

## Sensonic 6000

CHARACTERISTIC | FEATURES | TECHNICAL DATA | SENSORS | EQUIPMENT | APPEARANCE

The largest of Sensonic's analysers equipped with electrochemical cells. It can fit even up to 7 EC cells and up to 3 NDIR sensors. Sensonic 6000 has a large (320\*240), graphical LCD with backlighting. Datalogger with SD card for storing results and built-in ribbon printer for standard (non-thermal) paper. The Sensonic 6000 analyser is offered in two versions:

- In basic configuration the analyser is not equipped with the gas dryer and works with the probe holder + gas probe pipe. It can be paired with Sensonic D-2 gas dryer with heated hose.
- Analyser equipped with a built-in NAFION® type gas dryer and heated hose - configuration especially recommended for measurement of gases highly reactive with water or disturbed by its presence (SO<sub>2</sub>, HCl, NO<sub>2</sub>, Cl<sub>2</sub>).

# Sensonic 6000

## CHARACTERISTIC

## FEATURES

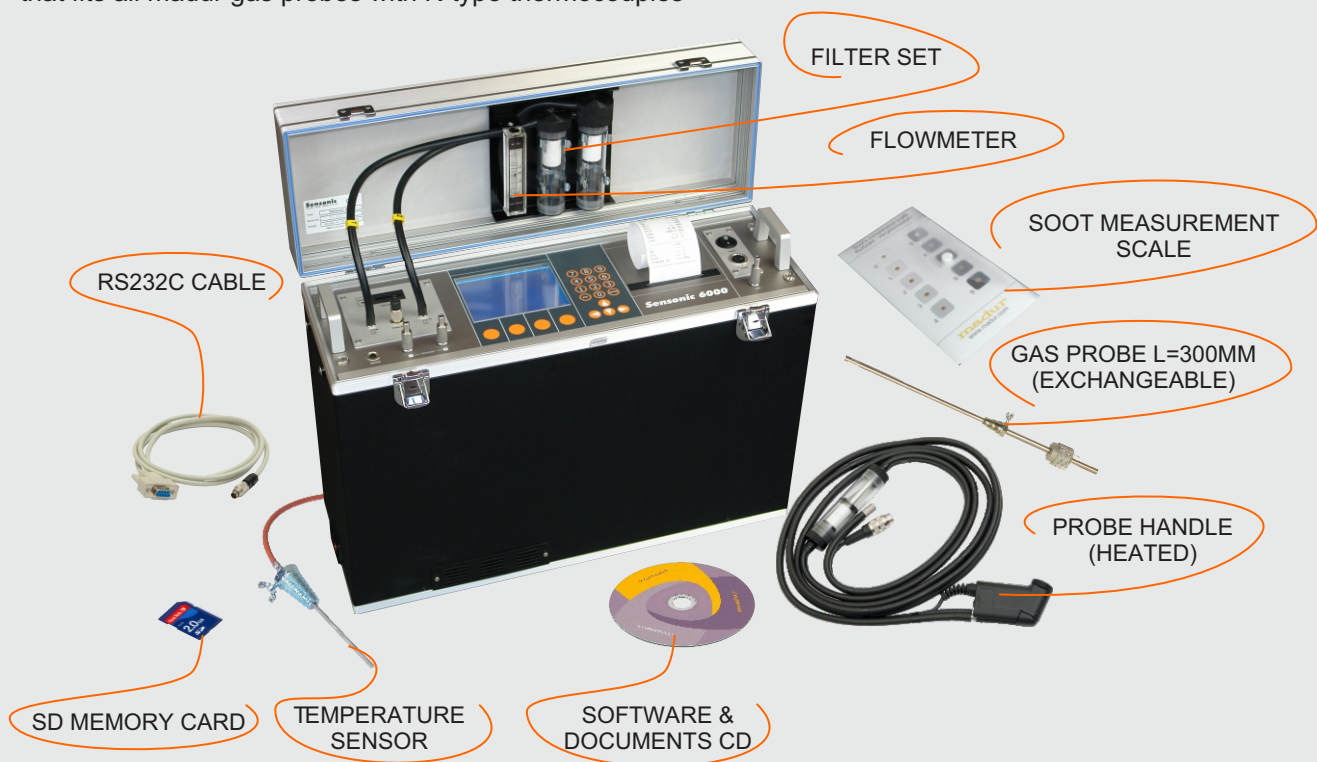
## TECHNICAL DATA

## SENSORS

## EQUIPMENT

## APPEARANCE

- Equipped with up to 7 electrochemical cells
- Equipped with up to 3 NDIR sensors
- Built-in 58mm ribbon, graphic printer
- Built-in rechargeable battery for up to 8 hours of operation (for basic configuration with probe holder + probe pipe)
- Measurements of gas and ambient temperatures, optionally 8 additional inputs for temperature sensors
- Additional gas filter with condensate trap (installed in the lid)
- Differential pressure sensor - for measurements of chimney draft and flow velocity (with help of Pitot tube)
- Soot measurement programme
- Analogue outputs (4-20mA / 0-10V) - optional
- SD card data-logger for saving results
- Calculations of many additional parameters
- Firmware for gas calibrations
- FOR ANALYSER IN A VERSION:
  - Works with madur standard probe holder and probe pipe
  - Possibility to work with full-size gas dryers (like Sensonic D-2)
- FOR ANALYSER IN B VERSION:
  - Built-in NAFION® dryer with peristaltic pump for condensation removal
  - Driver for heated hose
