SensoTech

制药行业

在线分析: · 相检测

· 溶剂浓度

· 悬浊液

· 三组分混合物

· 结晶化监控

· 进料控制

建立工艺分析标准。

积极创建新型解决方案。

一切基于绝对的开拓精神。

SensoTech 是工艺液体分析和优化系统的供应商。自1990年成立起，我们逐步发展成为液体浓度和密度在线测量工艺分析仪的领先供应商。我们的分析系统树立了全球同类产品的行业标准。

我们的创新系统制造于德国，其主要原则是在连续过程中测量超声速和密度。我们已将该方法完善成为极高精度和极易使用的传感器技术。

除浓度和密度的测量外，主要应用范围还包括相界面检测或复杂反应监控，例如聚合反应和结晶化。我们的LiquiSonic®测量和分析系统能够确保最优产品质量和最高设备安全。由于其对资源的高效利用，其同样有助于降低成本，并因此广泛应用于各种行业，例如化工与制药、钢铁、食品技术、机械及设备工程、汽车制造等等。
量和分析系统能够确保最理想的产品质量和最大程度的设备安全. 由于资源利用率较高，所以削减了成本，其广泛应用于多个行业，例如化工, 制药, 钢铁, 食品技术, 机械和设备工程以及汽车制造等.

我们的目标是始终实现客户生产设施的最大生产潜力。即使在苛刻的生产工艺条件下，SensoTech系统也能提供高度准确和可重现的测量结果。在线分析避免了具有安全风险的人工取样过程，并能够立即应用到自动化系统中。同样，通过高性能配置工具还可调整所有参数，以便您可以快速轻松应对工艺波动。

我们以卓越成熟的技术协助您改进生产工艺，并以尖端新颖的方法寻求各种解决方案。在您的行业中，不管您的要求多么特殊，我们都将为您提供应用支持。而在工艺分析方面，我们树立了行业标准。

过程分析

Contents

1　应用

1.1 应用领域

制药业对生产过程的质量要求很高。因此，在线过程监控是一个关键因素。

在众多制药应用中SensoTech可为工艺液体监控提供可靠的解决方案。

此外，测量系统非常适合连续、实时监控相分离和结晶过程。

这样就能实现高效的过程控制和提高过程安全性。即使在恶劣工作环境下，LiquiSonic®系统坚固耐用，免维护。

工艺步骤	应用
进料部门	溶剂、酸、碱等的产品标识 · 水、异丙醇、正己烷、钾盐 检查进料质量和浓度 · 硫酸中的含水量 避免错误填充和与高活性物质混合 · 过氧化氢、异丙醇、一氯乙酸
浓度测量	几秒钟内完成质量控制 · 不同的缓冲溶液、批次 溶剂中的水含量 · 甲醇、乙醇、丁醇 蒸馏物质和产品 · 乳糖在水中的含量 控制原料浓度 · 烧碱 液体混合 · 异丙醇和水 固体溶解站 · 柠檬酸
相检测	检测储罐中的相位 · 溶剂/产品相 分离油相和水相 · 乙醇基草药提取物
溶剂回收	反应物和蒸馏物的浓度控制 · 甲醇/四氢呋喃水溶液 · 乙腈/甲基叔丁基醚水溶液
晶体化	过程监控 · 有机溶剂中的原料药（活性药物成分） 目标晶体成核 · 利用种晶 新物质的表征 · 使用LiquiSonic® Lab进行研发 确定蜕变区、饱和度和成核过程 · 优化生产工艺（动力学） 晶体含量 · 乙醇中的水杨酸
悬浮液测量	物质沉淀 · 布洛芬/乙醇水溶液 在母液和悬浮液中测量 · 盐水中的磁粉

