

SERVOMEX PRODUCT OVERVIEW

KILN GAS ANALYSIS SYSTEM

SPECIALIST SOLUTIONS

CO₂ C₂H₄ HCl CO CH₄ NO COCl₂ N₂O

Designed to solve production problems, but with maintenance teams in mind - simple, fast and inexpensive for low cost of ownership and long durability.

Probe

Retractable or fixed

Water cooled or high temperature super-alloy

Electrical or pneumatic retractor

Robust 'rack and pinion' retractor

Effective blowback system due to in-line filter and probe

No special or expensive coolants required for cooling system

Quick and easy filter exchange



Conditioning System

Simple, but effective design

Suitable for high levels of SO₂

Auto-calibration system

Control and Electrics

Efficient plug and play installation

No special tools

Compatible with any DCS

Robust display panels

Application Overview

Production managers in Cement Plants require continuous gas analysis in order to optimise operation, maintain high quality of clinker, burn fuels more efficiently, increase use of alternative fuels, and protect the environment.

In short, gas analysis provides data to optimise the cement production process:

- ✓ Kiln disturbances are identified and controlled before they become issues (i.e. high levels of sulphurs that may cause clogging)
- ✓ Clinker quality is optimised and maintained through controlling 'flame quality' (i.e. through NO level monitoring)
- ✓ Maximised fuel consumption by optimised and maintained combustion (i.e. CO and O₂ monitoring)
- ✓ Control and reduction of pollutant emissions
- ✓ Increased production levels achieved through optimised precalciner (CO₂), optimised combustion (CO, O₂) and constant quality of clinker/less disturbances and adjustments (NO, SO₂)

System Design

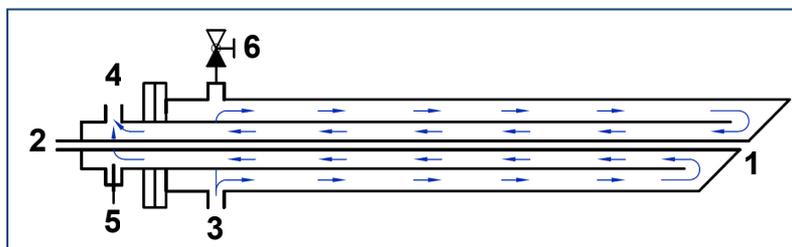
The Servomex Kiln Gas Analysis System comprises a:

- Water cooled or high-temperature-alloy probe
- Electric or pneumatic, self extracting retractor
- Heated filter with 'pulsing' blowback
- Intelligent water cooler
- Heated sample line
- Sample conditioning cabinet including:
 - Servomex 4900 gas analyser for monitoring O₂ (Paramagnetic), CO, NO, SO₂ and CO₂ (infrared)
 - Robust compressor cooler
 - Membrane filter
 - SO₂ handling system (optional)
 - Electrical panel with Allen Bradley PLC

Sampling System

Probe

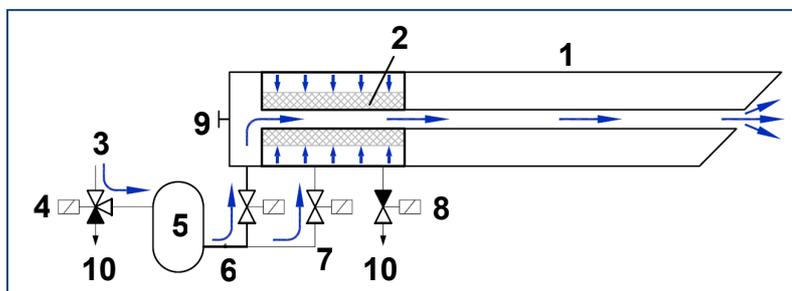
The probe is constructed from 310S stainless steel and water-cooled to allow operating temperatures up to 1400°C. The inner tube carries sample gas to the conditioning system whilst the outer pipes carry cooling water to protect the probe. At the probe tip the cooling water (already heated) is returned in the middle section where it maintains the inner sample tube above the dewpoint of the sample gas. The sample tube is made from a single straight tube which exits in the centre of the 45° angled probe tip, to minimise particulate introduction. This design ensures that both the blowback and rodding, should this be necessary, totally clear the sample tube of dust.



