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**SensoTech** 



## **Bath monitoring**

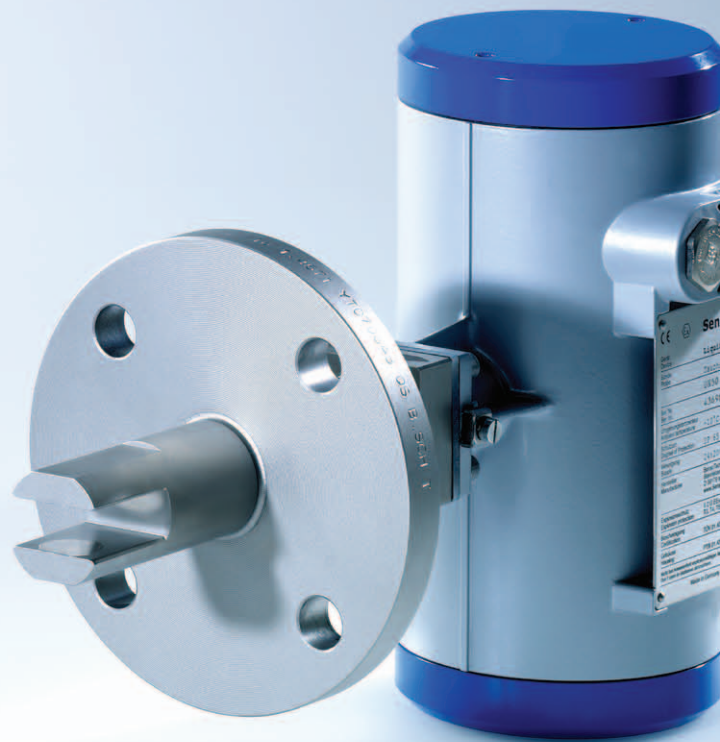
Inline analytical technology for:

- cleaning
- rinsing
- treatment
- hardening
- coating

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Robust, ac



**LiquiSonic®**

quality, **saving resources: LiquiSonic®.**  
-value, **innovative sensor technology.**  
accurate, **user-friendly.**

LiquiSonic® is an inline analytical system for determining the concentration in liquids directly in the production process. The analyzer is also used for phase separation and reaction monitoring. Sensor installation within the product stream means an extremely fast measurement that responds immediately to process changes.

User benefits include:

- optimal plant control through online and real-time information about process states
- maximized process efficiency
- increased product quality
- reduced lab costs
- immediate detection of process changes
- energy and material savings
- instant warning of interruptions in the process water or process liquid
- repeatable measuring results

LiquiSonic's® 'state-of-the-art' digital signal processing technology guarantees highly accurate, fail-safe measuring of absolute sonic velocities and liquid concentrations.

Integrated temperature detection, sophisticated sensor design, and know-how from SensoTech's extensive measurement history in numerous applications promises users a highly reliable, long-lived system.

Advantages of the measuring method are:

- absolute sonic velocity as a well-defined and retraceable physical quantity
- independence from conductivity, color or optical transparency of the process liquid
- installation directly into pipes, tanks or vessels
- robust, all-metal, gasket-free sensor design with no moving parts
- corrosion-resistant by using special material
- maintenance-free
- use in temperatures up to 200 °C (390 °F)
- accurate, drift-free measurements
- stable measurements even amid gas bubbles
- controller connection capacity reaching up to four sensors
- data transmission via fieldbus (Profibus DP, Modbus), analog outputs, serial interface or Ethernet



**Inline process analysis**



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# 1 Processes



The LiquiSonic® analyzer allows a continuous monitoring of cleaning, degreasing, quenching, rinsing and treatment baths in all common industrial surface treatment and cleaning processes.

There is a great variety in different industrial sectors and processes. Among other things, spray or immersion baths are used to remove film like or particulate impurities from components. In baths for surface treatment, for example, anti-corrosion coatings are applied or surfaces are being densified or hardened by active substances.

Technologically, these processes are implemented in individual baths or cascaded. The graphic below shows an example of the use of LiquiSonic® during a treatment step. The analyzer is used for dilution control (initial control) and continuous bath monitoring.

## 1.1 Initial control

During the mixing of bath chemicals from supplied concentrates and the solvent (e.g. water), dilution control for target concentration is necessary as it ensures an efficient use of the materials used with consistent implementation of quality-related parameters. The dilution control can also be done directly in the bath in a separate storage tank.

