



## Steel and rolling mills

Inline analytical technology for:

- monitoring of pickling bath
- acid regeneration
- emulsion control
- electrolytic galvanizing
- roller chrome plating

Increase quality, save resources: LiquiSonic®.  
With high-quality, innovative sensor technology.  
Robust, precise, user-friendly.

## LiquiSonic®

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 life system.

### Advantages of the measuring method are:

- absolute sonic velocity as a well-defined and retraceable physical quantity
- independent 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

## Inhalt

LiquiSonic®	2
Processes	4
<b>Introduction</b>	<b>4</b>
<b>Pickling</b>	<b>5</b>
<b>Acid regeneration</b>	<b>6</b>
<b>Cold rolling</b>	<b>6</b>
Reversing mill	7
Tandem mill	7
<b>Electrolytic galvanizing</b>	<b>8</b>
<b>Roller chrome plating</b>	<b>9</b>
<b>Further applications</b>	<b>9</b>
LiquiSonic® System	10
<b>LiquiSonic® 20 and 30</b>	<b>10</b>
<b>LiquiSonic® 40</b>	<b>11</b>
<b>Accessories</b>	<b>12</b>
Controller and field housing	12
Fieldbus	12
4G-industrial router	12
Network integration	13
Quality and Support	14
SensoTech	15



# Processes

## Introduction

In the steel production, the LiquiSonic® measuring technology is used in numerous process levels to optimize operations. With this technology it is possible to save process chemicals, such as acids and cooling lubricants without influencing the surface finish negatively. Thus, the online measuring technology ensures a permanent and consistently high quality of products.

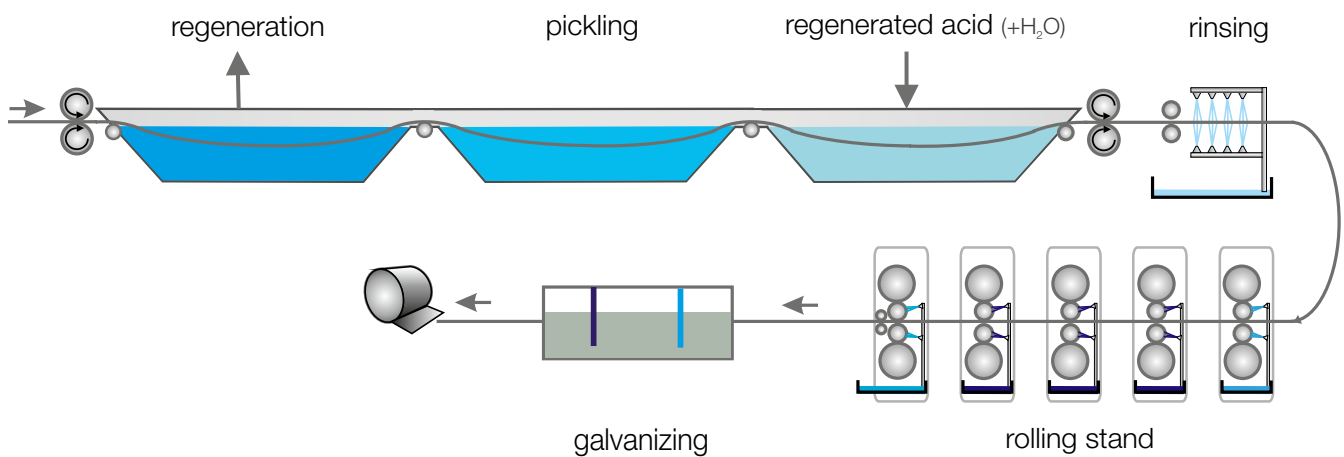
In the following, applications in pickling bath and cold rolling processes are demonstrated as examples, whereas related measuring tasks are used in further processes. Regarding the measuring technology, hydrochloric acid pickling solutions do not differ from sulfuric acid pickling solutions. The surface finish is explained, for example, within the galvanizing process in the following.

For the concentration determination of different process liquids, the LiquiSonic® measuring technology is integrated into process engineering operations for the steel production. The device is in two different versions available, the LiquiSonic® 30 and LiquiSonic® 40. Both devices detect the new process status within seconds and transfer the data volume to the Process Control System.

LiquiSonic® 30 consists of up to four sensors and a controller. Ultrasonic sensor has the actual ultrasonic measuring path and the highly precise temperature detection. The sensors are connected with the controller digitally to enable a fail-safe data exchange. The controller calculates and presents the concentration as well as communicates with the user. A modern touchscreen enables an easy handling. After system installation, the controller display shows directly the desired concentration.

For the measurement of tertiary blends, it is possible to calculate a further measured quantity, for example conductivity, in addition to the sonic sensor. In pickling solutions, the LiquiSonic® 40 system can detect the individual components, such as acids and metal salts, apart from each other.

LiquiSonic® has been proven at customers worldwide and performs the measuring tasks successfully over decades, as the advantages like robustness and being maintenance-free especially satisfy in rough environments of the steel production.



