



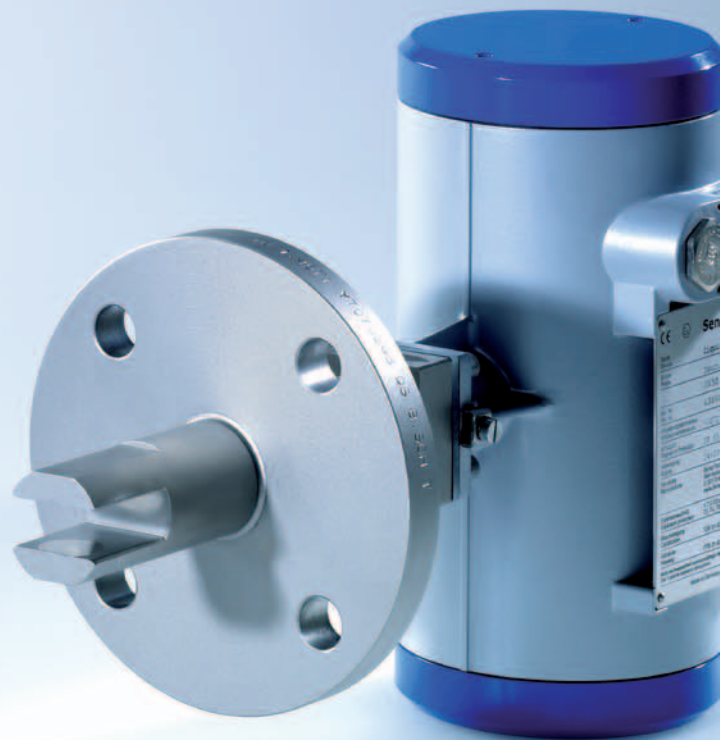
Sulfuric acid and oleum

- Inline analytical technology for:
- concentration & density
 - blending
 - warning limit detection

Increasing c

With high

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 running process and without delay. The device is based on high-precision measurement of the absolute sonic velocity and process temperature and thus allows the calculation and monitoring of concentrations.

Benefits for the user include:

- optimal plant control through online information about the state of the process
- maximization of efficiency of processes
- increasing of the product quality
- reduction of costs for laboratory measurements
- immediate detection of process failures
- saving of energy and material costs
- immediate detection of interruptions in the process water or process liquid
- reproducible measuring results

Using the latest digital signal processing technology ensures a highly accurate and fail-safe measurement of the absolute sonic velocity and the concentration.

In addition, integrated temperature sensors, a sophisticated sensor design and the know-how resulting from numerous series of measurements and many applications guarantee a high reliability of the system with a long lifetime.

Advantages of the measuring method are:

- absolute sonic velocity as a well-defined and retraceable physical value
- independent of color, conductivity and transparency of the process liquid
- installation directly into pipelines as well as tanks or vessels
- robust and completely metallic sensor design without gaskets or moving parts
- maintenance-free
- corrosion resistance by using special material
- use at temperatures up to 200 °C
- high, drift-free measuring accuracy even with high concentration of gas bubbles
- connection of up to four sensors per controller
- forwarding of measuring results through field-bus (Profibus DP, Modbus), analogue outputs, serial interface or Ethernet



Inline process analysis

Contents

1	Applications	6
1.1	Introduction	7
1.2	Sulfuric acid	7
1.3	Oleum	8
1.4	Sulfuric acid and oleum	9
2	LiquiSonic® system	10
2.1	LiquiSonic® 20 and 30	11
2.2	LiquiSonic® 40	12
2.3	Accessories	13
2.3.1	Controller and field housing	13
2.3.2	Fieldbus	14
2.3.3	Modem	14
2.3.4	Network integration	14
2.3.5	Web server	14
2.3.6	Software SonicWork	15

1 Applications



1.1 Introduction

Optimal and reliable process control requires fast information through robust and rapid process analytical technology. The use of the LiquiSonic® analyzer and its easy integration into existing plant technology results in an improvement of the asset utilization, process safety and product yield under relatively low project costs.

