

MEASURING
AUX
RELAYS
2
3

AquaGas SmartCEMS

Syngas Online Analyser

Syngas Applications

CO, CO₂, O₂, N₂, CH₄, C_xH_y and H₂

Smart **CEMS**
MADE TO MEASURE



AQUA
GAS

Smart CEMS

- Automated Monitoring System integrated in Australia by [AquaGas](#).
- Monitoring equipment is designed and manufactured by [MADUR](#) in Europe within the frame of an OEM agreement. Madur monitoring system are CE and ISO certified
- Data Acquisition and Handling System is designed and manufactured in UK by [a1cbiss](#). CDAS Software Suite is Mcerts certified for CEM application.



madur

MADUR

- Madur electronics was founded in 1984 in Vienna
- In 1994, Madur headquarters moved to Poland
- Handheld, portable and stationary gas analysers
- Large selection of sensors for complex gas matrix
- Broad selection of gas conditioning and sampling methods
- Field replaceable components (pre-calibrated sensor)
- AquaGas distributorship since 2013.



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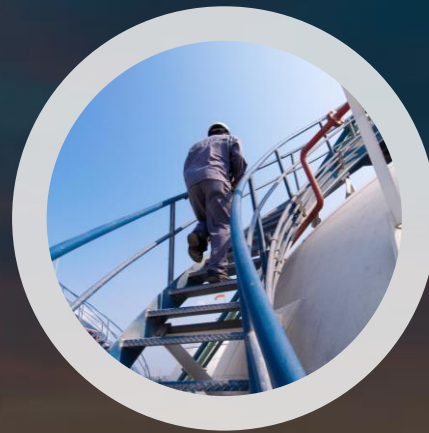


a1cbiss

- A1-cbiss was created in 1989
- Offer a wide range of gas detection & cems solutions
- Now serve hundreds of customers
- Within a variety of industrial markets
- Mcerts certified gas monitoring solutions
- AquaGas distributorship since 2013.

AquaGas Monitoring Systems

- Founded in 2013, based on the Gold Coast
- Systems integrator of AMS (automated Monitoring Systems)
- Turnkey solutions for environmental compliance and process control
- Focused on customer satisfaction
- Air, Water, Emissions and Process gas
- High performance and cost-effective technologies
- Strong support of suppliers' network
- Industry leading manufacturers: HORIBA, Fives Pillard, DURAG...



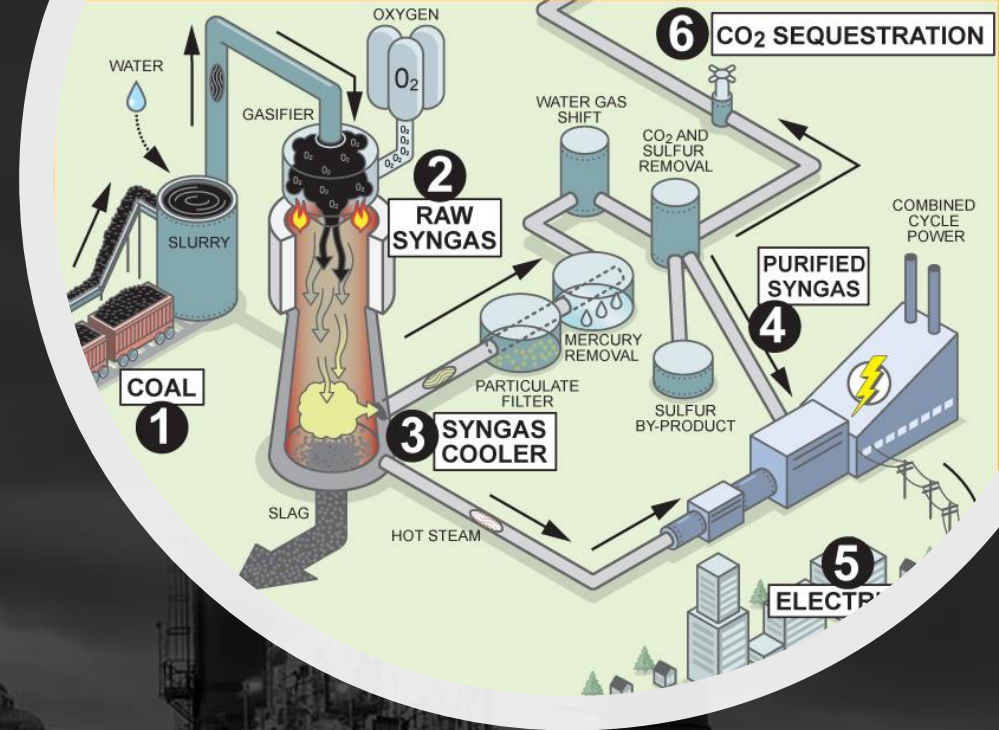
Smart CEMS Syngas Main Features

- Online Monitoring of Syngas Primary constituents in Syngas and HC streams
- Powerful sensor combinations for complex gas matrices
- Fully supported by AquaGas in Australia, New Zealand and the Pacific Islands (sales and services)
- CO, CO₂, O₂, N₂, CH₄, C_xH_y and H₂, gas temperature, velocity and flow
- Modular and flexible design offering a pertinent selection of measuring and sampling methods
- Complies with international standards (EN14181, WA CEMS code, EPAs, NGER)
- Semi-automatic or automatic redundancy for greater data availability
- Empower NGER National Greenhouse and Energy Reporting
- Mcerts DAHS computer and CDAS software suite
- No requirements for carrier, purge or zero gas.



Smart CEMS Syngas Applications

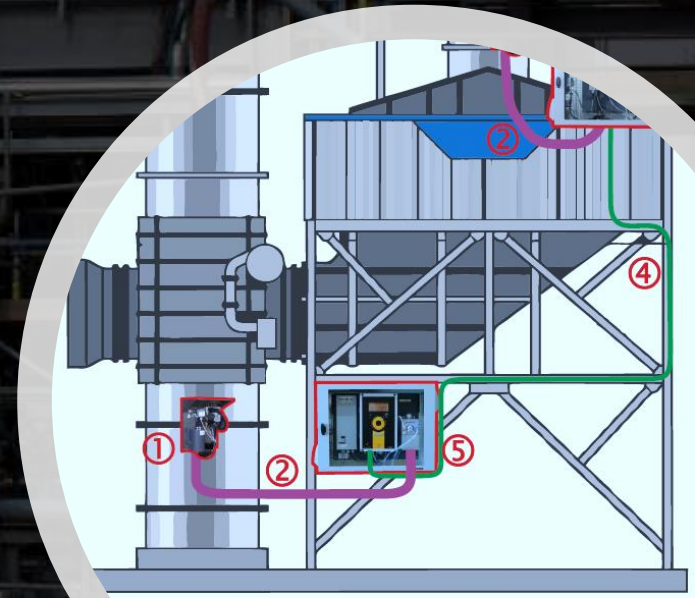
- Emissions monitoring at the stack or sinter plant: CO, SO₂, NO_x, O₂
- Raw material storage hall: CO monitoring
- Raw material silo: C₂H₂ and O₂ monitoring
- Downstream of blast furnace uptake duct: CO, CO₂, CH₄ H₂
- After dust bags - Early detection of explosion risk for the dust bags from CO contents of the blast furnace gas CO CO₂, CH₄ H₂
- Determination of the calorific value of the blast furnace gas for billing purposes CO, CO₂, CH₄ Calorific value H₂, N₂, O₂, CO
- Optimizing the converter process from the composition of the converter off gas CO, CO₂, O₂ CO, CO₂, H₂
- Scrubber efficiency and OCS: H₂S and VOC
- Syngas composition and BTU real-time monitoring: : C_xH_y, CH₄, CO₂, O₂, H₂S and VOC
- Reporting as per NGER National Greenhouse and Energy Reporting CO, CO₂, CH₄ Calorific value H₂, N₂, O₂, CO
- Monitoring compliance of dust emission with existing regulations CO Dust
- Monitoring compliance of pollutant emission with existing regulations CO, NO, SO₂, O₂ Dust



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Smart CEMS Syngas Additional Features

- Versatile selection of sample gas conditioning method incl. Peltier, Nafion, Compressor
- Extended monitoring capabilities with the inclusion of key components such as HF, HCl, NH₃
- Modular sampling train enabling optimal sampler transfer (up to 90m sampling line)
- Compact design
- Cost effective compare to typical intricates Syngas monitoring systems (spectrometer, multigas NDIR, Gas Chromatograph)

