



# Hydrofluoric acid

- Inline analytical technology for:
- concentration & density
  - limit monitoring
  - blending
  - alkylation

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Robust, ac



**LiquiSonic®**

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

-value, **innovative sensor technology.**

curate, **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:

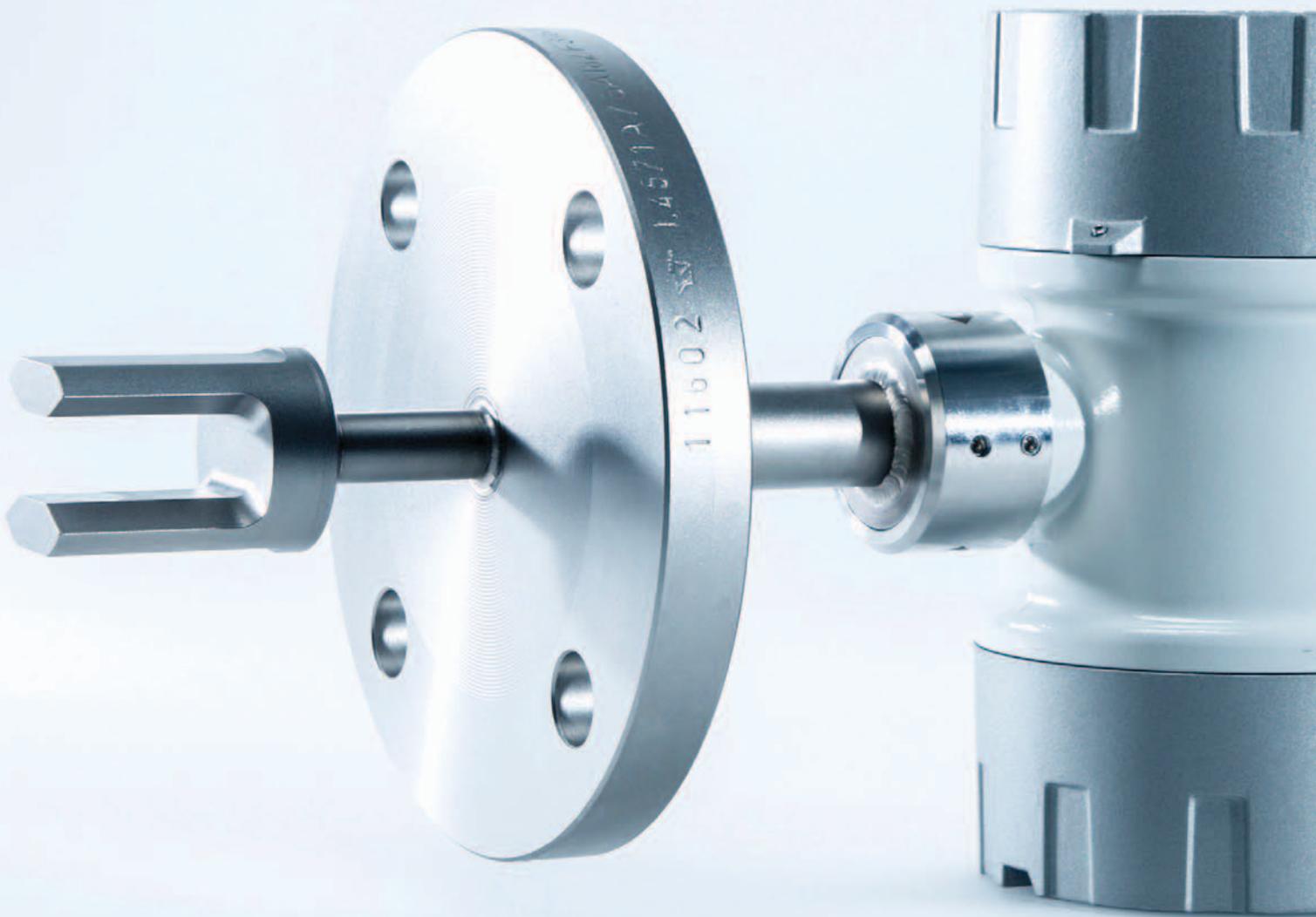
- optimal plant control through online and real-time information about process states
- maximized process efficiency
- increased product quality
- reduced lab costs
- immediate detection of process changes
- energy and material savings
- instant warning of interruptions in the process water or process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



## 1.1 Concentration measurement in binary liquids

Sonic velocity depends on substance compressibility and density. With a known distance ( $d$ ) between the sonic transmitter and receiver, sonic velocity ( $v$ ) can be computed simply by clocking the travel time ( $t$ ) of the sonic signal ( $v = d / t$ ).

