SensoTech



LiquiSonic® OCM

Inline analytical technology for online crystallization monitoring

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LiquiSonic®

quality, **saving resources: LiquiSonic®.**

-value, **innovative sensor technology.**

curate, **user-friendly.**



LiquiSonic® is an inline analysis system, that detect the concentration in a liquid directly in the process and without any time lag. The device is based on the accurate measurement of sonic velocity and temperature and enables so the monitoring of processes and complex reactions.

Benefits for the user include:

- online determination of saturation, supersaturation or crystal content
- continuous process control
- saving of energy and raw material
- optimal process utilization
- reproducible process management with proprietary “fingerprint“ technology

Advanced methods of calculation and innovative sensor technologies enable precise and reproducible measuring results even under difficult process conditions. Additionally, integrated temperature sensors, the sophisticated sensor design as well as the know-how gained from several series of measurements and applications ensure a high reliability of the system with a long lifetime.

The advantages of the measuring method are:

- absolute sonic velocity as unique and traceable physical property
- installation directly in pipes, tanks and vessels
- independent on color, conductivity and transparency of the process liquid
- rough sensor design; all wetted parts are stainless steel without sealing, optical windows or adhesive bonding
- maintenance free
- no influences by mechanical vibrations and pressure peaks as well as non-corrosive by special alloys or plastic coats
- measurement in temperature up to 200 °C
- connection of maximum four sensors to one controller possible
- forwarding of measuring results through fieldbus (Profibus DP, Modbus), analogue outputs, serially or Ethernet



Online crystallization monitoring

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1 Fundamentals of crystallization



Crystallization processes are very important in both the chemical and pharmaceutical industry. The sonic velocity measuring plays an ever greater role in the determination of crystallization parameters and in the control of crystallization processes.

The sonic velocity measuring enables to determine the nucleation and saturation point and, thus, the metastable range.

During the crystallization, it is possible to measure the difference to the saturation (degree of saturation), the degree of supersaturation or the crystal content and to determine it as a control variable for influencing the crystallization.

When a solid substance is dissolved in a liquid, the liquid is absorptive up to a certain concentration. If further substance is added to the liquid, it will no longer be dissolved, the solution is saturated and the substance remains in its solid form.

This “maximum“ concentration of a solution is called solubility or saturation concentration. The saturation concentration depends on the temperature. The temperature, at which the solution becomes saturated, is called saturation temperature. If the temperature is increased, more substance can be dissolved (except for negative solubility), and the saturation concentration becomes larger.

If the concentration is lower than the saturation concentration, the solution concerned is called unsaturated solution.

It applies at constant temperature:

$$S = \frac{c_{tot} - c_{sat}}{c_{tot}}$$

S = saturation
c_{tot} = total concentration
c_{sat} = saturation concentration

If the temperature of an unsaturated solution is decreased, it can be cooled down for many solutions to a temperature which is lower than the saturation temperature without causing the solid substance to become crystallized. Then the solution is supersaturated. If it is cooled down further, spontaneous nucleus or crystal formation occur at a certain temperature called nucleation temperature.

If the suspension is then reheated, the crystals become dissolved again. When reaching the saturation temperature, all crystals are dissolved. The saturation temperature is usually higher than the nucleation temperature.

The supersaturated range between the saturation temperature and the nucleation temperature is called metastable range.

By using LiquiSonic® systems in crystallization processes the following advantages result for the user:

- improved plant utilization by
  - continuous display of undersaturation and supersaturation
  - process control via the crystallization parameters
  - avoiding spontaneous nucleation
- energy saving by
  - fast achieving of required seeding point
  - continuous determination of crystal content
  - optimal approaching of the final process point
- saving of raw material by
  - precise setting of the required product quality
  - reproducible approaching of the seeding point

2 LiquiSonic® OCM



2.1 Components

2.1.1 Two immersion type sensors

Both sensors contain the measurement of sonic velocity and the temperature. The wetted parts consist of stainless steel 1.4571 as standard. The rugged and completely enclosed design does not need any gaskets or “windows” for process and is thus completely maintenance free.

