CMS -7

madur gas monitoring system

www.madur.com

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

CMS-7 is a full size CEMS system equipped with up to 6 electrochemical sensors (more cells on demand), that are backed up with up to 3 NDIR sensors. Manufactured according to the principles of ISO 10396.
CMS-7 is divided into 3 modules: the analyser, the conditioner and the power supply module.
All three are mounted in a server-type cabinet with a cart to move it around.
Onboard data logger with SD card allows to collect measurement results for weeks time.

CMS -7

- CMS-7 is a modular CEMS system
- It consists of three modules in 19'' rack standard:
  - Conditioner module - height 5U
  - Analyser module - height 4U
  - Power supply module - height 2U
- All above are mounted in 19'' cabinet of 12 U height
- Cabinet's front door is glass to protect steering panels, yet allows to view and control the work of the CEMS
- Back door is hinged, what allows to easily access the gas and electrical connections of all analyser's modules
- In the back door, at the bottom, there is a main panel of electric and gas connectors, and at the side a connection of the heated hose

CONDITIONER INCLUDES

- Driver and steering of heated hose and heated filter
- Gas dryer (Nafion® or condensation type)
- Two fibreglass filters installed in the front panel
- Flow indicator installed in the front panel
- Gas pump (diaphragm) and condensate pump (peristaltic)
- Solenoid valve for ventilation
- Paramagnetic oxygen sensor (if it is installed)

ANALYSER MODULE INCLUDES

- Set of electrochemical cells (O2 + up to 5 toxic sensors)
- Set of NDIR sensors (up to 3)
- Other measurement systems (temperature measurements, pressure, flow, etc.)
- Large (320*240), graphical, monochromatic LCD display and steering keyboard
- CPU administrative computer
- Analogue outputs
- Communication interface
- Data-logger with SD card

MAIN CONNECTION PANEL
- LOCATED AT THE BOTTOM
OF THE CABINET'S BACK DOOR

VIEW AT THE BACK PANELS OF ALL CMS-7 MODULES.
CONNECTORS ARE ACCESSIBLE AFTER OPENING THE CABINET'S BACK DOOR.