## 1.2 Bath maintenance

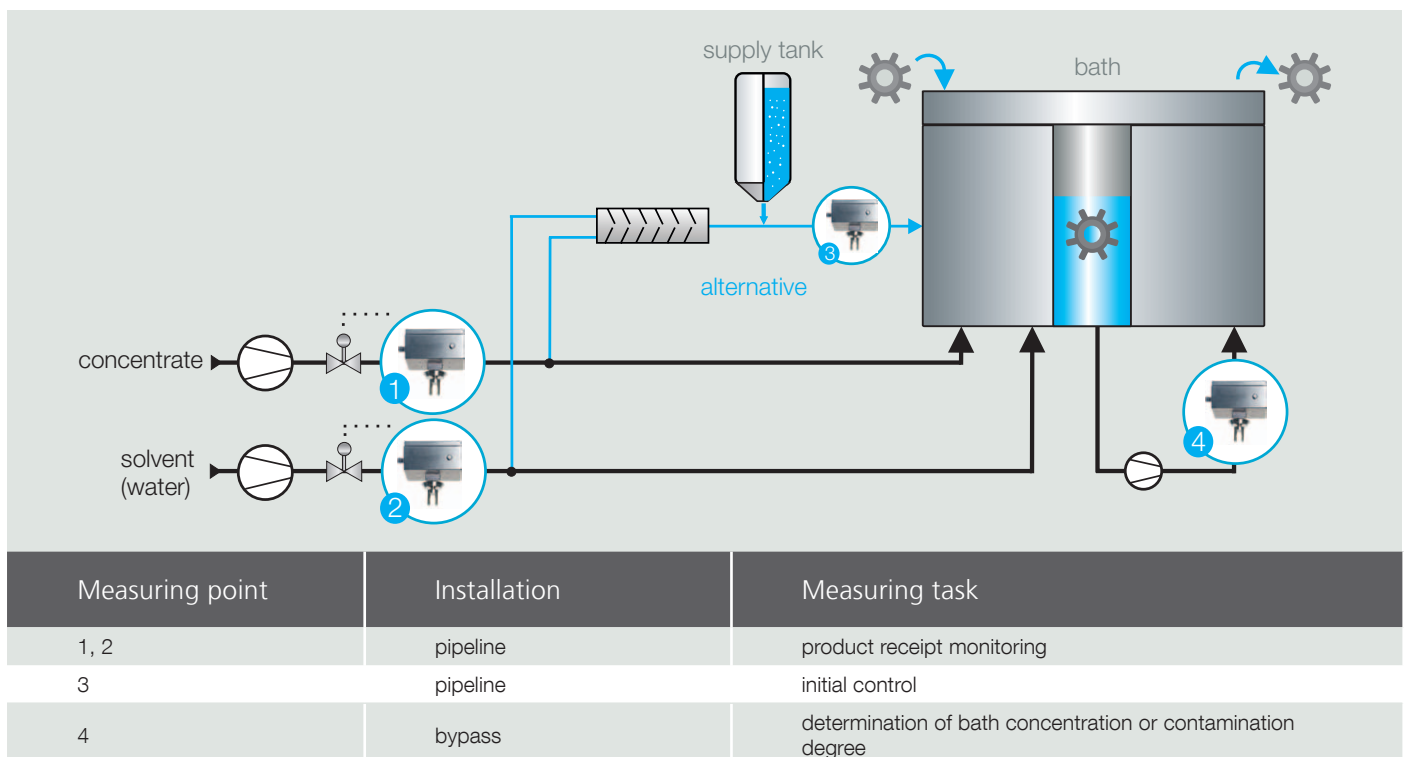
For bath maintenance, process documentation is particularly important. It acts as a direct evidence of the compliance with the quality related parameters „bath concentration“ and „bath temperature“ within the process chain.

Furthermore, information on bath concentration is used in the bath process as automated reaction to the process, in order to „resharpen“ the bath. In the cleaning process, it results into re-dosing of the cleaner or solvent to compensate for carryover or evaporation-related losses.

If cleaning baths are changed in batches, the determination of the contamination degree may be relevant. When the maximum contamination level is reached, a bath change is signaled automatically. The time of bath change is flexible and depends on the intensity of the industrial parts contamination and capacity.

