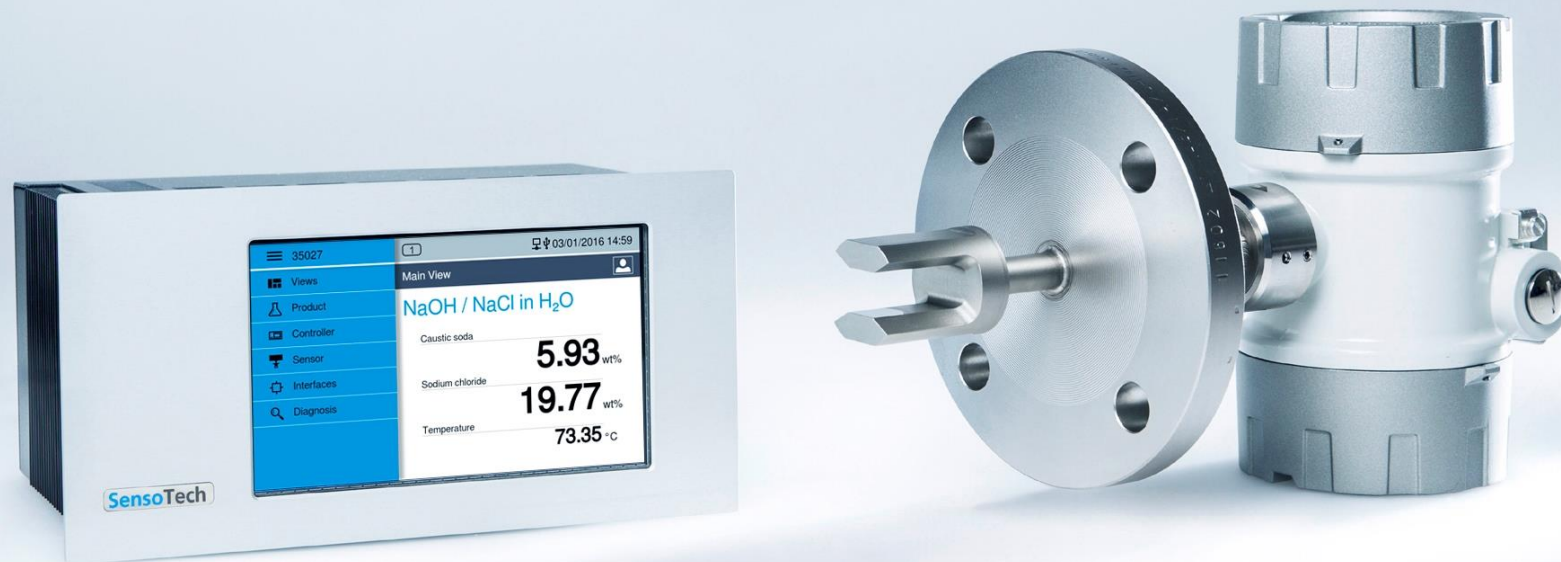




Gas scrubber and neutralization

Introduction

Gas scrubber - powerful absorption units

- gas scrubbing: one of the most commonly used industrial chemical processes in the world
- typical wet gas scrubber applications:
 - process gas scrubber are mostly NaOH-based and used for numerous gases
 - emergency vent scrubber (EVS) to absorb toxic or environmentally hazardous gases and vapors
- application areas:
 - chemical sector, esp. polymer production
 - petrochemical sector
 - disposal facilities
- SensoTech:
 - strong references for scrubbing
 - large product database (over 1300 process liquids measured, own laboratory)
 - long-term satisfied customers

LiquiSonic® 40 has established itself as well-known, accurate & robust analyzer.