1.2 浓度测量

LiquiSonic®传感器可提供稳定的温度补偿浓度值。
与其他测量方法相比，声速原理不受液体颜色、透
明度和电导率的影响。

可成功达成以下任务：
· 进料监控和检测
· 中间产品的质量监控
· 控制和监测（稀释、浓缩、泄漏）
· 最终产品的质量监控

LiquiSonic®系统直接安装在管道中，可提供出色的
过程监控--高度精确且免维护。在生产过程中进行
实时测量，可避免错误批次和安全风险。

1.2.1 实例： 溶剂回收和处理

在药品生产过程中，溶剂为载体成分，随着时间的
推移会被水稀释或污染。
随后，这些污染水需要像其他杂质一样从溶液中分
离出来。

大多数有机溶剂在蒸馏塔中循环使用。回收的溶剂
用于下游工艺。通过这种方式可以节约资源，避免
浪费，并最大限度地减少新溶剂的采购。

LiquiSonic®分析仪能可靠、精确地测定原料和回收
产品的浓度，且免维护。因此，生产过程可以得到
精确控制。

优势一览：
· 工厂自动化
· 蒸馏效率更高
· 最终产品质量最佳
· 提高工厂产能
· 节约资源
· 材料的可持续利用

1.2.2　3组分测量

LiquiSonic®40测量系统可以测量3组份混合物的浓度。三组分混合物通常是指在载液或溶剂中含有两种物质的液体。

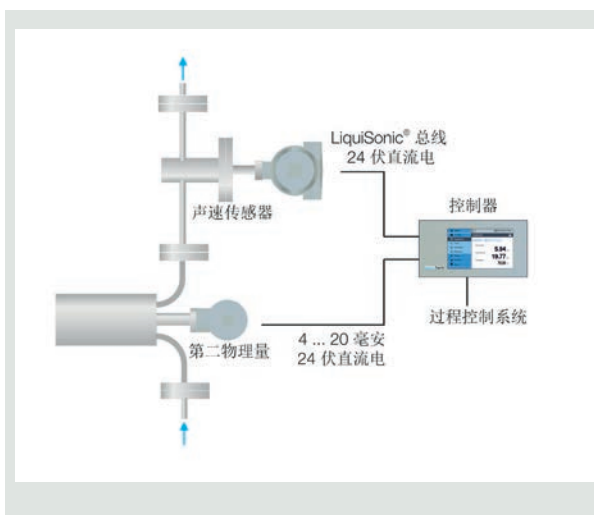测量原理基于以下事实，即液体中单个成分的浓度变化会对某些物理值产生不同的影响。这些物理值包括声速、密度、pH值、折射率或其他已知变量。

如果载液中两种成分的浓度发生变化，则需要两个物理值来确定浓度。

如果浓度变化与物理值变化之间的关系明确，则可以根据分析数学关系描述，通过已知的物理值变化来确定每种单一成分的浓度。

通常，这种关系可以用图表说明。下图显示了在恒温条件下，各成分浓度不同时声速和密度的示例:

浓度1: c_1 = 10 % .. 15 %
浓度2: c_2 = 11 % .. 19 %

LiquiSonic®与密度计联用

作为计算模型，这些关系存储在LiquiSonic®控制器40中。因此，控制器可根据相关物理值计算并显示单个成分的浓度。通过对两个物理值的并行分析，可以同时确定不同温度下的两个浓度。