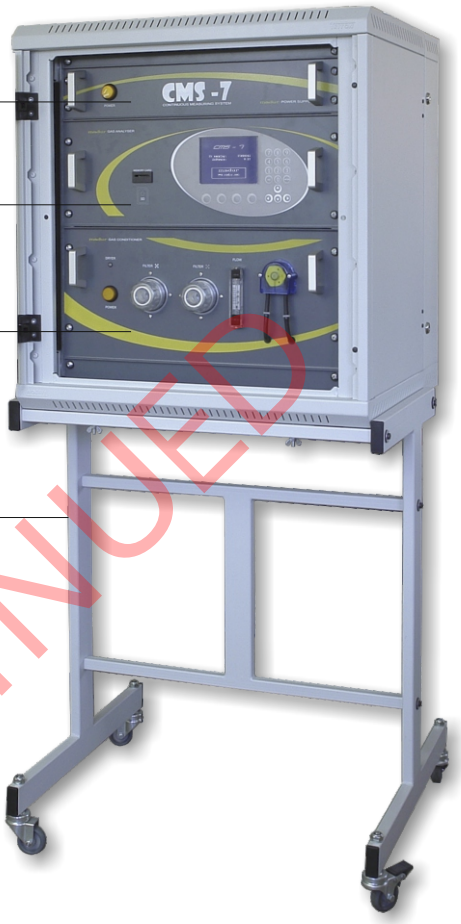
CMS -7

POWER SUPPLY UNIT

GAS ANALYSER UNIT

GAS SAMPLE CONDITIONER UNIT

CART



HEATED HOSE CONNECTION

CART FOR CMS-7 CABINET

CMS -7

ANALYSER UNIT

Dimensions (W * H * D)	470 mm * 310 mm * 160 mm
Weight (without accessories)	12,0 kg ÷ 12,8 kg
Casing material	Aluminum padded with foam and fabric (polyester)
Operating conditions	T: 10°C ÷ 50°C, RH: 5% ÷ 90% (non-condensing)
Storing temperature	0°C ÷ 55°C
Power supply: input | maximal power consumption	115V AC or 230V AC | 90W (without heated hose)
Data memory: size | number of results	32 kB | 30 reports + 10 banks (1024 sets of data)
Display	Graphical LCD 320*240, with variable contrast and backlighting
Analogue outputs (optional)	Eight current (0/4mA ÷ 20mA) and eight voltage (0V ÷ 10V) outputs
Gas pump | gas flow	Diaphragm, max 2l/min | 90l/h (1,5l/min)
Purging pump for CO sensor	Diaphragm, max 1,5l/min
Communication interface with PC computer	RS-232C
Gas filtering	1. Heated filter included in the heated hose 2. Built-in final filter (behind the gas dryer) with replaceable insert

GAS CONDITIONING UNIT WITH CONDENSATION DRYER, HEATED HOSE DRIVER, HEATED HOSE

Drying method	Water condensation by rapid cooling down
Cooler type	Based on Peltier element
Cooler temperature	+5°C electronically stabilized
Cooler temperature hysteresis	~1°C
Maximum gas flow for efficient drying	100l/h
Condensate pump	Peristaltic, 38ml/min
Heated hose temperature	+120°C electronically stabilized
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)

CMS -7

GAS CONDITIONING UNIT WITH NAFION® DRYER, HEATED HOSE DRIVER, HEATED HOSE

Drying method	Water transfer through Nafion®membrane driven by partial vapour pressure differential - first order kinetic reaction
Cooler type	Based on Nafion® exchanger
Cooler temperature	n/a
Under pressure in Nafion® collar	~500 mbar
Ready to operate after	1 minute
Condensate pump	n/a
Heated hose temperature	+120°C electronically stabilized
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)

MEASUREMENTS

Variable	Method	Range | Resolution	Accuracy	Time (T_{90})
T_{gas} - gas temperature	K-type thermocouple	-10 ÷ 1000°C | 0,1°C	± 2°C	10 sec
T_{gas} - gas temperature	S-type thermocouple	-10 ÷ 1500°C | 0,1°C	± 2°C	10 sec
T_{amb} - boiler intake air temperature	PT500 resistive sensor	-10 ÷ 100°C | 0,1°C	± 2°C	10 sec
T_1 & T_3 – external temperatures	K-type thermocouple	-10 ÷ 1000°C | 0,1°C	± 2°C	10 sec
T_1 & T_3 – external temperatures	S-type thermocouple	-10 ÷ 1500°C | 0,1°C	± 2°C	10 sec
T_2 & T_4– external temperatures	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	0 ÷ 100% | 0,1%	± 5% rel.	10 sec
Eta - η combustion efficiency	Calculated	1 ÷ 120% | 0,1%	± 5% rel.	10 sec
U_1 & U_2 – analogue inputs (voltage)	Delta-sigma ADC	-20V ÷ +20V | 0,01V	± 2 rel.	10 sec
I_1 & I_2 – analogue inputs (current)	Delta-sigma ADC	-20mA ÷ +20mA |0,01mA	± 2 rel.	10 sec