Using sonic velocity, the control unit calculates the concentration or density of the liquid. Various other concentration measures are also possible to gauge, e.g. Brix, solid contents, or original gravity.

The ultrasonic meter has no moving mechanical parts and is virtually wear-free and ageless. Typical sensor design configures both the transmitter and receiver within a single durable construction.

This method pinpoints liquid concentration values optically independent of fluid color or transparency with excellent reliability and accuracy within  $\pm 0.1$  m%.

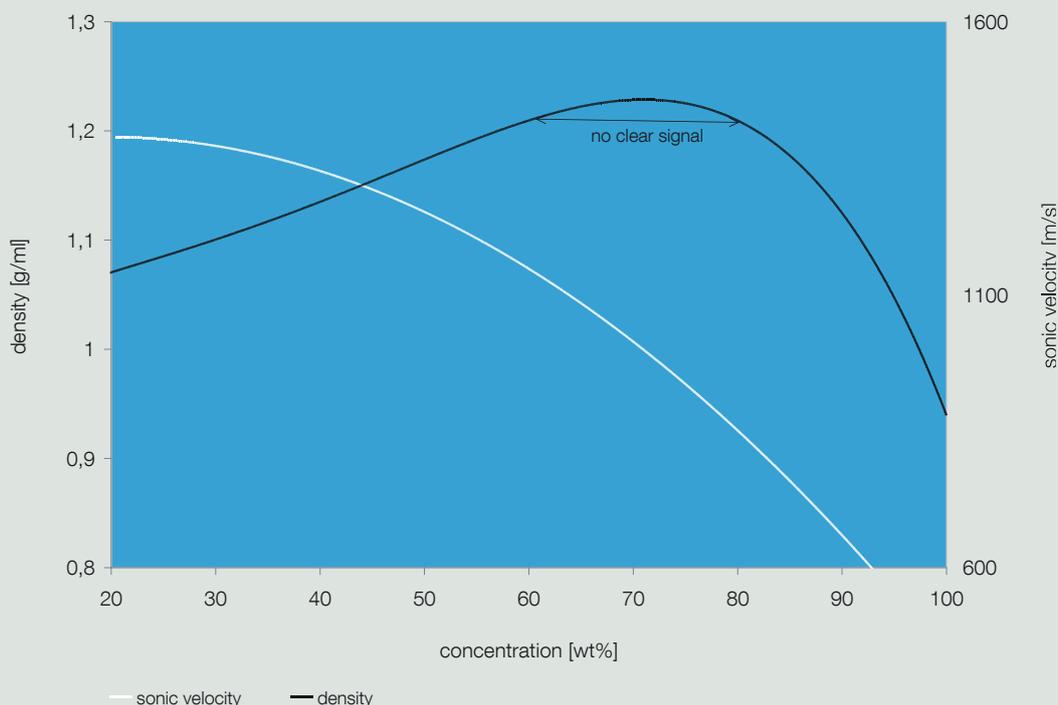
The graph below depicts the dependence of both sonic velocity and density on the hydrofluoric acid concentration (HF in wt%). Because sonic velocity is quite sensitive to hydrofluoric acid concentration, the LiquiSonic® sensor generates a clear signal, thus measuring reliable process information continuously.

Density detection is somewhat limited with unclear signals at HF-concentrations between 65 wt% and 80 wt%.

The LiquiSonic® analyzer installs directly within any process vessel, tank, or pipe without a costly bypass solution.

By virtue of a special protective ETFE coating, the sensors work in very reactive environments, even in hydrofluoric acid.

### Dependence of sonic velocity and density on hydrofluoric acid concentration



## 1.2 3-component analysis

The LiquiSonic® 40 analyzer can gauge concentrations within three-component flow mixtures. Concentration changes of individual components within a liquid mix often exert differing sensitivity effects on certain physical properties.