Gas scrubber

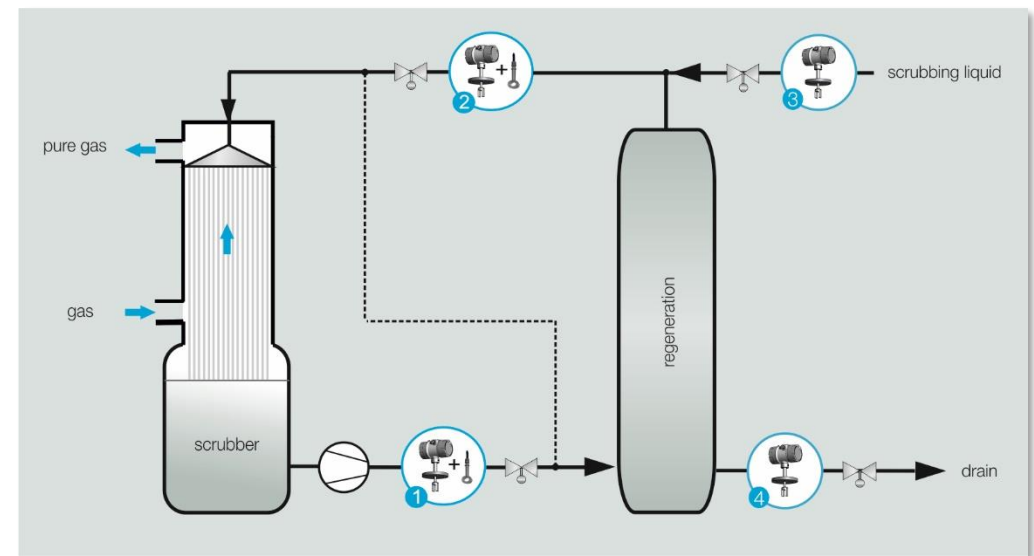
Production process with LiquiSonic® applications

Gas scrubber types

- packed tower scrubber
- ejector scrubber
- venturi scrubber

LiquiSonic® applications

- inline measurement of the scrubbing liquid (1)
- control of regeneration (2)
- monitoring of incoming liquid (3), refreshing
- waste water monitoring (4)