CMS -7

Method	Range | Resolution	Accuracy	Time (T_{90})	Conformity
O_2 - OXYGEN				
Electrochemical	20,95% | 0,01%	± 0,1% abs. or 5% rel.	45 sec	
Electrochemical, partial pressure	20,95% | 0,01%	± 0,1% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure	25,00% | 0,01%	± 0,1% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure	100,00% | 0,01%	± 0,1% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
CO - CARBON MONOXIDE				
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%	± 0,005% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochem., with H_2 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; Method 10
NDIR	100% | 0,1%	± 0,5% abs. Or 5% rel.	45 sec	EN 15058; Method 10
CO_2 - CARBON DIOXIDE				
NDIR	1% | 0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039; OTM-13
NDIR	5% | 0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039; OTM-13
NDIR	25% | 0,1%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039; OTM-13
NDIR	100% | 0,1%	± 0,5% abs. or 5% rel.	45 sec	ISO 12039; OTM-13
CH_4 – METHAN				
NDIR	5% | 0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR	10% | 0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR	25% | 0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR	50% | 0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR	100% | 0,1%	± 0,5% abs. or 5% rel.	45 sec	
NO - NITRIC OXIDE				
Electrochemical	1 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	CTM-022
Electrochemical	5 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	CTM-022
NO_2 - NITROGEN DIOXIDE				
Electrochemical	1 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	60 sec	CTM-022
SO_2 - SULPHUR DIOXIDE				
Electrochemical	1 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	
Electrochemical	5 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	

CMS -7

Method	Range | Resolution	Accuracy	Time (T_{90})	Conformity
H_2S- HYDROGEN SULPHIDE				
Electrochemical	1 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	70 sec	
H_2- HYDROGEN				
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	
CL_2- CHLORINE				
Electrochemical	250 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	60 sec	
HCl- HYDROGEN CHLORINE				
Electrochemical	100 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	120 sec	
CHF_3- FLUOROFORM (REFRIGERANT R23)				
NDIR	2,5% | 0,01%	± 0,05 % abs. or 5% rel.	45 sec	
SO_2- SULPHUR DIOXIDE				
NDIR	1% | 0,01%	± 0,05 % abs. or 5% rel.	45 sec	
NO_2- NITROGEN DIOXIDE				
NDIR	1% | 0,01%	± 0,05 % abs. or 5% rel.	45 sec	

STANDARD EQUIPMENT

SUPPLIED ALONG WITH THE DEVICE

- Three modules installed in 19” 12U cabinet:
  - Power supply unit
  - Gas analyser unit with selected types of sensors
  - Gas sample conditioning unit with selected type of gas dryer
- Ambient temperature sensor with 3m cable and magnetic holder
- Analyser's cart
- 3m PVC hose for outlet gas
- SD card for data-logger
- SD card reader (USB type to connect with PC computer)
- CD with software and manuals

ADDITIONAL EQUIPMENT

NECESSARY FOR THE ANALYSER TO WORK

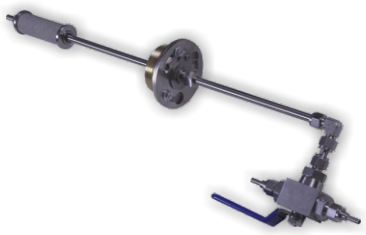
- Heated hose

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.
Standard length of hose is 3m, it is possible to order other lengths of hoses.
It is especially advised when dealing with high humidity and SO_2, NO_2 and other gases highly reactive with water.

- Gas probe pipe

Exchangeable gas probe pipe mounted on the probe holder or heated hose with M30x1 fitting.
It has thermocouple type K (in some configurations type S) for measurement of gas temperature and a threaded fixing cone. With the heated hose is a complete gas probe.
There are many probe pipes available. They differ in length and working temperature.

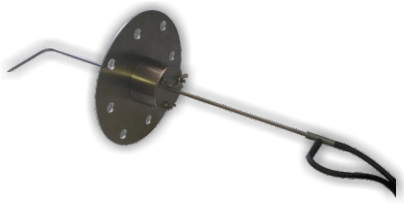
- Stationary gas probe



Gas probe designed specially for stationary purposes. Probe is available in different lengths and is equipped with suitable holder (different types are available).
Optionally it may also be equipped with:
- Thermocouple for measurements of gas temperature.
- Sintered stainless-steel filter (cleanable) - especially recommended when dealing with high concentration of dust and soot.
- "Blow-back" cleaning option - valve that allows to switch between measured gas and the compressed air inlet that is used for cleaning the sintered filter.