过程温度也会被记录并纳入计算模型。因此，各组分的浓度值始终得到温度补偿。
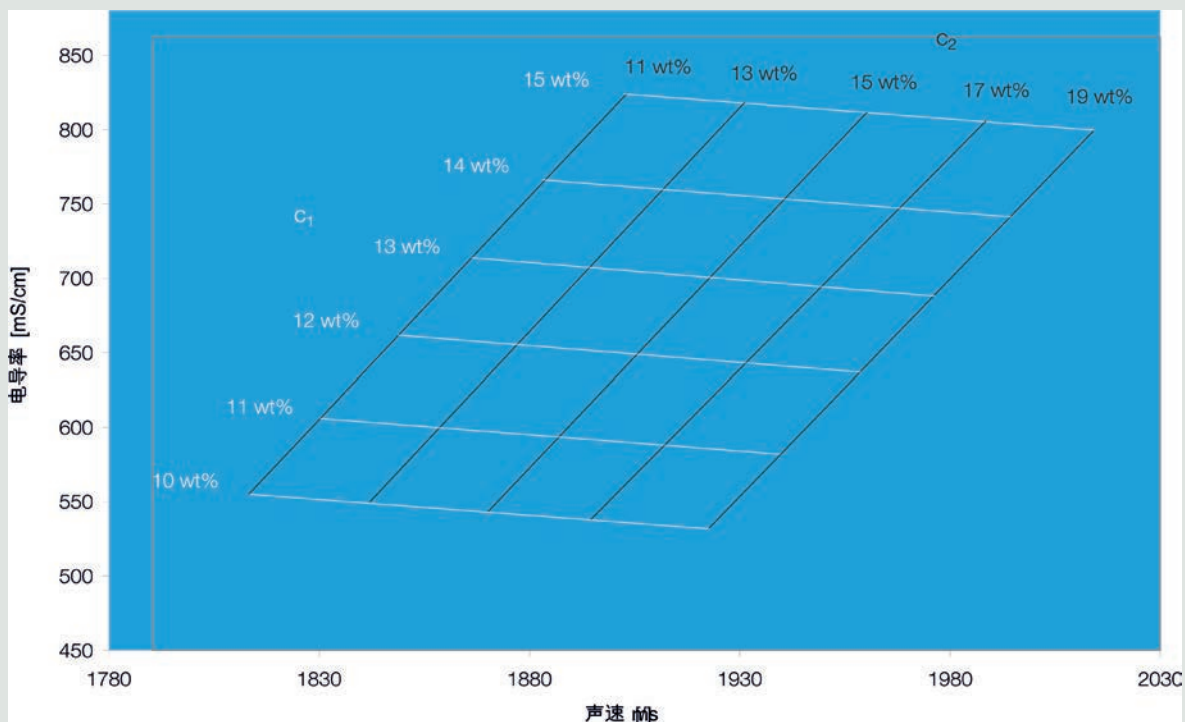
1.3　进料控制

为了达到最佳的生产效果，高质量的进料是必不可少的。这首先需要对交付的工艺液体进行监控。如果能及早发现偏差或缺陷产品，就能迅速采取纠正措施，从而节省生产资源。

此外，还可根据产品特定的声速值对交付的物质进行清晰的识别和分离。

使用LiquiSonic®分析仪可以直接在进料部门对交付的产品进行简单快速的监控。在加工过程中，液体直接在交货点取样。
这样，不同批次中的交叉污染和产品质量波动就能立即被检测出来。

特别是要避免高活性物质混合不当而造成的意外填充。LiquiSonic®具有保护功能，经认证可用于潜在爆炸性环境。

1.4　相检测

在许多工艺工程中间步骤中，必须有效地将不同的产品相从载体相中安全分离出来。这在连续和间歇工艺中都要做到这一点。在间歇式工艺中，通常通过手动更换阀门以及目视观察相变来实现。但这种方法的重复性较低。使用LiquiSonic®浸入式传感器时，上述步骤可自动实现。

下图中的声速斜率显示了各个阶段之间典型而显著的信号变化。LiquiSonic®可提供清晰的信号，安全且可重复地分离产品相和载体相。特别是，传感器的响应速度非常快，仅需几秒钟，因此具有很高的选择性。这就实现了出色的相位识别和后续产品节省。

LiquiSonic®在连续相分离中的应用与此类似。在这种情况下，两个传感器可持续监测液体进料和沉淀池中要分离的相流。这样，在提高产品产量的同时，也提高了设备的生产能力。