Overview of the specific process steps in the steel production

# Pickling

Pickling baths are used downstream of the hot rolling process, but also in many other fields of the metal-working industry to remove, modify, passivate or clean surfaces in a defined manner.

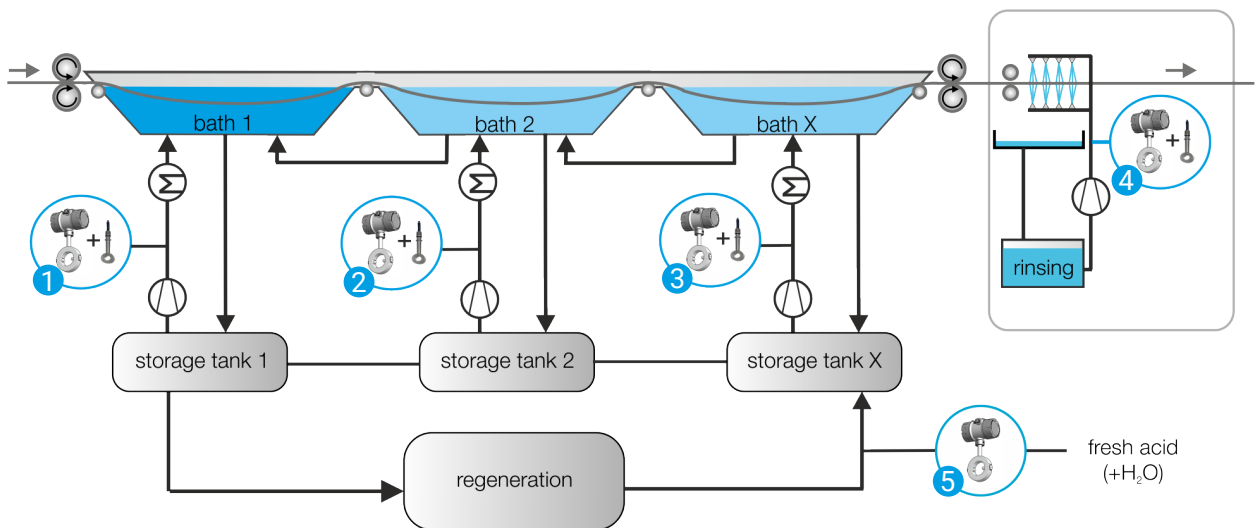
To this end, pickling solutions are employed, mainly consisting of a mixture of mineral acids. The concentration of these acids decreases during the pickling process, whereas the portion of disturbing components such as contaminations and carry-over increases.

## Pickling process

The LiquiSonic® measuring technology provides a solution for online measurements of pickling bath concentrations facilitating redosing of the required quantity of fresh acid. This ensures a continuous, optimum pickling bath quality. Delays in time as a result of sampling and lab analyses are avoided.

To date, LiquiSonic® is used successfully for the pickling bath applications listed below:

- sulfuric acid ( $H_2SO_4$ )
- phosphoric acid ( $H_3PO_4$ )
- hydrochloric acid (HCl)
- nitric acid ( $HNO_3$ )
- hydrofluoric acid (HF)



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

Beizprozess

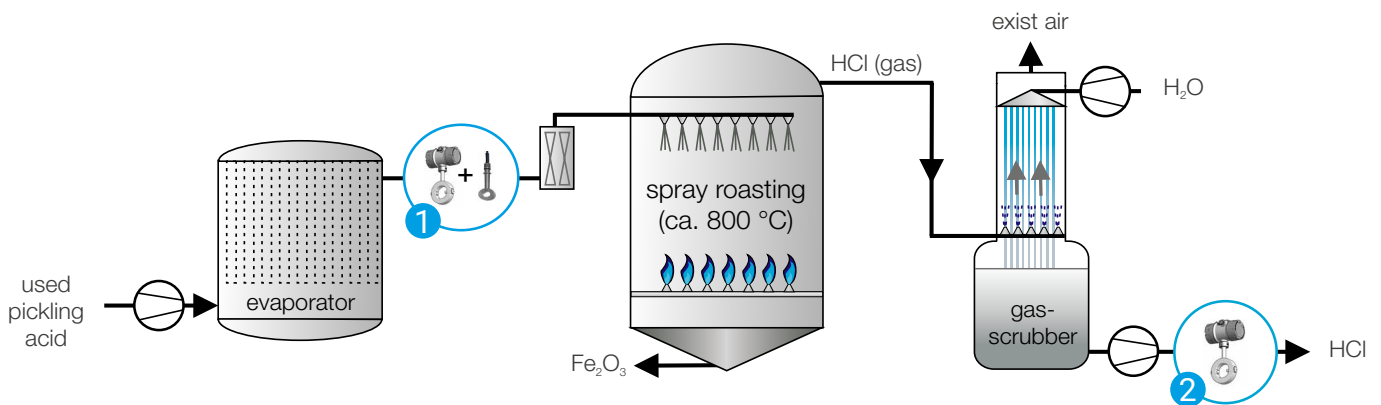
## Acid regeneration

In the regeneration, the used pickling acid is refreshed and removed from contaminations such as iron salt. The type of the procedure depends on the respective used pickling acid. A very known procedure is the crystallization for the recovery of sulfuric acid as well as the spray roasting or buttering-floating procedure for the recovery of hydrochloric acid. A further procedure, which is used for mixed acids, is the dialysis, but also ion exchangers are employed.