There are several industries where the LiquiSonic® systems for concentration measurement in sulfuric acid and oleum can be applied:

- sulfuric acid and oleum production
- synthesis gas drying in the chemical and petrochemical industry
- etching and pickling agents in the steel industry
- ore processing in mining
- raw material for sulphate fertilizer
- basic chemical for various chemical products

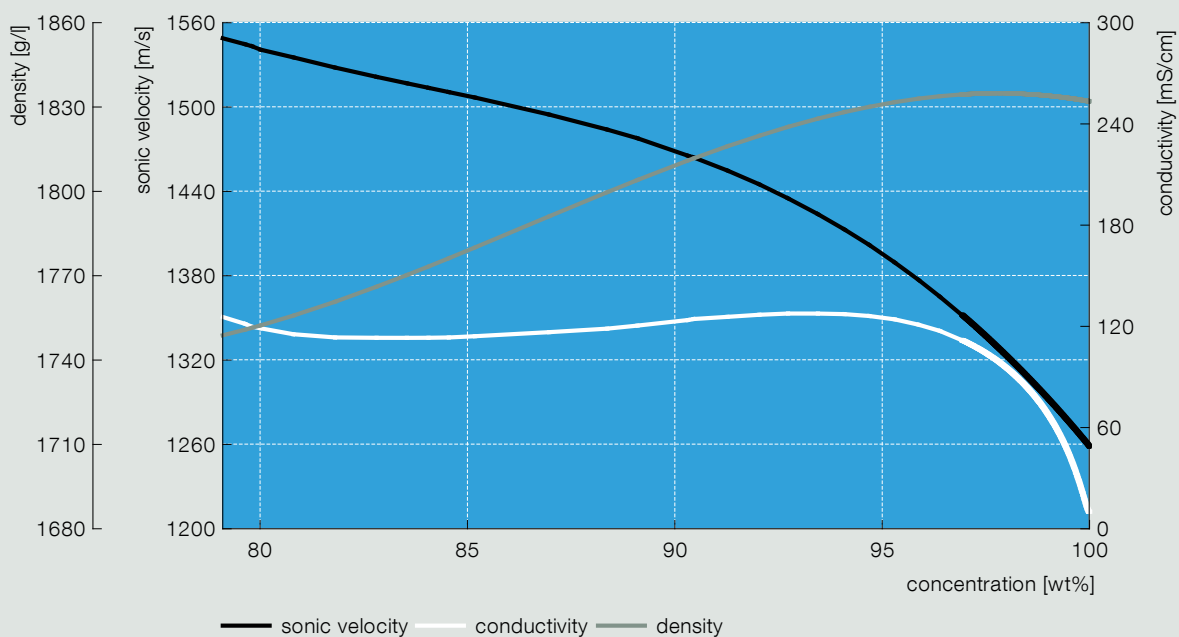
1.2 Sulfuric acid

Sulfuric acid is one of the most important basic chemicals and is used in many ways. Due to its hygroscopic character, sulfuric acid is for example used for drying of gases, in which the measuring range varies between 80 wt% and 100 wt%.

As a consequence of the high dependency of sonic velocity on the sulfuric acid concentration, the measurement with LiquiSonic® reaches an accuracy of ± 0.05 wt%. Compared to conductivity and density measurement LiquiSonic® generates a clear signal in the concentration range and therefore provides reliable process information at any time.

Additionally, concentration-dependent parameters such as sonic velocity, density or conductivity are strongly temperature-dependent. In contrast to many other analyzers, LiquiSonic® is equipped with a static and dynamic temperature compensation.

