate the level of humidity of the sample used for the analysis (e.g. on the bags of pellets this information is indicated, for other fuels the value must be measured)





Special

By selecting "Special" a customized fuel can be set, in case a not listed fuel is used and its parameters A, B, CO2max are not known.



Boiler type

Select the type of boiler to verify (normal or condensation)

To perform immediately the suction test select 'option indicated with "+ Tir"

Note: for solid fuels is not possible to select the condensation type because there are no boilers/stoves of this type for solid fuels

4.4.5.2 *"O_2 Reference*

Configuration of the level percentage of reference oxygen used to calculate the values of the undiluted CO, NO, NO2, etc..
The value to be included varies depending on regional regulations.

4.4.5.3 *"Soot"*

Entry screen for values of soot resulting from test type "BACHARACH" external (hand pump or other). With 3 measurements and the insertion of the 3 values, the instrument will determine the average of three measurements.
This average value will be inserted in the analysis print out.

4.4.5.4 *"Fire Power"*

Procedure of manual input or calculation of the fire power.

For fuels: Methane, LPG, Diesel, Fuel oil, it can be calculated by monitoring the cubic m3 consumed in the time of 2 minutes.
Record the cubic meters as indicated by the system meter counter.
Start the procedure by pressing ***(Left Arrow).*** *After the countdown of 2 minutes, note the value of cubic meters shown on the meter and calculate the number of cubic meters consumed (the difference compared to the initial ones). Insert the value of cubic meters consumed in the instrument, the Boston calculates the fire power and memorize the value to include it in the analysis print out.*

In case of system not equipped with a meter, or in case of already known value of the fire power, it can be entered manually by pressing ***(Left Arrow).***

4.4.5.5 *"Atm. Pressure."*

Insert the barometric pressure for the calculation of the dew point.

4.4.5.6 *"Undiluted"*

Menu to enable the display (and subsequent printing) of undiluted gas values.
The calculation of the concentration of undiluted gas is carried out with reference to the O2 set in
[Menu]-[05 Parameters]-"02 Ref. O_2"

4.4.5.7 *"Boiler Temp."*

Insert the boiler temperature indicated by the manufacturer. This data will be printed on the analysis receipt.

4.4.5.8 *"Measuring units"*

Configuration submenu of the measuring units. . At the next power tool maintains engineering units configured by 'user

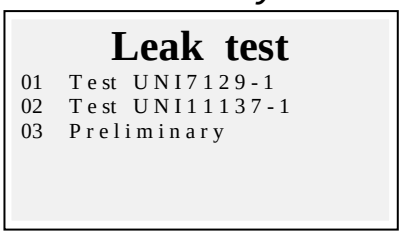
4.4.6 "06 External probe"

Procedure for use of external probes.
The probe is detected automatically and according to the connected probe the

corresponding screen is displayed.
For details, see the instructions supplied with the probe.

4.4.7 "07 Leak test

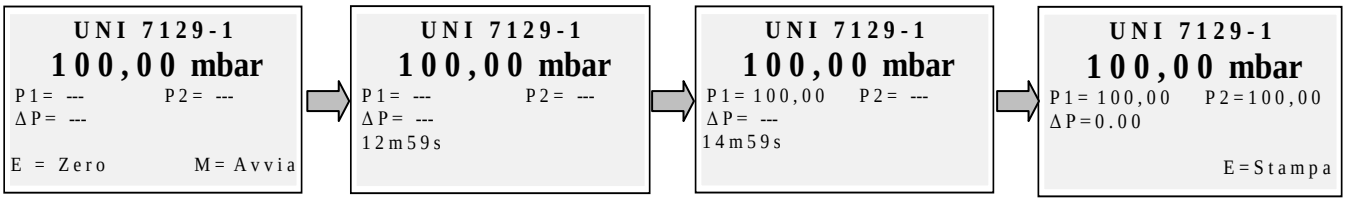
Procedure for system leak test.



It is possible to select, depending on the system to be tested, three types of test, based on the applicable standard.

4.4.7.1 *"07 Leak test - UNI 7129-1"*

Leak test procedure for system with pressure greater than or equal to 100mbar as provided by the UNI 7129-1 standard

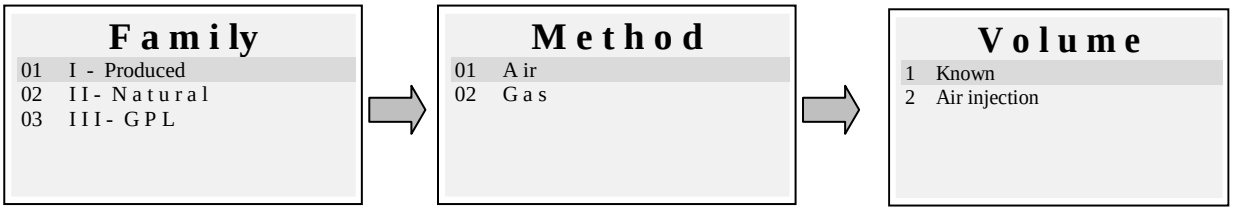


Reset if necessary with "enter" the measurement of pressure and then connect the instrument to the system.

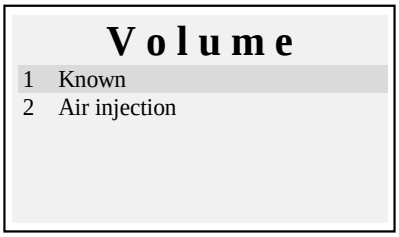
Pressurize the system at a pressure equal to or greater than 100mbar and start the procedure with "menu"

4.4.7.2 *"07 Leak test - UNI 11137-1"*

System leak test procedure with air or gas as provided by the standard UNI 11137-1

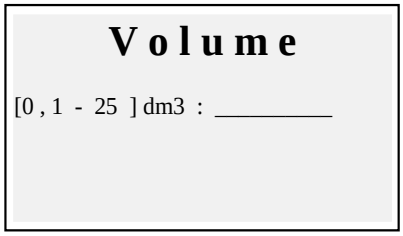


Select the type of system to be tested (new installation or in use)
Then select the family range of the fuel operating the system
Select the test method (if test performed with Air or Gas)



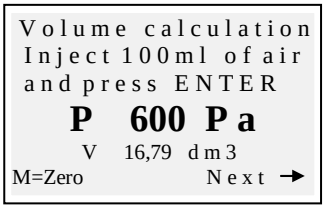
If the system volume is known select option " 1 Known"
If the system volume is unknown it can be measured through an appropriate procedure by selecting "2 air injection". In this case the system has to be empty.

Selecting "1 Known" leads to the Volume insertion screen.