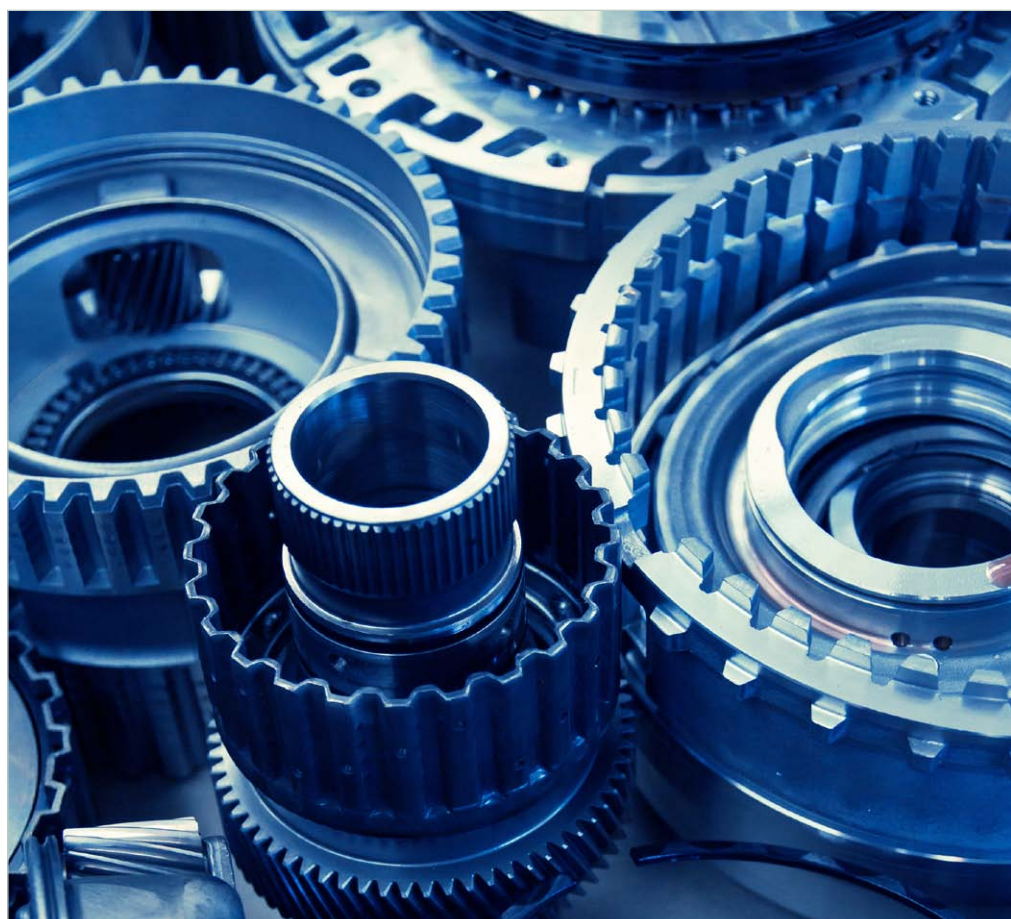
In cleaning baths, LiquiSonic® is successfully used to detect the concentration of different types of cleaner, such as:

- aqueous cleaners, e.g. Vigon
- semi-aqueous cleaners, e.g. Axarell
- nonaqueous cleaners, e.g. n-propanol
- alkaline cleaners, e.g. Wigol VR X VRX 621
- neutral cleaners, e.g. FeroClean N
- acidic cleaners, e.g. Septacid BN-PS



Bath monitoring by the LiquiSonic® analyzer

## 2 Applications





## 2.1 Metal processing

### 2.1.1 Cleaning

In the metalworking industry, different cleaning products are used depending on the cleaning method and surface contamination. These cleaning products usually consist of different components such as tensides and complexing agents, which have a high cleaning power in combination. Only the continuous concentration monitoring of these cleaners ensures a consistently good cleaning result.

Depending on the material of the components, cleaning baths with aqueous or nonaqueous cleaners are used. Different baths are combined in order to achieve a high level of cleanliness of the components. In order to avoid transmission, rinsing baths are put between. Thus, the component is led through various cleaning stages in order to prepare it for coating, for example.

Furthermore, pickling baths are used to etch, modify, passivate or clean surfaces. Mostly, pickling solutions are used, which mainly consist of mineral acids such as hydrochloric acid. The concentration of these acids decreases during the pickling process, while simultaneously the proportion of interfering components such as dirt and contamination increases.