Before the used pickling acids will be cleaned, they are evaporated to concentrate the acid. After that the acid is separated, whereas the cleaned acid will be added to the pickling process and the resulting metal oxides are used as valuable raw materials in other industry sectors.

In most of the pickling baths, hydrochloric acid (HCl) is used, whereas iron salt ( $\text{FeCl}_2$ ) arises during the process. The resulting used pickling acid will then be refreshed in the spray roasting procedure. The following chart demonstrates the application of LiquiSonic®.

After the evaporation, the LiquiSonic® 40 system is used to determine the acid and the metal salt apart from each other. At the end of the regeneration, the LiquiSonic® 30 system is used to detect solely the acid concentration, as the metal salts have been removed before.



Measuring point	Installation	Measuring task
1	pipeline	3-component measurement, e.g. HCl and $\text{FeCl}_2$ in $\text{H}_2\text{O}$
2	pipeline	control the fresh acid

Roasting process

## Cold rolling

During the cold rolling process (typically 40 to 70 °C), the thickness of the rolling stock will be reduced. Process technical liquids such as rolling oil emulsions, temper rolling liquids or process detergents. Typically, these process liquids are circulated and regenerated in closed circuits.

SensoTech offers tried and proven solutions to ensure continuous quality control of these liquids for numerous typical suppliers such as Quaker, Henkel or Houghton. LiquiSonic® for rolling mills are successfully employed for all types of rolling stands and treatment plants for stainless steels, but also for carbon steels and non-ferrous metals (e.g. aluminium).

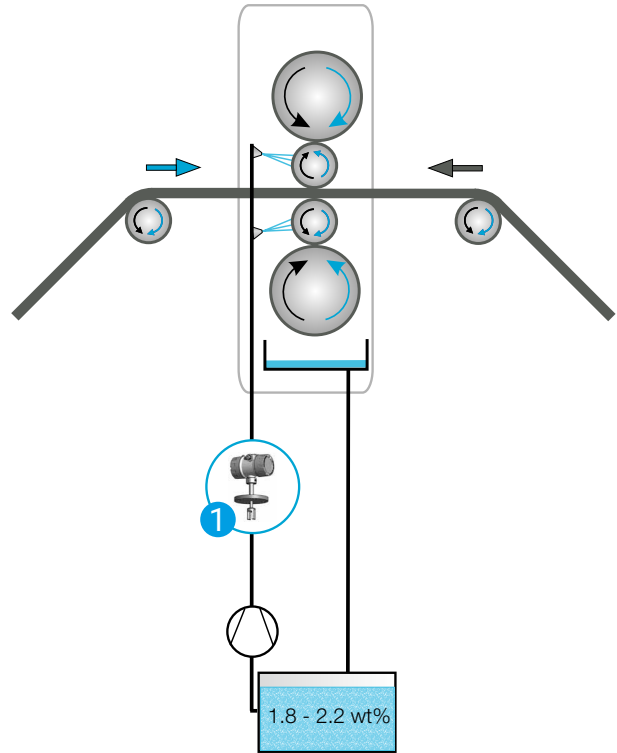
In a specific application such as reversing mill and tandem mill, the concentration of the rolling oil-in-water emulsion is directly measured in the transport pipeline from the emulsion tank to the rolling stand and controlled at a constant concentration level. This prevents variations in the quality of the rolling stock caused by over and under lubrication. Such effects mainly occur as a result of unavoidable water loss and foreign oil carry-over, like high-performance circulating oil and hydraulic oil.

