



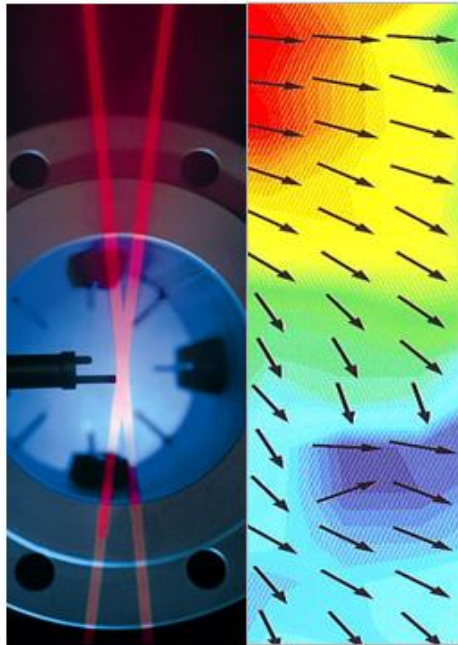
## **Biogas Monitoring – „Why and How?“**

**Jan Talkenberger, Manager International Sales, Binder GmbH**

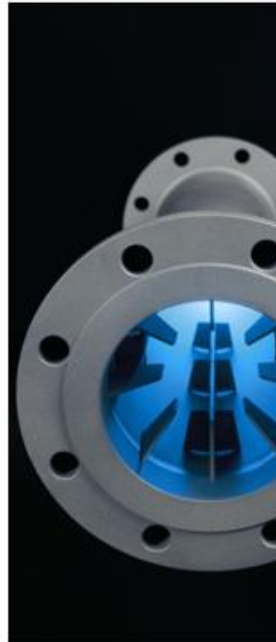
## ■ Introduction

- Binder's core business is Gas Flow Metering and Control.
- Aeration Control System & Digester Gas Flow Metering & Gas Analysis

Real Gas Flow Calibration



Gas Flow Conditioning



Gas Flow Measurement



Gas Flow Control



# BINDER



**Binder Group AG** Finance Holding



**Binder Engineering GmbH** Sales & Service Companies in DE / F / CH / NL / B / China, Singapore, Malaysia



**BINDER GmbH** Manufacturing Company for Gas Flowmeter, Gas Analyzer and Control Systems  
with following products: **COMBIMASS® / VACOMASS® / CAMASS®**



**INSTRUM AG** Manufacturing Company for Stainless Steel Pressure Regulators and Valves



**BETA B.V.** Manufacturing Company for Pressure and Temperature Switches



[www.bindergroup.info](http://www.bindergroup.info)

## Contact Persons



Jan Talkenberger  
Manager International Sales  
[jan.talkenberger@bindergroup.info](mailto:jan.talkenberger@bindergroup.info)  
+49 1733069903  
Binder GmbH  
Buchbrunnenweg 18  
89081 Ulm, Germany



Alex Hwong  
Sales Director South East Asia Pacific  
[alex.hwong@bindergroup.info](mailto:alex.hwong@bindergroup.info)  
+60 192234005  
B-3A-25 Blk Bougainvillea, 10 Boulevard,  
Lebuhraya Sprint  
47400 Petaling Jaya, Selangor, Malaysia