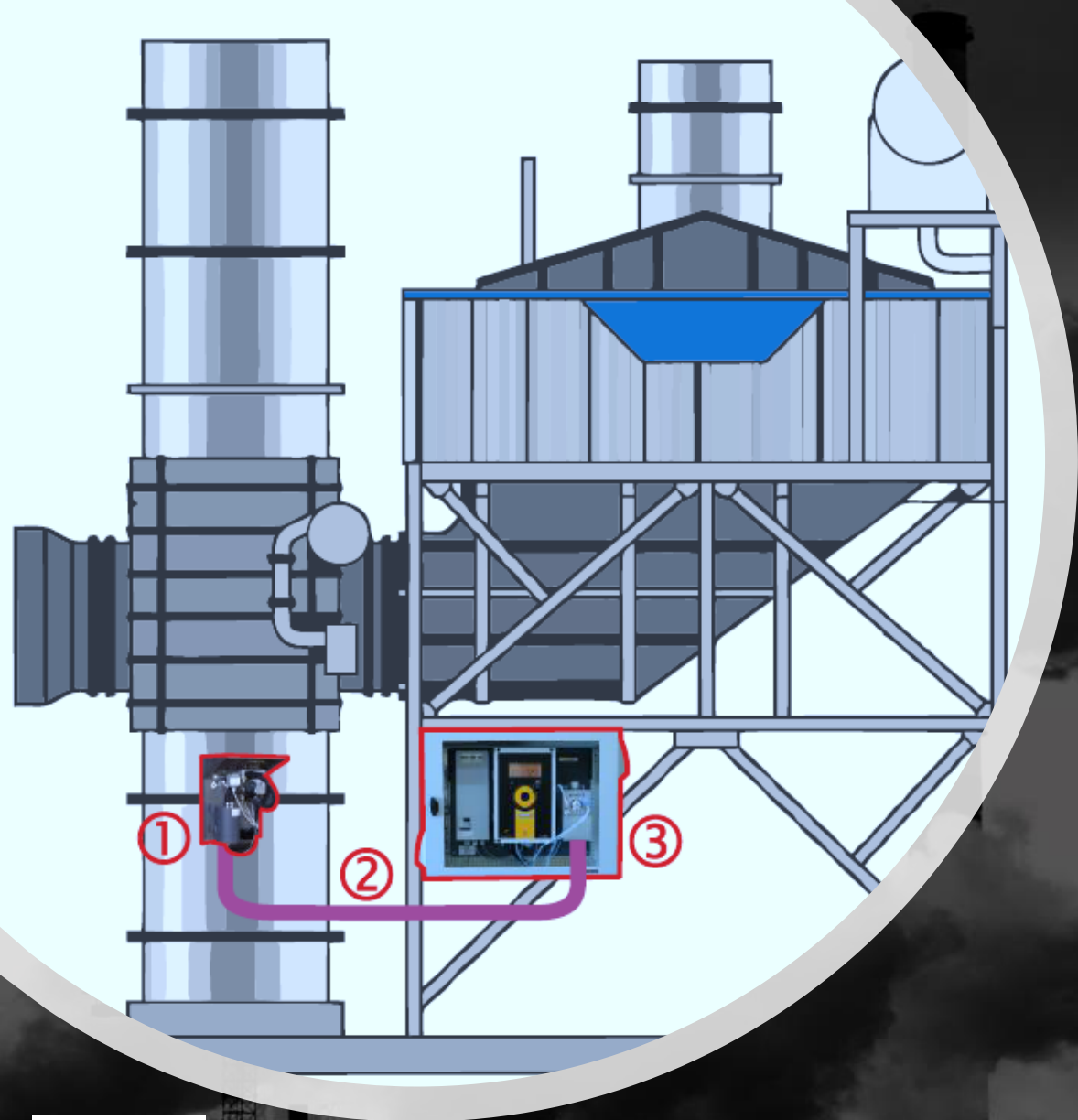


Smart CEMS Syngas References

- SUEZ Perth WA
- YARA Pilbara WA
- VISY Smithfield NSW
- Gippsland Water VIC
- NYRSTAR Port Pirie SA
- ENVIROPACIFIC Barangaroo remediation site Sydney NSW
- PYROCAL Power Station Loganholme QLD
- Gold Coast City Council QLD
- Brisbane Utilities Brisbane QLD
- And more.



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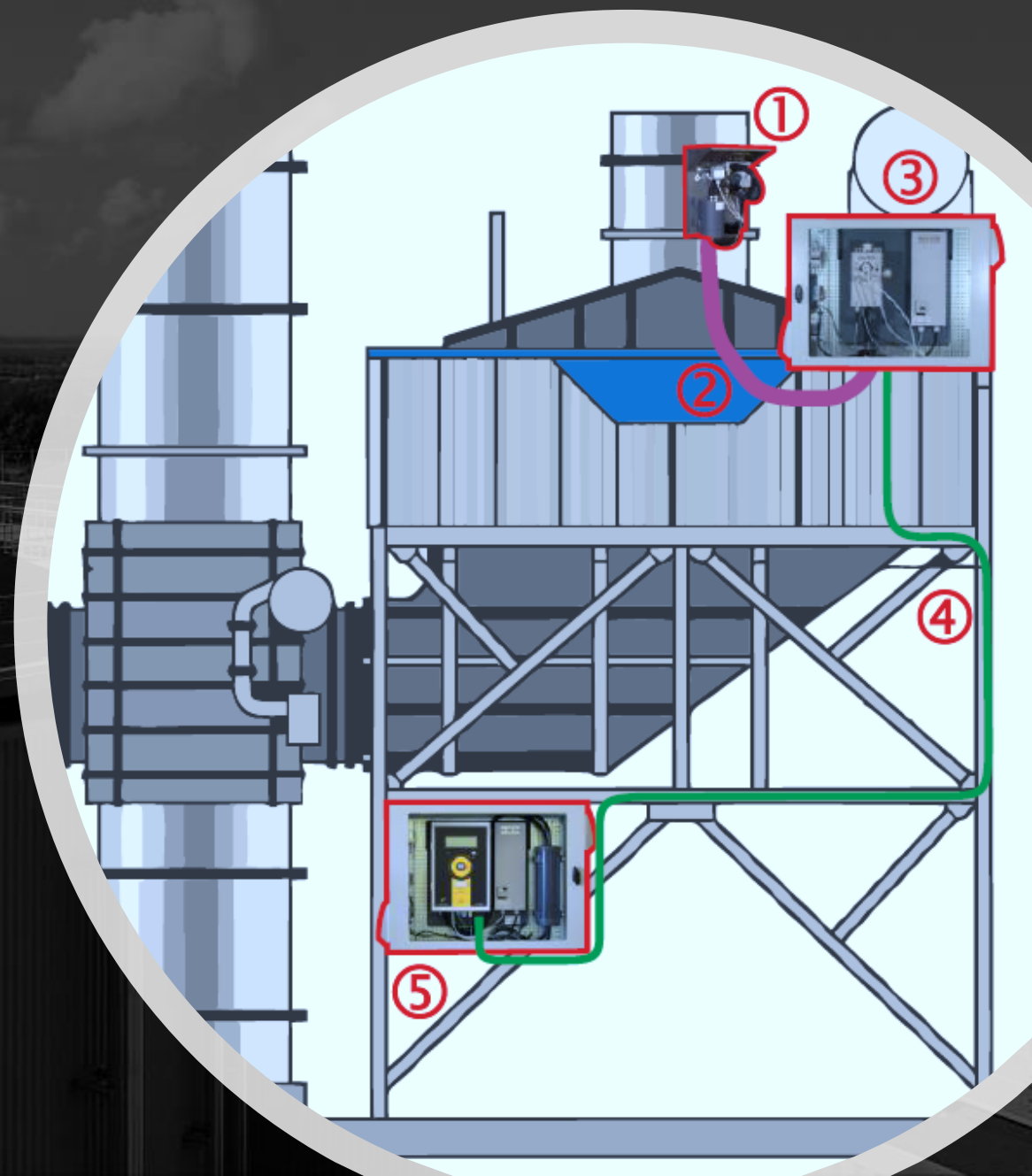
SmartCEMS Configuration Compact

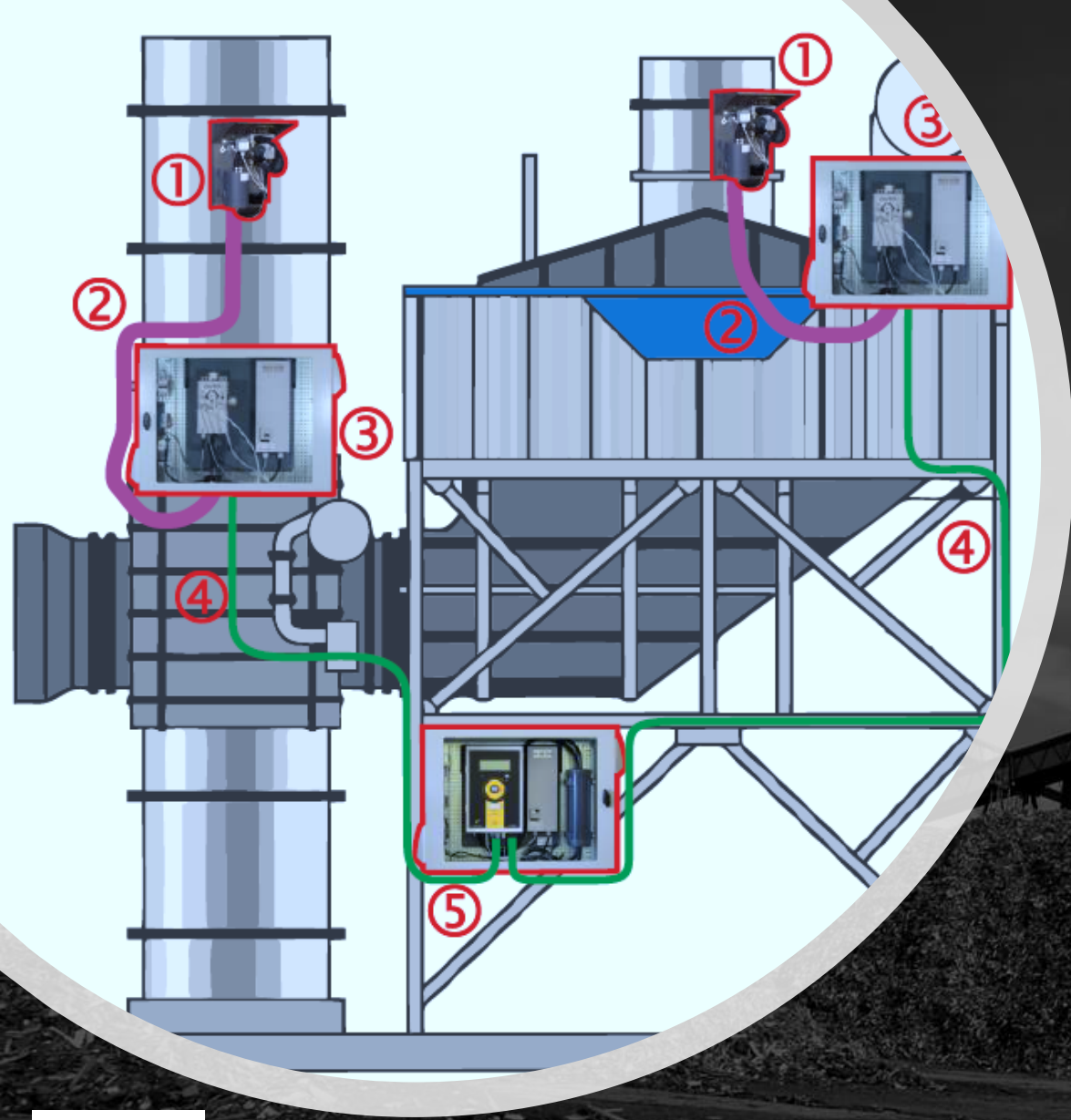
Direct Extractive

1. Stationary gas sampling probe with optional heated filter, insitu filter and backflush
2. Heated sample line (1 to 5m)
3. Mamos Multigas CEM Analyzer with MD3 gas conditioning system with Peltier cooler, peristaltic pump and particulate filter with optional IP55 housing.