## Reversing mill

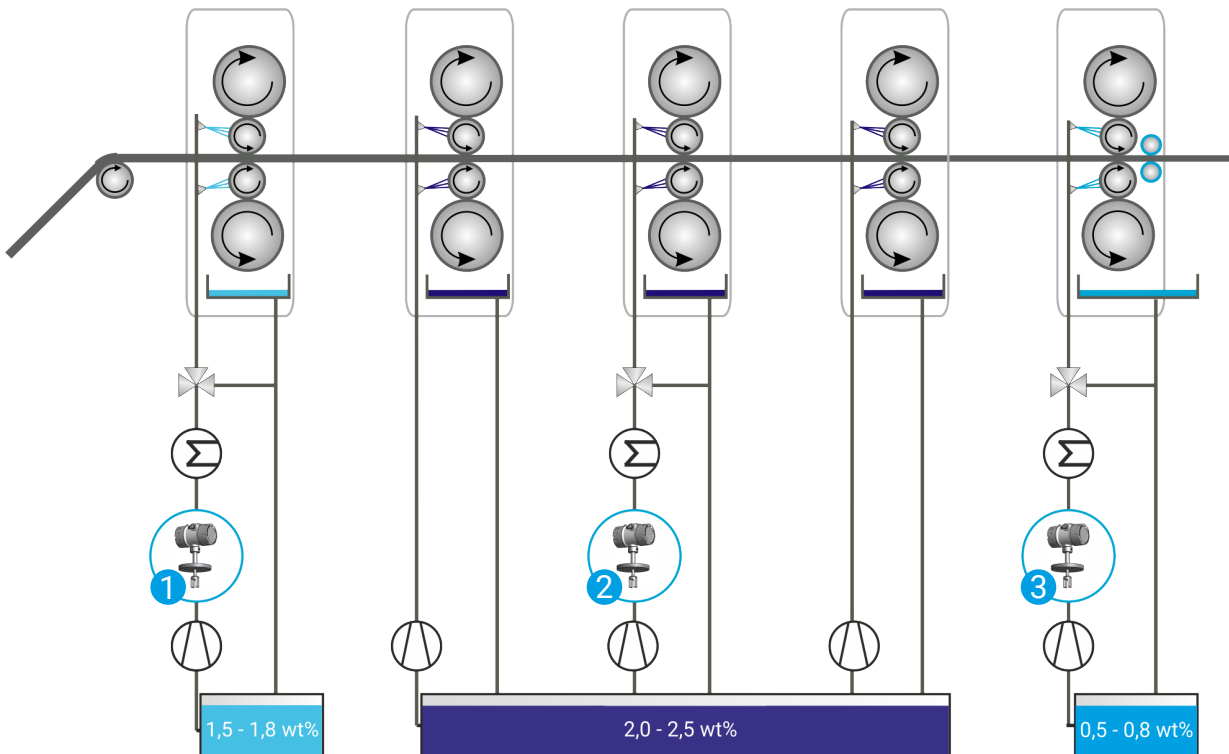
In reversing mills, the rolling oil will run for several times through the mill (passes). This is beneficial for production plants with low capacity and for having of a better microstructure.

## Tandem mill

The tandem mill is used in larger production plants, as the metal strip is running continuously to ensure a higher throughput. By using different emulsion concentrations an optimal surface finish can be guaranteed.



Application area of LiquiSonic® at the reversing mill



Measuring point	Installation	Measuring task
1 2 3	pipeline	monitoring of rolling oil-water emulsion

Application areas of LiquiSonic® at the tandem mill

# Electrolytic galvanizing

In order to modify the surface of steel concerning properties, such as corrosion resistance, it is required to galvanize the steel. There are different possibilities, such as electrolytic galvanizing or hot galvanizing.

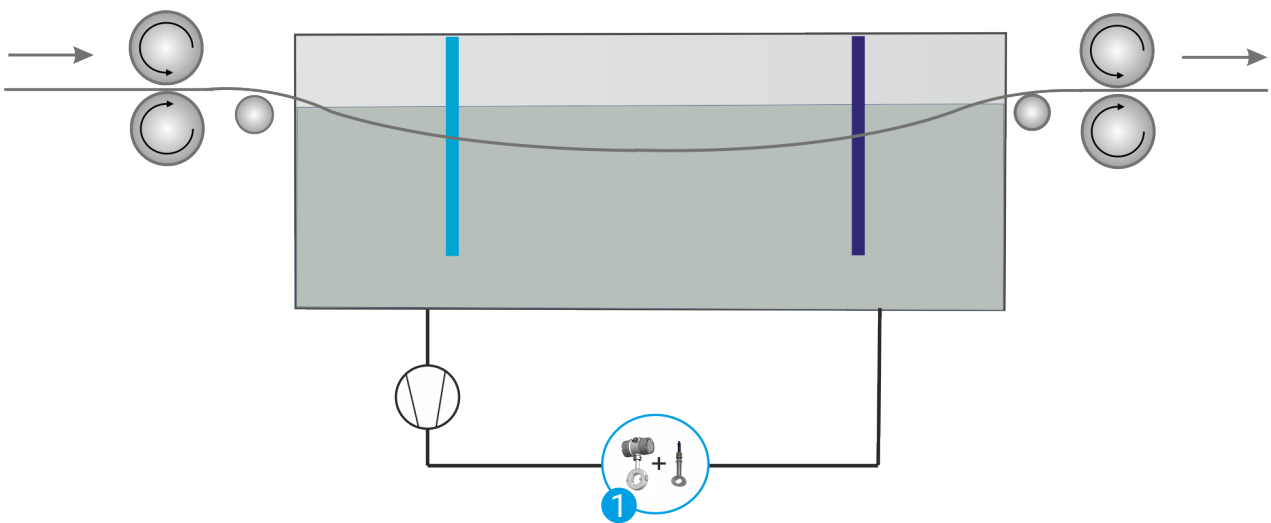
The ultrasonic measuring technology has been established particularly in the continuous electro-galvanizing to achieve layer thickness from 2.5 to 7.5 µm. By means of direct current in an aqueous solution, the steel strip is coated with zinc from 18 to 54 g/m<sup>2</sup>. The electrical fields of the zinc bath have no influence on the measuring technology.