The same effect equivalent to pickling with strong acids occurs in the use of acidic and alkaline cleaners such as Gardoclean. These cleaners remove light oxide layers on the surfaces.

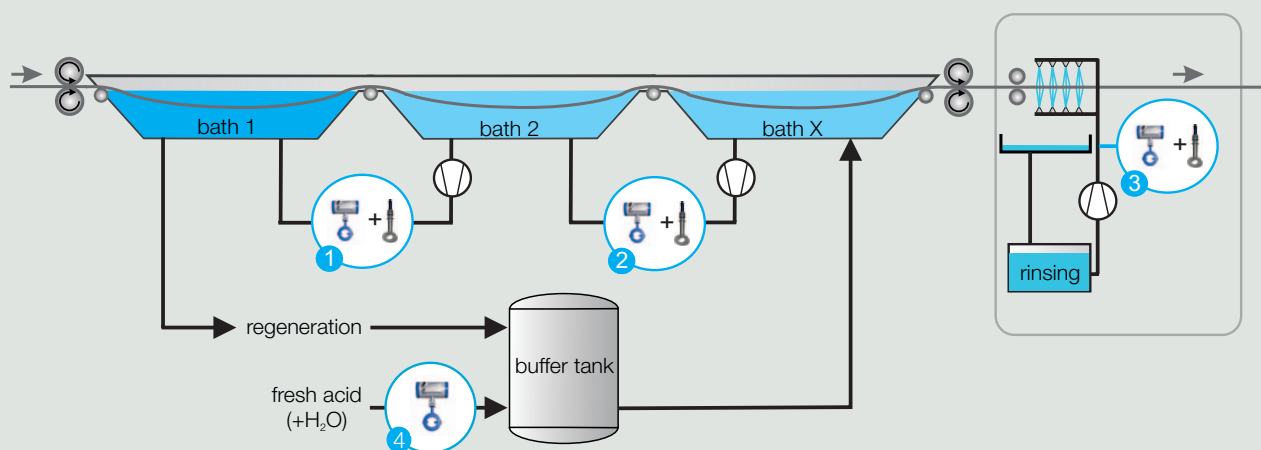
After pickling the metal surface, the acid residues will be removed that eventually accumulate in the rinsing liquid. The cleaning is necessary to stop the surface process and prevent uncontrolled surface activities.

#### Your benefits:

- chemical resistance of the LiquiSonic® sensors through the use of special material (e.g. Halar)
- no running costs, as LiquiSonic® works completely maintenance-free
- reduction of manual sampling and laboratory costs
- signaling when rinsing bath change is required
- avoidance of overdosing and danger of component damages

### 2.1.2 Hardening

Hardening is the process of heating a component to hardening temperature of quench and subsequent rapid cooling (quenching). During this process the component's structure changes, resulting in a significant increase in hardness. As quenchant saline solutions or oils are used, for example.



Measuring point	Installation	Measuring task
1, 2	pipeline or bypass	monitoring the pickling bath
3	pipeline	monitoring the rinsing bath
4	pipeline	concentration measurement and fresh acid redosing control

There is a high correlation between the concentration of the quench liquid and its efficiency. For example, an underdosing can lead to a too strong quenching effect. Consequently, this can cause cracks in the material, which reduce the quality of the final product in terms of the required hardness.

The concentration of the quenchant greatly varies by evaporation or discharge of the hardened parts. The use of a LiquiSonic® online monitoring shows significant advantages, because an undesirable decrease in the concentration will be detected in real time. This rapid intervention, for example a dosage, in the ongoing process is possible. So the risk to produce products of poor quality, will be greatly reduced.

#### Your benefits:

- avoiding incorrect dosages
- preventing cracking
- insufficient hardening in case of overdose
- reproducible results by ensuring a constant quenching
- targeted and efficient process control through in-line measurement and real-time online information
- ensuring optimum hardness of products