## Thai – German Biogas Conference, Bangkok, Thailand, 20 November 2017

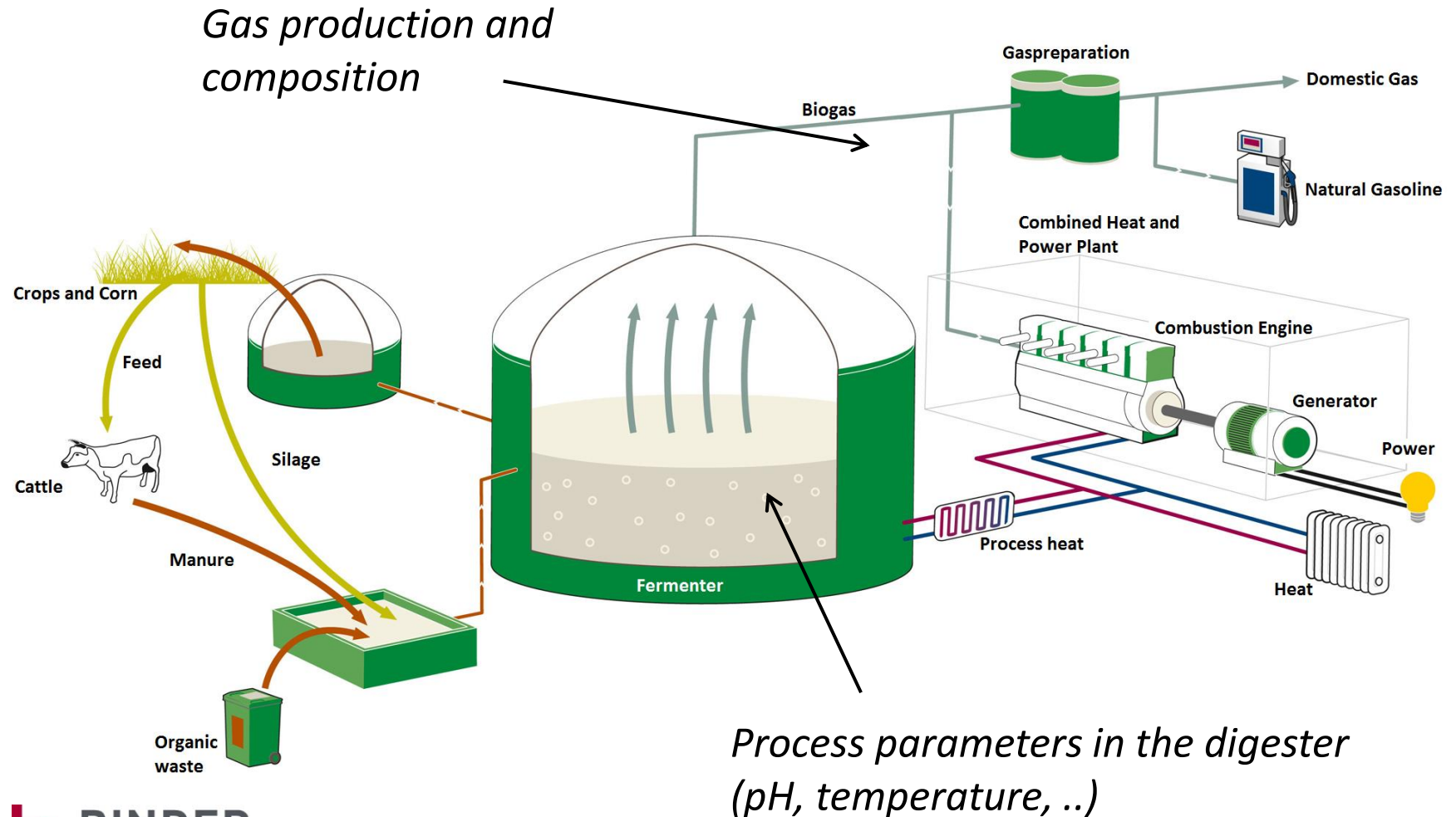
- Biogas Plant Monitoring
- Biogas particularities
- Technology



## Why is it necessary to monitor Biogas Plants?



## Parameters to be monitored in a biogas plant



## Equipment used for treatment and utilization of the biogas

- H<sub>2</sub>S scrubber
- Blowers or compressors
- Biogas engine (CHP unit)
- Biogas upgrade technology (Membrane, ...)