Advantage of sonic velocity over conductivity and density



1.3 Oleum

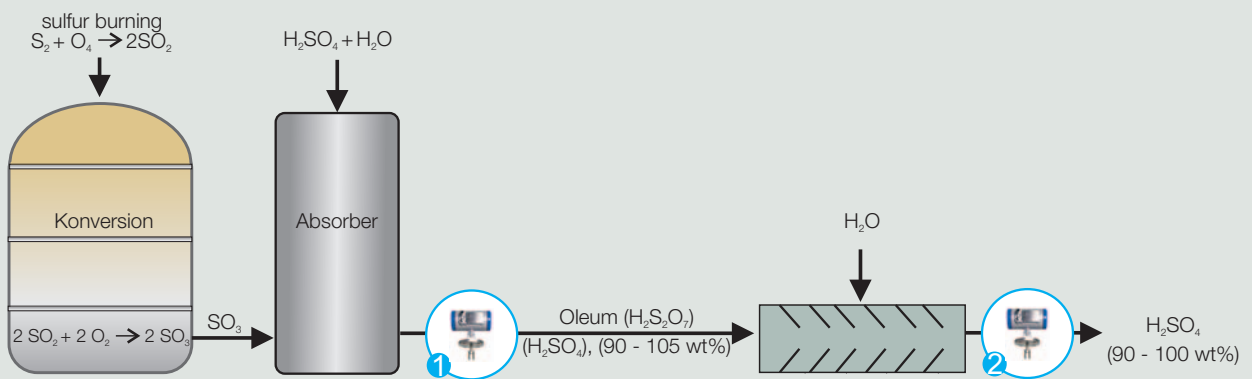
Oleum is produced by dissolving of SO_3 (sulfur trioxide) in 100 % sulfuric acid. Often it is also referred as fuming sulfuric acid or disulfuric acid. In free SO_3 , typical measuring concentrations are from 0 wt% to 60 wt%, and for H_2SO_4 from 100 wt% to 115 wt%.

Oleum is used in the following applications:

- setting up of highly concentrated sulfuric acid
- production of caprolactam and nylon
- nitration processes in combination with nitric acid

For example, SO_3 is produced in the contact process by sulfur combustion. Thereby SO_2 (sulfur dioxide) arises, which oxidize to SO_3 . Eventually, SO_3 has to be collected in sulfuric acid as due to the intense exothermic reaction, a collection in water is not possible. The resulting oleum can be monitored inline by the LiquiSonic® analyzer, so that the process can be optimally controlled.

Monitoring of oleum production by using LiquiSonic®



Measuring point	Installation	Measuring task
1	pipeline	concentration determination in the SO_3 absorber up to oleum
2	pipeline	monitoring the blending to get the requested concentration