- 1 45° sample inlet
- 2 Sample exit
- 3 Cooling water inlet
- 4 Cooling water exit
- 5 Temperature sensor
- 6 Air bleed valve

Blowback

To reduce maintenance and ensure measurement validity the sample extraction probe is kept clean by periodically undertaking “blow-back”. This is introducing a sequence of air pulses to loosen debris and expel it from the probe. To ensure a sufficient pressure of air is readily available a 6 litre reservoir is maintained in a box mounted on the probe carriage.



- 1 Water Cooled Probe
- 2 In-line filter
- 3 Air inlet
- 4 Charging valve
- 5 Reservoir
- 6 Probe blowback valve
- 7 Filter blowback valve
- 8 Vent valve
- 9 Rodding port
- 10 Vent

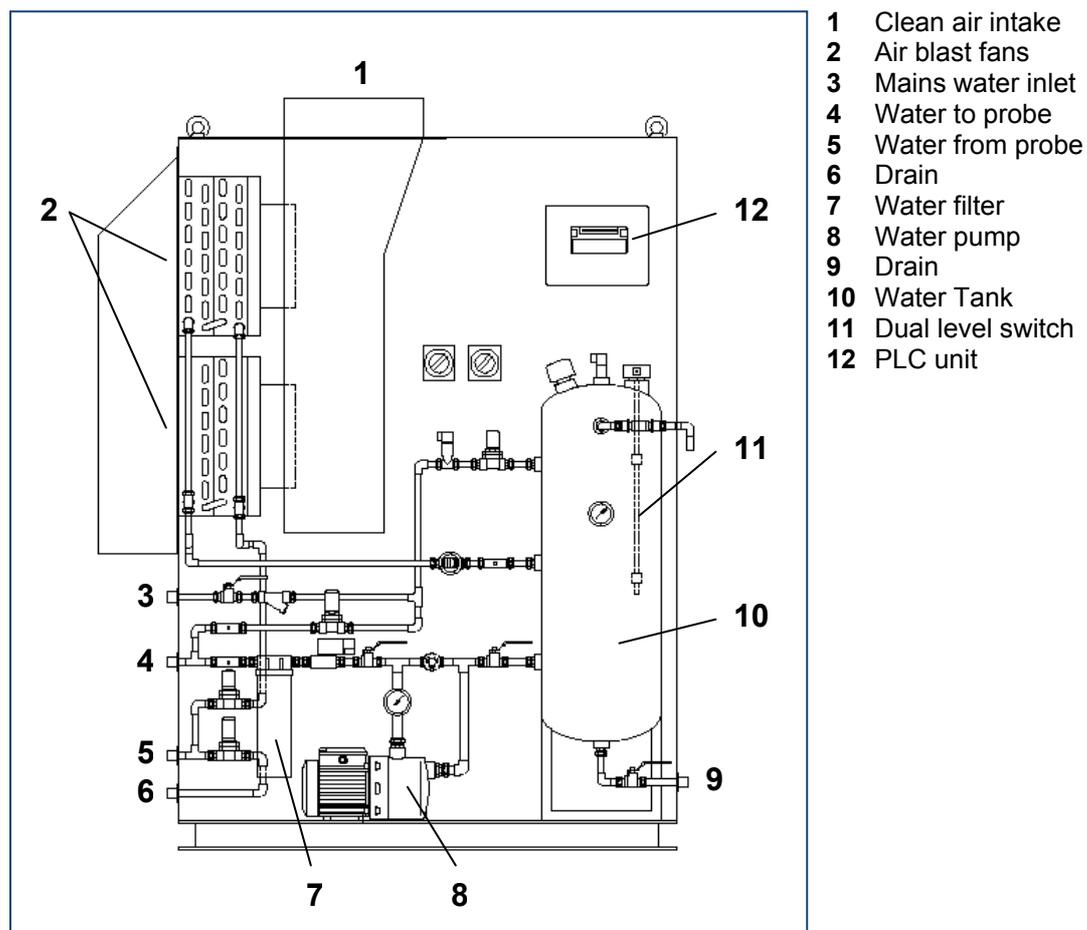
Water Cooler

The coolant system is housed in a 125cm wide x 180cm high x 60cm deep cabinet and is capable of operating in ambient temperatures of up to 50°C. The cooler uses two air-blast fans to remove heat from the coolant circuit and temperature is maintained by modulating the on/off time of the second of these fans. To minimise the routine cleaning requirements of the heat exchangers the cooling system draws air from an elevated position away from dust sources by using a 5 metre air inlet stack.

