PIOX® - The superior solution
Accurate - Reliable - Safe - Efficient

Configurations

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Concentration range</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphuric Acid</td>
<td>0...80 %</td>
<td>PIOX® R</td>
</tr>
<tr>
<td></td>
<td>PTFE Chemical Design variant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wetted parts:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Complimentary PTFE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Housing material:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PTFE powder coated Stainless Steel 316L/316TI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Process connection:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DIN/ISO design, proprietary FLEXIM flow cell</td>
<td></td>
</tr>
<tr>
<td>Sulphuric Acid</td>
<td>80...100 %</td>
<td>PIOX® S721 SA</td>
</tr>
<tr>
<td></td>
<td>Non-invasive Ultrasonic Process Analyser</td>
<td>Stainless Steel transmitter housing</td>
</tr>
<tr>
<td>Steam</td>
<td>0...4 %</td>
<td>PIOX® R</td>
</tr>
<tr>
<td></td>
<td>Chemical Design variant</td>
<td></td>
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<tr>
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<td>Wetted parts, materials:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stainless Steel 316L/316TI</td>
<td></td>
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<td></td>
<td>Housing material:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stainless Steel 316L/316TI</td>
<td></td>
</tr>
<tr>
<td>Steam</td>
<td>60...100 %</td>
<td>PIOX® S721</td>
</tr>
<tr>
<td></td>
<td>Non-invasive Ultrasonic Process Analyser</td>
<td></td>
</tr>
</tbody>
</table>

PIOX® ST21 SA (PIOX® S721)

Non-invasive ultrasonic process analyser for determination of concentration, density and mass flow rate of Sulphuric Acid

- Measurement accuracy:
  - Mass flow: ± 1.2 % of rd. ± 0.01 m/s (ext. calibr.)
  - Concentration: ± 0.5 % of rd. ± 0.01 m/s (Process calibr.)
  - Density: up to 0.1 % of reading

- Operating temp. of media:
  - -4°C ... +100°C (up to +200°C with Wavinjector®)

- Inputs:
  - Current (0/4 mA ... 20 mA), Voltage, Frequency, Impulse, Alarm

- Outputs:
  - Many combinations available, possible types:
    - Current (0/4 mA ... 20 mA), Voltage, Frequency, Impulse, Alarm

- Communication protocols:
  - HART, Modbus, Foundation Fieldbus, Profinet

- Degree of protection:
  - Sensor: IP67, ATEX (IECEx) Zone 0/1, 1, 2
  - Transmitter: up to IP66, ATEX (IECEx) Zone 2 and FM Class I, Div. 2 optional

- Degree of protection for Temperature compensated concentration measurement (W%) of Sulphuric Acid through Reflection index

- Measurement accuracy:
  - 0.1 w%; nD: 0.0002
  - Operating temp. (media): -20 °C ... (+ 130 °C) + 150 °C
  - Fluid pressure: PN 10, PN 16, on request PN 40
  - Degree of protection for Explosion protection:
    - Transmitter: up to IP65, ATEX (IECEx) Zone 0, 1, 2
    - Transmitter: up to IP65, ATEX (IECEx) Zone 2 and FM Class I, Div. 2 optional

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Solutions for Sulphuric Acid and Oleum Producers and Demanding Industries

Non-Invasive Flow and Massflow Measurement of Sulphuric Acid, Oleum and Water - Acid and Oleum Strength and Density
PIOX® S – Non-invasive Concentration and Mass Flow measurement of strong Sulphuric Acid and Oleum

By measuring non-invasively from the pipe wall outside and never being in direct contact with the medium flowing inside, PIOX® S is the ideal solution for monitoring strong sulphuric acid and oleum:

- The system measures sulphuric acid concentration and mass flow directly on the main production lines.
- It accurately determines the acid strength in real time.
- It significantly increases plant safety as it does not require any pipe opening or welding for installation nor any additional flanges.
- The measurement is free of wear or abrasion and thus also virtually maintenance free.
- It can never be a source for potential leaks and subsequent process shut-downs.

PIOX® R - For Concentration Monitoring of Diluted Sulphuric Acid and Oleum

PIOX® R is the measurement instrument of choice for determining the concentration and density of sulphuric acid (0…80%) and Oleum (0…40%), due to its:

- Corrosion resistant carbon fibre reinforced PTFE sensor head design.
- The highly precise optical technology measures the acid strength with laboratory accuracy directly in the process.
- Its internal self-diagnostic tools allow for predictive and very cost effective maintenance efforts.
- Due to its patented transmitted light principle PIOX® R offers a complete drift free, precise and long term stable measurements.