SmartCEMS Configuration Split

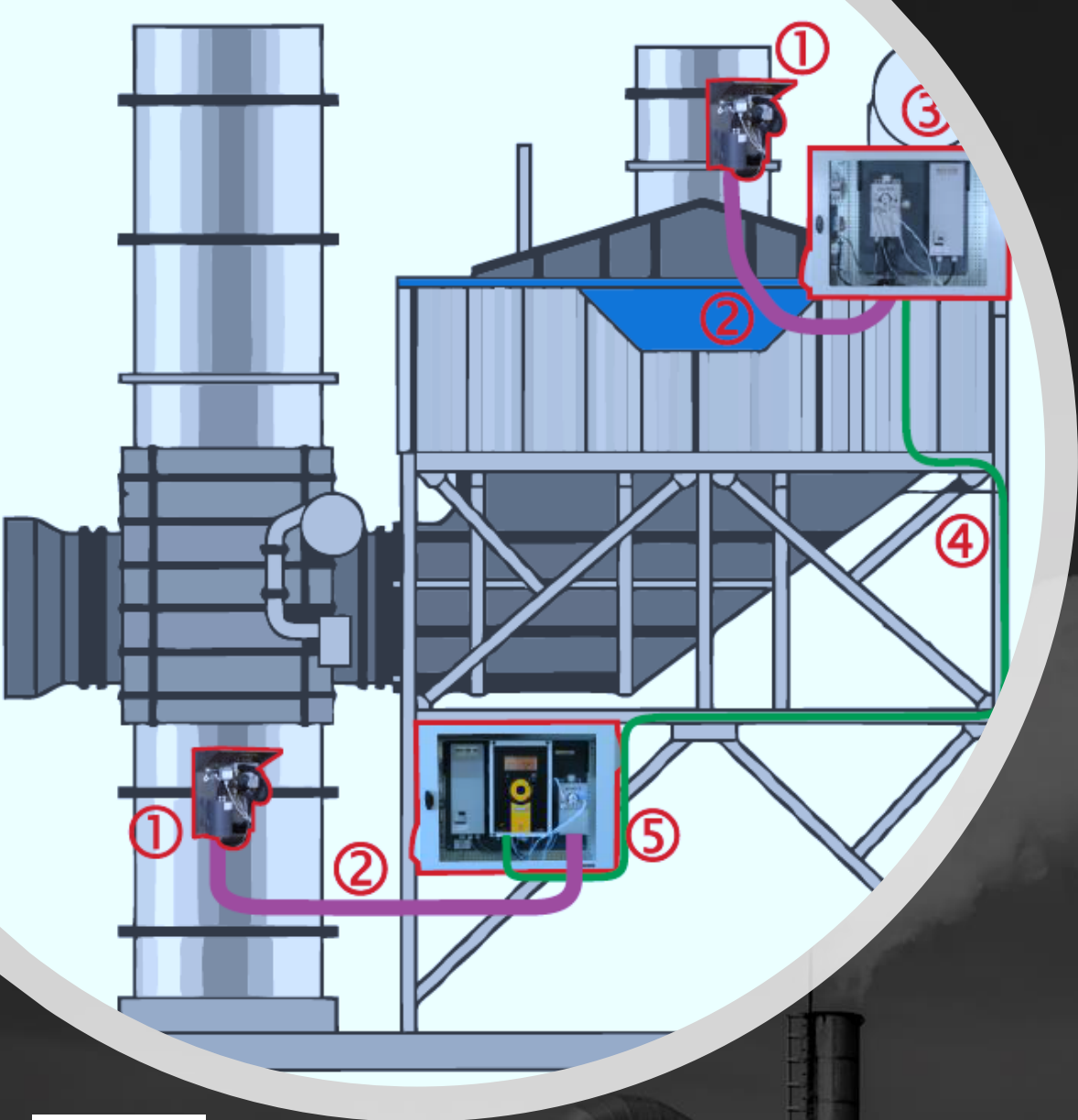
1. Stationary gas sampling probe with optional heated filter, Insitu filter and backflush
2. Heated Sample line short (1 to 3m)
3. MD3 gas conditioning system with Peltier cooler, peristaltic pump and particulate filter installed near the sampling probe assembly and integrated into the AC housing.
4. Non-heated sampling line with gas and electric cables – up to 100M
5. Mamos Multigas CEM Analyzer with optional IP55 housing





SmartCEMS Configuration Two stream Multiplexer

1. Stationary gas sampling probe with optional heated filter, Insitu filter and backflush
2. Heated Sample line short (1 to 3m)
3. MD3 gas conditioning system with Peltier cooler, peristaltic pump and particulate filter installed near the sampling probe assembly and integrated into the AC housing.
4. Non-heated sampling line with gas and electric cables – up to 100M
5. Mamos Multigas CEM Analyzer with optional IP55 housing



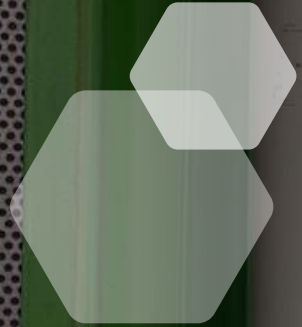
SmartCEMS Configuration

Two stream Multiplexer

Twin Split compact with remote dryer

1. Stationary gas sampling probe with optional heated filter, In situ filter and backflush
2. Heated Sample line short (1 to 3m)
3. MD3 gas conditioning system with Peltier cooler, peristaltic pump and particulate filter installed near the sampling probe assembly and integrated into the AC housing.
4. Non-heated sampling line with gas and electric cables – up to 100M
5. Mamos Multigas CEM Analyzer with optional IP55 housing

SmartCEMS Syngas System overview



Smart CEMS

Analytical Performances

Lower Detection Limits

Gas	LoD	Unit
CO	0.01	%vol.
CO2	0.01	%vol.
CH4	0.01	%vol.
O2	0.01	%vol.
H2	0.01	%vol.
CxHy	0.01	%vol.



SmartCEMS Syngas Analytical Performances

Measuring Ranges

Gas	Range	Unit
CH4	0-10 / 0-25 / 0-50 / 0-100	%vol.
CxHy	0-10 / 0-25 / 0-50 / 0-100	%vol.
CO2	0-10 / 0-25 / 0-50 / 0-100	%vol.
O2	0-25	%
H2	0-100	%
Syngas Temp	-50 to 100	°C
Diff Pressure	-10 to +40	hPa
Gas velocity	1 to 50	m/s

The logo for AQUA GAS is displayed in a white circle. The word "AQUA" is in a large, blue, sans-serif font. Below it, the word "GAS" is in a large, bold, black, sans-serif font. To the left of "GAS" is a circular icon containing a white line graph with a black dot at the end of the line, set against a grey background.

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Analytical Performances

Accuracy and Response Time

Gas	Accuracy	Time T (90)
CH4	± 0.05 % abs.	45s
CxHy	± 0.05 % abs.	45s
CO2	± 0.1 % abs.	45s
O2	± 0.1 % abs.	45s
H2	± 0.1 to 1 % abs.	45s
Syngas Temp	0.1°C	5s
Diff Pressure	1Pa	5s
Gas velocity	0.1m/s	5s



AQUAGAS

MONITORING
SYSTEMS

Smart CEMS Analytical Performances

Approved Methods

- O₂, CO: ISO 12039, CTM-030
- CO₂: ISO 12039, OTM-13
- CH₄: ISO 12039, OTM-13
- C_xH_y: ISO 12039, OTM-13
- NO, NO₂: EPA Method CTM022 (Emissions reporting)
- VOC : USEPA Method 21 Photo Ionization Detection (PID)
- Flow, velocity and temperature: USEPA method 2C

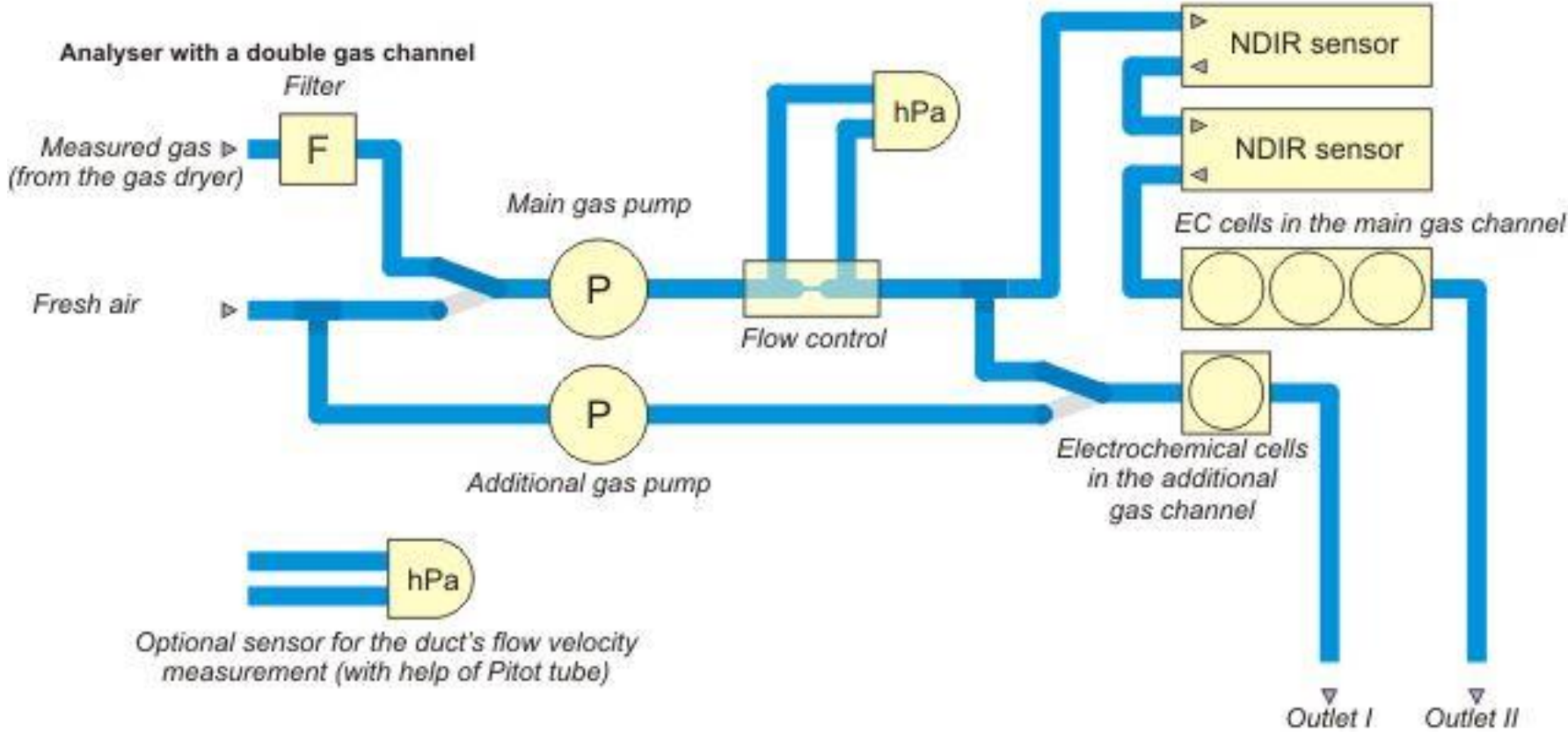


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SmartCEMS Syngas
Flow diagram