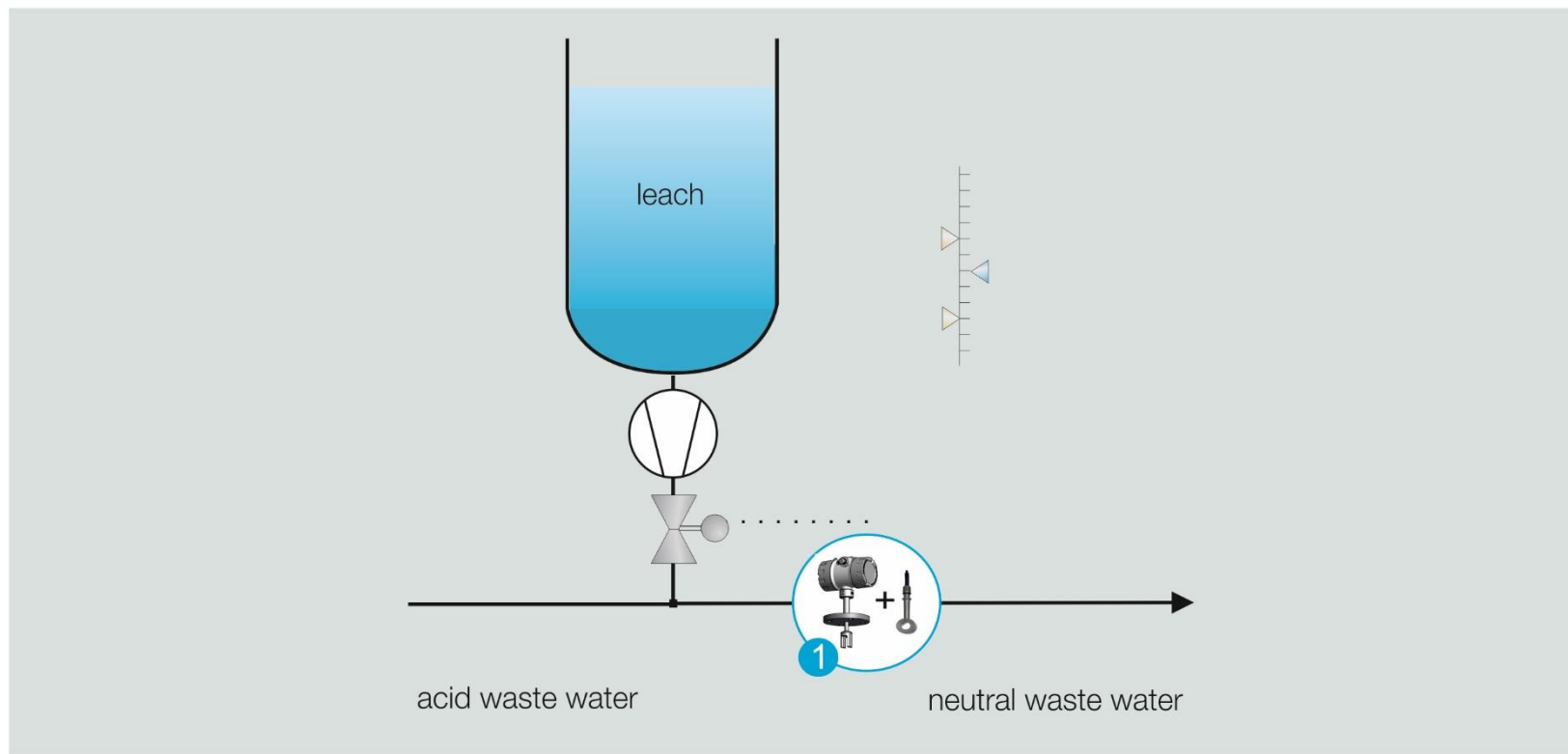
Gas scrubber

Types

Type	Application	Scrubbing mechanism
Chlorine gas scrubbers	NaOH / NaCl (+NaOCl) in H ₂ O	$\text{Cl}_2 + 2 \text{NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$
Phosgene scrubbers	NaOH / NaCl (+Na ₂ CO ₃) in H ₂ O	$\text{COCl}_2 + 4 \text{NaOH} \rightarrow 2 \text{NaCl} + \text{Na}_2\text{CO}_3 + 2 \text{H}_2\text{O}$
SO _x scrubbers	NaOH / Na ₂ SO ₄ in H ₂ O	$\text{SO}_2 + 2 \text{NaOH} + 1/2 \text{O}_2 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
NO _x scrubbers	NaOH / NaNO ₃ (+NaNO ₂) in H ₂ O	$2\text{NO}_2 + 2 \text{NaOH} \rightarrow \text{NaNO}_3 + \text{NaNO}_2 + \text{H}_2\text{O}$
CO _x scrubbers	NaOH / Na ₂ CO ₃ in H ₂ O	$\text{CO}_2 + 2 \text{NaOH} \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O}$
Benfield process	K ₂ CO ₃ / KHCO ₃ in H ₂ O	$\text{CO}_2 + \text{K}_2\text{CO}_3 + \text{H}_2\text{O} \rightarrow 2 \text{KHCO}_3$
Syngas drying	H ₂ SO ₄ in H ₂ O	H ₂ SO ₄ is hygroscopic

Neutralization

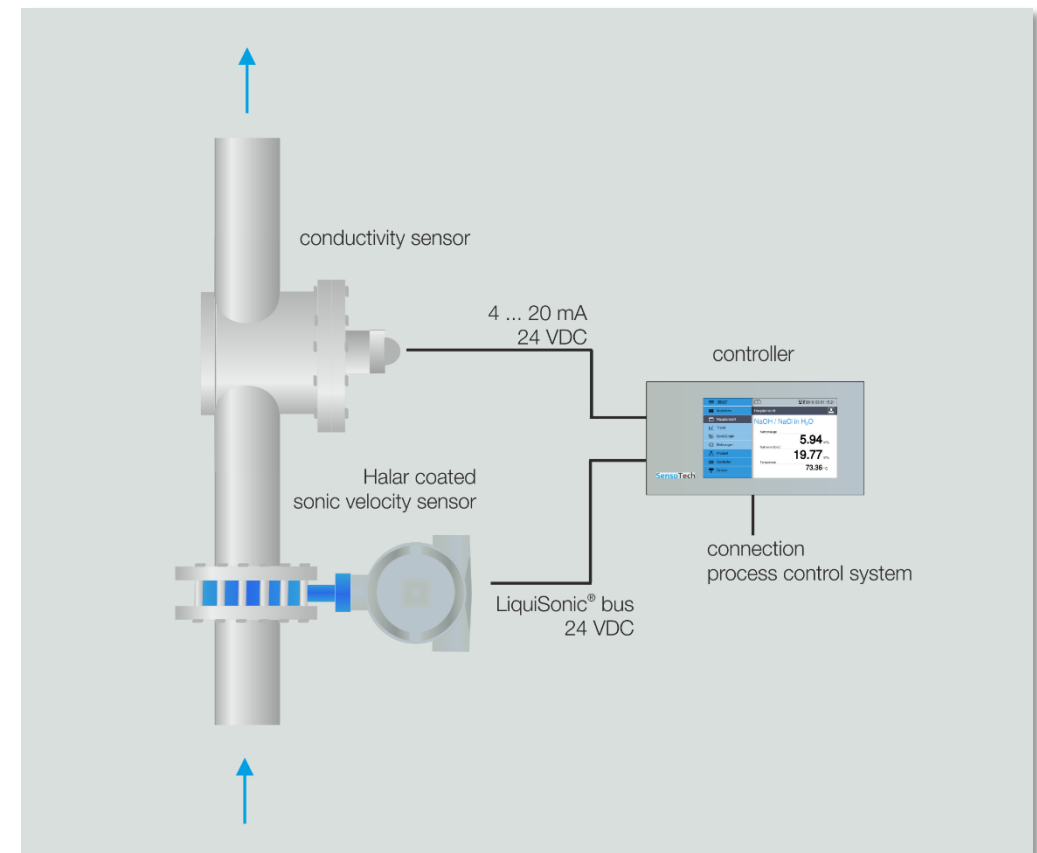
Waste water process with LiquiSonic® application