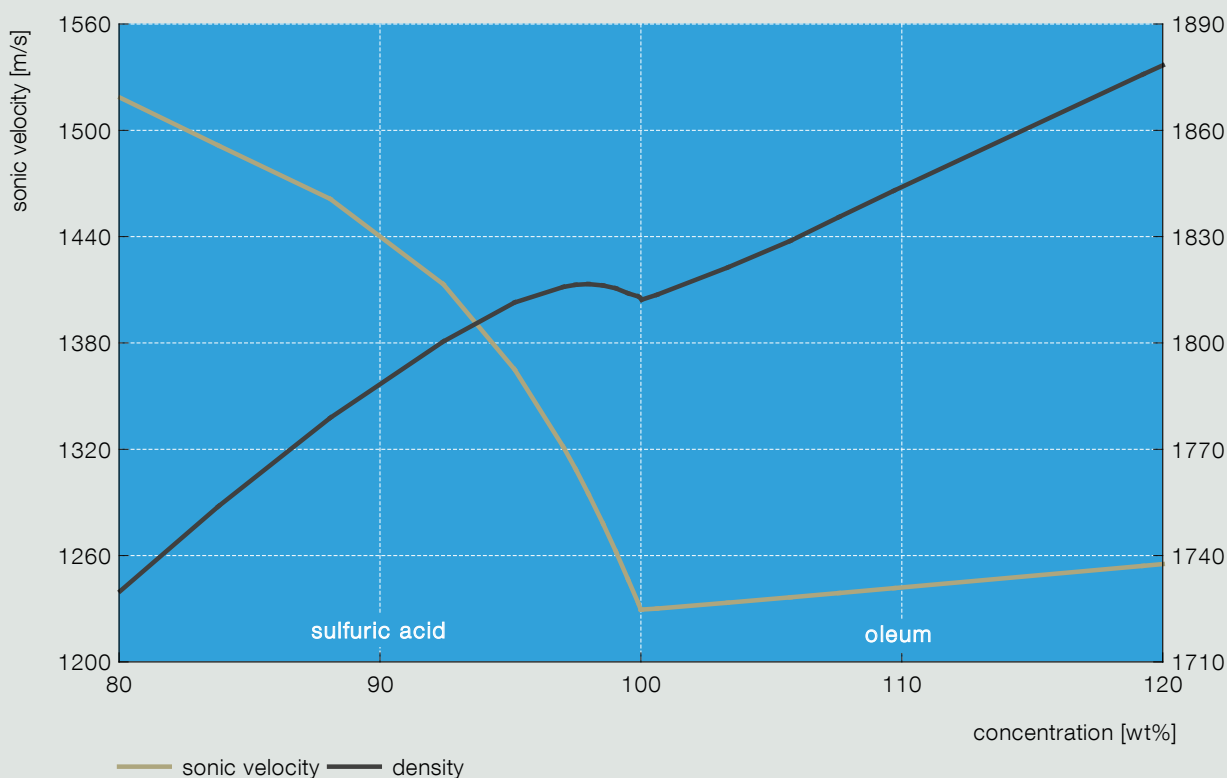
1.4 Sulfuric acid and oleum

By mixing sulfuric acid with oleum, any concentrations of high concentrated sulfuric acid can be adjusted. The adjustment requires a continuous inline monitoring of the concentration. Furthermore, the oleum entails a potential hazard and should not occur in certain absorption processes. The warning signals integrated in the LiquiSonic® analyzer signalize this prematurely and the information will be sent to the process control system by the periphery of the analyzer.

The course of the sonic velocity shows an inflection point at 100 wt%. Therefore, one sensor is not enough to achieve a definite measurement in the process fluid sulfuric acid / oleum. For that reason, the LiquiSonic® 40 system includes an additional density sensor that enables an accurate measurement together with sonic velocity in sulfuric acid and oleum as well. Thus, a precise and reliable concentration measurement is guaranteed.

The ultrasonic sensor incorporates two temperature sensors determining accurately the temperature, that will be forwarded to the LiquiSonic® controller calculating the concentration. Therefore, the LiquiSonic® 40 analyzer operates temperature compensated and highly accurate, even at strong fluctuations in the process conditions.

Characteristics of sonic velocity and density in liquid of sulfuric acid and oleum



2 LiquiSonic[®] system



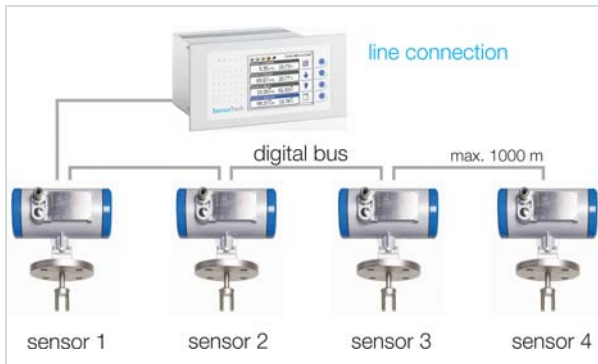
2.1 LiquiSonic® 20 and 30

The LiquiSonic® system consists of one or more sensors and a 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 maximum distance of 1,000 m between controller and sensor.

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



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 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.

The sensor electronics is integrated in a closed die-cast housing with a protection degree of IP65 and enables the cleaning of process systems, for example, through a high pressure cleaner.

The immersion sensor Ex 40-40 is especially used in hazardous areas and is approved by ATEX and IECEx certification zone 0 to 2. The sensor can be delivered with explosion protection type II 2 G EEx de IIC T3, T4, T5 or T6.