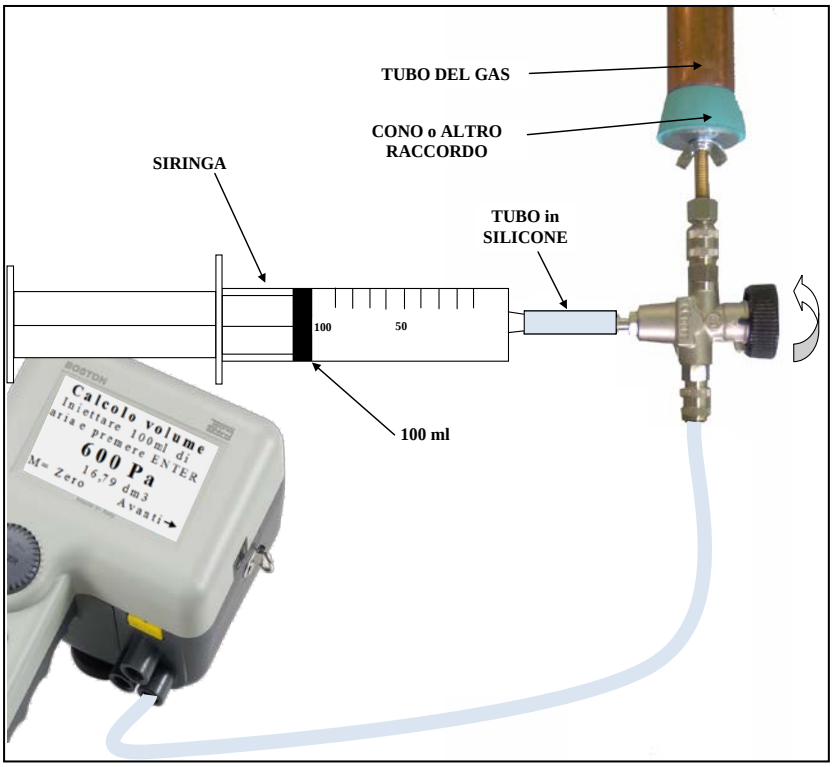


Enter the value of the volume of the system under test (by pressing "enter") Turning rotary encoder letters and numbers will be displayed, with the "right arrow" go to the next character, with "left arrow" to previous one, with "Enter" pass to the next line. To delete letters, press and hold simultaneously the "Menu" and "left arrow"

Selecting *" 2 Air injection" leads to the procedure of Volume calculation.*



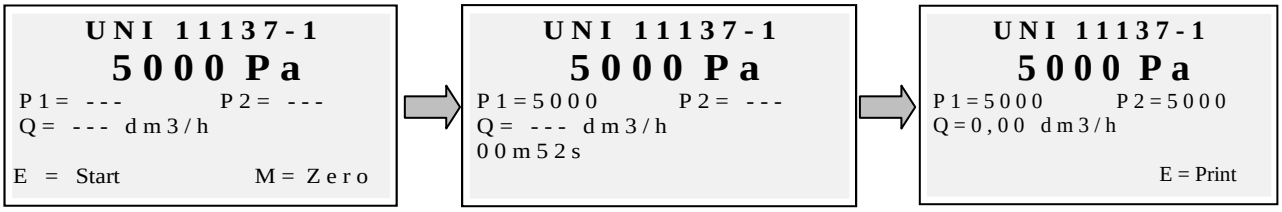
Inject 100ml of air in the system and close the tap. (supplied with the optional leak test Kit)



Wait pressure displayed on screen to stabilize.
The calculated volume is updated in real time.

Press the button (Right Arrow) to continue, the volume value is stored, then used for calculations of the estate and in the case of selection of printing, printed on the receipt.

The start procedure screen is then displayed

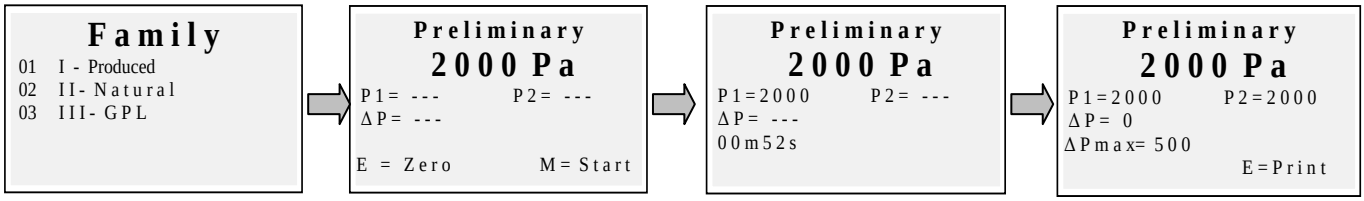


If needed, reset to zero with "enter" the measure of pressure (when the instrument is not under pressure).
Connect the instrument to the system as required by the standard.
Pressurize the system with air (in the case of test with air) or with the supplied gas (in the case of test with gas). With the "Menu" key starts the procedure, which

automatically detects the pressure drop in the time provided by the standard and calculates the value of the losses encountered. At the end the test result can printed by pressing "enter".

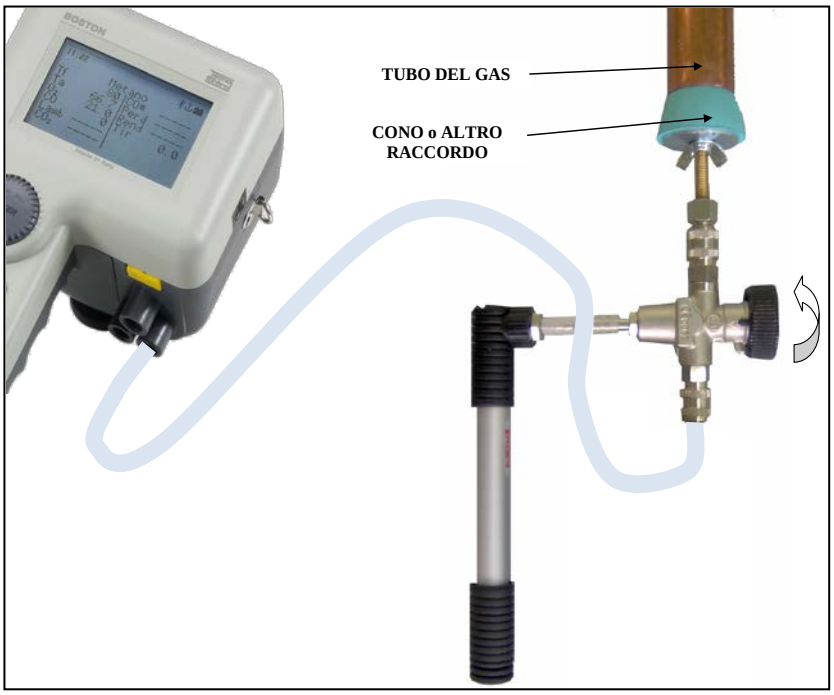
4.4.7.3 *"07 Leak test - Preliminary UNI 11137-1"*