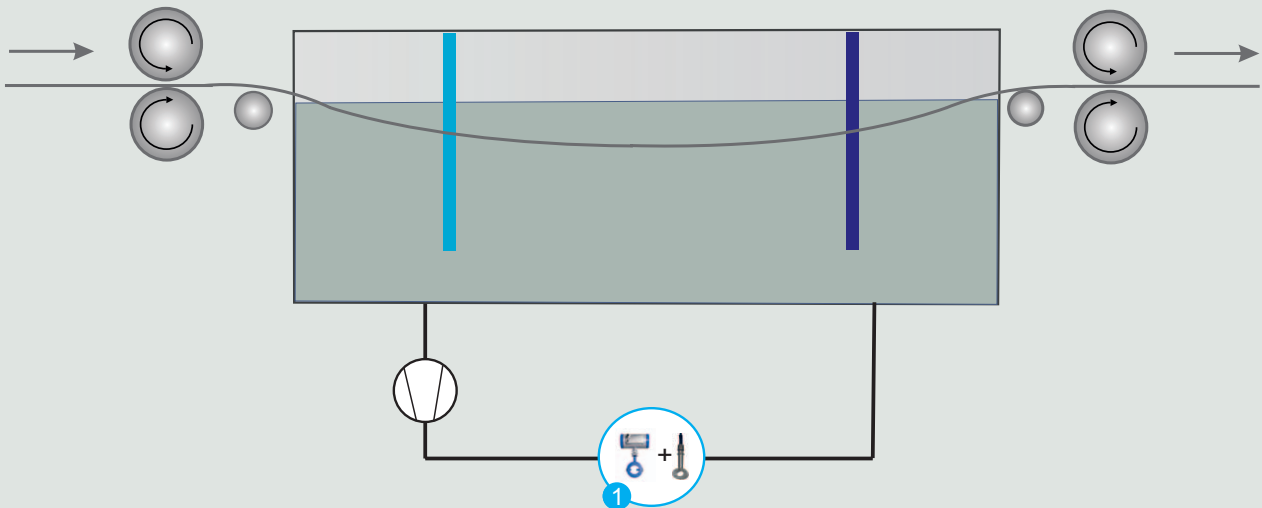
### 2.1.3 Coating

Before each coating, the components are cleaned in regard to the degree of impurity. A high demand for inline analysis is required for coating with liquid substrates such as adhesion promoters or corrosion protection as an effective and efficient coating can be guaranteed through monitoring the concentration and quality of the coating materials.

A corrosion protection of metallic materials can be ensured through the application of protective agents such as Wigol. These inhibit the formation of rust over several weeks. The temporary protection enables a longer storage of the products between the processing steps.

After the coating, another product cleaning is performed in order to remove excess coating material and thus ensure optimum surface quality.

In all these processes, a maximum process safety, a continuous process documentation and optimum use of energy and raw materials can be achieved through an inline concentration monitoring by the LiquiSonic® sensors.



Measuring point	Installation	Measuring task
1	pipeline	determination of the acid and zinc salt concentration