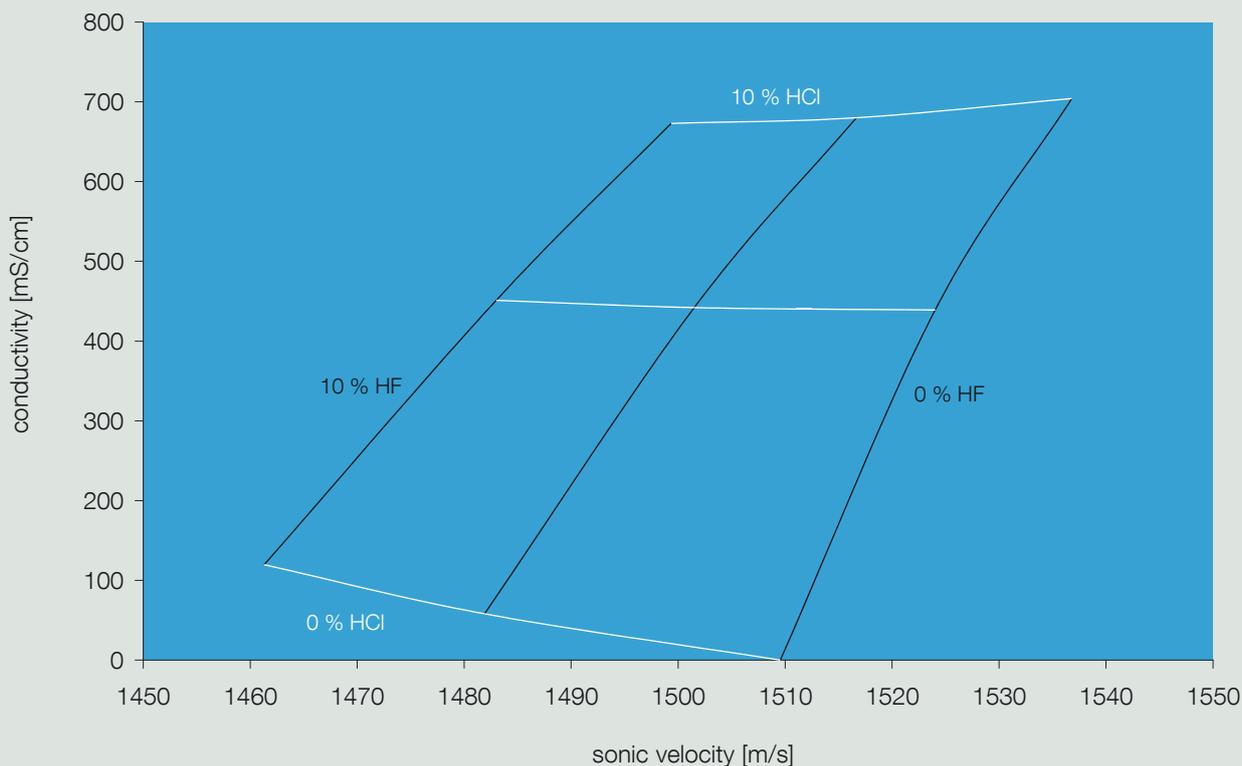
With a clear and strong relationship between a varying concentration and an affected physical property, each component concentration can be determined from a measured physical change according to an analytical mathematical function.

The graph below reveals an example of sonic velocity and conductivity at different concentrations for each of two components (HCl and HF in water) at temperature of 30 °C.

Useful computation models are stored in the LiquiSonic® 40 control unit. With the relevant physical parameter in hand, the controller calculates and displays concentrations for each single component. By a parallel analysis of two physical measures, two concentrations can be pinpointed simultaneously at varying temperatures. In addition to conductivity, physical properties like density or refractive index may also factor into a 3-component analysis.

Since process temperature plays a highly sensitive role, it's tracked very accurately as a significant element in the calculation model. The concentration measures of the components must always be temperature-compensated.

### Influence of dual-media concentrations on the two physical properties sonic velocity and conductivity





## 2 LiquiSonic<sup>®</sup> system



The LiquiSonic® system consists of one controller and one or more sensors. The controller 30 can include up to four sensors.

The ultrasonic sensor houses both the actual ultrasonic measuring path and the highly precise temperature detector (Pt1000).

Each sensor works autonomously and can be deployed in different applications. The liquid-contacting areas of the device are secured in corrosive HF-acid flows by a standard ETFE coating (layer thickness of 1.5 mm to 2 mm).

The rugged, completely enclosed design requires no gasket or "window", making it totally maintenance-free.