The composition of the electrolyte is of essential importance for the coating result, whereby zinc salt is the principle component that should be applied on the surface of the steel. Depending on the application, the electrolytes are either acidly or alkaline and contain additives in traces to optimize the coating result.

When using the LiquiSonic® 40 system, concentrations of the electrolyte can be determined separately. By determining the zinc salt and the acid, it is then possible to control the re-dosing in order to keep the zinc bath in the optimal concentration and to ensure a high quality of coating.

By using special materials and coatings, such as HALAR (also known as E-CTFE) or PFA having a chemical resistance against a number of liquids, the sensors determine the concentration maintenance-free over years.

LiquiSonic® measurement technology is also successfully used by operators for other galvanic processes such as electroplating. With the precise real-time measurement of PSA (Phenolsulfonic Acid), MSA (Methanesulfonic Acid), and tin sulfate, operators can optimize their process control, reduce the need for time-consuming laboratory analysis, and increase the efficiency of their production processes.



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

Verzinkungsanlage

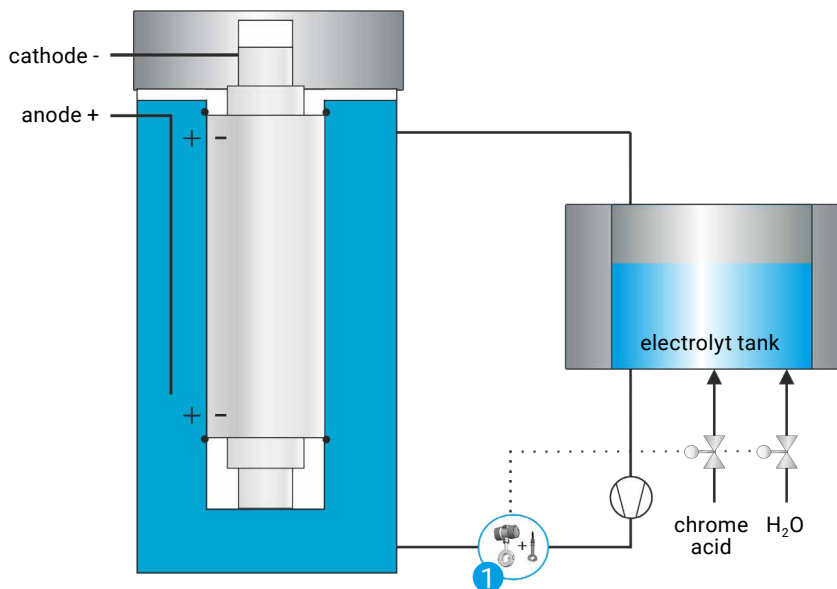


## Roller chrome plating

There are different methods of the plating process for working and skin pass rolls, which are used for the forming process in the steel industry. By performing these plating processes, the roll surface becomes harder and the wear can be reduced. Beside this, it is also possible to generate targeted surface structures of rolls, which cause optimal embossing characteristics on the roll product. This is important for downstream processes like galvanizing or painting of the roll product to ensure excellent adhesive properties. In the forming process, lubricating and slip properties are also dependent on the quality of the roll surface, because adhesive properties can be improved.

The most famous methods for roll plating are melting and galvanization or electroplating. The electrolytic chrome plating is widely used specifically in the galvanic process. Here, the rolls are inserted in a chrome bath filled with a chrome electrolyte, in which are several anode electrodes. As the roll is used as a cathode, the chrome ions are deposited metallically on the roll surface.

The LiquiSonic® measuring technology detects the individual components of the chrome electrolyte, such as chrome acid and sulfuric acid. Therefore, the process safety can be increased as well as the continuous sharpening can be automated and optimized.



Measuring point	Installation	Measuring task
1	pipeline	monitoring of sulfuric acid and chrome acid strength

Chrome bath with LiquiSonic® measuring point in the transmission line

## Further applications

The range of LiquiSonic® applications in the steel production is wide. Besides pickling and chrome baths, acid regeneration, cold rolling and electrolytic galvanizing the LiquiSonic® systems have been tested and used successfully in the following applications:

- concentration monitoring of temper fluids
- emulsion control of cutting and drilling fluids
- detection of flotation and decomposing agents for the production of raw materials
- detection of leakage in waste water
- quenchant control
- cooling bath control in power plants

Even for new applications, we provide the best possible solutions. With our unique technical knowledge, we are the specialists for ultrasonic measuring systems in the field of innovative measuring and analytical processes. This knowledge is also adapted in tailor-made and customized applications to develop solutions.

The extensive knowledge and the experiences increased from numerous applications of our well-educated employees help to devise unexpected solutions for new challenges.

The application specialists of SensoTech have detailed knowledge of the specific requirements to the fields of application and fully immerse themselves in the tasks demanded by customers. Each SensoTech device is perfectly adapted to industry-specific conditions of the installation place, so that we ensure the suitable solution with high quality even for extraordinary measuring tasks and applications under difficult conditions.