PIOX® R precisely determines the concentration, density and mass flow rate of sulphuric acid by non-invasively measuring the sonic velocity of the medium.

Advantages:

- Extreme reliability due to no direct contact with the medium.
- Highest accuracy over a wide flow, concentration and temperature range (up to 400 °C).
- Increased plant safety and available flexibility - no pipe works or process shut-downs required.
- Certified for usage in hazardous areas (ATEX, IECEx Zone 1/2 and FM Class I, Div. 1/2 certified).

Precise 0 to 100% Sulphuric Acid Strength and Mass Flow Measurement with PIOX®

PIOX® S precisely determines the concentration, density and mass flow rate of sulphuric acid by non-invasively measuring the sonic velocity of the medium.

Advantages:

- Extreme reliability due to no direct contact with the medium.
- Highest accuracy over a wide flow, concentration and temperature range (up to 400 °C).
- Increased plant safety and available flexibility - no pipe works or process shut-downs required.
- Certified for usage in hazardous areas (ATEX, IECEx Zone 1/2 and FM Class I, Div. 1/2 certified).

Precise 0 to 100% Oleum Strength and Mass Flow Measurement from PIOX®

PIOX® R is the measurement instrument of choice for determining the concentration and density of sulphuric acid (0…80%) and Oleum (0…40%), due to its:

- Corrosion resistant carbon fibre reinforced PTFE sensor head design.
- The highly precise optical technology measures the acid strength with laboratory accuracy directly in the process.
- Its internal self-diagnostic tools allow for predictive and very cost effective maintenance efforts.
- Due to its patented transmitted light principle PIOX® R offers a complete drift free, precise and long term stable measurements.
PIOX® S – Non-invasive Concentration and Mass Flow measurement of strong Sulphuric Acid and Oleum

By measuring non-invasively from the pipe wall outside and never being in direct contact with the medium flowing inside, PIOX® S is the ideal solution for monitoring strong sulphuric acid and oleum:

- The system measures sulphuric acid concentration and mass flow directly on the main production lines.
- It accurately determines the acid strength in real time.
- It significantly increases plant safety as it does not require any pipe opening or welding for installation nor any additional flanges.
- The measurement is free of wear or abrasion and thus also virtually maintenance free.
- It can never be a source for potential leaks and sub-sequent process shut-downs.

PIOX® R - For Concentration Monitoring of Diluted Sulphuric Acid and Oleum

PIOX® R is the measurement instrument of choice for determining the concentration and density of sulphuric acid (0...80%) and Oleum (0...40%), due to its:

- Corrosion resistant carbon fibre reinforced PTFE sensor head design.
- The highly precise optical technology measures the acid strength with laboratory accuracy directly in the process.
- Its internal self-diagnostic tools allow for predictive and very cost effective maintenance efforts.
- Due to its patented transmitted light principle PIOX® R offers a complete drift free, precise and long term stable measurement.

Advantages:

- Extreme reliability due to no direct contact with the medium.
- Highest accuracy over a wide flow, concentration and temperature range (up to 400 °C).
- Increased plant safety and availability - no pipe works or process shut-downs required.
- Certified for usage in hazardous areas (ATEX, IECEx Zone 1/2 and FM Class I, Div. 1/2 certified).

Precise 0 to 100% Sulphuric Acid Strength and Mass Flow Measurement with PIOX®

PIOX® S precisely determines the concentration, density and mass flow rate of sulphuric acid by non-invasively measuring the sonic velocity of the medium.
PIOX® S – Non-invasive Concentration and Mass Flow measurement of strong Sulphuric Acid and Oleum

By measuring non-invasively from the pipe wall outside and never being in direct contact with the medium flowing inside, PIOX® S is the ideal solution for monitoring strong sulphuric acid and oleum:

- The system measures sulphuric acid concentration and mass flow directly on the main production lines
- It accurately determines the acid strength in real time
- It significantly increases plant safety as it does not require any pipe opening or welding for installation nor any additional flanges
- The measurement is free of wear or abrasion and thus also virtually maintenance free
- It can never be a source for potential leaks and subsequent process shut-downs

PIOX® R - For Concentration Monitoring of Diluted Sulphuric Acid and Oleum

PIOX® R is the measurement instrument of choice for determining the concentration and density of sulphuric acid (0...80%) and Oleum (0...40%), due to its:

- Corrosion resistant carbon fibre reinforced PTFE sensor head design
- The highly precise optical technology measures the acid strength with laboratory accuracy directly in the process
- Its internal self-diagnostic tools allow for predictive and very cost effective maintenance efforts
- Due to its patented transmitted light principle PIOX® R offers a complete drift free, precise and long term stable measurements