The coolant reservoir holds approximately 50 litres of water / antifreeze mixture and the level is controlled by level switches; the low level switch ensures that there is sufficient liquid within the system to safely run the coolant pump and the high level switch prevents overfilling.

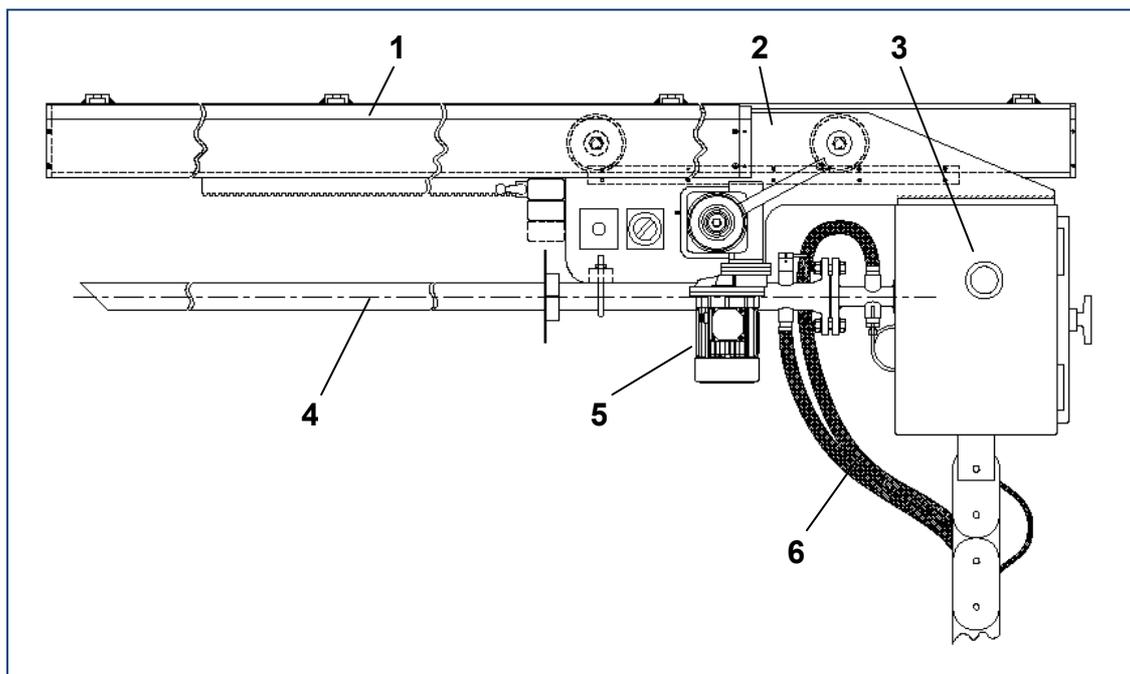
To minimise erosion within the probe and heat exchanger there is a fine cotton-wound cartridge filter to remove particles from the re-circulating stream.

In the event of the coolant pump failing the system will automatically switch to mains water and retract the probe (Isolation valves are provided either side of the pump, allowing change out in around 20 minutes should this become necessary).



Retraction System

The sample probe is mounted on a retractor which comprises an "I" beam with an electrical/pneumatic motor and a high torque rack and pinion. The retractor is manually controlled via a local control panel, but is also monitored by the system PLC, which automatically retracts the probe in the event of an over-temperature alarm. In the event of power failure the probe retracts automatically for self-protection.