# LiquiSonic® System

## LiquiSonic® 20 and 30

The LiquiSonic® system consists of one or more sensors and one controller.

The ultrasonic sensor has the actual ultrasonic measuring path and the highly precise temperature detection.

The controller 30 is a highly efficient device which includes up to four sensors. They can be installed in different steps with a standard maximum distance of 1,000 m between controller and sensor. As option, higher distances are possible.

The controller 20 is a variant with a reduced scope of functions and only to one sensor connectable.

For use in hazardous areas, the immersion sensor Ex 40-40 is approved by ATEX and IECEx certification (Ex d IIC T1 to T6 Ga/Gb, zone 0 / zone 1) and FM certification (Class I, Division 1, Groups A, B, C, DT1-T6).

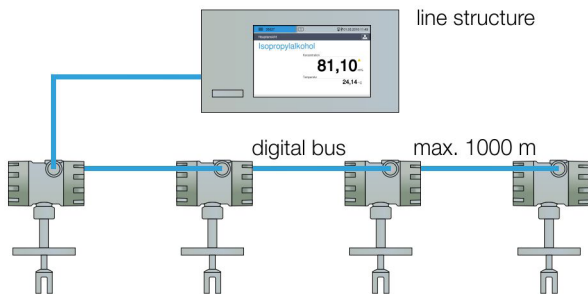
The controller 30 processes and displays the measuring results. The operation via the high resolution touch screen is easy and intuitive. Secure network integration including web server allow operating the controller alternatively via a browser with a PC or tablet.

The process data is updated every second. The displayed value can be adjusted to internal reference values. If the measuring values exceed or fall below the threshold, the display shows an alarm message and a signal will be sent immediately.

The data can be transmitted in several defined analog or digital forms or through different fieldbus interfaces to communicate with process control systems or computers.

The controller features an integrated data logger which can store up to 2 GB of process information with up to 32 (optional 99) data sets for different process liquids. For processing on the PC, the data can be transferred via network or USB port. In addition, the controller enables easily creating process reports for documentation purposes.

The event log records states and configurations such as manual product switches, alarm messages or system states.



Controller with connection of maximum four sensors

Each sensor works autonomous and can be used in different applications. The liquid-wetted parts of the sensor are made of stainless steel DIN 1.4571 as standard. The rugged, completely enclosed design requires no gaskets or "window", making it totally maintenance-free.

Additional sensor features such as flow / stop or full / empty pipe monitoring greatly advance process control. The LiquiSonic® high-power technology stabilizes measuring results, even when facing gas-bubble accumulations or large-scale signal attenuation through the process flow.

The special sensor electronics are integrated in a closed die-cast housing with a protection degree of IP65. If necessary, the electronics housing can be mounted apart from the sensor.



Immersion sensor Ex 40-40

# LiquiSonic® 40

The LiquiSonic® 40 analyzer enables the determination of concentration in 3-component liquids. For example, in neutralization processes it is possible to determine separately the concentration of the scrubbing solution and the salt.

The measuring principle is based on the fact that concentration changes of individual components of a liquid affect physical quantities like sonic velocity, conductivity or density. This characteristic is stored as calculation mode in the evaluation unit (controller) to convert the physical variables in concentration values.

With the parallel detection of two physical variables (sonic velocity and conductivity), it is possible to determine two concentrations at the same time.

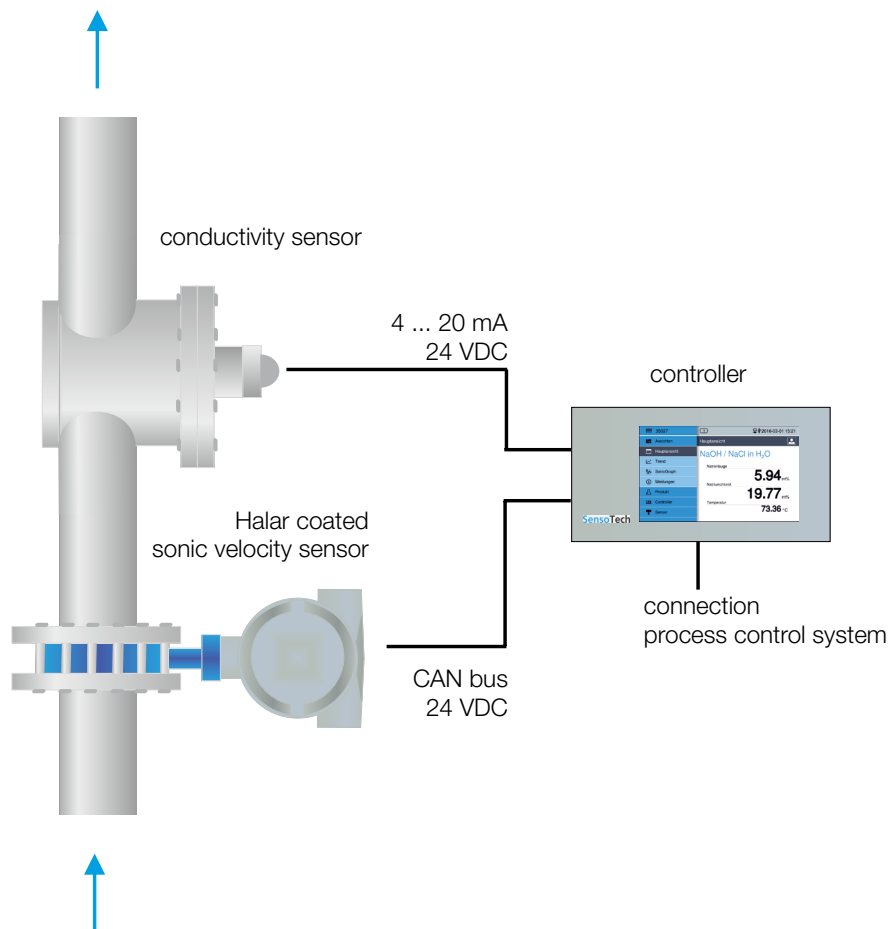
The measuring values are available for the user or process control system over analog outputs as well as fieldbus.