Special high-power technology stabilizes measurement results, even when facing gas-bubble accumulations or large-scale signal attenuation through the process flow.

The sensor electronics integrate into an enclosed die-cast housing that offers a protection degree of IP65.

LiquiSonic® 40 system, for use in 3-component mixtures, is equipped with a controller 40 and an ETFE-coated flange sensor featuring a PFA / PEEK-coated conductivity detector.

The controller processes the measuring data and is the interface to the operator by displaying the concentration values. The displayed value can be adjusted to internal reference values through a calibration function. All process data or related values will be refreshed every second. If the measuring values are either within or outside the threshold, it will be shown immediately in the display. System information and error messages are also clearly shown on the display.

The measuring data can be transmitted via several adjustable analog or relay outputs as well as via different fieldbus interfaces to process control systems or computers.

The controller has a data log that stores up to 15,000 datasets each with 32 measuring values. The software SonicWork facilitates to read-out the data log and to create its own process reports in an easy manner.

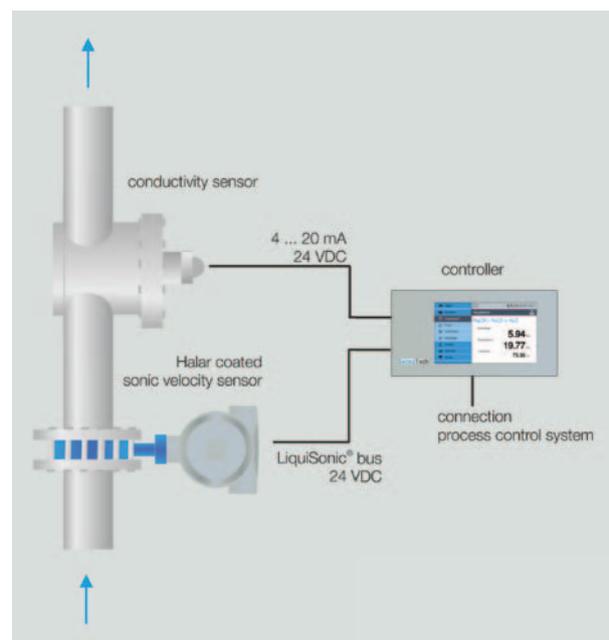
An additional function integrated in the controller is the event log. This feature documents events like manual product switch, changes on date, time or system states.



LiquiSonic® flange sensor with ETFE coating



LiquiSonic® controller in a plastic wall mount housing



LiquiSonic® 40 measuring system

## 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.



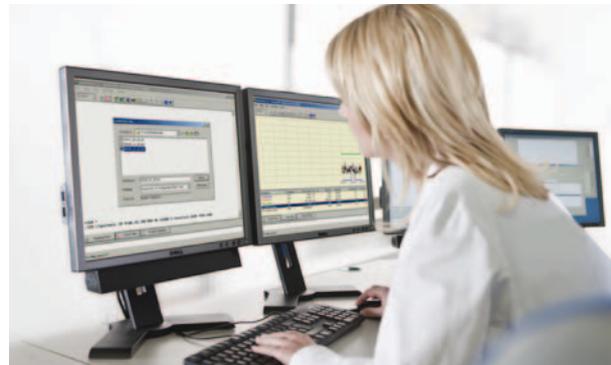
Creative research is another pillar of our company. The specialists in our research and development team provide valuable new ways to optimize product attributes, such as testing new types of sensor designs and materials or the sophisticated functionality of electronics, hardware and software components.

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**

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liquids, **we set the measure.**

ovative **sensor technology.**

accurate, **user-friendly.**

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**  
Steinfeldstr. 1  
39179 Magdeburg-Barleben  
Germany

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

**SensoTech Inc.**  
1341 Hamburg Tpk.  
Wayne, NJ 07470  
USA

T +1 973 832 4575  
F +1 973 832 4576  
sales-usa@sensotech.com  
www.sensotech.com

**SensoTech (Shanghai) Co., Ltd.**  
申铄科技(上海)有限公司  
No. 35, Rijing Road, Pudong New District  
上海市浦东新区外高桥自由贸易区日京路35号1241室  
200131 上海,中国  
China  
电话 +86 21 6485 5861  
传真 +86 21 6495 3880  
sales-china@sensotech.com  
www.sensotechchina.com



**In liquids, we set the measure.**