  - Works with heated hose with built-in heated gas filter and with standard M30x1 fitting, that fits all madur gas probes with K-type thermocouples



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CHARACTERISTIC	FEATURES	TECHNICAL DATA	SENSORS	EQUIPMENT	APPEARANCE
ANALYSER		VERSION A		VERSION B	
		WITHOUT BUILT-IN DRYER		WITH BUILT-IN NAFION® DRYER	
Dimensions (W * H * D)		500 mm * 395 mm * 173 mm			
Weight (without accessories)		12,2 ÷ 13,2kg		13,7 ÷ 14,7kg	
Casing material		Plywood covered with aluminium			
Operating conditions		T: 10°C ÷ 50°C, RH: 5% ÷ 90% (non-condensing)			
Storing temperature		-20°C ÷ 55°C			
Power supply: Input   maximal power consumption		115 VAC or 230 VAC   90 W (without heated hose)			
Battery: type  work time   charging time		Lead-acid, rechargeable 3x6V / 4,5Ah   16h   12h			
Data memory: type   size   number of results		SD flash card  max 4GB   practically unlimited			
Display		Graphical LCD 320*240, with variable contrast and backlighting			
Printer		High-speed dot matrix, graphic printer for 2,25" (57,5 ± 0,5mm) normal paper			
Gas pump   gas flow		Diaphragm, max 2l/min (with automatic flow control)   90l/h (1,5l/min)			
Purging pump for CO sensor		Diaphragm, max 1,5l/min			
Communication interface with PC computer		RS-232C			
Gas filtering		Built-in final filter (behind the gas dryer) with replaceable insert		<ol style="list-style-type: none"> <li>1. Heated filter included in the heated hose</li> <li>2. Built-in final filter (behind the gas dryer) with replaceable insert</li> </ol>	
<b>BUILT-IN GAS DRYER, HEATED HOSE DRIVER, HEATED HOSE</b>					
<b>CONCERNS ONLY THE B VERSION (WITH BUILT-IN NAFION® DRYER)</b>					
Dryer type		Based on Nafion® exchanger			
Drying method		Water transfer through Nafion membrane driven by partial vapour pressure differential - first order kinetic reaction			
Maximum gas flow for efficient drying		100 l/h			
Heated hose temperature		120°C electronically stabilised			
Heated hose temperature hysteresis		~ 5°C			
Heated hose length		3m (optionally 5m or 10m)			
Heated hose power consumption		360W (max)			
Heated hose thermocouple wires		K-type (S-type optionally)			