For the application in aggressive liquids, the standard LiquiSonic® 40 is equipped with a Halar (also known as E-CTFE) coated flange sensor and a PFA or PEEK coated conductivity sensor, which are chemically resistant to a number of substances.

The flange sensor has a highly efficient ultrasonic ceramic to ensure the measurement even at high portion of gas in the liquid. For the application in hazardous areas, the flange sensor has an ATEX and IECEx approval (II 1/2 G / Ex d IIB T1 to T6 Ga/Gb).



LiquiSonic® controller and Halar coated flange sensor



LiquiSonic® 40 measuring point

# Accessories

There are several possibilities to install the LiquiSonic® analyzer appropriately and to facilitate the integration into the process control system. The following products have proved to be useful.



Controller housing 19" 4 HU

## Controller and field housing

The controller is designed for rack-mounted systems. It is alternatively available with a 19" housing 4 HU.

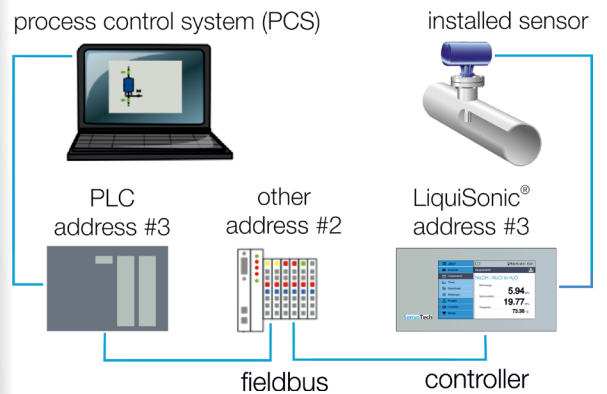
In order to be able to mount the controller into the field, two variants of field housings made of plastic or stainless steel can be delivered, which meet on-site conditions in an optimal way.

- material: anodized aluminum
- dimensions: 482.9 (19") x 177 (4 HU) mm
- application: rack-mounted system

## Fieldbus

The fieldbus option provides the possibility to integrate the controller in a PCS or to automate the process flow via PLC. Beside the transfer of measuring values like concentration and temperature it is also possible to exchange parameters and control data (for example product switch).

The controller supports different fieldbus systems and follows the standards recommended by the respective standards organizations. Common variants are Modbus and Profibus DP.



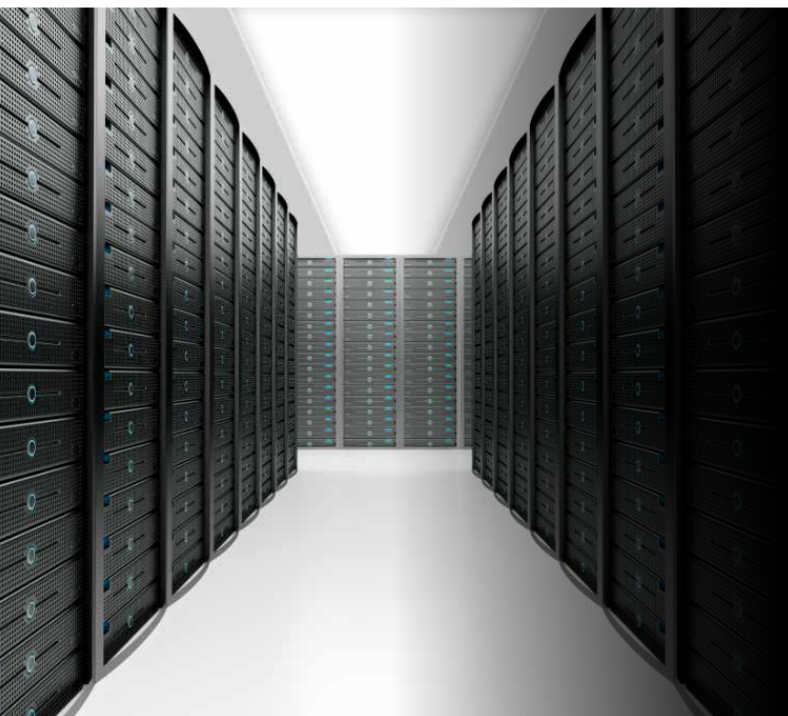
Connection interfaces

## 4G-industrial router

With a 4G-industrial router it is possible to operate the LiquiSonic® controller remotely. For this purpose, the controller is connected to the 4G-industrial router and appropriate IP address must be entered in the browser on the PC.