Precise 0 to 100% Sulphuric Acid Strength and Mass Flow Measurement with PIOX®

PIOX® S precisely determines the concentration, density and mass flow rate of sulphuric acid by non-invasively measuring the sonic velocity of the medium

Advantages:

- Extreme reliability due to no direct contact with the medium
- Highest accuracy over a wide flow, concentration and temperature range (up to 400 °C)
- Increased plant safety and available flex - no pipe works or process shut-downs required
- Certified for usage in hazardous areas (ATEX, IECEx Zone 1/2 and FM Class I, Div. 1/2 certified)

Precise 0 to 100% Oleum Strength and Mass Flow Measurement from PIOX®
Drying Tower

Acid Strength

Absorption Tower

Inlet Volume

Flow and Acid Strength

Diluter Effectivity

Accurate HRS Tower Concentration

in Hot Acid

Waste Water

Acid Strength

Water Balance

Direct Acid Consumption

Non-Invasive Flow and Massflow Measurement of Sulphuric Acid, Oleum and Water - Acid and Oleum Strength and Density

PIOX® - The superior solution

Accurate - Reliable - Safe - Efficient

Configurations

Fluid

Concentration range

Configuration

Sulphuric Acid

0...80 %

PIOX® R

PTFE Chemical Design variant

Wetted parts, materials:

Completely PTFE

Housing material:

PTFE powder coated Stainless Steel 36541.4201

Process connection:

DN80/45 Design, proprietary FLEXIM flow cell

Sulphuric Acid

80...100 %

PIOX® ST21 SA

Non-invasive Ultrasonic Process Analyzer (Stainless Steel transmitter housing)

Wetted parts, materials:

Completely PTFE

Housing material:

Stainless Steel 310/1.4501

Process connection:

DN80/45 Design, proprietary FLEXIM flow cell

Sulphuric Acid

80...100 %

PIOX® S721 SA

Non-invasive Ultrasonic Process Analyser (Stainless Steel transmitter housing)

Media

Concentration

Configuration

Sulphuric Acid

0...80 %

PIOX® R

Chemical Design variant

Wetted parts, materials:

Stainless Steel 310/1.4501

Housing material:

Stainless Steel 310/1.4501

PIOX® S721 SA

Non-invasive Ultrasonic Process Analyser

Wetted parts, materials:

Stainless Steel 310/1.4501

Housing material:

Stainless Steel 310/1.4501

Technical Facts

PIOX® ST21 SA

PIOX® S721 SA

Non-invasive ultrasonic process analyser for determination of concentration, density and mass flow rate of Sulphuric Acid

Measurement accuracy

Mass flow:

± 1.2 % of rd. ± 0.01 m/s (ext. calibr.)

Concentration:

± 0.5 % of rd. ± 0.01 m/s (Process calibr.)

Density:

up to 0.1 % of reading

Operating temp. of medium:

-45 °C ... +200 °C

up to 0.1 °C

Inputs:

Current is possible as 4-20 mA with wave

Frequency, Impulse: in pt 100/1000 4-Loop, Current, Voltage

Outputs:

Many combinations available, possible types:

Current (0/4 mA ... 20 mA), Voltage,

Frequency, Impulse, Alarms

Communication protocols:

HART, MODBUS, Foundation Fieldbus, ProBus

Degree of protection / Explosion protection:

Sensor: IP67, ATEX (IECEx) Zone 0/1, 1, 2

Transmitter: up to IP66, ATEX (IECEx) Zone 2 and

FM Class I, Div. 2 optional

PIOX® R

Non-invasive Ultrasonic Process Refractometer for (temperature compensated) concentration measurement (wt%) of Sulphuric Acid through Refractive index

Measurement accuracy

0.1 wt%; nD: 0.0002

Operating temp. (medium):

-20 °C ... (+ 130 °C) up to +150 °C

Fluid pressure:

PN 10, PN 16, on request PN 40

Degree of protection:

Transmitters:

IP63, IP65, IP67, ATEX (IECEx) Zone 2 and

FM Class I, Div. 2 approved variants - please refer to PIOX® ST21 product variant

PIOX® S721 SA

Non-invasive Ultrasonic Process Analyzer for determination of concentration, density and mass flow rate of Sulphuric Acid through Refractive index

Measurement accuracy:

± 1.0 %, ± 0.5 %

Operating temp. (medium):

-20 °C ... +150 °C

Fluid pressure:

PN 16, PN 40, unimpeded PN 63

Degree of protection / Explosion protection:

Transmitters:

IP63, ATEX (IECEx) Zone 2, 1, 2

Transmitters:

Up to IP65, ATEX (IECEx) Zone 2 and

FM Class I, Div. 2 optional

Non-Disturbing Flow and Massflow Measurement of Sulphuric Acid, Oleum and Water - Acid and Oleum Strength and Density

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Drying Tower Acid Strength
Absorption Tower Inlet Volume
Flow and Acid Strength
Diluter Effectivity
Accurate HRS Tower Concentration in Hot Acid
Waste Water Acid Strength
Water Balance
Direct Acid Consumption
Solutions for Sulphuric Acid and Oleum Producers and Demanding Industries
Non-Invasive Flow and Massflow Measurement of Sulphuric Acid, Oleum and Water - Acid and Oleum Strength and Density

PIOX® - The superior solution
Accurate - Reliable - Safe - Efficient

Technical Facts

**PIOX® ST21 SA (PIOX® ST21)**
Non-invasive ultrasonic process analyser for determination of concentration, density and mass flow rate of Sulphuric Acid

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Concentration range</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphuric Acid</td>
<td>0…80 %</td>
<td>PIOX® R</td>
</tr>
<tr>
<td></td>
<td>Wetted parts, material:</td>
<td>PTFE Chemical Design variant</td>
</tr>
<tr>
<td></td>
<td>Housing material:</td>
<td>PTFE powder coated Stainless Steel 316L(1.4401)</td>
</tr>
<tr>
<td></td>
<td>Process connection:</td>
<td>DNIH/SH Design, proprietary FLEXIM flow cell</td>
</tr>
<tr>
<td>Stearic Acid</td>
<td>0…100 %</td>
<td>PIOX® ST21 SA</td>
</tr>
<tr>
<td></td>
<td>Wetted parts, material:</td>
<td>Stainless Steel 316L(1.4401)</td>
</tr>
<tr>
<td></td>
<td>Process connection:</td>
<td>DNIH/SH Design, proprietary FLEXIM flow cell</td>
</tr>
</tbody>
</table>

** PIOX® R Inline Process Refractometer for**
(temperature compensated) concentration measurement (w%) of Sulphuric Acid through Refractive Index

<table>
<thead>
<tr>
<th>Measurement accuracy</th>
<th>Mass flow:</th>
<th>± 1.2 % of rd. ± 0.5 m/s (DIN 19660) ± 0.01 m/s (Process calibr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concentration:</td>
<td>± 0.5 % of rd. ± 0.01 m/s (Process calibr.) up to 1% of reading</td>
</tr>
<tr>
<td></td>
<td>Density:</td>
<td>± 0.1 % of reading up to 0.1 % of reading</td>
</tr>
</tbody>
</table>

** Operating temp. of media:**
-40 °C ... +200 °C (up to +400 °C with WaveInjector®)

**Inputs:**
- 4 Inputs: Current, Voltage, Temperature, Pressure

**Outputs:**
- Many combinations available, possible types of output: Current (4-20 mA), Voltage, Frequency, Impulse, Alarm

**Communication protocols:**
- HART, Modbus, Foundation Fieldbus, ProBus

**Degree of protection / Explosion protection:**
- Sensor: IP67, ATEX (IECEx) Zone 0/1, 1, 2
- Transmitter: up to IP66, ATEX (IECEx) Zone 2 and FM Class I, Div. 2 optional

**PIOX® B Inline Process Refractometer for**
Temperature compensated concentration measurement (w%) of Sulphuric Acid through Refractive Index

<table>
<thead>
<tr>
<th>Measurement accuracy</th>
<th>Mass flow:</th>
<th>± 1.0 % of rd. ± 0.5 m/s (DIN 19660) ± 0.01 m/s (Process calibr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concentration:</td>
<td>± 0.5 % of rd. ± 0.01 m/s (Process calibr.) up to 1% of reading</td>
</tr>
<tr>
<td></td>
<td>Density:</td>
<td>± 0.1 % of reading up to 0.1 % of reading</td>
</tr>
</tbody>
</table>

** Operating temp. of media:**
-20 °C ... +130 °C

**Discharge pressure:**
- 5 bar, 10 bar, unregulated 2 bar

**Degree of protection / Explosion protection:**
- Transmitter: up to IP68, ATEX (IECEx) Zone 2 and FM Class 1, 2 optional

**FLEXIM**
More than 25 years of experience in Flow Measurement and Process Analytical Technology

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