3-component-analysis

Combination of sonic velocity and conductivity

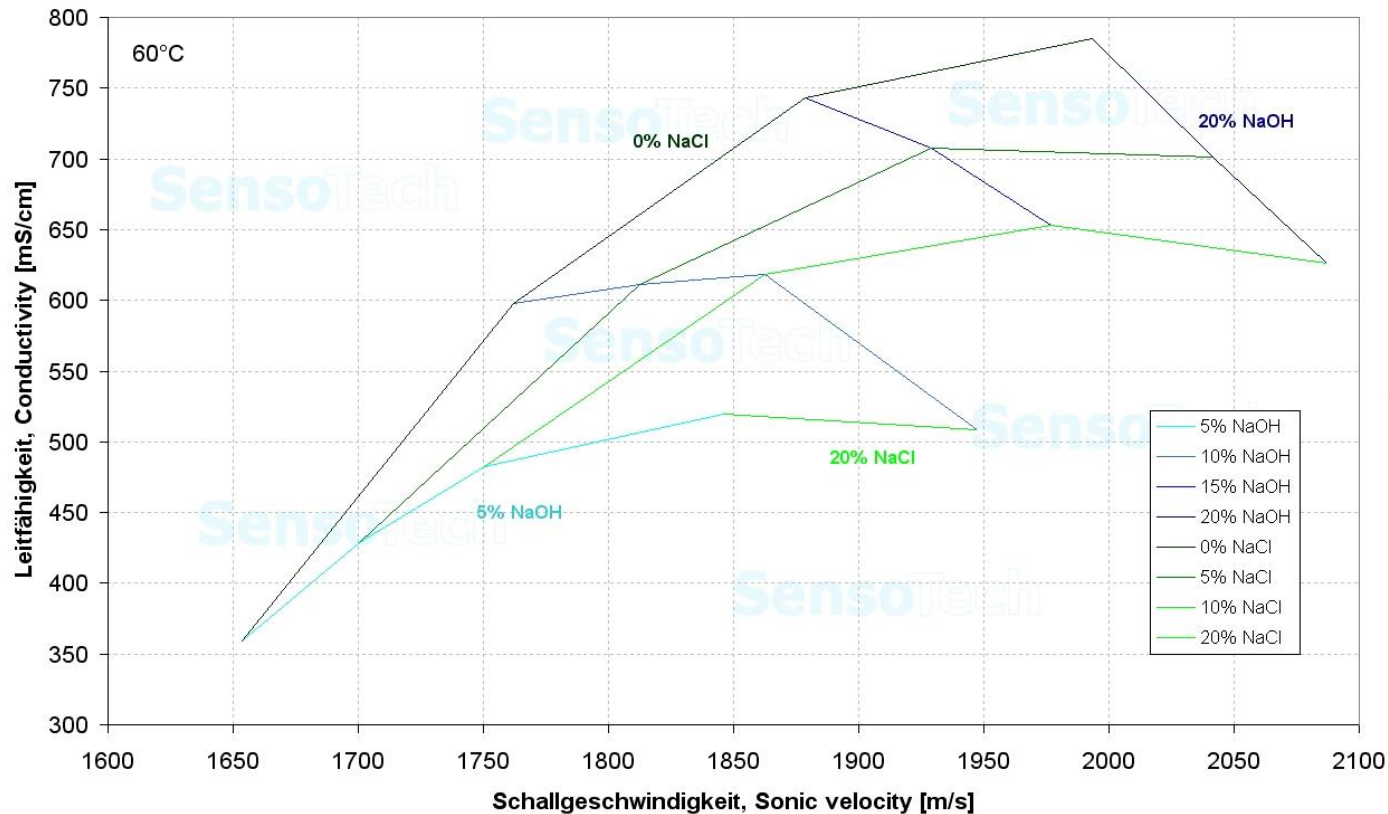
- Halar-coated ultrasonic flange sensor and PEEK-coated conductivity sensor for maximum corrosion resistance
- determination of absorption liquid concentration (NaOH, H₂SO₄)
- determination of salt concentration (NaCl, Na₂CO₃)