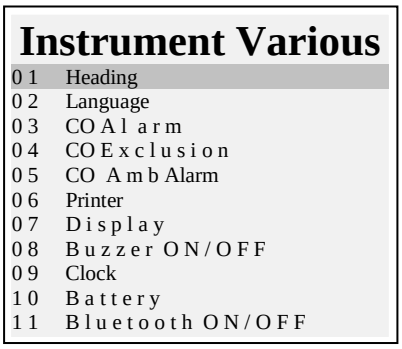
Preliminary test procedure as provided by the standard UNI 11137-1



Select the family corresponding to the gas of the system, if necessary reset to zero with "enter" the measurement of pressure and then connect the instrument to system. Wait a stable reading and press "Menu". The instrument will perform the measurements according to the standard. At the end the test result can printed by pressing "enter"

A diagram of the setup
For large systems is suggested the 'use of the inflator in place of the pump.





4.4.8 [08 Various]

Instrument configuration submenu

4.4.8.1 *"Heading"*

Configuring the heading printed on the receipt of analysis
Access the input screen. Turning the rotary encoder, the letters and the numbers are displayed, with the "right arrow" to go to the next character, with "left arrow" go the previous one, with "Enter" to go to the next line. To delete letters, press and hold simultaneously the "Menu" and "left arrow" keys.

4.4.8.2 *"Language"*

Configuring the instrument language (user interface language and language of printing)

4.4.8.3 *"CO Alarm"*

Configuring the CO alarm

4.4.8.4 *"CO Exclusion"*

Configuring the CO exclusio

4.4.8.5 *"CO ambient alarm"*

Configuring the CO ambient alarm

4.4.8.6 *"Printer"*

Configuring the printer (choice of the used printer model)

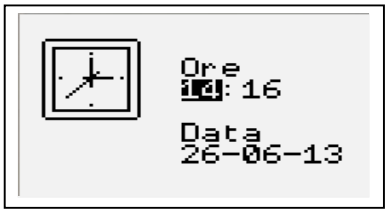
4.4.8.7 *"Display"*

Configuring the display: setting the contrast, backlight and turn on time of the backlight.

4.4.8.8 *"Buzzer ON/OFF"*

Configuring the buzzer

4.4.8.9 *"Clock"*



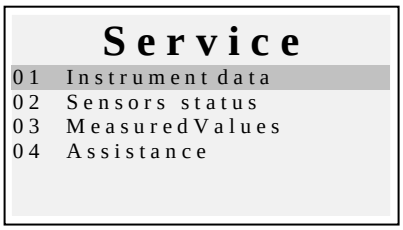
Configuring the clock (setting time and calendar)

4.4.8.10 *"Battery"*

Battery status display (level and status of charge)

4.4.8.11 *"Bluetooth ON/OFF"*

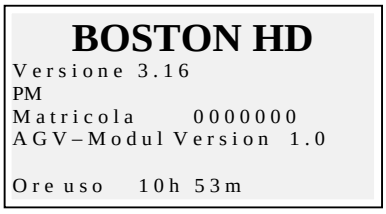
Bluetooth module activation/de-activation menu (if installed)



4.4.9 [09 Service]

Submenu of service parameters display

4.4.9.1 *"Instrument data"*



Instrument data display (SN, firmware version, ……..)

4.4.9.2 *"Sensors status"*

Sensors satus display

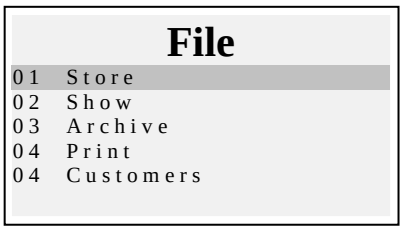
4.4.9.3 *"Measured values"*

Displaying the value in mV of the output signal of the sensors

4.4.9.4 *"Assistance"*

Displaying of the service center data

4.5 File



*Pressing the key **(ENTER)** from the main screen, access to the menu instrument management data (customers, analyzes made)*
An analysis can be seen, memorized, retrieved from archive, printed, insert or select a customer, check the amount of free memory, delete the saved data.

4.5.1 "Store"

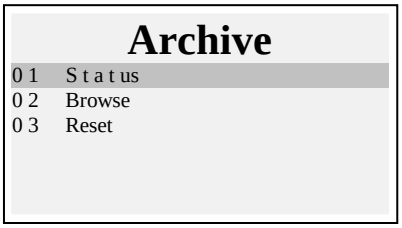
Selecting this function the current analysis is stored, linking it to the customer selected in the menu "customers" (if previously selected)

4.5.2 "Show"

Selecting this function the current analysis is displayed.

4.5.3 "Archive"

Submenu of archive management: control of the memory occupied, management of the individual analyzes memorized, memory reset.



4.5.3.1 *"Status"*

Displays the total amount of analysis tha can be memorized, the number of analyzes have already saved and how many may still be memorized

4.5.3.2 *"Browse"*

Displays the archive of analysis, ordering them by the memory date.
From this screen a single analysis can be deleted, or displayed and then printed by pressing the enter key

4.5.3.3 *"Reset"*

Procedure to clear the archive memory (reset)

4.5.4 "Print"

Selecting this function, multiple copies of the analysis can be printed (selectable from a minimum of one copy to a maximum of five copies)

4.5.5 "Customers"

Customers management screen:
The customer to match with the analysis to be carried out can be selected and new customers can be inserted.

To add new customers, press "Menu" to access the entry screen. Turning the rotary encoder the letters and numbers are displayed, with the "right arrow" go to the next character, with "left arrow" to the previous one, with "Enter" go to the next line.
To delete letters, press and hold simultaneously the "Menu" and "left arrow" keys

5 Infrared printer

The instruments is supplied with thermal infrared printer.

Description:

A: Infrared door: align with the instrument infrared Led

B: Mode key. Turn on key

C: Status Led

D: Battery charge plug

(same charger supplies with the instrument)

Operating environmental condition:

Temperature	*0 – 50°C*
Humidity	*10% - 85% Rh*

To replace the printer paper please proceed as it follows:

1. *Open the cover by lifting the transparent window.*
2. *Pull out the roll and if necessary, eject the remaining paper from the printer.*
3. *Insert the new roll of paper threading the flap into the slit of introduction and operate the drive with the appropriate button.*

To replaced the batteries in the printer please proceed as it follows:

1. *Remove the battery cover on the back of the printer*
2. *Remove the 4 batteries and insert the new ones matching the polarity*

For more information about the printer please consult the manual supplied with the product.