*Typically this all are sophisticated and rather expensive devices.*

## How monitoring of biogas becomes essential



- Performance of H<sub>2</sub>S scrubbers:
  - Control operation of H<sub>2</sub>S scrubber according to cleaning performance or oxygen values
- Control and adjustment of CHP units
  - Adjust engine parameters according to changing CH<sub>4</sub> concentration
- Grid injection or other further use
  - Monitor gas quality (composition) and quantity

## Example: Monitoring of H<sub>2</sub>S concentration

- H<sub>2</sub>S filter shall clean the gas to a suitable concentration for following equipment
- Performance of the H<sub>2</sub>S filter depends on its principle and handling
- H<sub>2</sub>S concentration at scrubber output must be monitored!
  - Scrubber performance check
  - **Protect the gas-using equipment, e.g. CHP engine**



## Cost - CHP engine repair vs. Gas Analyzer

| CHP breakdown   | Gas Analyzer  |
|---|---|
| CHP repair: 20.000 – 50.000 EUR   | Purchase: 8.000 – 10.000 EUR  |
| Loss of income: 1.000 – 10.000 EUR  | Installation: 1.000 EUR   |
|   | Maintenance: 1.000 EUR / year   |
| <b><i>Total: 21.000 – 60.000 EUR</i></b>  | <b><i>Total: 10.000 – 12.000 EUR</i></b>  |
| <p>↓</p> <p>Thread:<br/>bankruptcy of plant operator</p>                          | <p><u>Additional benefit:</u><br/>use measured parameter to operate<br/>the plant more efficient and<br/>economic</p> |
|  |                                    |

|                                   |   |  |
|-----------------------------------|---|--|
| VEREIN<br>DEUTSCHER<br>INGENIEURE | Emissionsminderung<br>Biologische Abfallbehandlungsanlagen –<br>Kompostierung und Vergärung<br>Anlagenkapazität mehr als ca. 6.000 Mg/a<br><br>Emission control<br>Biological waste treatment facilities<br>Composting and anaerobic digestion<br>Plant capacities more than approx. 6.000 Mg/a | VDI 3475<br><br>Blatt 1 / Part 1<br><br>Ausg. deutsch/englisch<br>Issue German/English |
|-----------------------------------|---|--|

„... It is **highly advisable** to analyze the composition of the biogas in the raw state and before the CHP regarding CH<sub>4</sub>, H<sub>2</sub>S and O<sub>2</sub>. Thus, changes in the biogas and the cleaning measures function can be monitored. The analysis must be made regularly **at least daily**. In case of unevenly distributed feeding and expected fluctuations in the biogas composition, the analysis frequency needs to be adapted.

It is advisable to use **gas analyzer with set-limits and alarm** and opportunity to integrate them into an existing plant control. Methane sensors must be pressure and temperature compensated; hydrogen sulphide sensors also need to be sufficiently resistant with peak concentrations. **Regular calibration according to the manufacturer's instructions** are generally to follow... "

# BINDER

## Why is process monitoring necessary?

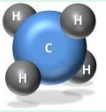


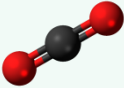
- **Supervision** of individual components, e.g. H<sub>2</sub>S scrubber
- **Protection** of sensitive equipment, e.g. CHP-engine
- **Preventive alarm** settings to react timely on process fluctuations
- **Improve** feeding cycles and reduce raw material usage
- **Comply** to legal requirements, e.g. evidence of biogas production volumes and gas-quality