间歇式工艺中的相分离
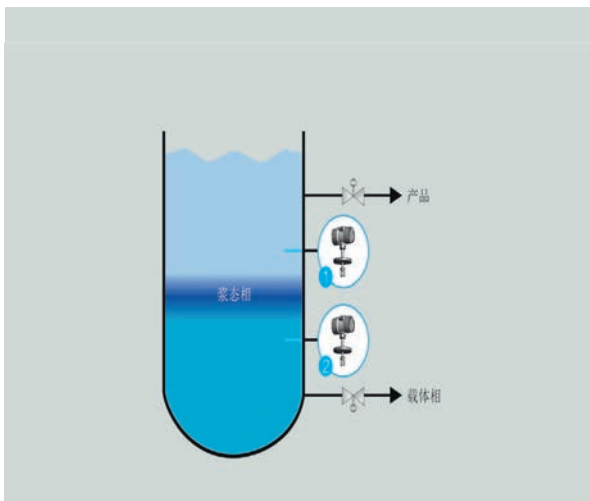
连续工艺中的相分离

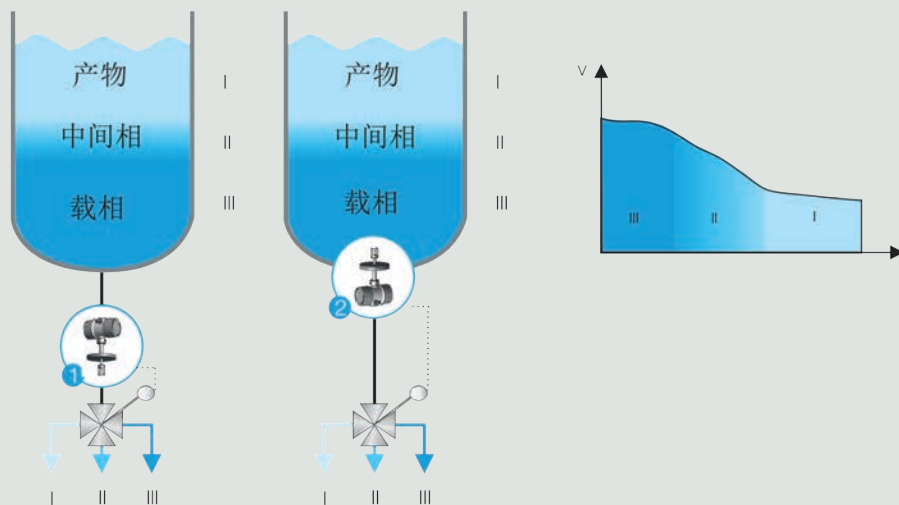LiquiSonic®应用实例:

· 硅树脂相

· 废水中的脂肪醇相

· 环氧树脂相

· 聚醚相

· 气-液相

与电导率传感器相比,LiquiSonic®传感器还可用于水相到有机相或有机相到水相的多种不同分离过程。通过连续测量,可以调节过渡相或浆料相中几乎所有的分离范围。

控制器的趋势视图可直接显示信号波形。同时,还可以调整数字控制器输出参数的阈值。对于独立解决方案,这些输出可直接切换可用的分流阀或阀组。
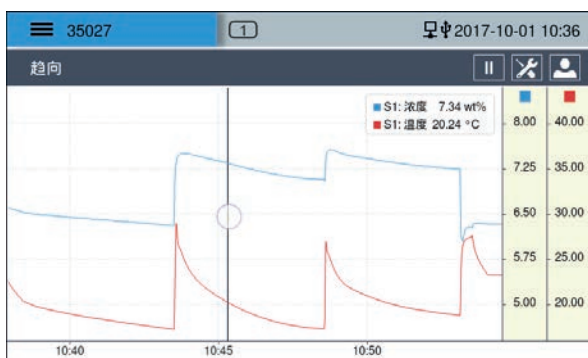
1.4.1　带LiquiSonic®传感器的排放阀