6 Maintenance

To keep the instrument in good working condition and to ensure the correctness of the measures in compliance with applicable regulations, an ordinary maintenance is necessary.
The instrument should be serviced at an authorized service center at least once a year (by law) or every 300 hours of use (time of use is viewable in the "Menu-Service-Instrument _Data") if a year has not passed since the last maintenance.
The operations of normal maintenance include the control of the calibration of instrument (with the Calibration report issuing) and the clearing of the flue gas pipes and of the pneumatic circuit.

It 's always advisable to clean the instrument, filter and flue gases probe at the end of the day.

For proper maintenance always use genuine sensors and spare parts and avoid performing maintenance by unauthorized service centers, to avoid invalidation of the warranty.

6.1 Instrument cleaning

To clean the instrument, use a cloth dampened with warm water.
Avoid harsh products such as thinner, alcohol, etc. ... that could damage or remove the treatment of the rubber coating of the shell or damage the protective glass of the display

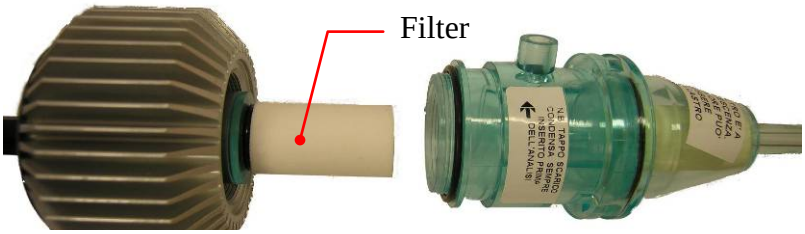
6.2 Flue gas probe

The probe and the suction pipe must be cleaned regularly, according to the use of the instrument, in order to prevent the formation of particulate inside and prevent corrosion.
The pipe must be disconnected from the instrument, washed with plain warm water and dried before use.
It is also possible to remove the residues inside the probe with a compressor (probe always disconnected from the instrument)

6.3 Condense collector

Unscrew the transparent bayonet cover of the condense trap and check the condition of the dust filter in the lower part. When the filter becomes gray (number of Bacharach scale soot of about 2-3), must be replaced

6.4 Additional filter



Models for the analyzes using solid fuels (wood, pellet ...) are provided with an additional filter FI092 (shown in the figure)

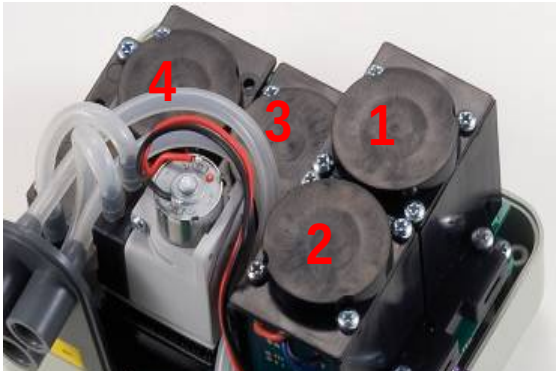
<u>When the filter becomes gray</u> (number of Bacharach scale soot 3), <u>it must be replaced</u>

6.5 *Flue gas suction pump*

Check the suction of the pump as shown below.
Extract the pipe "flue gas suction" (tube of larger diameter) of the probe from the instrument and close the hole on the instrument with a finger verifying that there is a depression.

6.6 Sensor cartridges replacement

With the new Tecnocontrol models of sensors, it is possible, in case of emergency, the replacement of the single sensor or of all sensors.



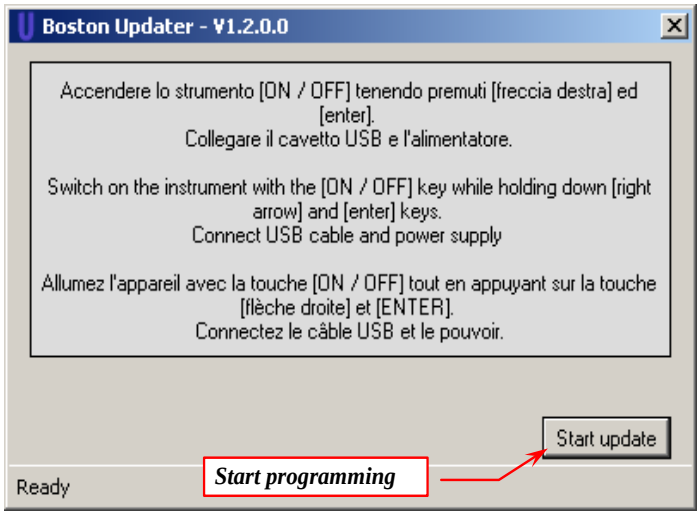
It is also possible to replace the pump or even the analysis chamber, thus avoiding in case of need to return the instrument to the manufacturer or the distributor.
To replace the sensor it is sufficient to remove the top cover of the instrument (by unscrewing the 4 screws), disconnect the sensor by unscrewing the 2 clear screws, and remove it from the motherboard where it is connected. Reconnect the sensor again sticking it in the 5 connection holes, close and calibrate the instrument.

POSITION	***TYPE of sensor***
1	O_2 / O_2 hi duration
2	CO (different range)
3	CO solidi / NO_2 / SO_2 / COambient
4	NO

TYPE	CARTRIDGE CODE	NOTE
O_2	ZB090	Replaceable by the customer on all BST series
O_2 0x3 - 8 years	ZB071	Replaceable by the customer on all BST series
CO - 2000ppm	ZB045	Replaceable by the customer on all BST series
CO - 20000ppm	ZB075	Replaceable by customer on BST 150 series only
CO - 100000ppm	SE048	Replaceable by customer on BST 150 series only
NO	ZB038	Replaceable by customer on BST210/310 series only
NO_2	ZB039	Replaceable at servic center
SO_2	ZB041	Replaceable by customer on BST310 series only
CO Ambient	ZB055	Replaceable by customer on BST410 series only

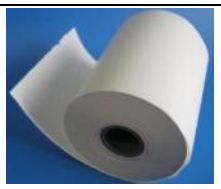
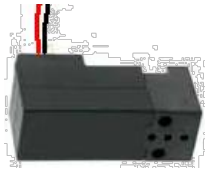
Note: The NO, SO2, CO Ambient sensors series update, as indicated in the above table, can be done at service center only.