3-component-analysis

Combination of sonic velocity and conductivity

- typical measuring range: 10 - 20 wt% NaOH, 5-15% NaCl, 40-60°C



3-component-analysis

LiquiSonic® 40

- LiquiSonic® 40 is the ideal solution for scrubber and neutralization monitoring
- input values are sonic velocity, conductivity and temperature
- 3-component analysis:
 - scrubbing liquid, salts and water
 - e.g. NaOH / NaCl in water

LiquiSonic® 40 provides accurate analysis even in scrubbing liquids with more than 1 salt.

- by displaying NaOH and „sum of salts“, e.g. NaOH / NaCl & Na₂CO₃ in water
- multi-component-mixtures can be monitored, if „sum of salts“ (3rd component) has stable composition

SensoTech has solved numerous scrubbing applications with different salts.
Ask us about your scrubber.

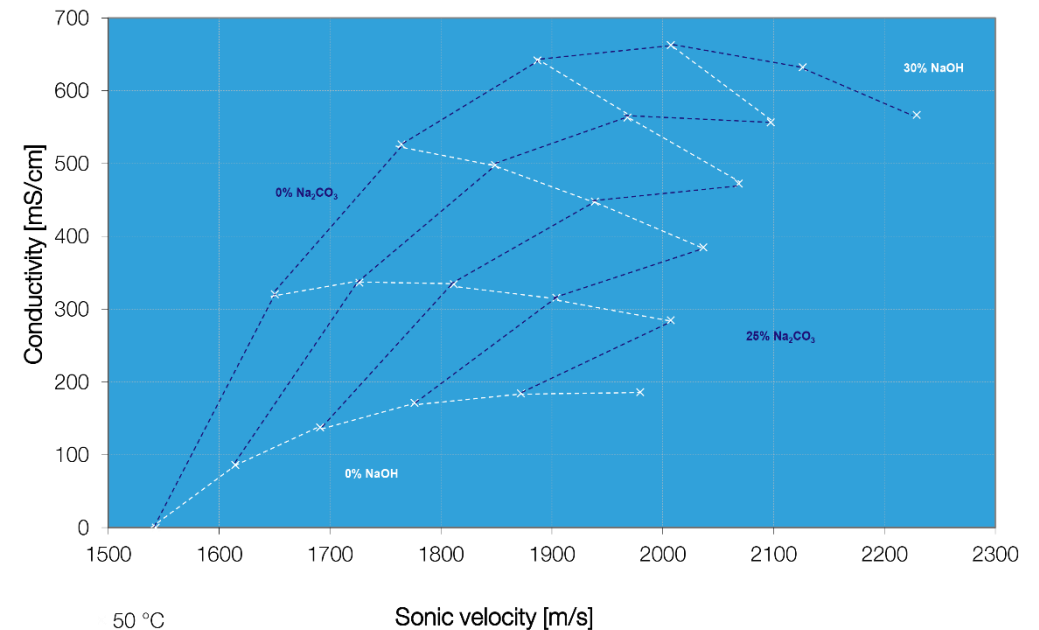


Industrial wet scrubber

Caustic soda - „king“ of wet gas scrubbing

- caustic soda is the most common wet gas scrubbing liquid
 - NaOH-based scrubbers:
 - process scrubber (NaCl & Na₂CO₃)
 - chlorine scrubber
 - gas sweetening (CO₂ and H₂S removal)
 - HF scrubber
- typical measuring task:
 - 10-20% NaOH, 5-15% Na₂CO₃, 30-40°C
 - 0-15% NaOH, 0-15% NaOCl, 20-40°C
 - 5-20% NaOH, 0-15% NaCl & Na₂CO₃
 - 5-10% NaOH, 15-25% NaCl, 90-110°C

LiquiSonic® 40 - the ideal NaOH & Na₂CO₃ analyzer



LiquiSonic® prevents NaOH under- or overdosing.