Galvanizing line

### Your benefits:

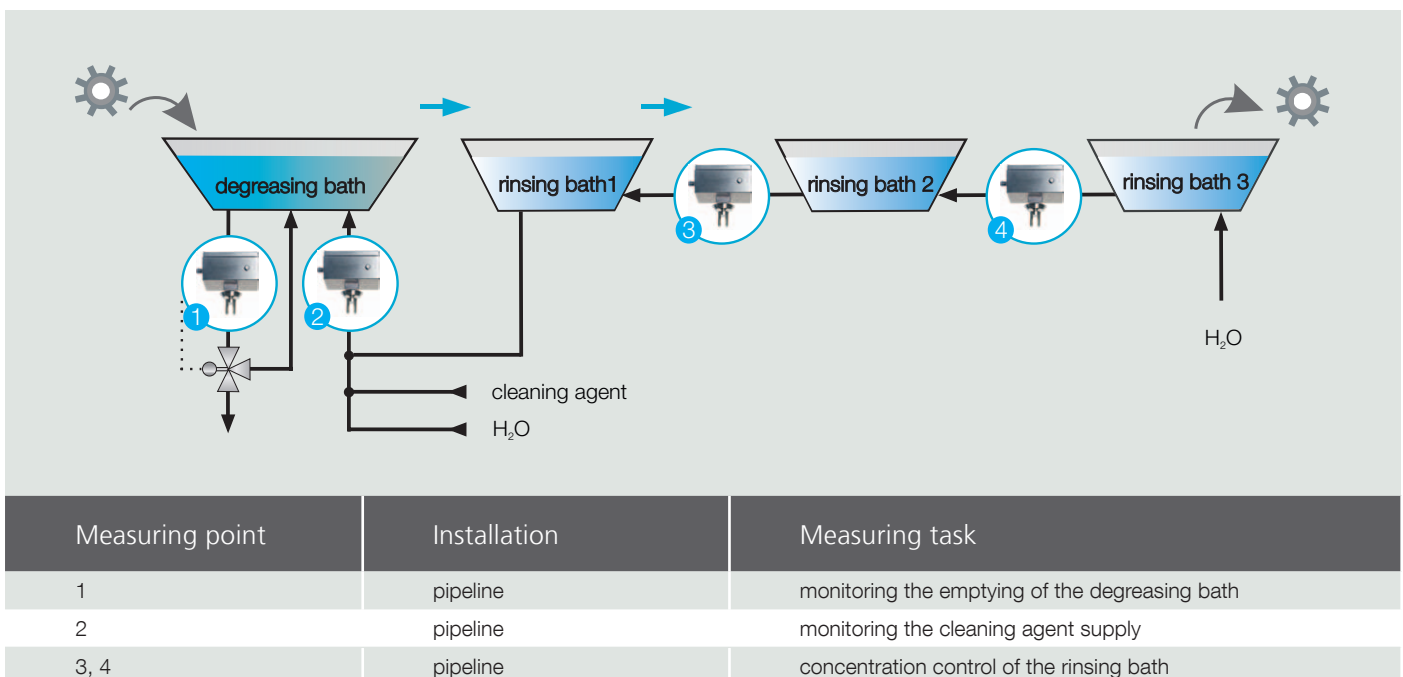
- flexible installation of sensors even in small plants
- avoidance of overdosing and danger of component damages
- optimal set up of the concentration for a resource-conserving handling
- low investment costs as up to four sensors can be connected to one LiquiSonic® controller
- chemical resistance of the LiquiSonic® sensors through the use of special material (e.g. Hastelloy C2000)
- traceability through a continuous documentation of the process control in the internal memory

## 2.2 Automotive and aircraft

In order to meet the cleanliness requirements of specific components and to ensure long-term reliability, impurities such as oil and mineral deposits are removed from finished components in the automotive and aircraft industry. Those impurities are applied during the forming processes, such as turning and milling, and would otherwise result in damages to the component once they are used under extreme loads.

At a high volume of cleaning processes, components are purified with aqueous cleaners such as Hakupur that consists of inorganic ingredients (builder) and tensides. These cleaners can remove oily ingredients well and disperse in the cleaning liquid.

When it comes to components with very high cleaning requirements and complex geometry solvents, such as tetrachlorethylene (perchloroethylene), are often used as they have a very high fat solubility. Additionally, the surface is dried and thus protected against corrosion.



Degreasing cascade

#### Your benefits:

- detection of impurity levels in batch processes and thus display when rinsing bath change is required
- optimal concentration control and thus maximum cleanliness of the component
- fully automatic dosing through the incorporation of the measuring technology into the process control system

In order to maintain the cleanliness, components are temporarily preserved before transport and storage. Depending on the duration of storage and type of preservative the protection lasts from a few hours up to years. An inline concentration monitoring with LiquiSonic® allows a continuous quality control of the preservative, such as Hölteroil, and thus ensures the protection of the components.

## 2.3 Semiconductor

In the semiconductor industry, residues of flux, resin and solder pastes of components and boards (PCB, printed circuit board) are being removed through the use of different types of detergents.

**Aqueous cleaner**, such as Vigon and Atron have the advantage of a very low VOC content (volatile organic compounds), which means that they only have a few volatile components. Furthermore, there are not flash points, so that cleaning plants are not subjected to the requirements of the Ex-protection. In most cases, aqueous cleaners contain tensides as detergent substances, which assimilate the impurities and capture the cleaning liquid.

**Nonaqueous cleaner**, such as Zestron consists mostly of polar solvents, which very well dissolves resins and greases. Frequently, several baths are combined with different solvents. Due to the prevalent requirements, LiquiSonic® sensors are applied that are allowed for the use in potentially explosive atmospheres due to the ATEX / IECEx approval, zone 0 to 2.

**Semi-aqueous cleaners** combine the advantages of both groups. These cleaners, such as Axarel remove flux residues particularly well and hold it in the cleansing agent. The consumption of the cleaner is detected by the LiquiSonic® measuring technology. Furthermore, it enables an automatic post-dosing. As a consequence, the efficiency of the cleaning system is always optimal.