7 Firmware update



1. *Connect the USB cable to the instrument*
2. *Holding down both buttons **"enter / print" + "arrow right"** switch on the instrument, which starts in BootLoader mode.*
3. *Connect the AL001charger*
4. *Run the program "Boston Updater, click the key" Load File "and select the file containing the firmware (e.g.: boston_v3.00.hex) Select the communications port assigned to the instrument, and finally press the key" Start update "*
5. *Wait for the confirmation of completion of programming, the instrument restarts in normal operation mode.*

8 Accessories and spare parts

 **PO144** *Kit "BACHARACH" / "lumpblack"*	 **ZB101** *Test evidences "BACHARACH"*	 **ZB102** *Comparison index "BACHARACH"*	 **VA036** *Professional case*
 **SW100** *Managenet software*	 **ZZ-SO201** *Complete gas probe 220mm / pipe 3m*	 **ZZ-SO20x** *Complete gas probe 220mm / pipe 1,5m*	 **ZZ-SO205** *Complete gas probe 300mm / pipe 3m*
 **ZZ-SO202** *Flexible gas probe 200mm / pipe 3m*	 **ZZ-SO111** *Combustion Air temperature probe l:13cm + 85cm cable*	 **ZZ-SO112** *Comb Air temperature bent probe l:85cm cable*	 **ZZ-SO100** *Combustion Air temperature probe l:16cm + 85cm cable*
 **FI090** *Set of 10 replacement filter (for flue filter)*	 **BST337** *Infrared thermal printer*	 **ZR102** *Roll of hermal paper for printer*	 **ZZ-RC100** *Complete condense collector*
 **AL001** *Power supplier/charger*	 **PO207** *Internal suction pump*	 **BA050** *Lithium battery*	 _____ *Additional filter kit*
 **SP100** *Heat exchangers/radiators cleaning brush*	 **EL010** *Selenoid valve*	 **KP400** *Leak test kit*	 **VA037** *Zaino rigido*

9 Further reading

9.1 FAQ (frequent questions)

Below we provide some thermo hydraulic background for those who first experience using the product.

FAQ COMBUSTION		
Which % of O2 is found during an analysis?	***During the analysis:*** *2÷5% (Sealed boilers)* *fino al 14% (Atmospheric boilers)*	***in air:*** *Oxygen in atmosphere is 20,9% approx.*
Which % of CO is found during an analysis?	***During the analysis:*** *as low as possible, no more than 1000ppm*	***in air:*** *0 ppm*
Which % of CO2 is found during an analysis?	***During the analysis:*** *10-11%(Depends by O2 and by fuel)*	***in air:*** *Near to 0%*
How is the "ambient temperature" probe used ?	*For atmospheric boilers the temperature of the room where the boiler is installed (combustion air) is considered.*	
	While for boilers with sealed combustion chamber, the temperature probe must be placed in the air intake by the threaded cone	
How is the "flue gas temperature" probe used ?	*It has be inserted into the hole of the chimneys at an ideal distance to read the highest temperature (in the center). Normally the flue gas temperature during the analysis of 120-300°C*	
What "suction" means ?	*It indicate the chimney suction value*	
What is the ideal effecency ?	*The law 10 (norm UNI 10389-1) specify the calculation formula.* *As an example::* *30.000Kcal boiler installed after 1993 th effecency eill be:* *a 70°C ≥ 89%* *a 50 °C ≥ 87%*	
What is tthe "lampblack" ?	*The measure of opacity of the gasses performed by Bacharach pump*	
What is "Lambda"□?	*It is the excess of air present in the flue gas. Ratio, expressed in%, between the difference between of the amount of air used for combustion, the stoichiometric amount of air and the stoichiometric amount thereof.*	
What are the "losses" ?	*The difference between the ideal efficiency (100%) and real efficiency: i.e. if the efficiency is 86%, the loss is 14%*	
What is the NO?	*One of the toxic gasses in the flue gas:* *"Nitric oxide"*	
What is the NO2?	*One of the toxic gasses in the flue gas:* *"Nitrogen dioxide".*	
What are the NOX ?	*The oxides of nitrogen in total, the sum of NO and NO2*	
What is SO2 ?	*One of the toxic gasses in the flue gas:* *"Sulfur dioxide".* *It represents the index of the presence of sulfur in the fuel*	
What is the dew point ?	*The temperature of condensation of the flue moisture*	
What is the reference of O2 (Oxygen) ?	*The data according to the norm for dry CO calculation*	

FAQ LEAK TEST	
When has the system to be serviced?	*1. Smell of gas in ambient.* *2. Replacement of appliances that use gas.* *3. Changing the type of gas supplied.* *4. Re-use of gas system not used for 12 months* *5. At least everyi 10 years*
Meter check	*This check must be made by closing the tap upstream of the meter and by performing 2 readings on the meter with an interval of 15 minutes.*
Leak test UNI7129	*Detect any leaks performed with Air, with duration of 15 minutes, at a pressure not less than 100mbar* *The system is conform if there is no pressure drop*
Leak test UNI 11137-1 "PRELIMINARy"	*Detect of any leaks performed with gas at the working pressure*
Leak test UNI 11137-1 ***Checking with direct method (Gas)*** ***Checking with indirect method (Air)***	*Detect any leaks performed with Air and gas.* *To be used in cases where it is possible to establish the volume of the system and only for systems having a volume not exceeding 25 dm3*
What is Qa ?	*Airflow dispersed in testing condition in dm3/h* *(indirect method (Air)*
What is Qg ?	*Gas flow dispersed in testing condition in dm3/h* *(indirect method (Gas)*
What is Qe ?	*Gas flow dispersed in testing condition in dm3/h* *(direct method (Gas)*
What is Pg ?	*Pressure reference for the test with gas expressed in Pascal*
What is Pa ?	*Air test pressure, expressed in Pascal*
What is Pe ?	*System working pressure*
What is f ?	*Coefficient of viscosity of the gas*

9.2 Formulas for calculation of parameter (flue gas analysis)

Calculation of carbon dioxide CO_2:

$$CO_2 = CO_{2\max} * (1 - \frac{O_{2mis}}{21})$$

O_{2mis} It is the measured oxygen concentration CO_{2max} it is the maximum possible concentration of carbon dioxide which can be produced with the fuel in use.

Efficiency calculation / Losses for NON condensing boilers:

$$\mathrm{Re}nd = 100 - q_s$$
$$q_s = (\frac{A}{21 - O_2} + B) * (T_f - T_a)$$

q_s represents the chimney loss of power (losses)
T_f e T_a are respectively the flue gas and the combustion air temperature
A and B are the coefficients depending on the type of fuel used.