Immersion sensor Ex 40-40

The controller 30 manages 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.

2.2 LiquiSonic® 40

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.

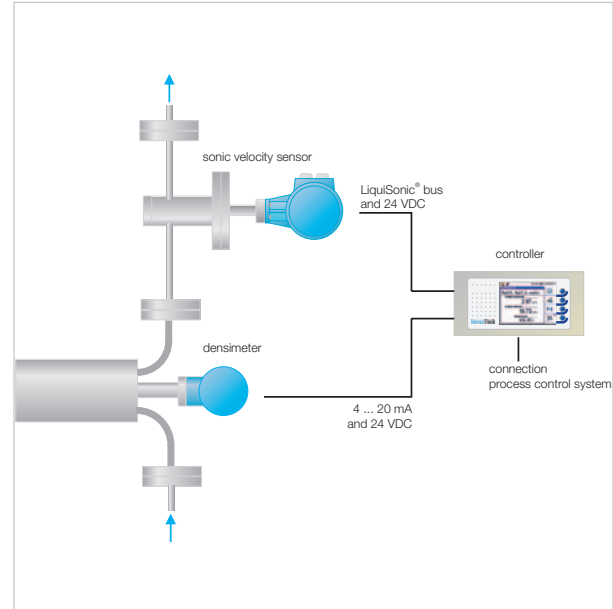
The measuring principle is based on the fact that concentration changes of individual components of a liquid affect physical variables like sonic velocity, conductivity and density. This characteristic is stored as calculation mode in the evaluation unit (controller) to convert the physical variables 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 corrosion 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 approval and an explosion protection type II 2 G Ex de IIC or II 1/2 G Ex de IIC and IIB T3, T4, T5 and T6.



LiquiSonic® 40 measuring point



LiquiSonic® controller and Halar coated flange sensor

2.3 Accessories

2.3.1 Controller and field housing

The controllers are designed for rack-mounted systems. In order to be able to mount controllers 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.

19" housing 3RU

material: anodized aluminum
 dimensions: 482.9 (19") x 133.3 (3RU) mm
 application: rack-mounted system



Wall mount housing (stainless steel)

material: stainless steel DIN 1.4301 (AISI 304)
 protection degree: IP66 (NEMA 4X)
 dimensions: 430 x 300 x 230 mm
 window: VSG with 6 mm thickness
 application: in areas with highly hygienic requirements like pharmaceutical and food industry, e.g. breweries



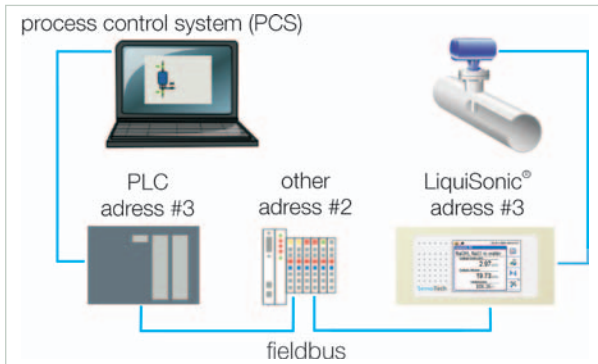
Wall mount housing (plastic)

material: plastic
 protection degree: IP56 (Nema 12)
 dimensions: 500 x 500 x 300 mm
 window: acrylic glass
 application: outdoor or under rough process conditions like gas scrubbers or pickling baths



2.3.2 Fieldbus

The fieldbus option provides the possibility to integrate the controller into a Process Control System (PCS) or to automate the process run via programmable logic controller (PLC). Beside the transfer of measuring values like the concentration or temperature, it is also possible to exchange parameters and control data (e.g. product switch).



Connection points

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

2.3.3 Modem

With a modem, it is possible to communicate with the controller via a phone connection. In doing so, the controller and the computer are respectively connected with a modem.