Especially with high-end components and chip fabrication, the quality of cleaning and thus the bath maintenance is of high importance in order to avoid electrical failures and corrosion.

Through the cleaning process, the electronic components are prepared for further processing such as wire bonding, encapsulation or coating. After cleaning, the components are rinsed in several steps in order to remove the detergent. Thereby, rinsing baths are enriched with cleaners. The use of LiquiSonic® enables, for example, the signalization of the change of rinsing bath to avoid a carryover.

#### Your benefits:

- optimal adjustment of the detergent concentration for a resource-conserving handling of the cleaners
- signaling when rinsing bath change is required
- traceability through a continuous documentation of the process control in the internal memory
- use of LiquiSonic® in potentially explosive atmospheres due to the ATEX / IECEx approval
- low investment costs as up to four sensors can be connected to one LiquiSonic® controller
- flexible installation of the sensors even in small plants
- space-saving installation, especially in compact cleaning baths through optional remote sensor electronics



## 2.4 Plastics

In the production of plastic components and polymeric intermediates, surface contaminations such as release agents, abrasion and dust are removed in order to further process the components in subsequent processes. These include, for example, gluing, coating or painting.

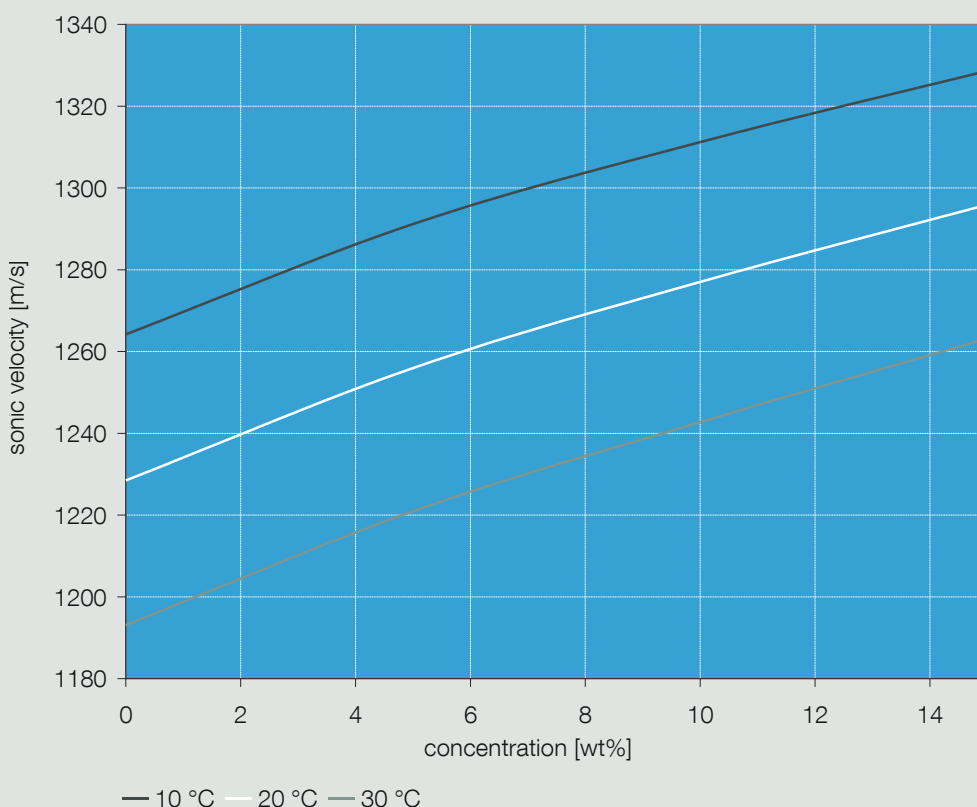
For other products, monomers, inhibitors and other additives must be removed from polymer. Mostly pure solvents like propanol are used to dissolve residual monomers in an optimal way. Often, different cleaning baths are combined with various solvents to achieve the maximum cleaning effect. In order to avoid transmission rinsing baths are put between to ensure that the detergent is being removed from the plastic component.

Plastic components are led through activation baths in order to prepare their surface for painting and coating. Thereby, the reactivity of the surface is being increased. Further surface treatment baths include the application of functional layers, whereby components are for instance immersed into or sprayed with antistatic agents such as Markstat or Antifrog. Especially the food industry and medical technology is experiencing a greater demand of surfaces with anti-bacterial effect.