Efficiency calculation / Losses for condensing boilers:

$$\mathrm{Re}nd = 100 - q_s + ET$$

q_s represents the chimney loss of power (losses)
ET is the increase due to condensation

Air excess calculation

$$\lambda = 1 + \frac{O_2}{(21 - O_2)}$$

Lambda (λ) is the air in excess

Air n index calculation

$$n = \frac{21}{21 - O_{2\_mis}}$$

n is the air index

$$CO_{(0)} = CO_{mis} * n$$

multiplying the air index by the value of CO measured the value of undiluted CO is obtained, reported at the condition O_2=0%

Undiluted CO calculation

$$CO_{(rifO_2\%)} = CO_{mis} * \left(\frac{21 - O_{2rif}}{21 - O_{2mis}} \right)$$

Whereas the reference value of Oxygen on which to base the calculation of the undiluted CO is not always zero, but it may vary depending on the regional standards, the calculation on the side is applied.

9.3 Formulas for calculation of parameter (air-tight)

Test method with air at a pre-defined pressure

$$Qa = \frac{V}{t} * \left(\frac{p1}{p2} - 1 \right)$$

Calculation of flow of dispersed air.
V is the volume of the system, t is the time of test (set by the standard depending on the gas family), p1 and p2 are the two pressures measured at the time interval t.

$$Qg = Qa * \frac{Pg}{Pa} * f * 60$$

Calculation of flow of dispersed gas in working conditions.
Qa is the flow of air dispersed previously calculated, Pg, Pa and f are defined by the standard depending on the family of gas.

Test method with gas at working pressure

$$Qe = \frac{V}{t} * \left(\frac{p1}{p2} - 1 \right)$$

Calculation of the flow rate of gas dispersed in working conditions.
V is the volume of the system, t is the time of test (set by the standard depending on the family gas), p1 and p2 are the two pressures measured at the time interval t.

$$Qg = Qe * \frac{Pg}{Pe} * 60$$

Calculation of the flow rate of gas dispersed in the reference conditions
Qe is the dispersed gas flow operating in working conditions previously calculated, Pg and Pe are defined by the standards depending on the family of gas

9.4 Characteristics

Parameter	*Sensor Type*	*Range of measure*	***Resolution***	***Precision***	***NOTE***
O_2	Electrochemical	0 …21% vol	0,1 % vol	±0,3 % vol	
CO - 2000	Electrochemical	0 … 2000 ppm	1 ppm	±20ppm	
CO - 20000	Electrochemical	0 … 20000 ppm	1 ppm	(0÷1000) ±100ppm (1000÷20000) ±10%rdg	
CO - 100000	Electrochemical	0 … 99999 ppm	10 ppm	(0÷1000) ±100ppm (1000÷99999) ±10%rdg	
NO	Electrochemical	0 … 1000 ppm	1 ppm	(0÷100) ±5ppm (100÷1000) ±5%rdg	optional
NO_2	Electrochemical	0 … 200 ppm	1 ppm	(0÷100) ±5ppm (100÷1000) ±5%rdg	optional
SO_2	Electrochemical	0 … 2000 ppm	1 ppm	(0÷200) ±10ppm (200÷2000) ±5%rdg	optional
COamb	Electrochemical	0 … 500 ppm	1 ppm	(0÷100) ±5ppm (100÷500) ±5%rdg	optional
CO_2	calculated	0 …100% vol	0,1 % vol	±0,1 % vol	
NO_X	calculated	0 … 1500 ppm	1 ppm	-	(No+5%) or ($NO+NO_2$)
Flue gas temperature	Tc K	0 … 1000°C	1°C	±2°C	
Cumbustion air Temperature	PT100	-10 …150°C	0,1°C	±1°C	
Suction	Semiconductor	-200 … 200 Pa	0,1 Pa	±0,5Pa	
Pressure	Semiconductor	-50 … 11000 Pa	1 Pa	1 Pa	

Power supply:	*External power supply 230 VAC for charging or direct power supply (for the printer too). Output voltage 18Vdc*
Battery	*Li-ion 7.2 Vdc 1.2 Ah*
Display	*LCD graphic FSTN*
Average autonomy	*8 / 10h*
Battery recharging time	*4 hours*
Printer	*External infrared; paper width 58mm*
Working temperature	*-10 +50°C*
Storage temperature	*-20 +55°C*
PC communication interface	*USB* *Bluetooth (optional)*
Protection index	*IP40*
Dimensions	*240mm x 130mm x 110mm*
Weight	*Approx 1,4 Kg*
Weight (with case)	*Approx 3 Kg (with case)*

10 Modelli

Il Boston HD è acquistabile in diversi modelli, configurati a seconda delle esigenze del cliente.

BST110	Analizzatore di combustione boston O_2 + CO Valigia standard, sonda fumi 150mm con tubo 1,5m
BST114	Analizzatore di combustione boston O_2 + CO Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m
BST210	Analizzatore di combustione boston O_2 + CO + NO Valigia standard, sonda fumi 150mm con tubo 1,5m
BST211	Analizzatore di combustione boston O_2 CO + NO Valigia standard, sonda fumi 300mm con tubo 3m
BST214	Analizzatore di combustione boston O_2 + CO + NO Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m
BST310	Analizzatore di combustione boston O_2 + CO + NO + SO_2 Valigia standard, sonda fumi 150mm con tubo 1.5m
BST311	Analizzatore di combustione boston O_2 + CO + NO + SO_2 Valigia standard, sonda fumi 300mm con tubo 3m
BST314	Analizzatore di combustione boston O_2 + CO + NO + SO_2 Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m
BST410	Analizzatore di combustione boston O_2 + CO +COamb Valigia standard, sonda fumi 150mm con tubo 1,5m
BST411	Analizzatore di combustione boston O_2 + CO +COamb Valigia standard, sonda fumi 300mm con tubo 3m
BST414	Analizzatore di combustione boston O_2 + CO +COamb Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m
BST510	Analizzatore di combustione boston O_2 + CO + COsolidi con elettrovalvola Valigia standard, sonda fumi 150mm con tubo 1,5m
BST511	Analizzatore di combustione boston O_2 + CO + COsolidi con elettrovalvola Valigia standard, sonda fumi 300mm con tubo 3m
BST514	Analizzatore di combustione boston O_2 + CO + COsolidi con elettrovalvola Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m
BST610	Analizzatore di combustione boston O_2 + CO + SO_2 Valigia standard, sonda fumi 150mm con tubo 1.5m
BST611	Analizzatore di combustione boston O_2 + CO + SO_2 Valigia standard, sonda fumi 300mm con tubo 3m
BST614	Analizzatore di combustione boston O_2 + CO + SO_2 Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m
BST710	Analizzatore di combustione boston O_2 + CO + COsolidi con elettrovalvola Valigia standard, sonda fumi 150mm con tubo 1.5m
BST711	Analizzatore di combustione boston O_2 + CO + COsolidi con elettrovalvola Valigia standard, sonda fumi 300mm con tubo 3m
BST714	Analizzatore di combustione boston O_2 + CO + COsolidi con elettrovalvola Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m
BST810	Analizzatore di combustione boston O_2 + CO + NO + NO_2 Valigia standard, sonda fumi 150mm con tubo 1.5m
BST811	Analizzatore di combustione boston O_2 + CO + NO + NO_2 Valigia standard, sonda fumi 300mm con tubo 3m
BST814	Analizzatore di combustione boston O_2 + CO + NO + NO_2 Valigia standard, sonda fumi flessibile 300mm con tubo 1,5m