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<b>MEASUREMENTS</b>					
Variable	Method	Range   Resolution	Accuracy	Time (T <sub>90</sub> )	
T <sub>gas</sub> - gas temperature	K-type thermocouple	-10 ÷ 1000°C   0,1°C	± 2°C	10 sec	
T <sub>gas</sub> - gas temperature	S-type thermocouple	-10 ÷ 1500°C   0,1°C	± 2°C	10 sec	
T <sub>amb</sub> - boiler intake air temperature	PT500 resistive sensor	-10 ÷ 100°C   0,1°C	± 2°C	10 sec	
Differential pressure	Silicon piezoresistive pressure sensor	-25 hPa ÷ +25 hPa   1 Pa (0,01hPa)	± 2Pa abs. or 5% rel.	10 sec	
Gas flow velocity	Indirect, with Pitot tube & pressure sensor	1 ÷ 50 m/s   0,1 m/s	0,3 m/s abs. or 5% rel.	10 sec	
Lambda λ - excess air number	Calculated	1 ÷ 10   0,01	± 5% rel.	10 sec	
qA - stack loss	Calculated	1 ÷ 100%   0,1%	± 5% rel.	10 sec	
Eta η - combustion efficiency	Calculated	1 ÷ 120%   0,1%	± 5% rel.	10 sec	

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Method		Range   Resolution	Accuracy	Time (T90)	Conformity
<b>O<sub>2</sub> - OXYGEN</b>					
Electrochemical		20,95%   0,01%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure		20,95%   0,01%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure		25,00%   0,01%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure		100,00%   0,1%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Paramagnetic		25,00%   0,01%	± 0,2% abs. or 5% rel.	45 sec	EN 14789; OTM-13
Paramagnetic		100,00%   0,1%	± 0,2% abs. or 5% rel.	45 sec	EN 14789; OTM-13
<b>CO - CARBON MONOXIDE</b>					
Electrochemical		4 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical		20 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical		10%   0,001% ppm	± 0,005% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochem. with H2 compensation		4 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
NDIR		10%   0,01%	± 0,05% abs. or 5% rel.	45 sec	EN 15058
NDIR		100%   0,1%	± 0,5% abs. Or 5% rel.	45 sec	EN 15058
<b>CO<sub>2</sub> - CARBON DIOXIDE</b>					
NDIR		5%   0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039
NDIR		25%   0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039
NDIR		100%   0,1%	± 0,5% abs. or 5% rel.	45 sec	ISO 12039