在制药和精细化工工艺中,盘底出口阀通常用于从容器或反应器中排出或输入非粘性液体。

将过程分析技术集成到排水阀中可实现实时过程监控,同时提高产品质量,减少批次周期时间、产品取样以及能源和材料成本。

此外,这种集成还为有效使用LiquiSonic®分析技术提供了一个合适的工艺切入点。这样就无需改装现有的反应釜。

SensoTech与一家著名制造商共同开发了底部出口阀(BOV)制造商共同开发了集成LiquiSonic®传感器的创新型底部出口阀。由于包括传感器在内的排污阀安装在容器底部,因此即使是低容量批次也可进行实时监控。该传感器通过了ATEX和IECEx认证。除浓度测量外,LiquiSonic®传感器还包括两个Pt1000温度传感器。

数据处理由经过验证的LiquiSonic®控制器的硬件和软件进行数据处理。例如,可通过现场总线将测量结果提供给过程控制系统。

1.5   晶体化

连续和间歇工艺中的结晶过程可通过测量系统测量声速。

因此，可以很容易地纠正错误或偏离工艺条件的情况，以达到所需的产品质量。

在大多数情况下，特征工艺条件可通过初步调查获得最佳反应过程。

通过使用典型的模拟或数字接口，可向用户或工艺控制提供理想过程中的微小偏差，例如，通过温度控制将结晶引导到理想的温度范围内。

下图包括对温度、声速和标准偏差三种不同工艺流程的评估。

在结晶工艺中使用LiquiSonic®系统可为用户带来以下优势：

优化通过
· 连续显示过饱和度和欠饱和度
· 通过结晶参数进行工艺控制
· 避免自发成核

节能通过
· 快速达到所需成核点
· 连续确定晶体含量
· 优化最终工艺点

通过以下方式节省原料
· 精确设定所需的产品质量
· 可重复地接近成核点

在实验室或技术中心，使用LiquiSonic® Lab可以轻松测定结晶参数以及成核点和饱和点，即所谓的"可转移范围"。系统的辅助功能大大简化了测量数据的记录和评估。