This remote connection provides the following advantages:

- downloading new product datasets on controller
- reading out the controller logbooks, e.g. to record product data for unknown liquids
- monitoring of all system functions via remote access
- configuration of controller and sensor via remote access
- worldwide and fast customer support by our service

Typical versions are GSM Modem and the analog modem.

2.3.4 Network integration

The LiquiSonic® controller has an Ethernet interface, with which via a SMB protocol the integration into a Microsoft Windows network is possible.

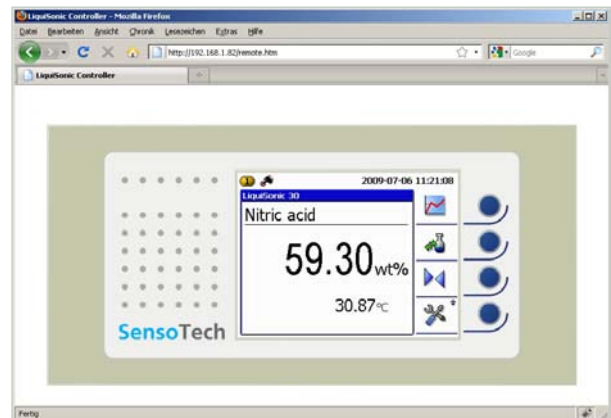
All controller integrated into the network appear in the “network environment“ within the group “LiquiSonic®“. After entering the user name and password the access to the stored logbooks is possible.

Furthermore, the Telnet protocol can be activated. Thus, all functions of the program SonicWork (e.g. remote control, query of status information, transfer of product datasets and calibration of products) are available in the network.

2.3.5 Web server

With the web server, a remote access to the LiquiSonic® controller within a network is possible without installing special application software.

The web server enables the direct access to the controller with usual web browsers (e.g. Firefox or Internet Explorer).



Controller operation via web server

2.3.6 Software SonicWork

SensoTech offers the software SonicWork, which enables an optimal configuration and data exchange of LiquiSonic® analyzers. With SonicWork the access to all configurations is open and the data memory can be read out with a PC or laptop.

Loading of product dataset

If the process changes, it can be necessary to pass a new product dataset for a certain product subsequently to measuring system being already in use.

Loading of device configurations

If the measuring task of LiquiSonic® being already in use changes, it is possible to adjust the device by loading a corresponding file to this task.

Reading-out of memory

Each LiquiSonic® controller contains an internal measured data memory, which stores up to 15,000 data-sets (lines) with respectively 32 measured values.

After deactivation of the device, these data remain available. When the data are read-out, they are available in a CSV format and can be further processed, if necessary.

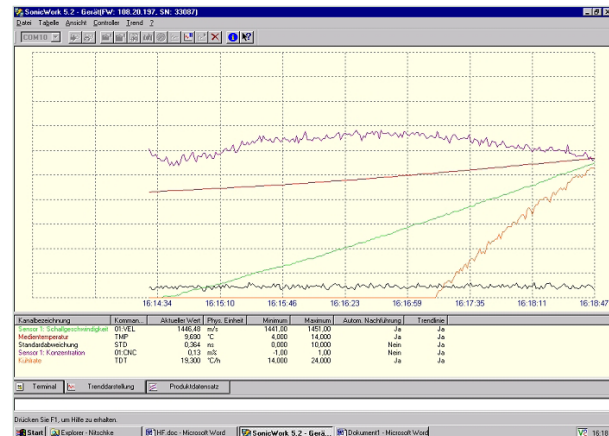
The memory is read-out in the department of research and development, because it is an optimal tool to evaluate reactions, trials and productions.

Remote Control of controller

SonicWork enables the remote control of LiquiSonic® controller. With the integration of devices into a network (TCP/IP) or with the connection of a modem, the devices can be operated from any sites. The same range of functions can be used, as they are available for direct operation of the device.