OPTIONAL EQUIPMENT

- 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 length of tubes are available. Pitot tube has 2m gas tubings to connect it with the analyser.
It may be provided with a suitable holder for stationary purposes.

ordering codes:
pitot tube 800mm - Z00-PITOT-8002
pitot tube 500mm - Z00-PITOT-5002

- Heated filter

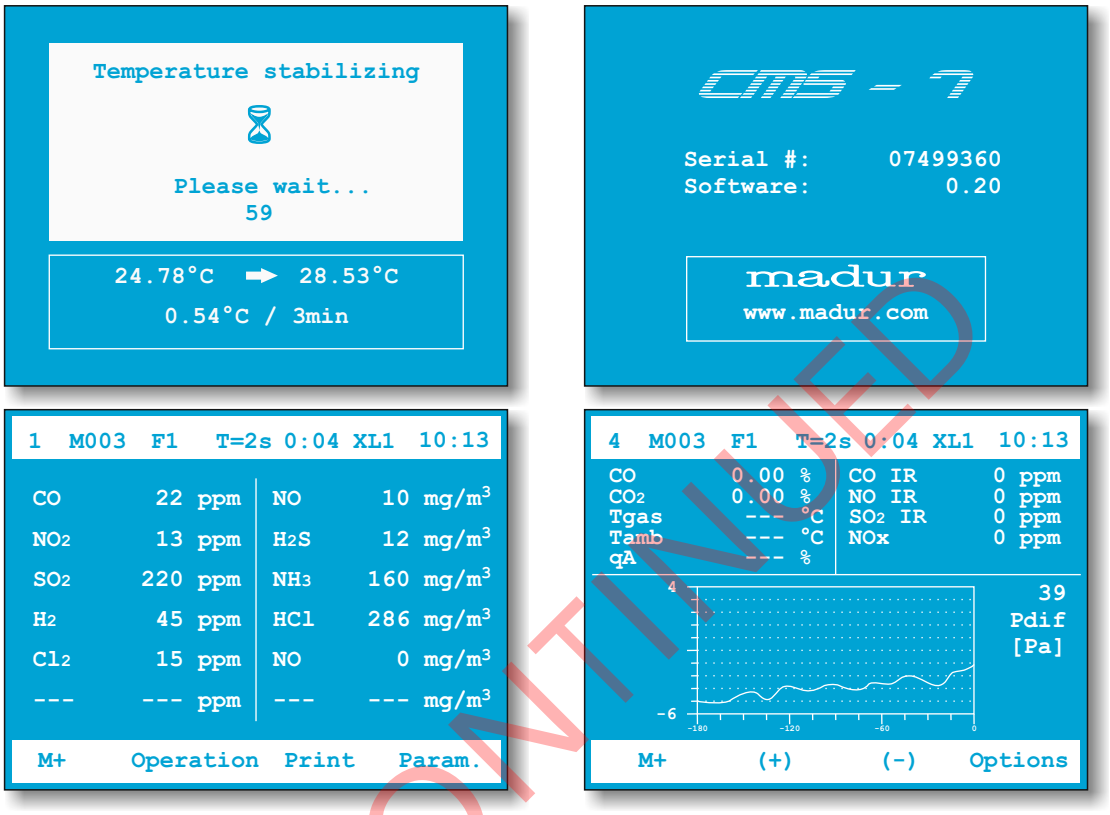
Heated filter is installed right after the gas probe.
It is best when it is paired with heated hose to prevent vapour from condensing.
The dust filter's size in the heated filter was enlarged (in comparison with a filter in the heated hose)
to allow longer maintenance-free work.

GAS ANALYSER MODULE - FRONT PANEL

GAS SAMPLE CONDITIONING UNIT - FRONT PANEL

POWER SUPPLY MODULE - FRONT PANEL

EXAMPLE PRINTSCREENS



GAS AND ELECTRIC CONNECTORS PANEL - BOTTOM OF THE CABINET'S BACK DOOR