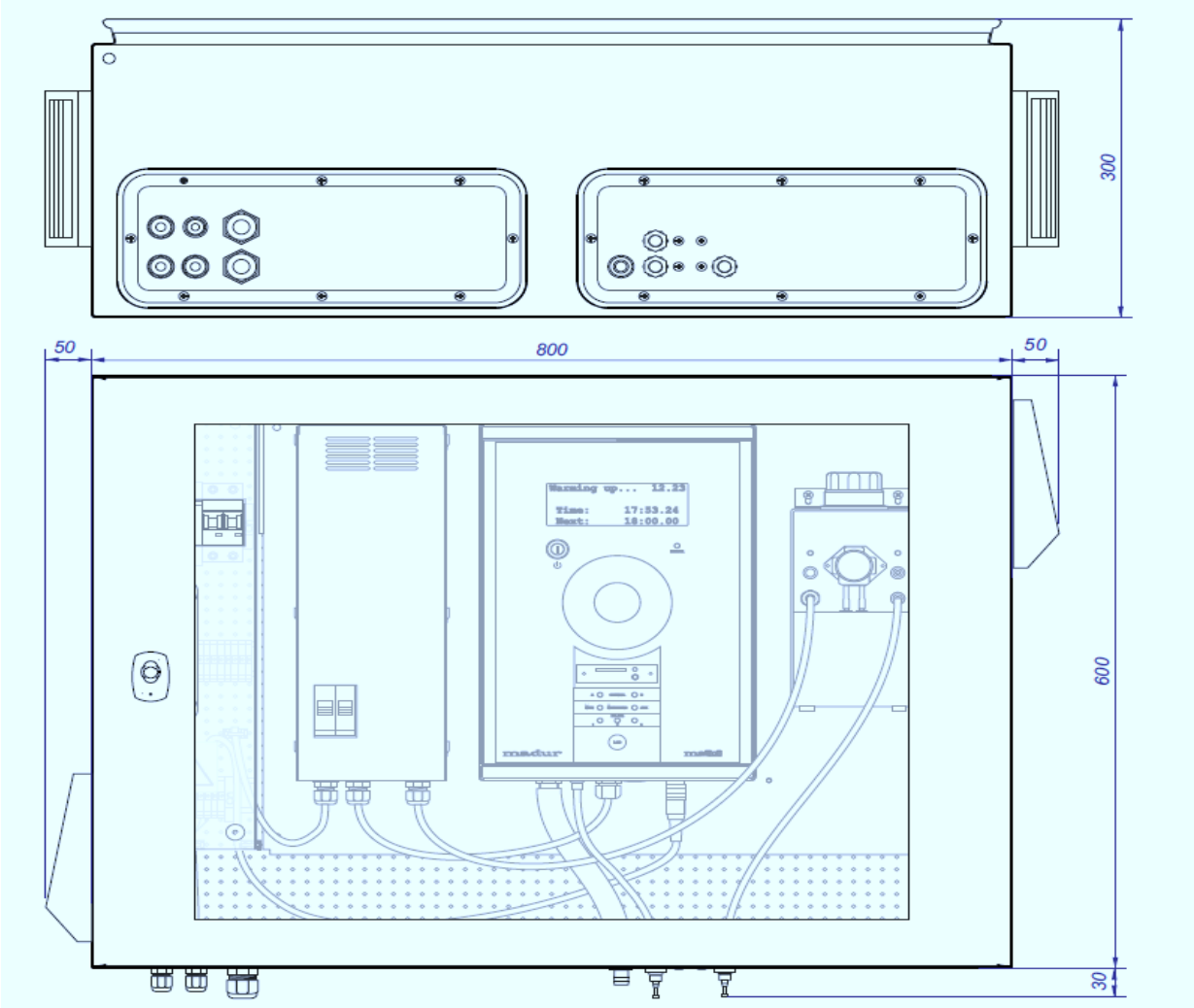
AQUAGAS

MONITORING
SYSTEMS

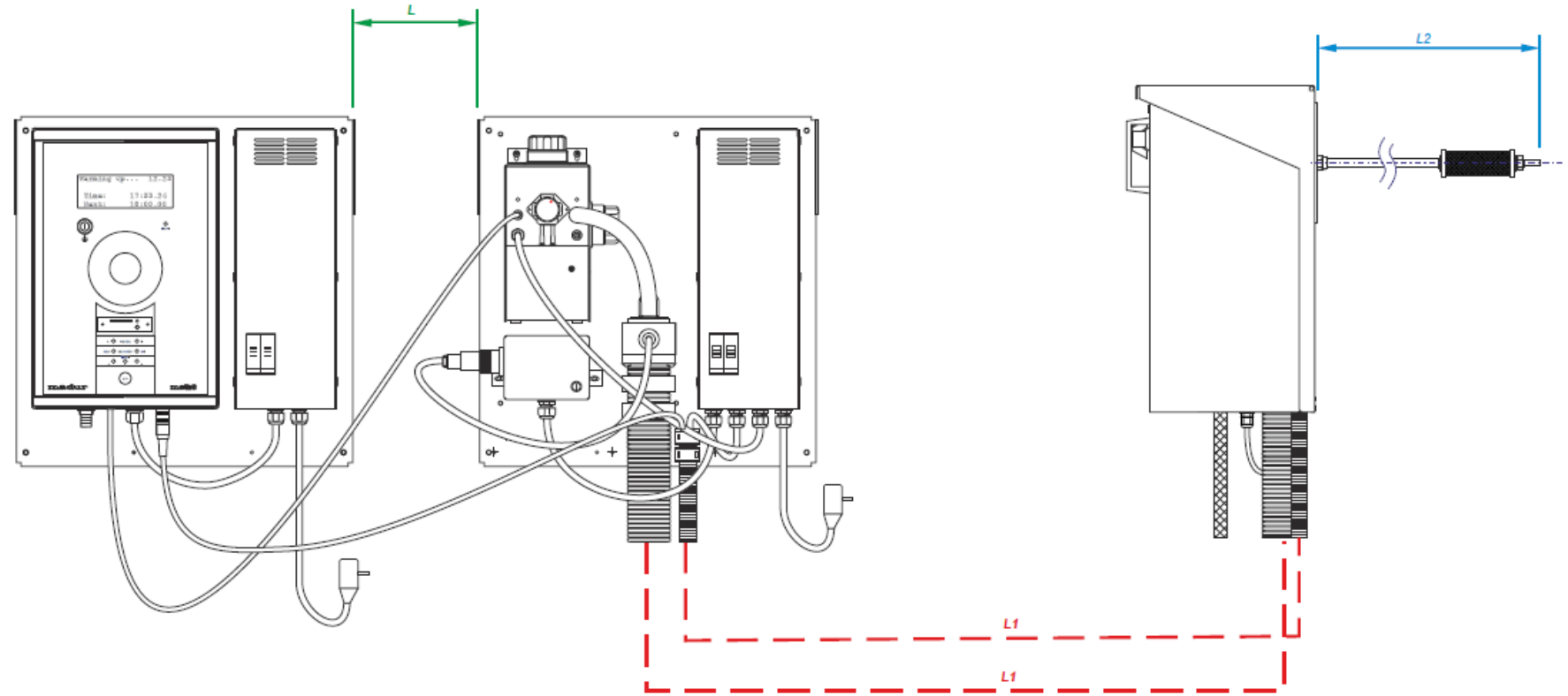


SmartCEMS Syngas
Enclosure

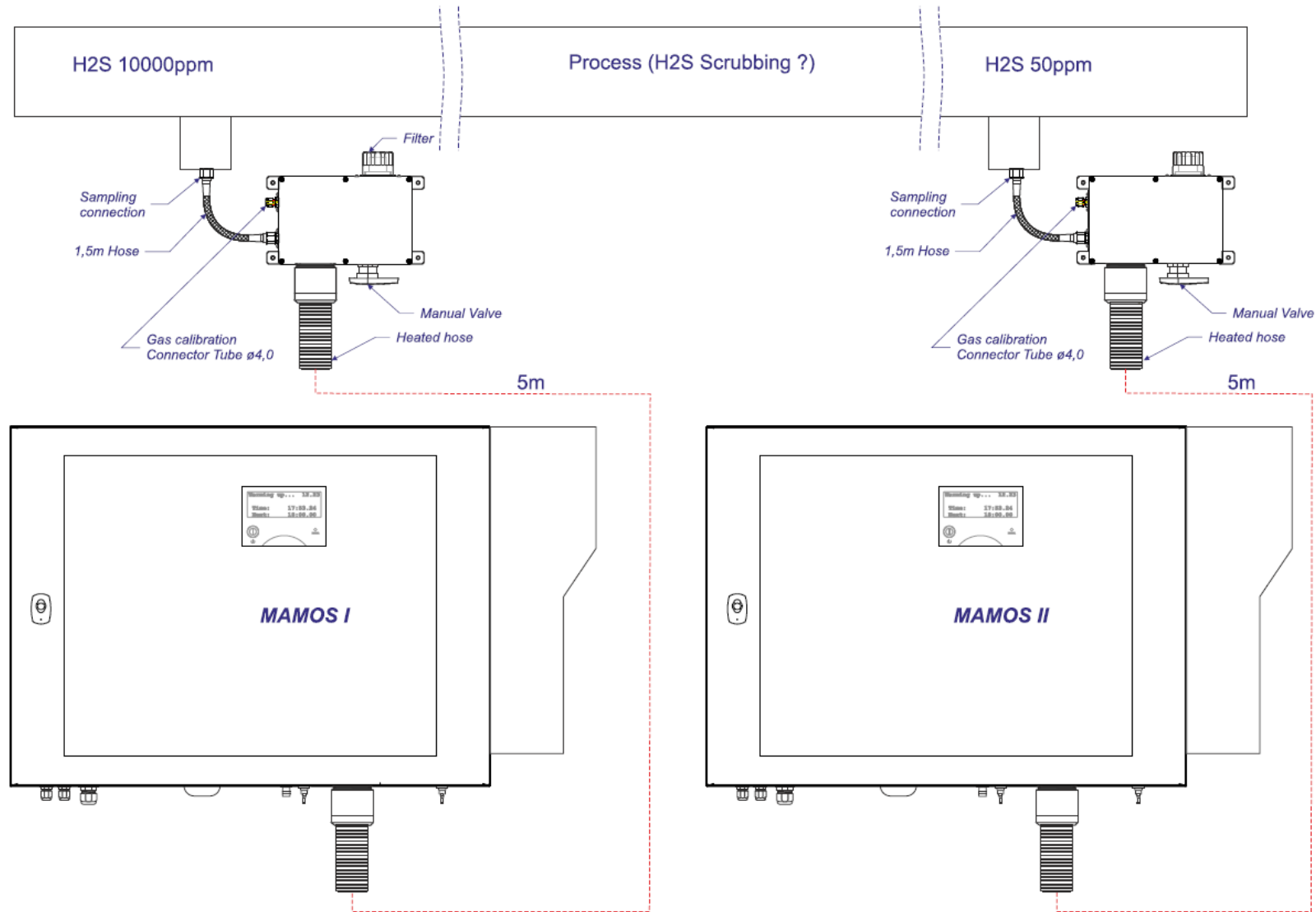
AQUAGAS



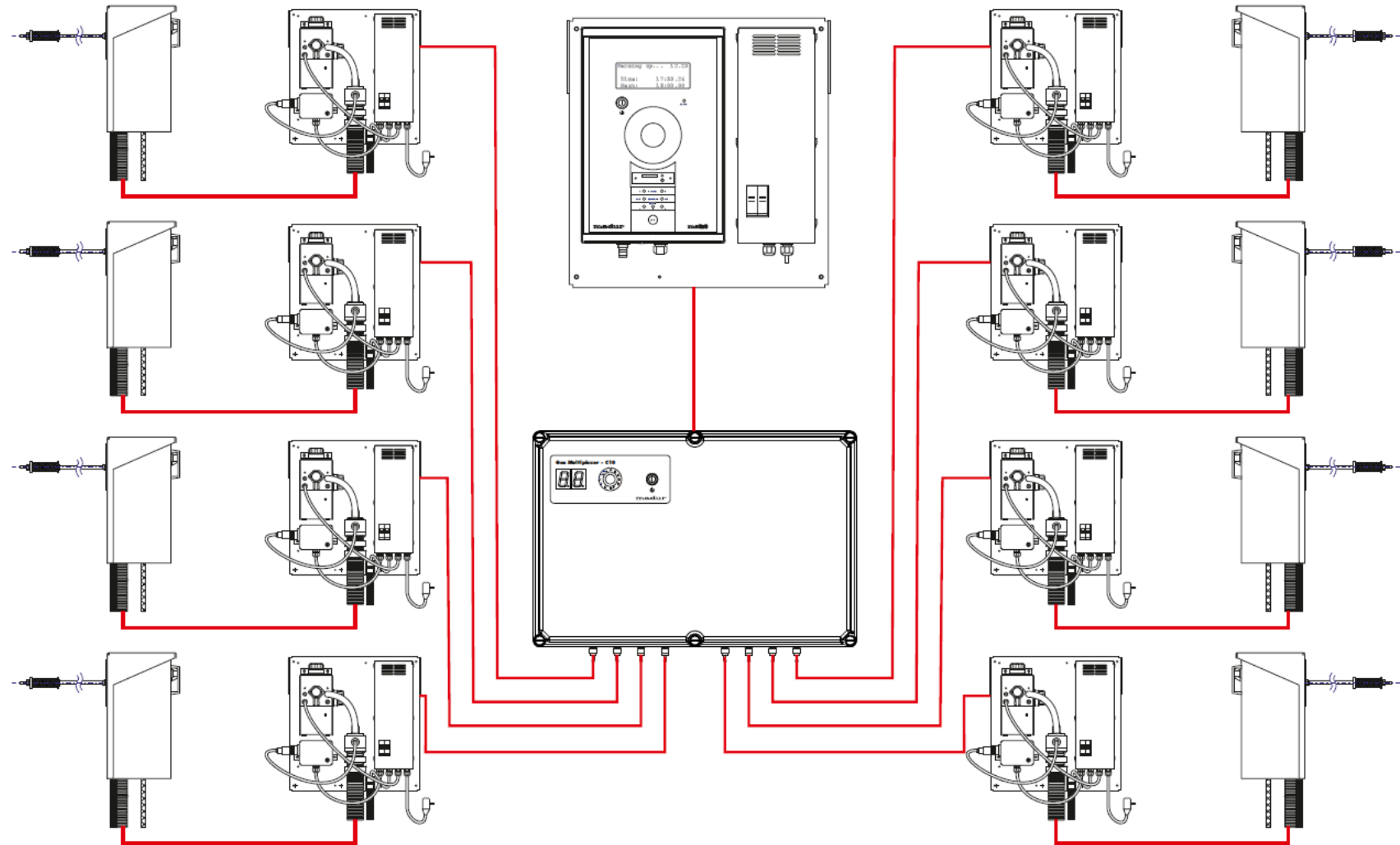
Smart Syngas General Arrangement



SmartCEMS Syngas Typical integration for scrubber monitoring



SmartCEMS Syngas 8 Streams Multiplexer



Smart CEMS

Main Components

- Sampling Probe (Madur)
- Pitot Tube (Madur)
- Heated Sample Line (Madur)
- CEMS switch panel (Madur)
- Duty and standby analysers (Madur)
- IVIS calibration terminal and switchover panel (a1cbiss)
- DAHS computer and CDAS software suite (a1cbiss)



SmartCEMS Syngas Sampling System

Sampling Probe

- Insitu Filter (20 microns)
- Light weight sampling probe
- Variable length of sampling tube (up to 3.5 m)
- Calibration solenoid valve for injection as per EN14181
- SS316L wetted components
- Backflush solenoid valve
- Flange mounted (adaptor available)
- Reduced maintenance



SmartCEMS Syngas Sampling System

Heated Sample Line

- Temperature controlled (150 deg C)
- Up to 50m length
- Prevent loss of targeted compounds (water soluble gases)
- Eliminate the risk of contamination
- Optimal and fast sample transfer
- IECEx solution available



SmartCEMS Syngas Sampling System

Pre-conditioning System

Gas purification unit designed for soot, tar, acid condensates continuous removal. Equipped with sampling Pump and Peristaltic pump, particulates filters and several inline scrubbers.

Scrubbers and Filters

- 2 x wash-bottles
- 1 x adsorption cartridge
- 1 x Particles Filter TF3000

Pump

- Capacity 38ml/min
- Sampling Pump PTFE coated 2 lpm



SmartCEMS Syngas Sampling System

Gas conditioning System

MD3 Peltier Cooler

- Temp set point: output gas dewpoint about +4°C