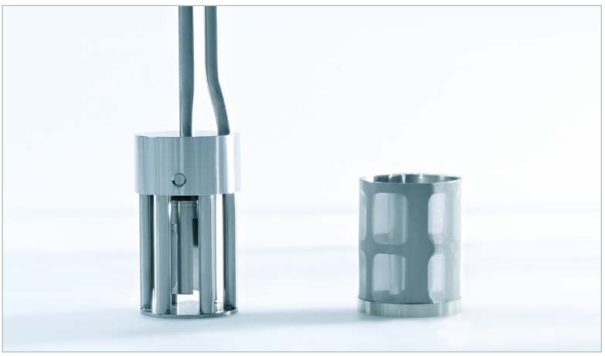
During the measurement one sensor is completely soaked into suspension (sensor 2) whereas the other one (sensor 1) comes only into contact with the solution due to membranous cladding (the so-called crystallization adapter).



Sensor with and without membrane

2.1.2 Crystallization adapter for suspensions

Crystals influence the ultrasonic signal, similar to concentration changes in solutions, which enable detecting the crystal content in suspensions. However, this effect is disadvantageous for detection of supersaturation during the crystallization in suspensions. That’s why it is recommended for this measuring task to use a crystallization adapter that keeps the crystals off the sensor and enables to determine the concentration of mother liquor.



LiquiSonic® sensor with crystallization adapter and exchangeable membrane

In a supersaturation, the concentration of the solution is larger than its saturation concentration. The supersaturation contributes significantly to the morphology of crystals during crystal growth.

The controller detects the degree of superaturation, which will then be displayed via periphery.

2.1.3 Controller 50

The controller analyzes the data of sensors and shows the process values. A modern microprocessor, which even copes with complex concentration calculations without any problems, operates this controller. Thus, it is easy to visualize, characterize and to control a crystallization process.

With the implementation of saturation and nucleation line as well as with the supersaturated section, the user gets the status of crystallization without time lag.



LiquiSonic® 50 Controller with housing

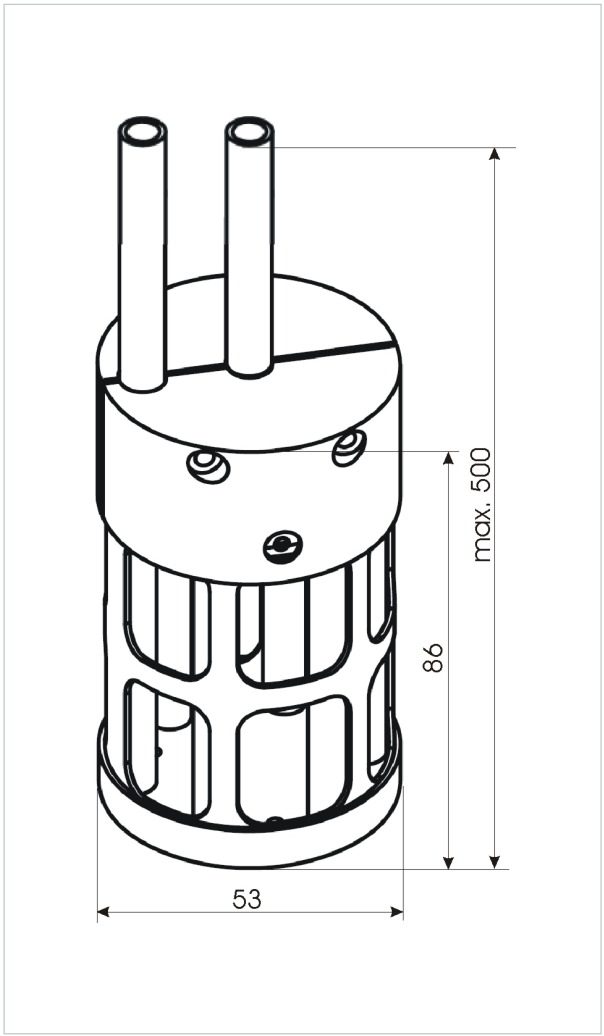
The Controller 50 will be delivered within a 19“ housing system with the following dimensions 550 x 170,6 x 425 (width x height x depth) and includes the periphery of the crystallization adapter.