每秒数次声波测量的统计评估
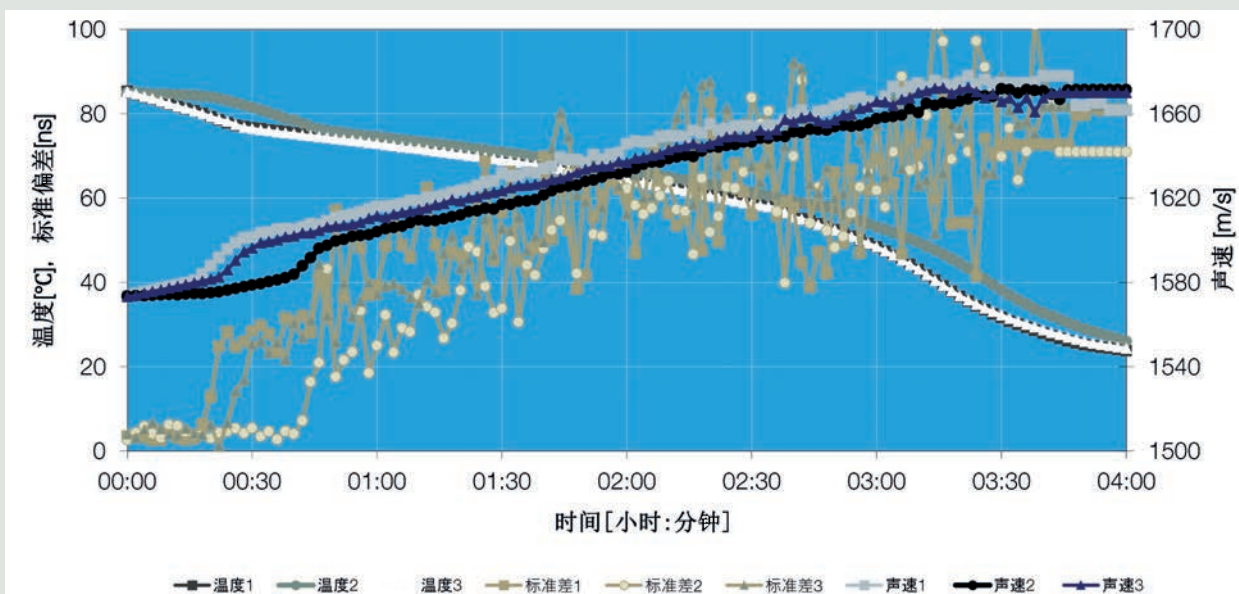
1.6　晶体化监测

每种悬浮液都有特定的声速特性取决于温度和浓度。相应的特性曲线也存储在LiquiSonic®系统中。这样就能分别直接在线测量固体浓度、晶体含量或干物质含量。

第二个物理值是衰减值。随着晶体尺寸的增大，衰减也随之增大。通过实验室记录的校准曲线可以得出晶体大小的结论。

在连续结晶过程中，可以通过测定在连续结晶过程中，可通过测定晶体含量来监测和控制分离。在间歇式工艺中结晶终点和晶体生长可以确定和监控。

与液体接触的传感器部件标准材质为316Ti不锈钢。这种坚固耐用的全封闭设计无需垫片或"窗口"，因此完全免维护。

在磨损性极强的悬浮液中，可使用哈氏合金或钛等材料。由于硬度高，它们是最佳选择。

下图显示了氯化钠溶解过程中的声速变化。线性增长是通过永久加入NaCl实现的。在成核点，溶剂已经饱和。因此，从这一点开始，声速会随着晶体含量的增加而逐渐上升。使用LiquiSonic®分析仪可对结晶过程进行最佳监控，并精确确定成核点。

声速取决于25℃时水中的氯化钠浓度

2 LiquiSonic® System

2.1   LiquiSonic® 20 und 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.
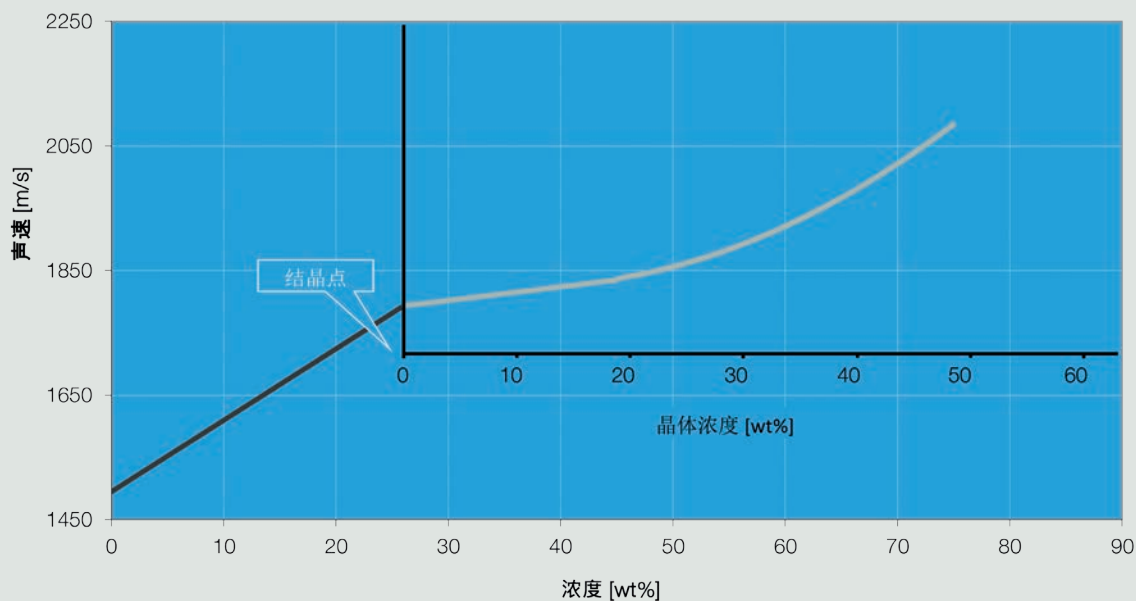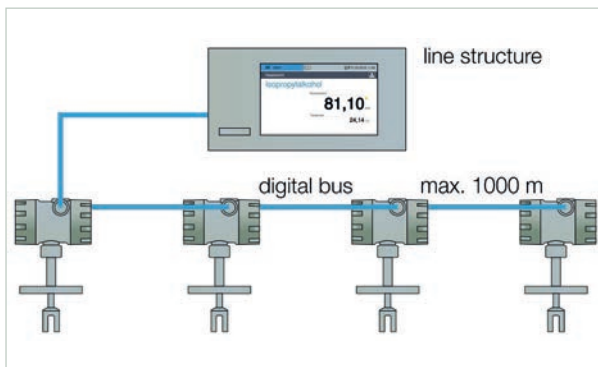