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Method		Range   Resolution	Accuracy	Time (T90)	Conformity
<b>CH<sub>4</sub> – METHANE</b>					
NDIR		5%   0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR		25%   0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR		100%   0,1%	± 0,5% abs. or 5% rel.	45 sec	
<b>NO - NITRIC OXIDE</b>					
Electrochemical		1 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379, CTM-022
Electrochemical		5 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379, CTM-022
<b>NO<sub>2</sub> - NITROGEN DIOXIDE</b>					
Electrochemical		1 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379, CTM-022
<b>SO<sub>2</sub> - SULPHUR DIOXIDE</b>					
Electrochemical		2 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379
Electrochemical		5 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379
<b>H<sub>2</sub>S- HYDROGEN SULPHIDE</b>					
Electrochemical		1 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	70 sec	
<b>H<sub>2</sub> - HYDROGEN</b>					
Electrochemical		2 000 ppm   1 ppm	± 10 ppm abs. or 5% rel.	50 sec	
Electrochemical		20 000 ppm   1 ppm	± 10 ppm abs. or 5% rel.	70 sec	
Thermal Conductivity Detector		10%   0,1%	± 0,5% abs. or 5% rel.	45 sec	
Thermal Conductivity Detector		25%   0,1%	± 0,5% abs. or 5% rel.	45 sec	
Thermal Conductivity Detector		50%   0,1%	± 0,5% abs. or 5% rel.	45 sec	
Thermal Conductivity Detector		100%   0,1%	± 0,5% abs. or 5% rel.	45 sec	
<b>CL<sub>2</sub> - CHLORINE</b>					
Electrochemical		250 ppm   1 ppm	± 5 ppm abs. or 5% rel.	60 sec	
<b>HCl - HYDROGEN CHLORIDE</b>					
Electrochemical		100 ppm   1 ppm	± 5 ppm abs. or 5% rel.	70 sec	
<b>N<sub>2</sub>O - NITRUS OXIDE</b>					
NDIR		2 000 ppm   1 ppm	± 10 ppm abs. or 5% rel.	45 sec	ISO 21258
<b>CHF<sub>3</sub> - FLUOROFORM (REFRIGERANT R23)</b>					
NDIR		2,5%   0,01%	± 0,05% abs. or 5% rel.	45 sec	
<b>SO<sub>2</sub> - SULPHUR DIOXIDE</b>					
NDIR		1%   0,01%	± 0,05% abs. or 5% rel.	45 sec	
<b>NO<sub>2</sub> - NITROGEN DIOXIDE</b>					
NDIR		1%   0,01%	± 0,05% abs. or 5% rel.	45 sec	
<b>VOC - VOLATILE ORGANIC COMPOUNDS</b>					
PIT - Photoionization Detector		100 ppm   1 ppm	± 5 ppm abs. or 5% rel.	120 sec	METHOD 21
PIT - Photoionization Detector		1 000 ppm   1 ppm	± 5 ppm abs. or 5% rel.	120 sec	METHOD 21

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### STANDARD EQUIPMENT

SUPPLIED ALONG WITH THE DEVICE

- 3m mains cable (type of plug to be selected)
- Comparison scale with paper filters for the soot test
- Gas filter with condensation trap and replaceable filter insert (pore size 5µm)
- Flow indicator
- Data-logger with 2GB SD card
- 2,5m RS-232C communication cable with DB9 female connector
- Software CD with programmes and manuals
- Quick-couplers for the pressure sensor (2pc.)
- External ambient temperature sensor (1pc.)

### ADDITIONAL EQUIPMENT

NECESSARY FOR THE ANALYSER TO WORK

- **Probe holder**

SUITABLE ONLY FOR THE A VERSION OF Sensonic 6000 (WITHOUT BUILT-IN DRYER).

Together with an exchangeable gas probe pipe the holder is a complete gas probe for extraction of gas samples. It has a single gas tube ended with quick coupler and electric cable ended with a 7-pin connector. Gas probe pipe is mounted with a M30x1 fastening. In the electric connector there is a PT500 sensor for measurement of ambient temperature.

Probe holder can be equipped with an in-line filter with a condensation trap (pore size of the filter inlet is 20µm). Probe holder is available in two versions:

- heated (with a slit for a filter for soot measurement test),
- unheated (without a possibility to perform soot test).



- **Heated hose**

SUITABLE ONLY FOR THE B VERSION OF Sensonic 6000 (WITH BUILT-IN NAFION DRYER). REPLACES THE PROBE HOLDER.

Heated hose with heated gas filter supplies gas sample to the analyser's conditioning module.

Hose has M30x1 threaded connection to fix gas probe pipe. The other end has magnetic quick coupler and electric connector to connect it to the analyser.

Standard length of hose is 3m, it is possible to order other lengths of hoses.

Hose is provided with a carrying bag.



- **Gas probe pipe**

Gas probe is immersed in the gas duct and is supposed to extract the gas sample and to measure its temperature.

Exchangeable probes are easily connected to probe holders (with M30x1 fastening). They have thermocouple type K (in some configurations type S) for measurement of gas temperature and a threaded fixing cone.

There are many probe pipes available. They differ in length and working temperature.

For work efficiency it is advised to own different probe pipes to be able to adjust to the measurement place.