Industrial wet scrubber

Benfield process

- CO₂ enriched gas has to be cleaned
- Benfield scrubber to absorb acidic components in the gas stream
- common scrubbing liquid:
 - hot potassium carbonate (K₂CO₃)
 - caustic soda
- application fields:
 - ethylene oxide / propylene oxide plant
 - ammonia synthesis
- typical measuring range:
 - K₂CO₃: 0 - 25 wt%,
 - KHCO₃: 0 - 25 wt%
 - 80 to 110 °C

Emergency vent scrubber

Absorption in the event of an accident

- EVS aims:
 - assurance of process and plant safety
 - maintain enough scrubbing liquid on hand
- EVS operation:
 - scrubbing liquid circulates continuously
 - mostly „clean“ non-toxic gas is scrubbed
 - if included, toxic or environmentally hazardous gas or vapour will be absorbed
 - NaOH is continually consumed and Na_2CO_3 is generated
- numerous application fields:
 - chlorine
 - phosgene
 - bromine
 - sulfur dioxide SO_2
 - CO_2 , NO_x , HF



Gas scrubber and neutralization

LiquiSonic® benefits

Gas scrubber

- automatically controls the scrubbing liquid concentration
- ensure maximum absorption and efficiency level of the gas scrubber
→ control refreshing, constant concentration level, approach to maximum of absorption
- avoids overdosing and underdosing

Neutralization

- avoid destructions of biological organism in waste water treatment

Gas scrubber & neutralization

- reduces efforts of lab measurements
- saves costs of materials
- provides direct information about the state of the process at any time
- data logging for quality management
- ensures consistent plant and system safety, even in emergency case (EVS)

Gas scrubber and neutralization

Online LiquiSonic® 40 vs. other measuring methods

pH value

„pH is not applicable to batch scrubbers using strong caustic (10–15 % NaOH). Strong caustic dehydrates the pH glass and greatly reduces sensor life.“ [1]

- over approx. 3 % NaOH no clear signal → steady pH 14

Conductivity (separately from LiquiSonic® 40)

„Conductivity is non-specific and will respond to both the scrubbing chemical and the scrubbing by-products produced by scrubbing.“ [1]

- no clear information without second physical value

LiquiSonic® 40

- displays scrubbing liquid (NaOH) **AND** byproducts (NaCl, Na₂CO₃)
- salt content is important information (influences scrubbing strength)
- optimal refreshing control, no salt overload
- online monitoring with real-time data logging
- no time-consuming and cost-intensive lab values

[1] <https://www.emerson.com/documents/automation/71958.pdf>

Gas scrubber and neutralization

LiquiSonic® 40 device

- LiquiSonic® controller 40 V10
- LiquiSonic® ultrasonic sensor:
 - immersion sensor 40-14 V10
 - flange sensor HALAR-coated
 - for hazardous areas available (ATEX, IECEx, FM, NEPSI certified)
- conductivity sensor, e.g. CM42/CLS50
- max. temperature: 120 °C (optional 200 °C)
- process connection: DIN, ANSI
- interface and communication:
 - remote control via webbrowser
 - ethernet and RS232-Interface
 - external data storage via USB
 - analog outputs: 4 x 4-20 mA
 - digital outputs: 6 x electronic relays
 - optional: profibus DP or modbus-RS485



Gas scrubber and neutralization

References



We are committed to quality in every way.





In liquids, we set the measure.

SensoTech GmbH
Germany

T +49 39203 514 100
info@sensotech.com
www.sensotech.com

SensoTech Inc.
USA

T +1 973 832 4575
sales-usa@sensotech.com
www.sensotech.com

SensoTech (Shanghai) Co., Ltd.
申铄科技(上海)有限公司

电话 +86 21 6485 5861
sales-china@sensotech.com
www.sensotechchina.com