Recording of process trends

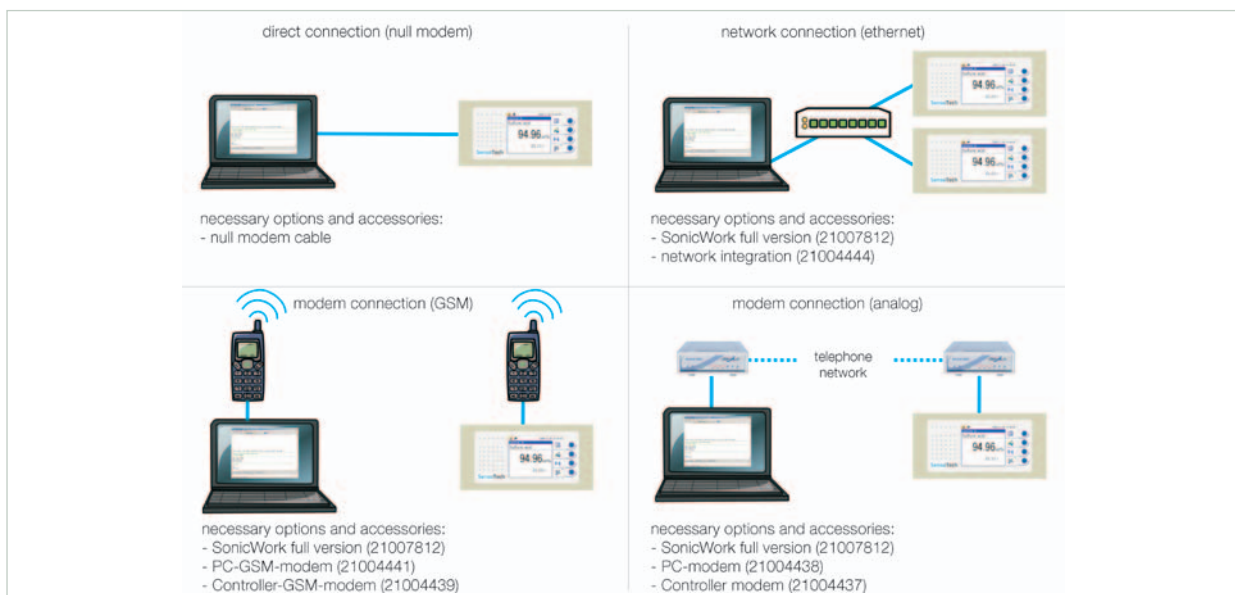
With SonicWork, it is possible to display process trends. In doing so, different measured data can be visualized in real time during a laboratory measurement and these data can also be stored to the internal memory in addition.



Trend chart via SonicWork

Calculation of product datasets

With the option „calculation of product datasets“ of SonicWork, the customer receives an effective tool, with which he can react quickly and flexibly on product changes or changes of product measuring ranges concerning their concentration and temperature. Therefore, it is possible to self-calculate the product datasets. Nevertheless, the employees of SensoTech are available at any time to assist you for validation of your product datasets to achieve a maximum accuracy.



Connection paths with Sonic Work

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.



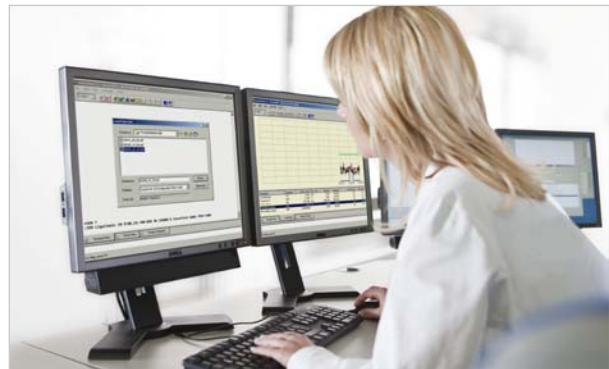
Creative research is another pillar of our company. The specialists in our research and development team provide valuable new ways to optimize product attributes, such as testing new types of sensor designs and materials or the sophisticated functionality of electronics, hardware and software components.

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.

Setting the sta

With passio

All based on ab

SensoTech



Always exchange push device in power off

Always exchange push device in power off

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 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

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



In liquids, we set the measure.