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## OPTIONAL EQUIPMENT & SPARE PARTS

### Ambient temperature sensor

- This ambient temperature sensor on a 3m cable is used for measurement of the boiler's inlet air. In basic configuration the ambient temperature is measured by sensor installed in the connector of the gas probe handle.

ordering code:  
Z40P-SENS-TEMP



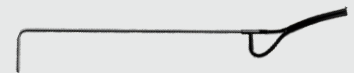
### Pitot tube

Pitot tube is an accessory that allows to perform measurement of the flow velocity of the gas stream. The measurement is performed indirectly – Pitot tube is connected to analyser's differential pressure sensor. Analyser recalculates the differential pressure on the Pitot tube's outlets to velocity.

A few lengths of tubes are available. Pitot tube has 2m gas tubings to connect it with the analyser.

ordering codes:

pitot tube 800mm - Z00-PITOT-8002  
pitot tube 500mm - Z00-PITOT-5002



### RS232C to USB converter

2.5m cable that allows to connect the analyser (its RS232C port) with USB port in PC computer (especially valuable when PC is not equipped with COM port).

ordering code:  
Z40P-USB-ADAP



### Bluetooth communication module

Module connected to the analyser's RS232C port, allows to communicate with PC computer over Bluetooth protocol.

ordering code:  
Z40P-BLUE-TOOTH



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## FRONT PANEL



## GAS AND ELECTRIC CONNECTORS

### SD/MMC CARD SLOT



RS-232C SOCKET

DIFFERENTIAL PRESSURE INLETS

FILTER SET INLET & OUTLET

EXTERNAL TEMPERATURE SOCKET

### A VERSION



POWER SWITCH

GAS PROBE SOCKET

GAS INLET

### B VERSION (WITH BUILT-IN DRYER)



GAS QUICK-COUPLER FOR HEATED HOSE (WITH MAGNETIC LOCK)



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## EXAMPLE PRINTSCREEN

## EXAMPLE PRINTOUT

Temperature stabilizing



Please wait...  
59

24.78°C ➔ 28.53°C  
0.54°C / 3min

1 M003 F1 T=2s 0:04 XL1 10:13

CO	22 ppm	NO	10 mg/m <sup>3</sup>
NO <sub>2</sub>	13 ppm	H <sub>2</sub> S	12 mg/m <sup>3</sup>
SO <sub>2</sub>	220 ppm	NH <sub>3</sub>	160 mg/m <sup>3</sup>
H <sub>2</sub>	45 ppm	HCl	286 mg/m <sup>3</sup>
Cl <sub>2</sub>	15 ppm	NO	0 mg/m <sup>3</sup>
---	--- ppm	---	--- mg/m <sup>3</sup>

M+ Operation Print Param.

**Sensonic 6000**

Serial #: 07499360  
Software: 0.20

**madur**  
www.sensonic-analysers.com

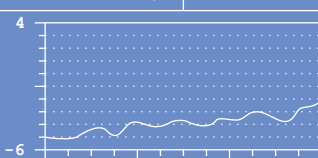
```

madur
*****
00:00.39      01.01.23
-----
FUEL: LIGHT OIL
O2rel      3 %
AVERAG. TIME: 2 sec
-----
BOILER POWER: 0.0 kW
FUEL FLOW    : 0.0 l/h
TEMPERATURE  : 0 °C
-----
TA 20.0°C TG **E**°C
O2 ***% CO2 ---%
-----
CO      0PPM
NO      0PPM
NO2    1PPM
---    --- PPM
---    --- PPM
NOx     1PPM
NOxrel  --- mg/m3
-----
EXCESS AIR...: ---
STACK LOSS...: --- %
EFFICIENCY...: --- %
EFFICIENCY*...: --- %
-----
m a d u r
Sensonic 6000
*****
    
```

4 M003 F1 T=2s 0:04 XL1 10:13

CO	0.00 %	CO IR	0 ppm
CO <sub>2</sub>	0.00 %	NO IR	0 ppm
Tgas	--- °C	SO <sub>2</sub> IR	0 ppm
Tamb	--- °C	NOx	0 ppm
qA	--- %		

39  
Pdif  
[Pa]



M+ (+) (-) Options