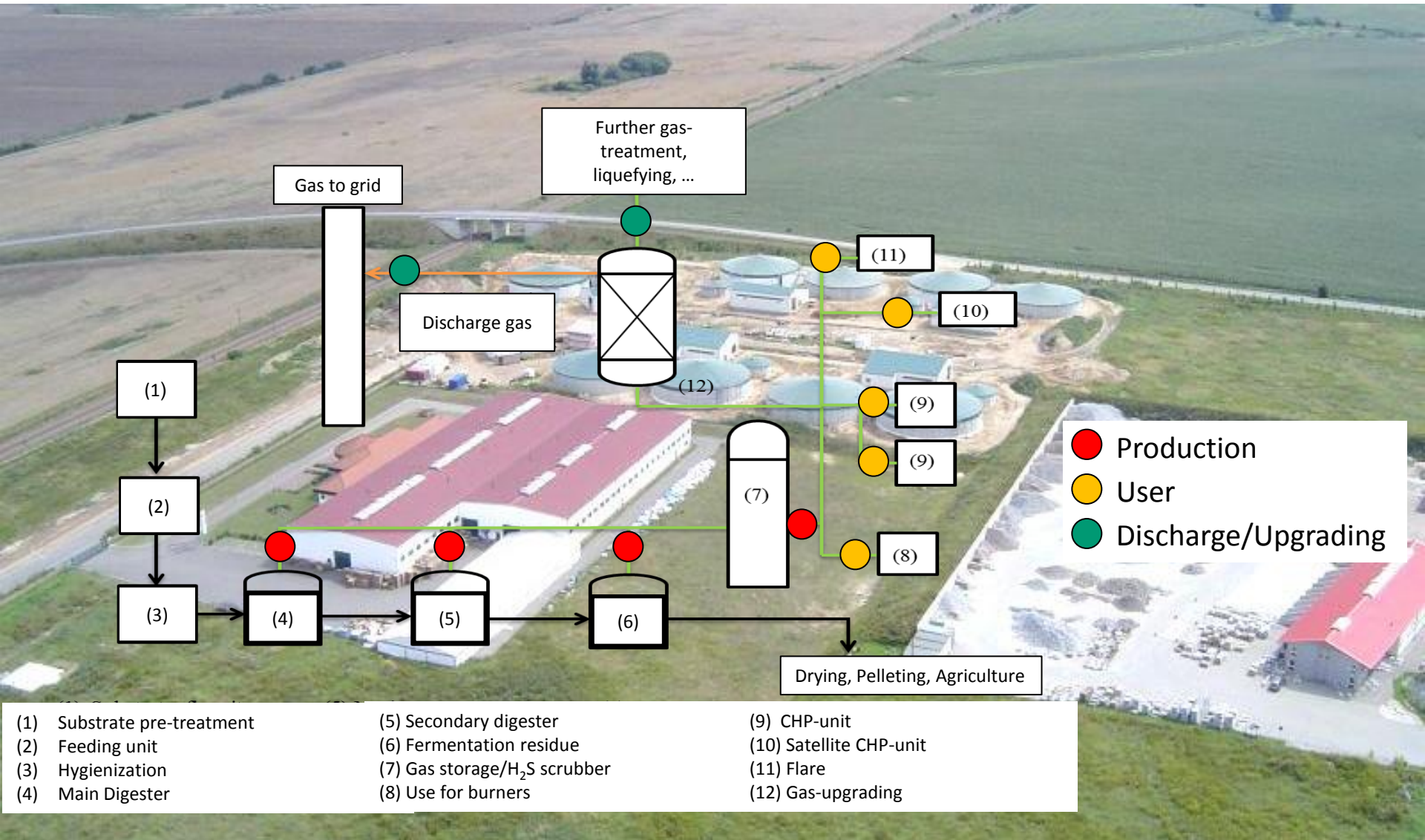
**→ *Increase of safety, efficiency and profitability***

## Biogas particularities



## BIOGAS – a mixture of different gases

|   | <i>Gas component</i>   | <i>Description</i>        | <i>Challenge</i>    |
|---|------------------------|---------------------------|---------------------|
|   | CH4 (Methane)          | The product which we want | Maximize yield      |
|  | H2S (Hydrogen Sulfite) | The problem               | Toxic and corrosive |
|   | O2 (Oxygen)            | Carefully to be watched   | Avoid explosion     |
|   | CO2 (Carbon Dioxide)   | Complementary to CH4      |                     |