È inoltre possibile richiedere configurazioni alternative non presenti a tabella

11 Guarantee

CONDITIONS OF GUARANTEE

DURATION

Tecnocontrol Srl, in the presence of defects for which it is established the liability of the manufacturer, guarantees the product for a period of 24 months from date of purchase by the end Customer (hereof named the Customer), which is proven by a valid receipt issued by the authorized dealer.
Note: the Sensors (i.e.: measuring sensors), the pump and the batteries are covered by a **12 months** period guarantee**.**

VALIDITY
The guarantee includes free repair or replacement of component parts of the instrument to be defective at their origin for manufacturing defects, excluding the cases mentioned in paragraph "Limitations of Liability."

Guarantee claims will be proven by the original certificate and by a valid document issued by the dealer at time of purchase, where the product model, the product serial number, the purchase date and the name of the reseller are stated

This present guarantee is void if the type or serial number of the product is modified, deleted, removed or defaced, and if repairs or modifications are carried out by unauthorized personnel or spare parts not original are used.

Note: The present guarantee does not cover regular maintenance operation or replacement of parts due to normal wear.

This commercial guarantee offered by Tecnocontrol Srl shall not affect the consumer's rights under the Decree. Nr.24 of February 2nd , 2002, issued in implementation of the European Directive 99/44/CE, as well as the Decree. n. 206.of September 6th , 2005

LIABILITY

During the warranty period, Tecnocontrol Ltd is committed to correct the defects caused by manufacturing defects, without any cost for the Customer. In the event that the defective instrument is missing one or more parts it will be repaired and returned without integrating the same parts, unless specifically requested to do so. If not possible to restore the instrument through the repair and/or if the same proves to be too costly in comparison to the value of the product, (evaluated at the discretion of Tecnocontrol Srl) the instrument will be replaced to the end customer with written notice, leaving unchanged the maturities and the guarantee terms of the original contract evidenced by the official receipt issued by the dealer at the time of purchase. In case of replacement of the instrument, and in case a similar instrument is not available, Tecnocontrol reserves the right to change the instrument with another of similar type, but different model, having however the same functions and the same purpose.

LIMITATION OF LIABILITY

The defectiveness is not attributable to Tecnocontrol Srl if it is found that causes have occurred outside the operation conditions of the product. The guarantee does not cover damage due to improper or faulty installation/use, or installation/use not in accordance with the instructions, or in their absence and/or not made as per the state of the-art; for incorrect or inadequate maintenance specified in the instruction manuals; or according to the common maintenance operations; for improper or wrong use, for neglected or improper use. In any case for any reasons not attributable to the manufacturer.

The guarantee excludes consumables (printer paper, filters, ...).

Tecnocontrol Ltd disclaims all liability for any damage that may directly or indirectly be caused by their products to people, animals or property as a result of failure to comply with all instructions given in the instruction manual, concerning use, operation and maintenance of the instrument