- Two inline filters
- Peltier cooler Stability +/- 1°C
- Cooling period: 5min
- Max gas flow 110 lph at inlet gas temp. 100°C and RH 100%

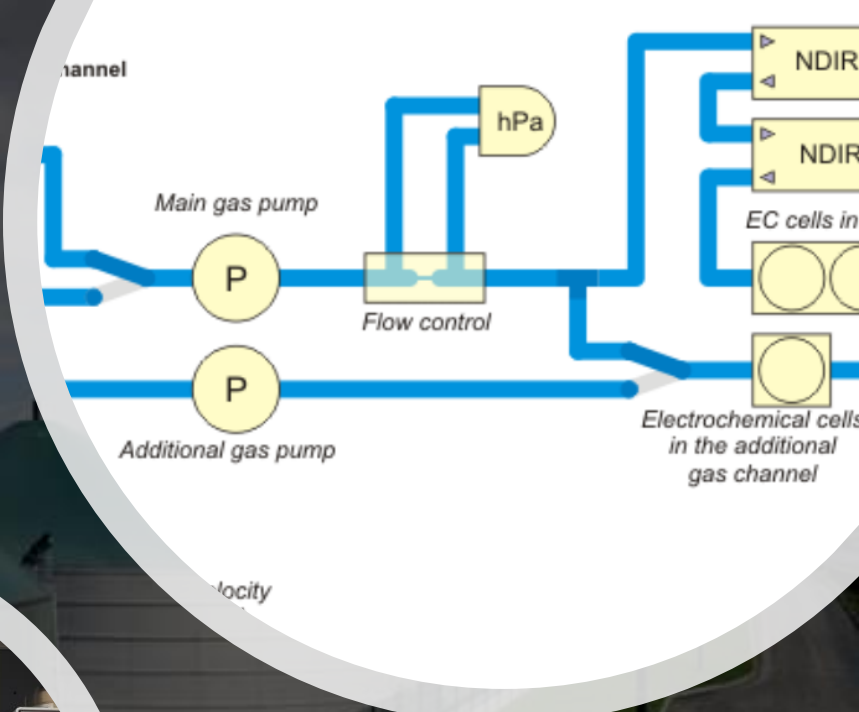
Peristaltic Pump

- Capacity 38ml/min



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SmartCEMS Syngas Multigas Analyser



- Proprietary gas paths and cells
- Safety filter
- PTFE coated Diaphragm 1.5 l/min with automatic flow control
- T: 10°C to 50°C; RH: 5% to 90% (non-condensing)
- Light (10kg) and compact design
- Madur's patented electronics and signal processing
- Mosys configuration, acquisition and trending software
- Field replaceable measuring cells
- Built-in data logger with SD card
- Large range of IOs incl. digitals (0-10 vdc; 4-20mA), analogues



U1	I1	U2	I2	U3	I3	U4	I4
0-10V x = O2	4.20mA x = CO2	0-10V x = ---	4.20mA x = ---	0-10V x = ---	4.20mA x = ---	0-10V x = ---	4.20mA x = ---
x max: 10,00% x min: 1,00%	x max: 25,00% x min: 5,00%	x max: 100 x min: 0	x max: 100 x min: 0	x max: 100 x min: 0	x max: 100 x min: 0	x max: 100 x min: 0	x max: 100 x min: 0

Start output test (5V or 10mA)

Behaviour of analogue outputs (common for all outputs):

During 'Ventilator' phase:

- Continue measurements
- Latch the last measured value
- Set electrical minimum
- Set electrical maximum

During 'Stand-by' phase:

- Continue measurements
- Latch the last measured value
- Set electrical minimum
- Set electrical maximum

When measurement error:

- Continue measurements
- Latch the last measured value
- Set electrical minimum
- Set electrical maximum

Outputs activity (for Twin-split configuration):

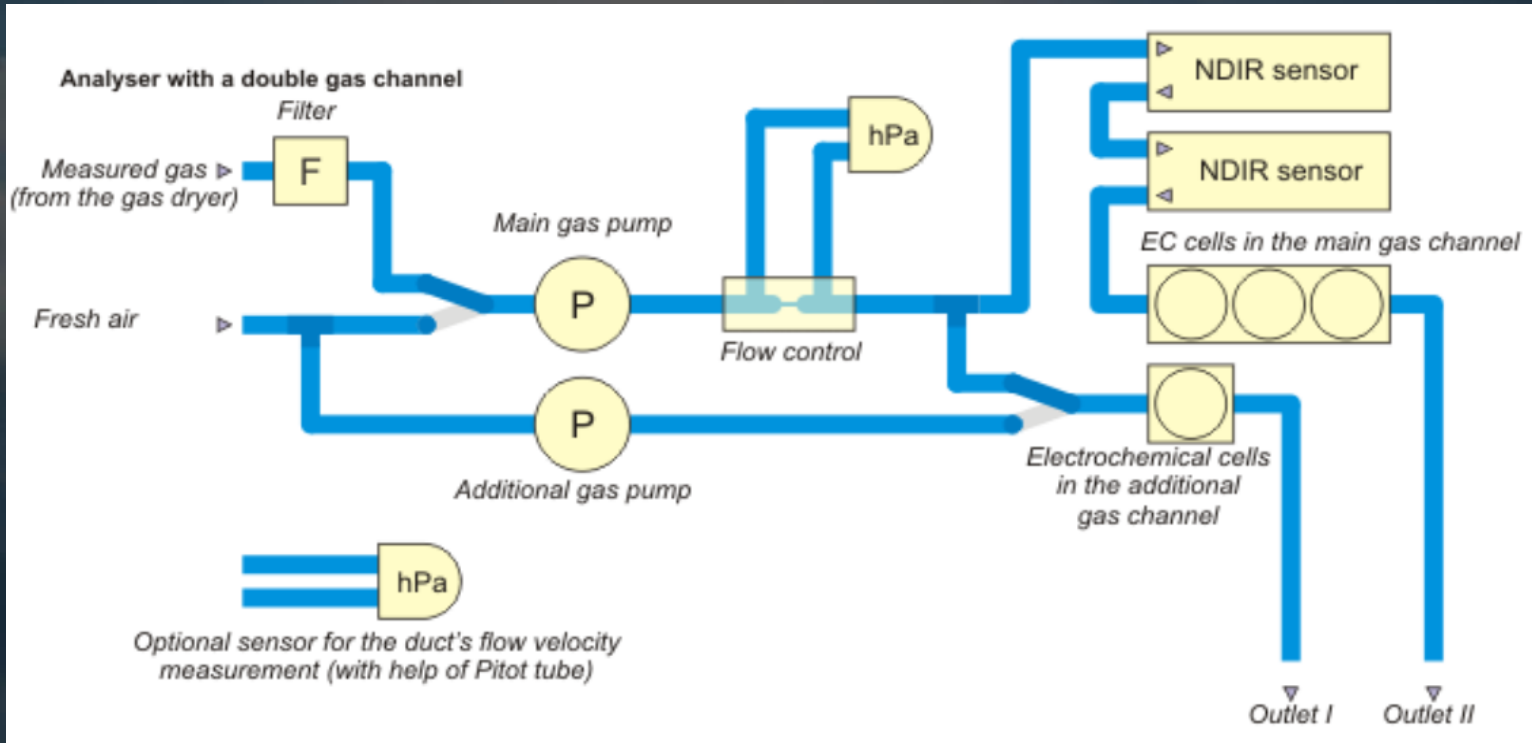
Always active

Outputs 2 & 4 are active during even cycles and keep the last value during odd cycles. The outputs 1 & 3 inversely.