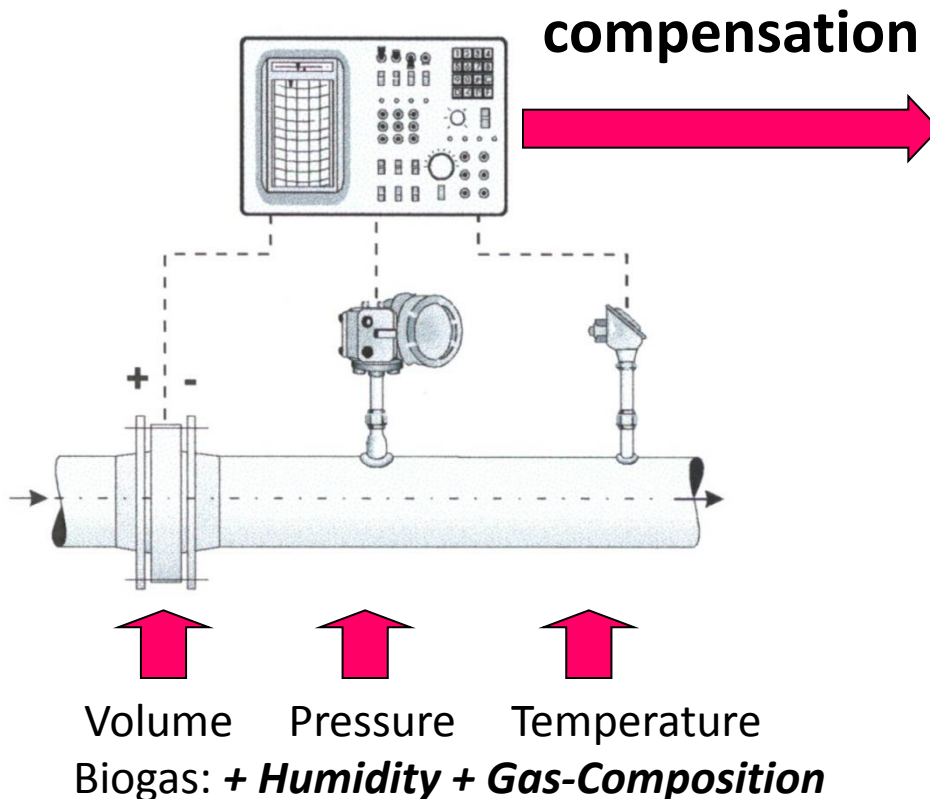


## Gas qualities on the different measuring points

| <i>Gas Production</i>            | <i>Gas User</i>                   | <i>Gas Upgrade</i>           |
|----------------------------------|-----------------------------------|------------------------------|
| dirty, wet, corrosive            | Less dirty, partly dry, corrosive | Clean, dry                   |
| low pressure (-3...+3 mbar)      | higher pressure (40...80 mbar)    | high pressure (bar ranges)   |
| low velocities (0,5...3m/s)      | higher velocity (8...15 m/s)      | high velocity                |
| CH <sub>4</sub> 48-54 Vol.-%     | CH <sub>4</sub> 48-54 Vol.-%      | CH <sub>4</sub> 95-98 Vol.-% |
| H <sub>2</sub> S up to 10000 ppm | H <sub>2</sub> S < 100 ppm        | H <sub>2</sub> S < 2 ppm     |
| O <sub>2</sub> 0-1 Vol.-%        | O <sub>2</sub> 0-1 Vol.-%         | O <sub>2</sub> 0-1 Vol.-%    |
| CO <sub>2</sub> 38-42 Vol.-%     | CO <sub>2</sub> 38-42 Vol.-%      | CO <sub>2</sub> 2-5 Vol.-%   |

## Definition Standard-Cubic-Meter

Measuring volumetric flow



Standard Volume  $V_0$

Gas Mass  $m$

p & T compensation necessary for:

- Orifice plates DP
- Vortex flow meter
- Turbine meters/ mechanical counters
- Ultrasonic flow meter
- Pitot tubes
- ...