### Your benefits:

- use of LiquiSonic® in potentially explosive atmospheres due to the ATEX / IECEx approval
- signaling when rinsing bath change is required
- optimal concentration regulation and thus a maximum cleanliness of the components
- low investment costs as up to four sensors can be connected to one LiquiSonic® controller
- traceability, especially in medical technology through a continuous documentation of the process control in the internal memory

### Water in n-propanol



## 3 LiquiSonic® system



The LiquiSonic® system consists of one or more sensors and one controller. One controller manages up to four sensors. These sensors can be installed in different steps as the cleaning systems consist in most cases of several baths or cleaning lines.

### 3.1 Sensors

The ultrasonic sensor has the ultrasonic measuring path and the highly precise temperature detection. Each sensor is autonomous and can be used in different applications. The measurement signal is transmitted 32 times per second, thus ensuring a stable and effective measurement.

The liquid-wetted parts of the sensor are usually made of stainless steel 1.4571. The rugged and completely enclosed design does not need any gaskets or “windows” to the process and is thus completely maintenance-free.

Different additional functions integrated in the sensor like flow stop monitoring and full/empty liquid monitoring in pipes increase the customer's benefit significantly.

A special high power technology ensures stable measurement results, even at high portions of gas bubbles and strong signal attenuation by process liquid.

Using cleaning baths in hazardous areas, sensors approved by ATEX and IECEx, zone 0 to 2, can be installed.

The sensor electronics is mounted in a closed stainless steel housing with IP68 degree of protection.

The sensors are preferably installed after the pump in circulating systems. Due to the option of separated electronics, the sensors can be installed in mini-plants with limited space. In case of low liquid flows, flow meter adapters having a minimum dead volume are used.



Immersion type sensor Clamp with separated electronics



Tri-clamp adapter for little pipelines

### 3.2 Controller

The controller 30 is an efficient and powerful evaluation unit that analyzes and visualizes the measuring data. The displayed value can be adjusted to plant internal reference values.

All process data will be updated every second. If the measuring results exceed or fall below thresholds, a signal will be sent immediately.

The measuring data can be transmitted via adjustable analogue or relay outputs as well as via different fieldbus interfaces or network to process control systems or PCs. Thus, the re-dose of the cleaner or the change of bath liquid can be regulated automatically.

The controller has a data log that fully stores the measuring results and serves as proof of compliance with the process parameters during audits.. With the software SonicWork, it is possible to read out the data log and to create easily process reports. If the process conditions change, the user can adapt or reload product data sets.

In addition, an event logbook is integrated in the controller. In this memory, events such as manual product change or alarm messages occurred are documented.



LiquiSonic® 30 controller with stainless steel housing

## 4 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.



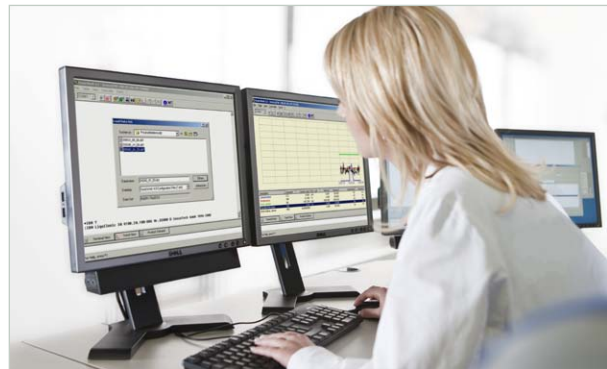
Creative research is another pillar of our company. The specialists in our research and development team provide valuable new ways to optimize product attributes, such as testing new types of sensor designs and materials or the sophisticated functionality of electronics, hardware and software components.

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 programs.

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

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**SensoTech**



Always exchange  
device is powered off!

Ethernet  
LNK  
ACT



standards **for process analysis.**  
n, that **creates new solutions.**  
bsolute **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 liquid concentration and density. 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. Beyond 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® measuring and analysis systems ensure optimal product quality and maximum plant safety. Thanks to their enhancing of 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 repeatable measuring results even under difficult process conditions. Inline analysis eliminates safety-critical manual sampling, offering real-time input to your automated system. Multi-parameter adjustment with high-performance configuration tools helps you 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.

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In liquids, we set the measure.