SmartCEMS Syngas Analyser

Proprietary gas paths and cells

- Inline filters
- Auxiliary gas path
- Independent monitoring
- Flow control



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SmartCEMS Syngas Analyser

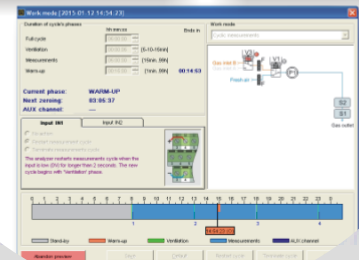


Input IN1

Input IN2

MoSys Software

- No action
- Restart measurement cycle
- Terminate measurement cycle
- User configurable measuring sequences
- USB or TCPIP direct connection
- Remote control
- Sensor calibration
- Work mode
- IOs testing
- Diagnosis
- Instrument network capabilities



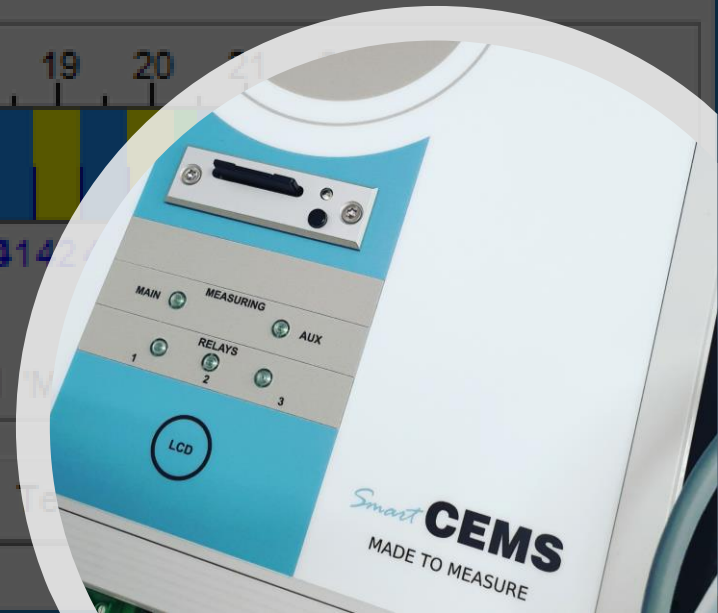
Stand-by Warm-up Ventilation Measurement A Measurement B

Preview

Save

Default

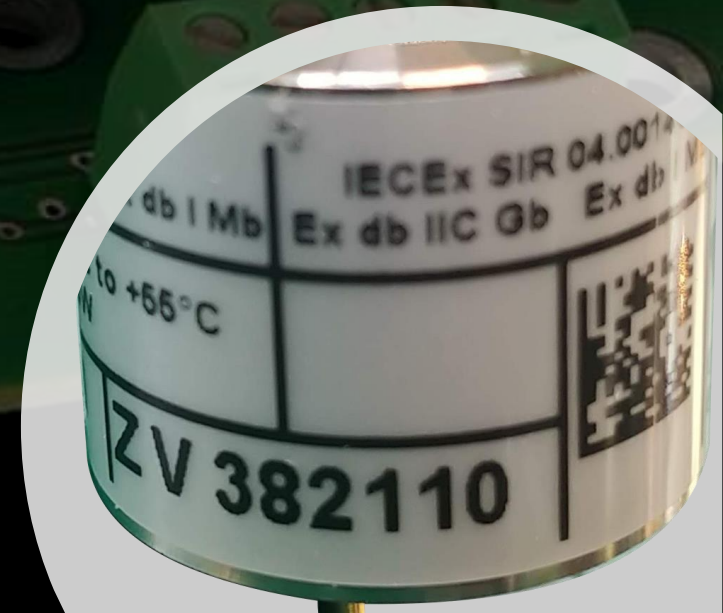
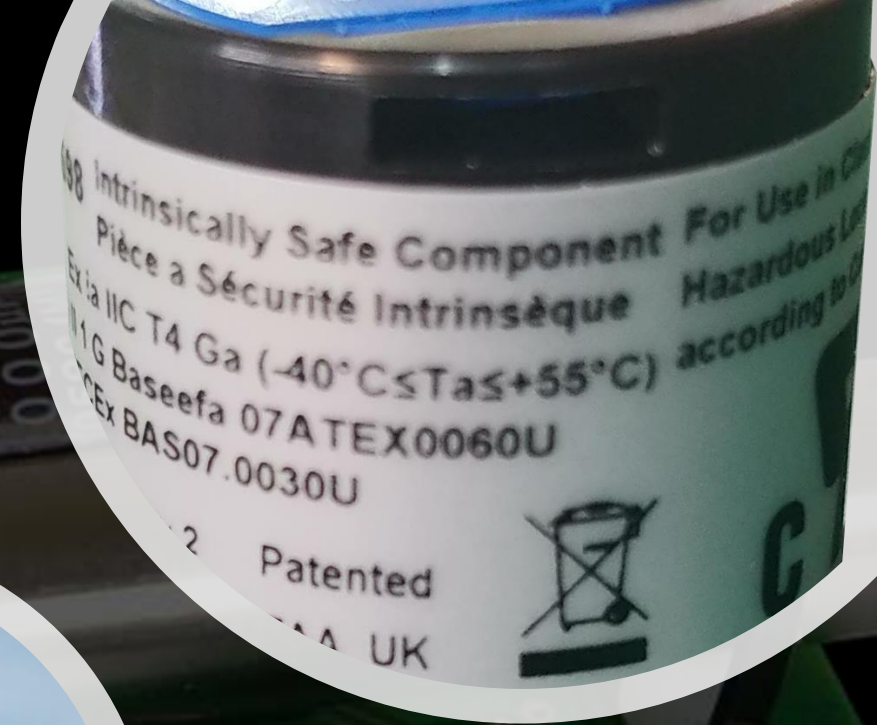
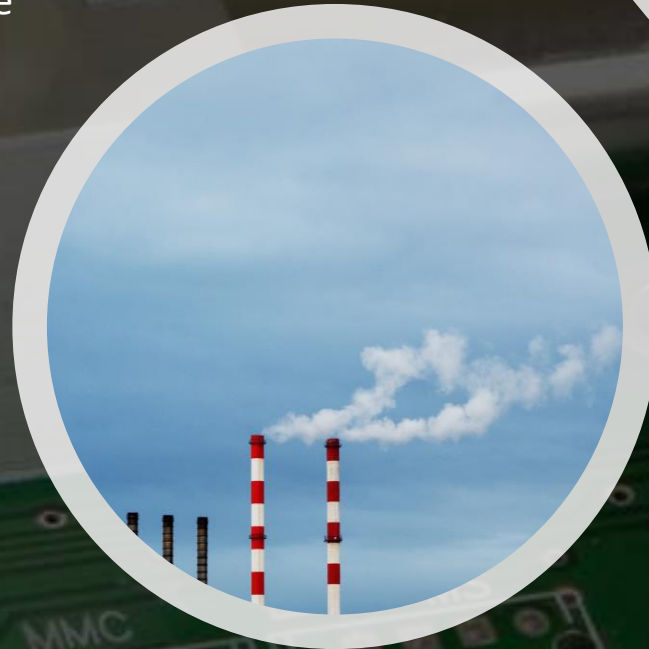
Restart cycle



SmartCEMS Syngas Analytical Performances

Measuring Principle

- CO₂, C_xH_y, CH₄: NDIR Non-Dispersive Infra-Red
 - Industrial-type construction – single path beam
 - Possibility to measure large concentrations up to 100% vol
 - Sensors are delivered pre-calibrated – easy to swap at site
 - Do not wear out in time, cannot be poisoned
- H₂: TCD Thermal Conductivity Detector
- O₂ Partial pressure
 - Long-life oxygen sensor (up to 7 years in air)
 - Range 0÷100% vol
 - Suitable for stationary analysers
 - Do not wear out in time, cannot be poisoned
- H₂S, NO, NO₂, CO: EC ElectroChemical
 - easy to use and to calibrate
 - low (ppm) and very low ranges possible
 - Cheap (er) in comparison to other methods
- Pressure: Silicon piezoresistive
- Temperature: K-type thermocouple



SmartCEMS Syngas

CDAS Data Acquisition and Handling System

Acquisition and data processing


- Raw data (Instrument value)
- Calibrated data
- Corrected data (3....11% O2 and dry gas compensation)
- National Greenhouse and Energy Reporting NGER
- Adjusted data (reportable values)

Trending and supervision

- Realtime trending
- Alarms display
- View meter and gauge

Syngas analyser control and data handling

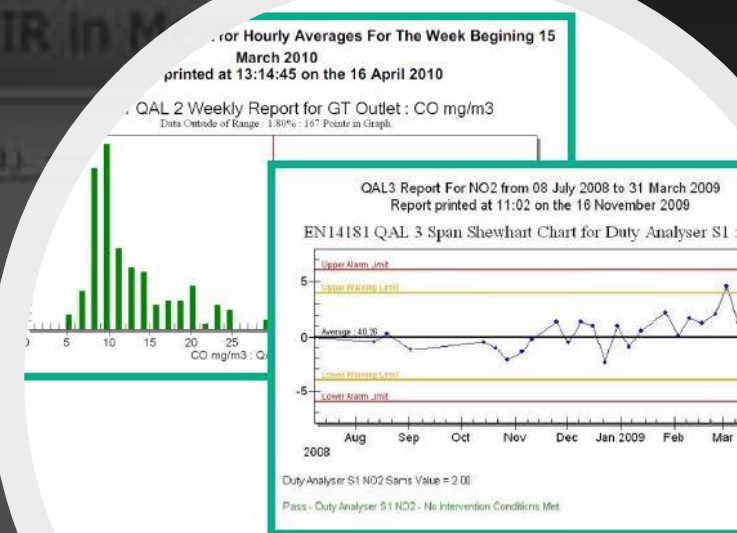
- Automatic redundancy
- Automatic calibration
- Data validation (measures and calibrations)