Further advantages for users are:

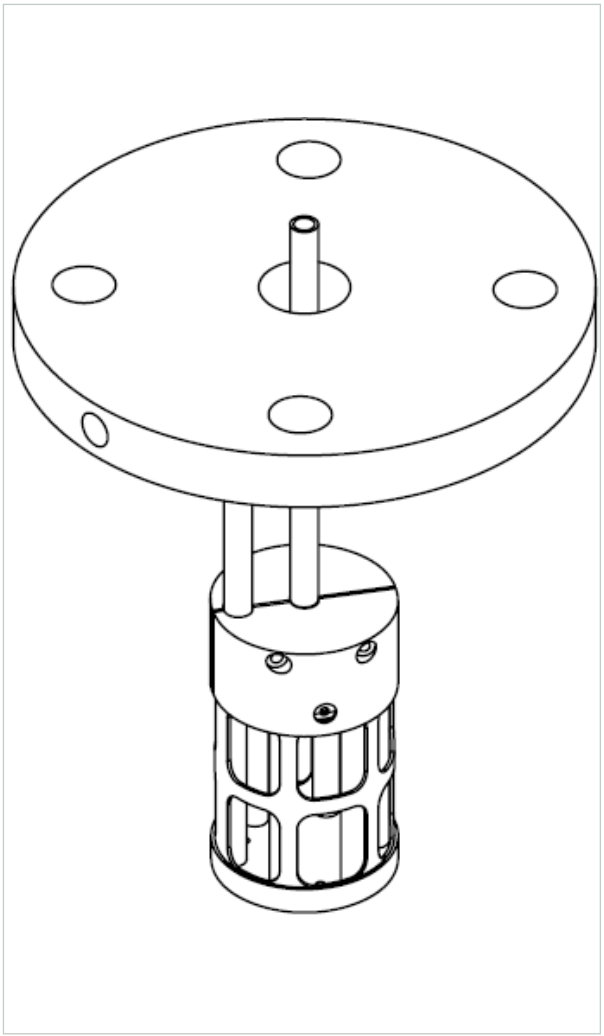
- memory of complex and dynamic characteristics including authorized process belts and limits
- presentation of saturation and nucleation lines as well as local assignment of current process values
- display of concentration, temperature and further-important process values
- simple parameterization of periphery for example
- interfaces like analogue and digital outputs, field-bus, ethernet
- automatic self-monitoring
- comfortable handling due to tree structure of system menu
- recording of events, for example exceeding the limit value
- memory of up to 256 products
- memory of up to 10 saturation and nucleation characteristics
- user management with authorization steps

2.2 Technical data of the sensor with crystallization adapter

dimensions	53 mm x 86 mm (diameter x height
installation length	max. 500 mm
material	stainless steel 1.4571
weight	approx. 250 g (without flange)
process temperature	0 °C to 120 °C
process pressure	0 bar to 16 bar
process connection	individual (plug or flange)



Sensor without flange



Sensor with flange

3 Quality and support





Enthusiasm for technical progress is the driving force behind our company as we seek to shape the market of tomorrow. As our customer you are at the centre of all our efforts and we are committed to serving you with maximum efficiency.

We work closely with you to develop innovative solutions for your measurement challenges and individual system requirements. The growing complexity of application-specific requirements means it is essential to have an understanding of the relationships and interactions involved.