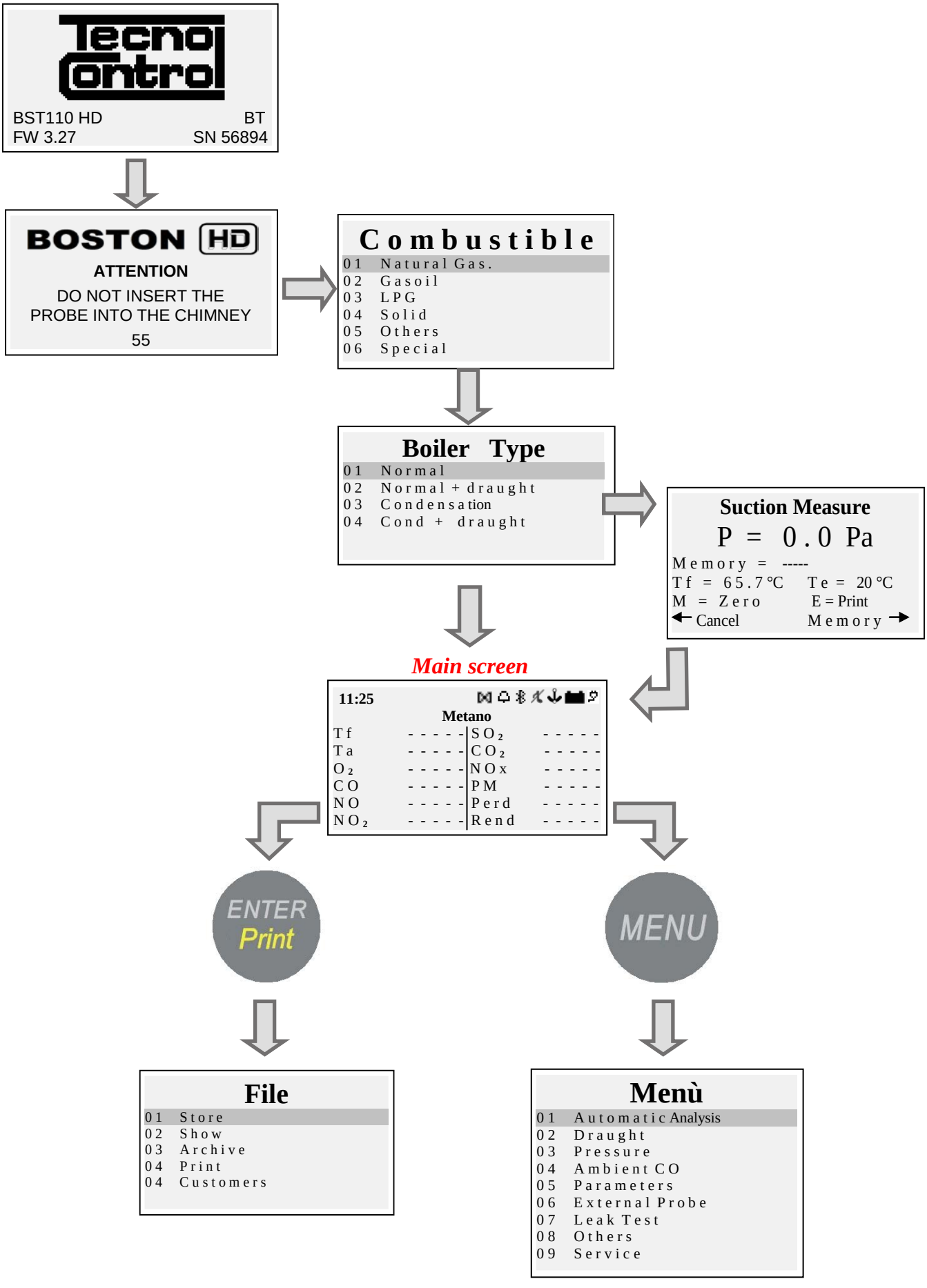
Model: _____

Serial number/series _____

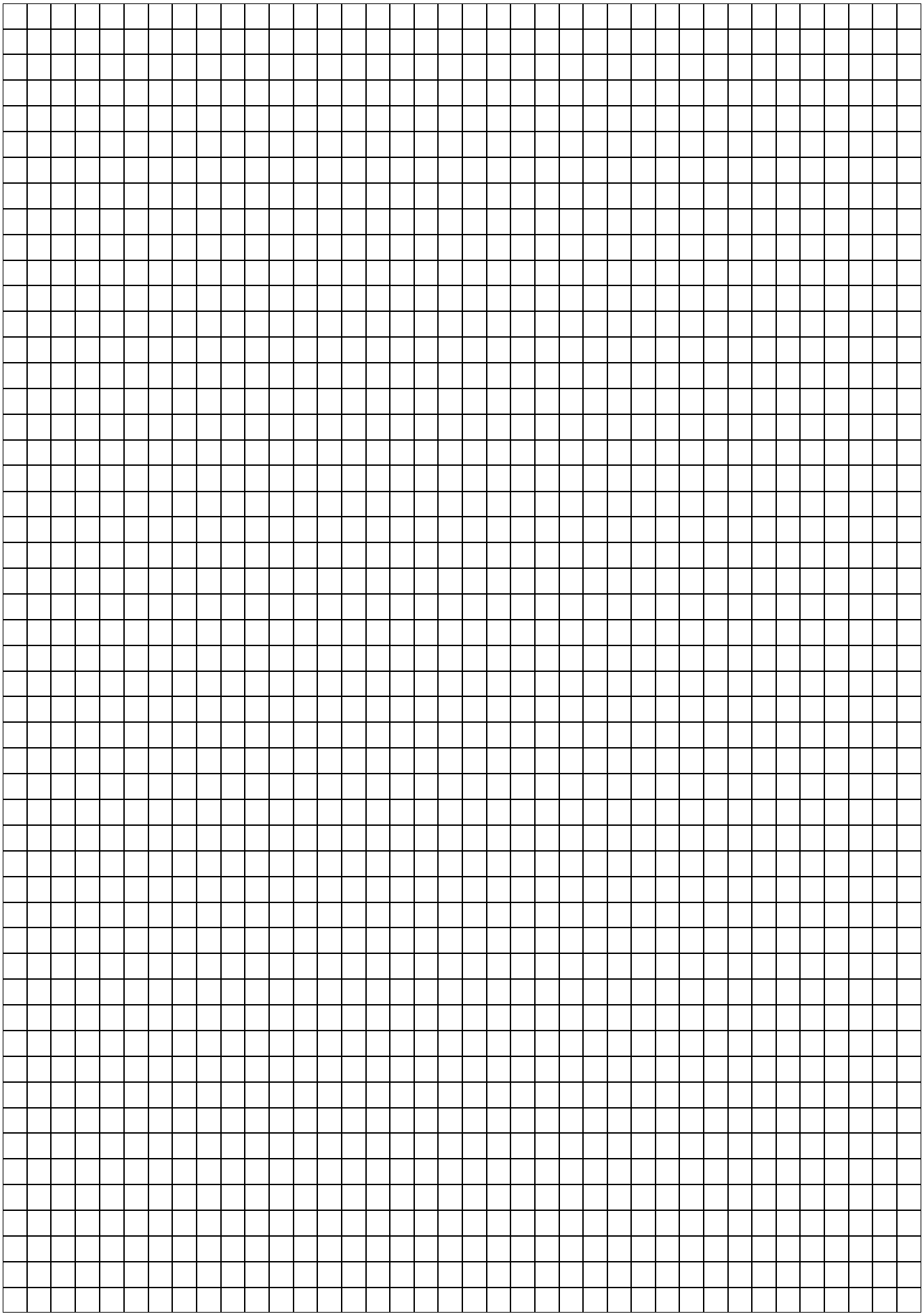
STAMP AND SIGNATURE DEALER/RESELLER

THIS CERTIFICATE OF GUARANTEE SHOULD NOT BE SENT, BUT ATTACHED TO THE PURCHASING RECEIPT
The warranty is valid only if accompanied by an official purchasing proof. We advise you to staple your purchasing proof received by the dealer and to keep it with this guarantee certificate.

12 Notes


Tecnocontrol
BST110 HD
BT
FW 3.27
SN 56894
BOSTON HD
ATTENTION
DO NOT INSERT THE
PROBE INTO THE CHIMNEY
55
Combustible
01 Natural Gas.
02 Gasoil
03 LPG
04 Solid
05 Others
06 Special
Boiler Type
01 Normal
02 Normal + draught
03 Condensation
04 Cond + draught
Suction Measure
P = 0.0 Pa
Memory = -----
Tf = 65.7°C Te = 20°C
M = Zero E = Print
Cancel Memory
Main screen
11:25
Metano
Tf ----- SO2 -----
Ta ----- CO2 -----
O2 ----- NOx -----
CO ----- PM -----
NO ----- Perd -----
NO2 ----- Rend -----
ENTER
Print
MENU
File
01 Store
02 Show
03 Archive
04 Print
04 Customers
Menù
01 Automatic Analysis
02 Draught
03 Pressure
04 Ambient CO
05 Parameters
06 External Probe
07 Leak Test
08 Others
09 Service

13 Notes



INFORMATION TO USERS: pursuant to Art. 13 of Decree n. 151 dated 25th July 2005 "Implementation of Directives 2002/95/CE, 2002/96/CE and 2003/108/CE on the reduction of us of hazardous substances in electrical and electronic equipment, and on the disposal of waste"

The symbol as shown on the equipment or its packaging indicates that the product at end of life must be collected separately from other waste.
The recycling of this equipment at the end of life is organized and managed by the manufacturer. The user who wishes to dispose of this equipment shall contact the manufacturer and follow the system that it has adopted to allow the separate collection of the equipments at the end of life.
The separate collection for the subsequent forwarding of recycling, treatment and environmentally compatible disposal, helps to avoid possible negative environmental and health effects and promote the reuse and/or recycling of materials making up the equipment.
Improper disposal of the product by the holder imply the application of administrative penalties provided by law.