The remote connection includes the following features:

- uploading new product data sets on the controller
- reading out the controller data storage, e.g. to record product data for unknown liquids
- monitoring and configuration of the controller and sensors
- worldwide and fast customer support by SensoTech service



## Network integration

The LiquiSonic® controller has an Ethernet interface, that makes the integration into the corporate network possible. After entering the user name and password, the access to the stored logs is possible.

Integrating the controller into the network enables remote control, view of status information, transfer of product data sets or calibration of products.

The Network integration includes

- web server (HTTP),
- command line (TELNET),
- file transfer (FTP),
- time synchronisation (NTP),
- e-mail notification (SMTP).



# 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 center 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 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 analyze 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.



In liquids, we set the measure.  
With innovative sensor technology.  
Tough, accurate, user-friendly.

# SensoTech

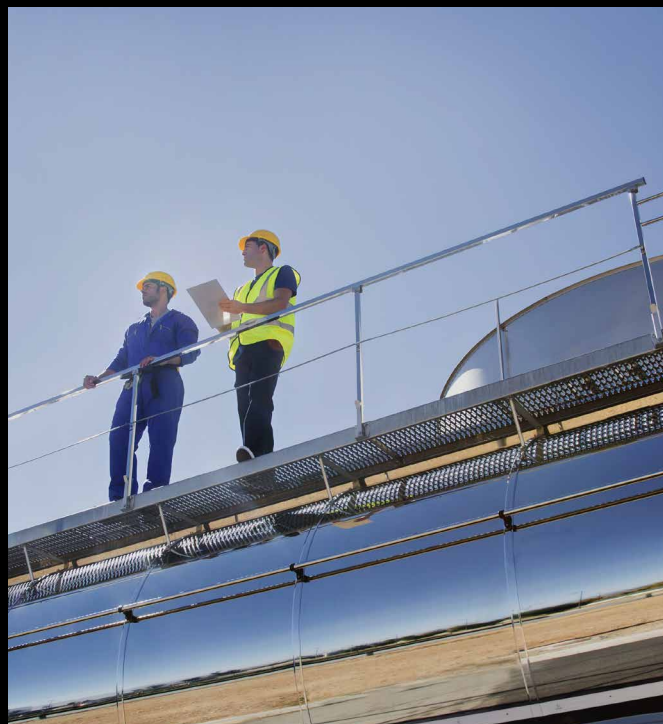
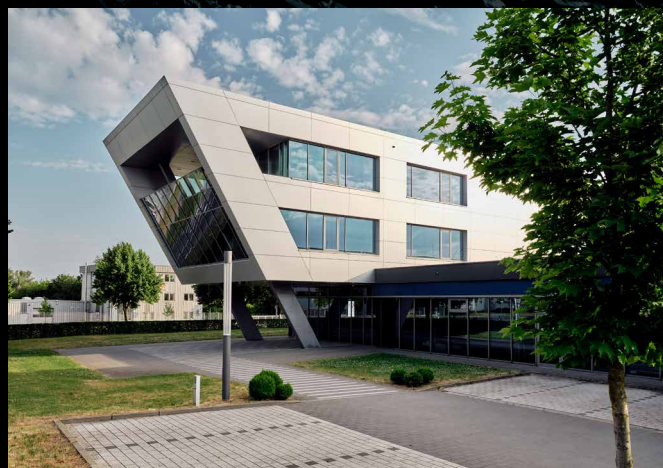
**SensoTech** is a provider of systems for the analysis and optimization of process liquids. Since our establishment in 1990, we have developed into a leading supplier of process analyzers for the inline measurement of liquid concentration and density. Our analytical systems set benchmarks that are used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

Manufactured in Germany, the main principle of our innovative systems is to measure ultrasonic velocity 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.





**SensoTech GmbH**  
Steinfeldstraße 1  
39179 Magdeburg-Barleben  
Deutschland  
+49 39203 514 100  
info@sensotech.com  
www.sensotech.com

**SensoTech Inc.**  
69 Montgomery Street, Unit 13218  
Jersey City, NJ 07303  
USA  
+1 973 832 4575  
sales-usa@sensotech.com  
www.sensotech.com

**SensoTech (Shanghai) Co., Ltd.**  
Room 609, Bldg.1, No.778, Jinji Road.  
Pilot Free Trade Zone, 201206 Shanghai  
China  
+86 21 6485 5861  
sales-china@sensotech.com  
www.sensotechchina.com



LSM136\_01\_16