- 1 'I' beam
- 2 Carriage
- 3 Heated filter unit
- 4 Water cooled probe
- 5 Motor
- 6 Water pipes

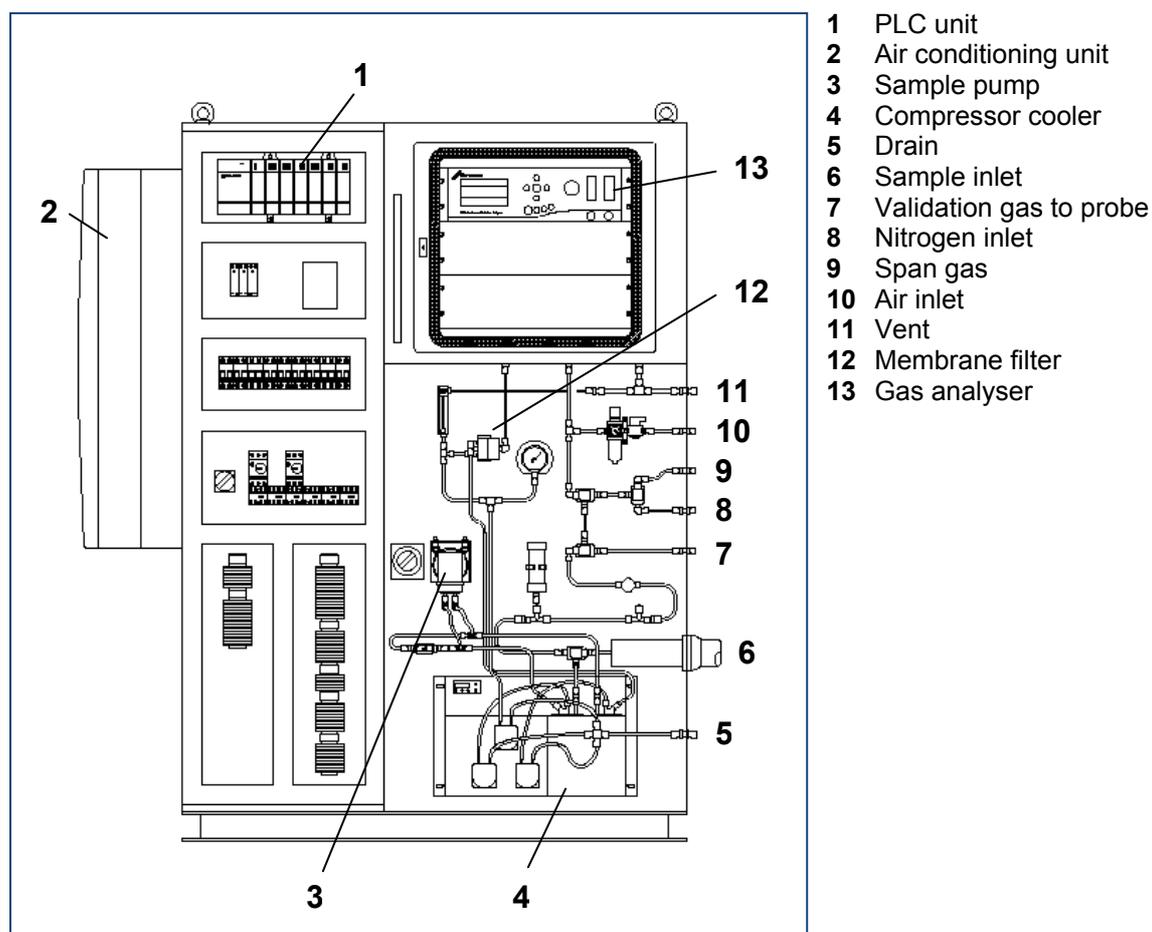
Analysis System

Conditioning System

The gas conditioning system is housed in a 125cm wide x 180cm high x 60cm deep air conditioned cabinet. A reliable diaphragm pump draws sample down a 120°C heated line, which ensures no condensation occurs during sample transport as this would affect the measurement (by dissolving SO₂) and encourage corrosion. Water vapour is then removed by passing the gas through a two-stage compressor cooler, which has proved its dependability over vortex or peltier types. In the event of extreme levels of water vapour a hydrophobic membrane filter protects the analytical instruments even if full flooding of the system occurs.