# BINDER

Technologies for  
Flow & Analyze of  
Biogas

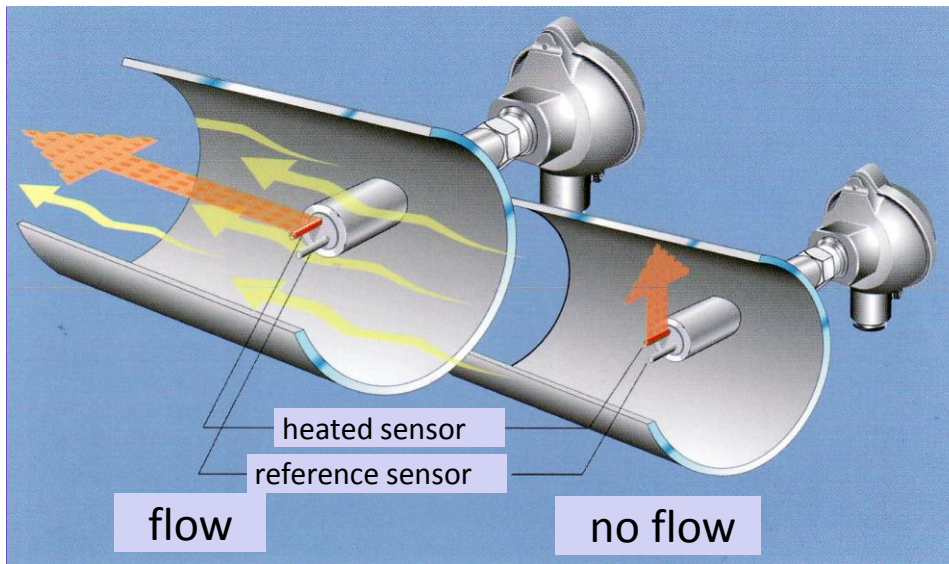


# BINDER

## COMBIMASS® - thermal gas flow measurement



## COMBIMASS® Thermal dispersion mass flow measurement



### Temperature:

Sensors measure resistance (by use of Pt100 sensors) – second sensor provides as reference

### Principle:

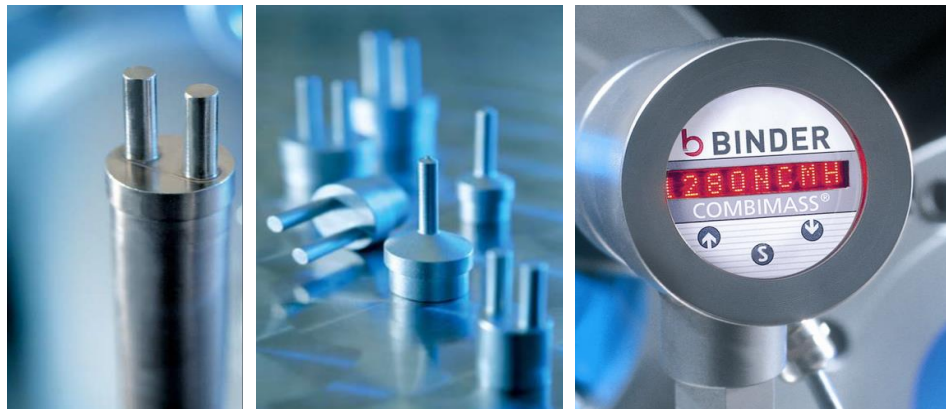
Dispersed heat provides as reference for the amount of gas-molecules passing by → direct mass-flow measurement

### Advantages:

Unaffected by pressure and temperature changes, very low pressure drop, precise even at low flow rates, reference sensor can be used to provide the gas temperature.

### Challenge:

A  $\text{CH}_4$ -molecule disperse a different amount of heat than a  $\text{CO}_2$ -molecule etc. Also water damp molecules disperse heat.



## BINDER Gas analysis



# BINDER

## Analyzer station **COMBIMASS<sup>®</sup> GA-s Hybrid**

The New flexible analyzer system:

- flexibility in cabinet sizes & material
- flexibility in size of graphic display
- flexibility in gas cells
- flexible for indoors/outdoors
- flexible in sampling frequency and sequence (continuously/ frequently)
- **Easy assembly and maintenance**



**Modular System for specific customer's requirement**

## Conclusions



## Conclusion

- Importance of Plant Monitoring
- Suitable solution for particular requirements
- Maintenance made easy

→ ***stable, safe and profitable*** operations



## Contact Persons



Jan Talkenberger  
Manager International Sales  
[jan.talkenberger@bindergroup.info](mailto:jan.talkenberger@bindergroup.info)  
+49 1733069903  
Binder GmbH  
Buchbrunnenweg 18  
89081 Ulm, Germany



Alex Hwong  
Sales Director South East Asia Pacific  
[alex.hwong@bindergroup.info](mailto:alex.hwong@bindergroup.info)  
+60 192234005  
B-3A-25 Blk Bougainvillea, 10 Boulevard,  
Lebuhraya Sprint  
47400 Petaling Jaya, Selangor, Malaysia