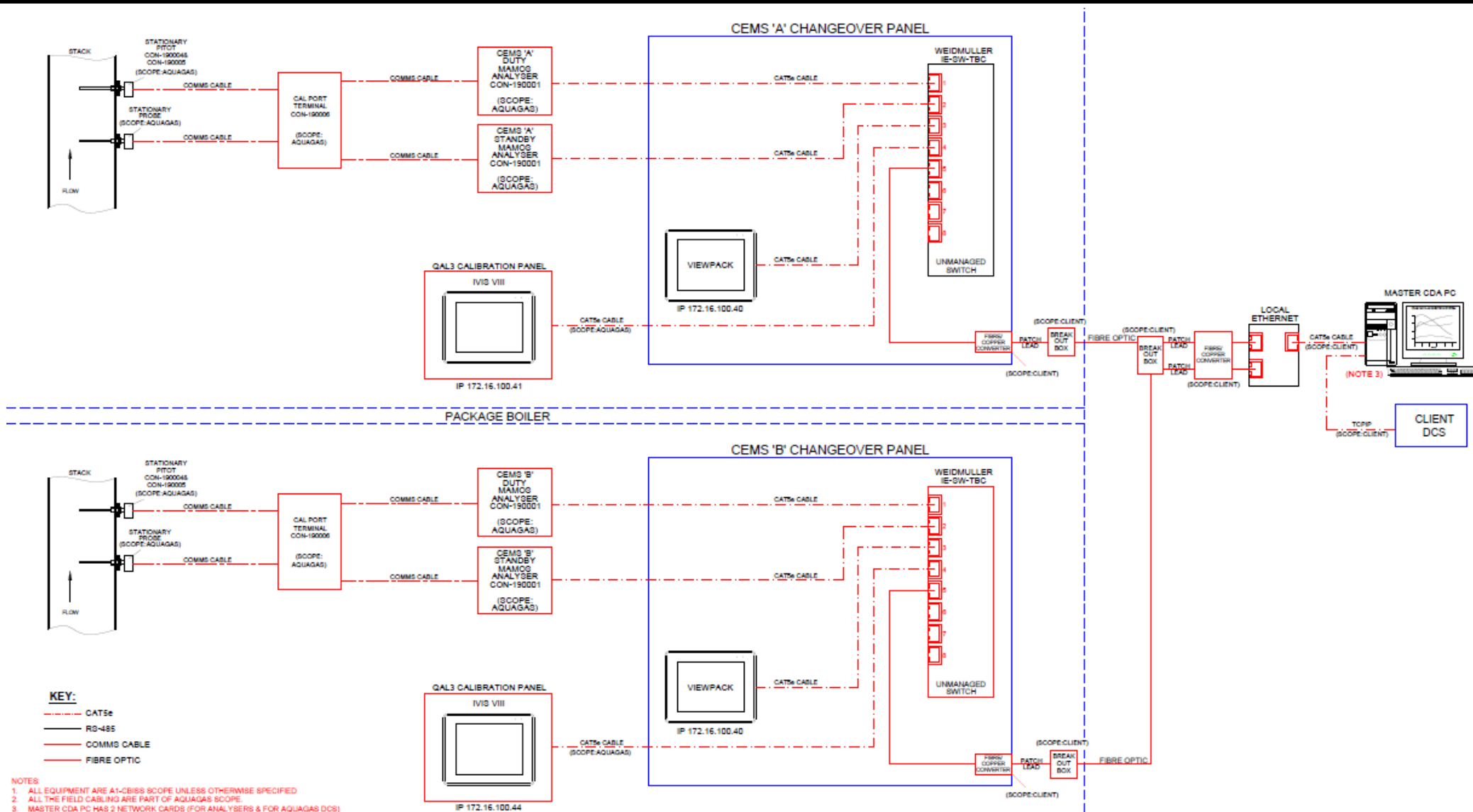
Calibrated Data	Corrected Data	Adjusted Data	One Minute Average	Current Fixed Thirty Minute Average	Current Fixed
43.40	62.76	62.76	60.19	66.13	66.13
3.25	4.70	4.70	4.51	4.90	4.90
69.65	100.73	100.73	96.60	106.08	113.48
1.97	2.85	2.85	2.69	2.91	3.29
0.81	1.16	1.16	1.14	1.37	1.09
170	136.70	136.70	138.88	143.36	136.83
8	11.98	11.98	11.34	12.16	11.66
	236.60	236.60	240.12	245.13	222.89
	1027.00	1027.00	982.08	996.39	963.0
	275.00	275.00	289.15	279.28	
	7.47	7.47	4.48	6.21	

Standby Analyser Offline
Standby Analyser Monitoring Stream One

Stream Two Running
MIR in Measure



SmartCEMS Syngas Communications



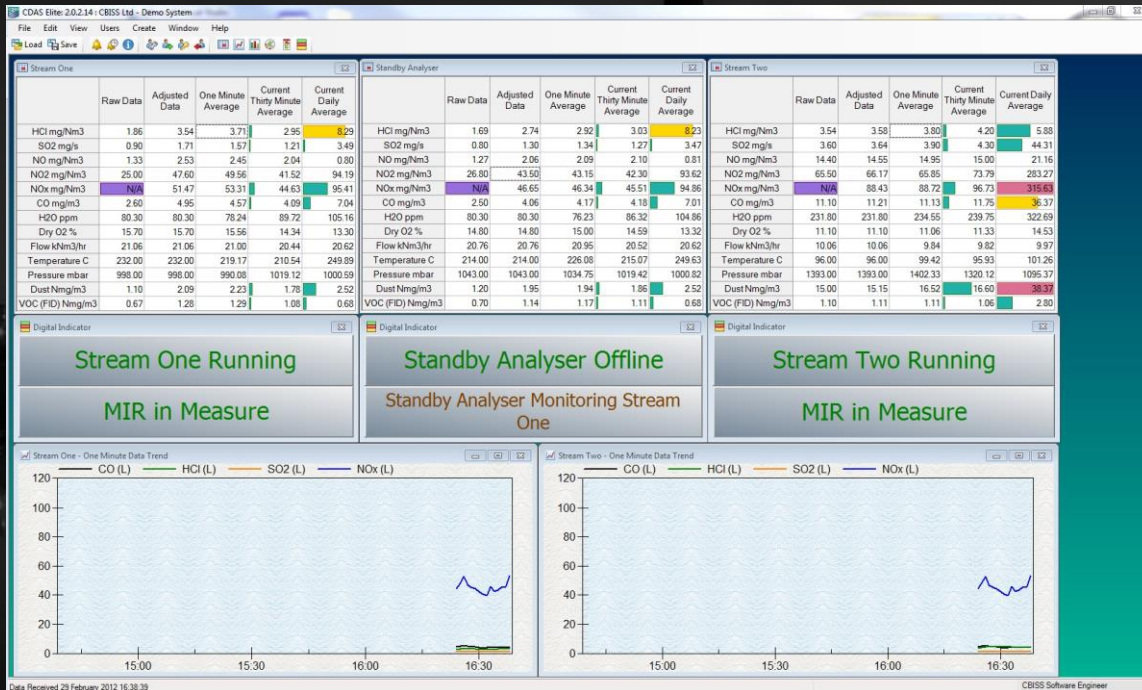
SmartCEMS Syngas CDAS Data Acquisition and Handling System

Compliance

- CGA
- EN14181 QAL3
- National Greenhouse and Energy Reporting
- WID, LCPD, IPPC
- Calibration of instrument to SRM instrument

Certifications

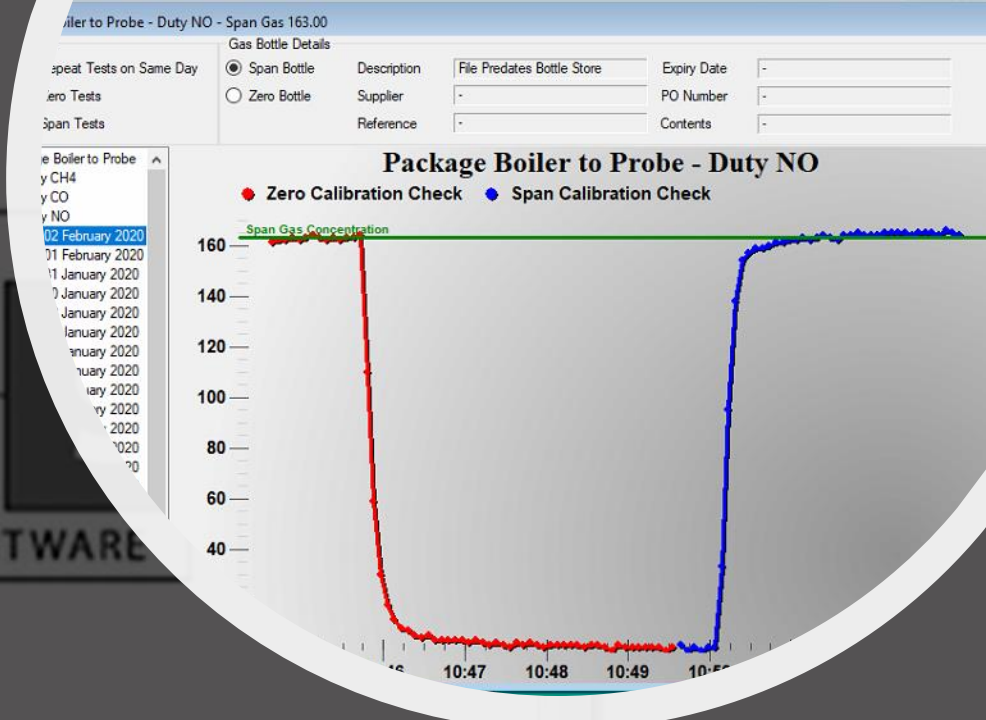
- MCERTS accredited (parts A, B, C1 & C2) real time data acquisition and reporting software



SmartCEMS Syngas CDAS Data Acquisition and Handling System

Calibrations

- CGA
- Calibration of instrument to SRM instrument
- Daily, weekly, monthly
- Automatic reporting
- Probe and analyser mode
- Local and remote control
- IVIS touchscreen interface



Installation:

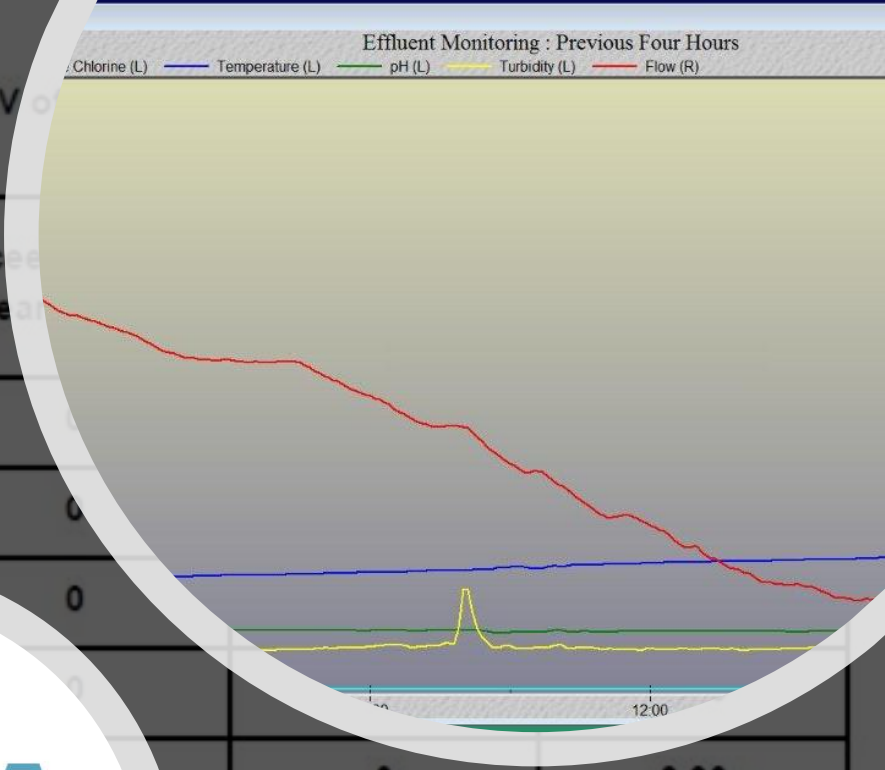
SEPA Half Hour Average Report for NOx mg/Nm3 On Channel Stream One with a Half Hourly ELV

SmartCEMS Syngas
CDAS Report

Month	Maximum Half Hourly Value	Time of Maximum Half Hour	Exceedances in Month to Date	Valid Half Hours in Month	Exceedances in Year
January	N/A	N/A	0	0	0
February	N/A	N/A	0	0	0
March	N/A	N/A	0	0	0
April	N/A	N/A	0	0	0
May	N/A	N/A	0	0	0
June	N/A	N/A	0	0	0
July	N/A	N/A	0	0	0
August	N/A	N/A	0	0	0
September	N/A	N/A	0	0	0
October	N/A	N/A	0	0	0
November	N/A	N/A	1	239	21
December	260.33	11 December 2009 00:00	66	354	87

Emissions logging

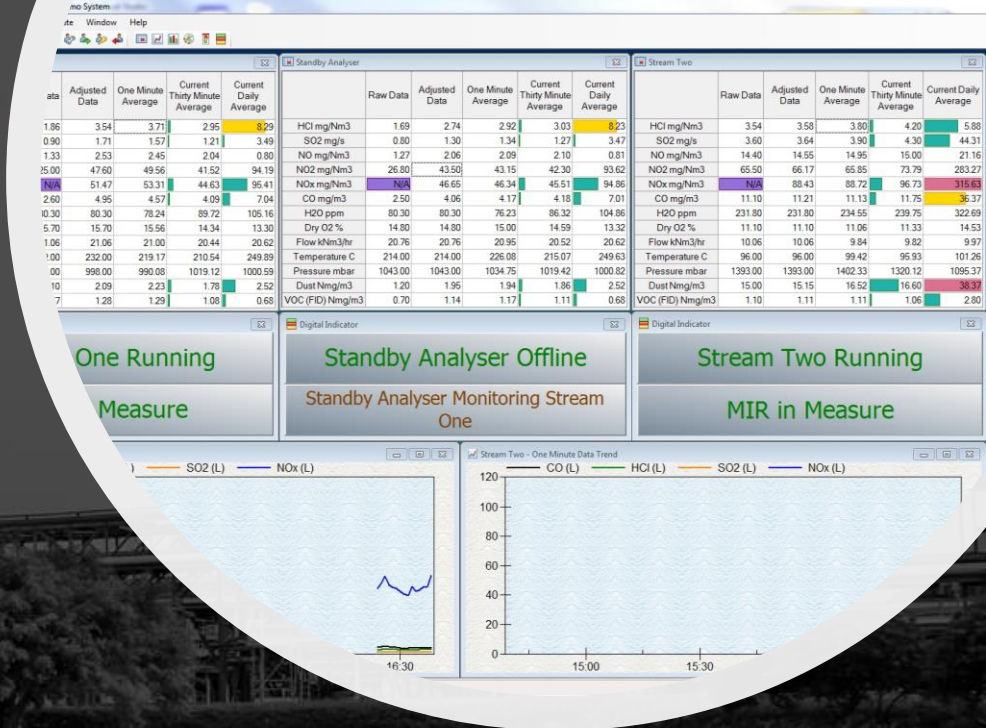
Logged Parameters	Raw data (Instrument value)
	NO, NO2, CO, CxHy, VOC in ppm and mg/Nm3
	O2, CO2, in ppm and mg/Nm3
	Stack Differential Pressure Pa
	Stack Static Pressure Pa
	Stack Temperature °C
	CEMS Enclosure temperature °C
	<u>Instrument status</u>
	Measuring / Standby / Alarm / Calibration
	<u>Plant operating conditions</u>
	Plant in operation
	Kiln Temp
	O2 Kiln
	<u>External commands</u>
	CEMS in Automatic Mode
	CEMS in Manual mode
	Standby Analyser measuring



SmartCEMS CDAS Report

Emissions reporting

Reported Data	NOx expressed as equivalent NO2 in ppmv at 11% O2
	CO expressed in ppmv at 11% O2
	Total VOCs expressed in ppmv at 11% O2
	Total NMHC expressed in ppmv at 11% O2
	Volumetric flow
	Stack gas temperature in degree Celsius
	Hourly, Daily, Weekly, Monthly and Yearly mass Emissions rates for SOx, CO, NOx and Total VOCs



SmartCEMS Syngas Systems Housing

Shelter

- CEMS Shelter Zone C/D
- Form 15 wind rating C3 for
- Cyclonic Zone D Category 2
- AC, Gland plate, Instrument mounting
- System integration, Wiring and tubing
- Desk, cupboard and workbench
- Lighting and power plugs
- 115 and 240 VAC Junction boxes
- Ambient temperature sensor

Field enclosure

- Fan (optional flow switch)
- IECEx certified solutions available
- Enclosed wiring and tubing
- Additional protection

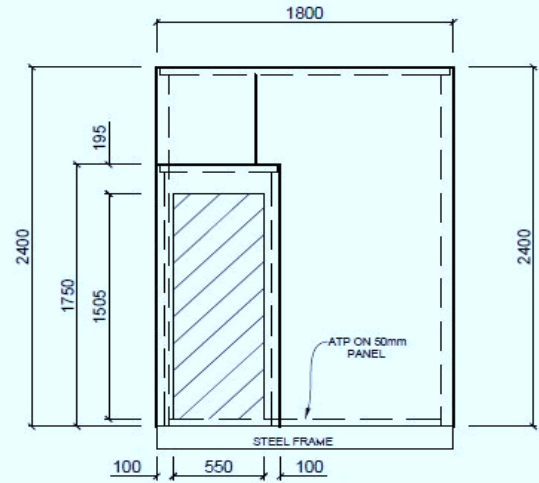
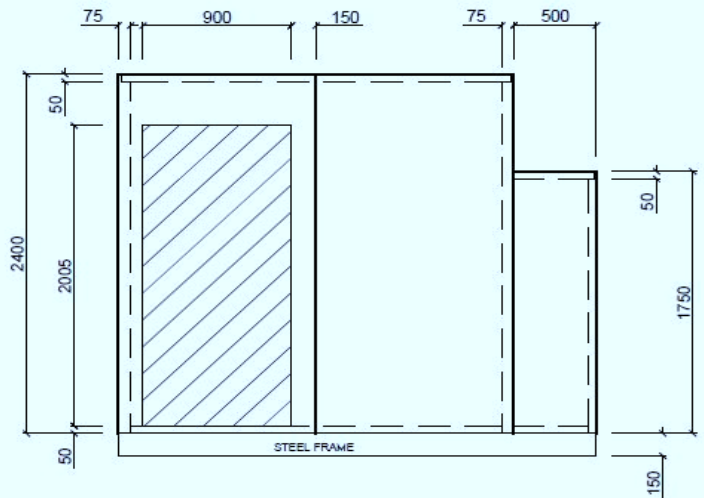
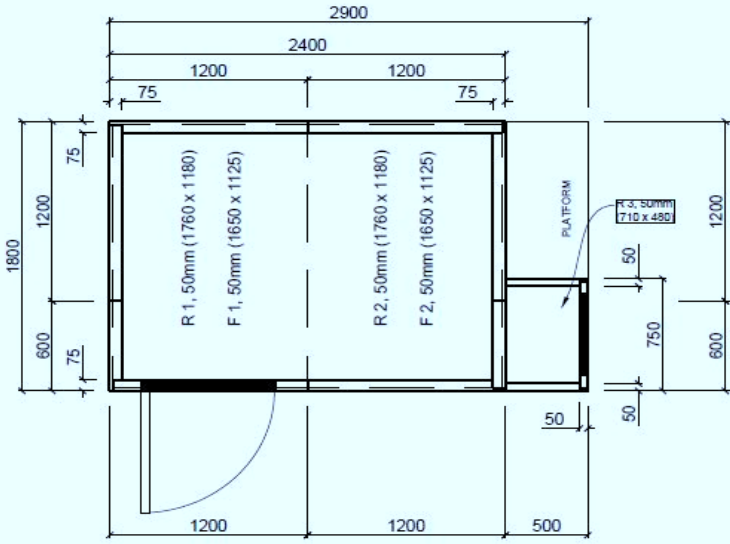


SmartCEMS Syngas Shelter

AQUAGAS



MONITORING
SYSTEMS





Smart CEMS Technical Support

Long term service agreements

- Supply of consumables and critical spares
- Remote diagnosis
- Installation, commissioning, maintenance, training
- Dedicated Technician factory trained by MADUR and A1CBISS assigned for ongoing support
- 4 visits a year to perform preventive maintenance tasks
- Maintenance visits scheduled at a time mutually convenient to both parties
- Free email and Phone support 24h/7d
- Site attendance within 72 hrs
- 24 months consumables delivered with the system and kept at site
- Critical Spares (field replaceable components) delivered with the system and kept at site
- 1 set of spare MAMOS measuring cells available off the shelves at AquaGas (for all gases)
- 1 set of MAMOS electronic board available off the shelves at AquaGas