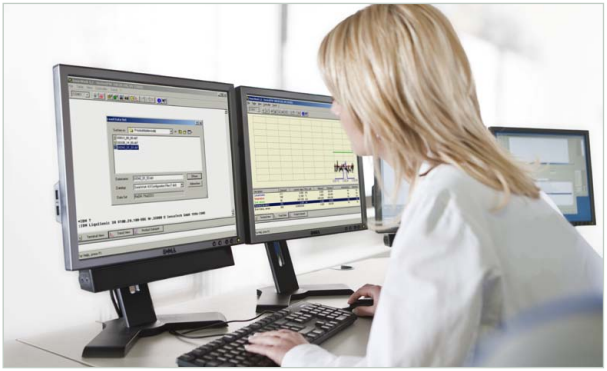
Creative research is another pillar of our company. The specialists in our research and development team provide valuable new ways to optimise product attributes, such as testing new types of sensor designs and materials or the sophisticated functionality of electronics, hardware and software components.

Our SensoTech quality management also only accepts the best production performance. We have been certified according to ISO 9001 since 1995. All device components pass various tests in different stages of production. The systems have all gone through an internal burn-in procedure. Our maxim: maximum functionality, resilience and safety.

This is only possible due to our employee`s efforts and quality awareness. Their expert knowledge and motivation form the basis of our success. Together we strive to reach a level of excellence that is second to none, with a passion and conviction in our work.

Customer care is very important to us and is based on partnerships and trust built up over time. As our systems are maintenance free, we can concentrate on providing a good service to you and support you with professional advice, in-house installation and customer training.

Within the concept stage we analyse the conditions of your situation on site and carry out test measurements where required. Our measuring systems are able to achieve high levels of precision and reliability even under the most difficult conditions. We remain at your service even after installation and can quickly respond to any queries thanks to remote access options adapted to your needs.



In the course of our international collaboration we have built up a globally networked team for our customers in order to provide advice and support in different countries. We value effective knowledge and qualification management. Our numerous international representatives in the important geographical markets of the world are able to refer to the expert knowledge within the company and constantly update their own knowledge by taking part in application and practice-oriented advanced training programmes.

Customer proximity around the globe: an important element of our success worldwide, along with our broad industry experience.


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SensoTech



ndards **for process analysis.**

n, that **creates new solutions.**

bridled **spirit of development.**

SensoTech is a provider of systems for the analysis and optimization of process liquids. Since our establishment in 1990, we have developed into a leading supplier of process analyzers for the inline measurement of the concentration and density of liquids. Our analytical systems set benchmarks that are used globally.

Manufactured in Germany, the main principle of our innovative systems is to measure ultrasonic velocity and density in continuous processes. We have perfected this method into an extremely precise and remarkably user-friendly sensor technology. As well as the measurement of concentration and density, typical applications include phase interface detection or the monitoring of complex reactions such as polymerization and crystallization.

Our LiquiSonic® measurement and analysis systems ensure optimal product quality and maximum plant safety. Thanks to their efficient use of resources they also help to reduce costs and are deployed in a wide variety of industries such as chemical and pharmaceutical, steel, food technology, machinery and plant engineering, car manufacturing and more.

It is our goal to ensure that you maximize the potential of your manufacturing facilities at all times. SensoTech systems provide highly accurate and reproducible measuring results even under difficult process conditions. Inline analysis eliminates safety-critical manual sampling and is immediately available for your automation system. All parameters can also be adjusted with high-performance configuration tools, so that you can react quickly and easily to process fluctuations.

We provide excellent and proven technology to help improve your production processes, and we take a sophisticated and often novel approach to finding solutions. In your industry, for your applications – no matter how specific the requirements are. When it comes to process analysis, we set the standards.



SensoTech GmbH
Steinfeldstr. 1
39179 Magdeburg-Barleben
Germany

T +49 39203 514 100
F +49 39203 514 109
info@sensotech.com
www.sensotech.com

In liquids, we set the measure.

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