The conditioning system also includes solenoid valves that allow for either automatic or manual calibration. As an option, if SO₂ is to be measured, calibration gases are passed through a saturation chamber and then the cooler, ensuring any effects on the measurements due to water loss in the cooler are calibrated out.

Finally, before exiting the conditioning system to the analysers, flow is monitored and an alarm raised in the event of problems.



Analyser

The Servomex 4900 gas analyser will measure oxygen (0-25%) via the magnetodynamic paramagnetic technique plus NO (0-3000ppm), CO (0-3000ppm) and SO₂ (eg 0-2500ppm or 0-5000ppm) via gas filter correlation (Gfx) infrared technology. Additional higher or lower measurement ranges are also available. The Servomex paramagnetic sensor is non-consumable and, provided it is protected from water and over-pressurisation, will last many years. Similarly, by using Servomex Gfx infrared transducers the benefits of a highly-accurate measurement with excellent cross-interference rejection, with low running costs and long source and chopper motor lifetimes.



Control System

The electrics are mounted within the left hand section of the above stated cabinet, which includes an Allen Bradley PLC as standard. This PLC controls the heat trace temperature, sample probe blowback, sample probe temperatures, automatic sample probe retraction, and fault alarms. These alarms are reported by the indicator panel located near the probe and local indicator panels mounted on the front of the system enclosure and water cooler enclosure.

The control/indicator panels include:

Probe

- Retractor motor fault
- Retractor stopped
- Probe temp. fault
- Water cooler fault
- Analyser system fault
- Probe insert
- Probe retract
- Manual blowback
- Emergency stop
- Reset alarm
- Lamp test

Cooler

- Mains water pressure low
- Water tank level low
- Pump fault
- Cooling fans fault
- Cooling water flow low
- Direct cooling from mains
- Cooler Start/OK
- Reset Alarm
- Lamp test

System

- Analyser fault/low flow
- Sample cooler high temp.
- Sample pump fault
- Heated filter Low temp.
- Analyser low temp.
- System high temp.
- Heat trace low temp.
- Probe blowback active
- Validation initiate/active
- Calibration initiate/active
- Reset alarm
- Lamp test

Technical Data

Process

Monitoring the hot dusty flue gas at the kiln/calcliner gas exit in dry cement kilns to measure: O₂, CO, NO, SO₂, and more.

Probe

Water cooled version
310S stainless steel

High temperature alloy version
C276 Hastelloy

Insertion lengths available
1.5m / 2.0m / 2.5m / 3.0m / 3.5m

Retractor

Mounted on universal 'I' beam
Robust rack and pinion drive
Either electric or pneumatic motor
Measures 600Wx800Hx(L+1250) mm approx.
(L = probe insertion length)
Weighs 140kg approx.

Air Supply

Requirements
8 bar minimum
Dried to +3°C
Free from oil and water

Consumption
Approx. 800 litres per probe movement
Approx. 30 litres per blowback sequence

Water Cooler

Closed system with automatic top-up
Measures 1500Wx1800Hx650mmD approx.
Weighs 250kg approx.

Water Requirements
Drinking water with glycol antifreeze

Sample System / Electrical Cabinet

Measures 1500Wx1800Hx650mmD approx.
Weighs 150kg approx.

Measuring Components and Ranges

O ₂	0-25 Vol%
CO	0-3000ppm
NO	0-3000ppm
SO ₂	0-2500/5000ppm

Other measurements are available see the Servomex 4900 Series gas analyser data sheet for details.

Power Supply

The complete system requires only one power supply connection.
230/400V AC ±5% 3ph+N 50/60Hz 4.6kW
(Neutral conductor necessary)

Signal Outputs

Analogue outputs
0/4-20mA output per measured component

Digital outputs
Overall system major fault
Validation/calibration active
Analyser service required
Sample system service required
Water cooler service required
Heated filter service required
Probe service required

Communication

Standard
RS232/DH485
Devicenet

Optional
Industrial Ethernet

Servomex has a policy of constant product improvement and therefore reserves the right to change specifications without notice.

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