Controller with connection of maximum four sensors

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.

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).

Immersion sensor Ex 40-40

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 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 creating easily process reports for documentation purposes.

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

2.2 LiquiSonic® 40

The LiquiSonic® 40 analyzer enables the determintion 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 agressive 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 re istant 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).
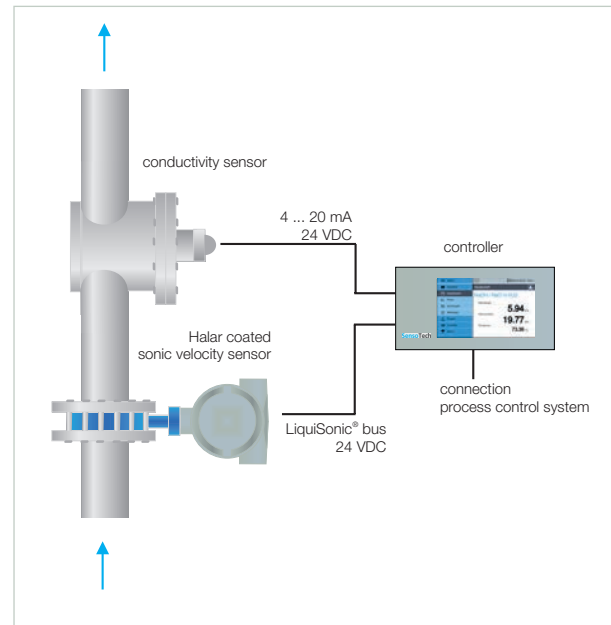
LiquiSonic® 40 measuring point

LiquiSonic® controller and Halar coated flange sensor

2.4   LiquiSonic® Lab

The LiquiSonic® Lab is especially used in laboratories, miniplants or as mobile device in process plants.

The system is provided with a splash water-proof housing, and hence is also suited for rough operating conditions.

The electronics of the controller and sensor are integrated in the housing, to which a laboratory sensor is connected. This lab sensor can be made of various materials depending on the application.

The controller processes the sensor data and is the interface to the operator by displaying the concentra-tion values. Being equipped with a high-tech microprocessor, the controller even copes with complex concentration calculations.

The internal data memory has a capacity of up to 32,000 records. By reading out via the integrated TCP/IP or RS-232 interface, it is possible to create easily own process reports.

The displayed value will be updated every second.

Measuring Point Manager

To further reduce efforts of monitoring the process and simplify the handling of the LiquiSonic® Lab Unit, the Measuring Point Manager is provided. This allows an easy switching of the measuring point and thus the product, depending on where the employee is currently located.
The actual product to be measured is assigned to the measuring point in advance. Thereby time is saved and operating errors are avoided.

Measuring Point Manager of the LiquiSonic® Lab Controller
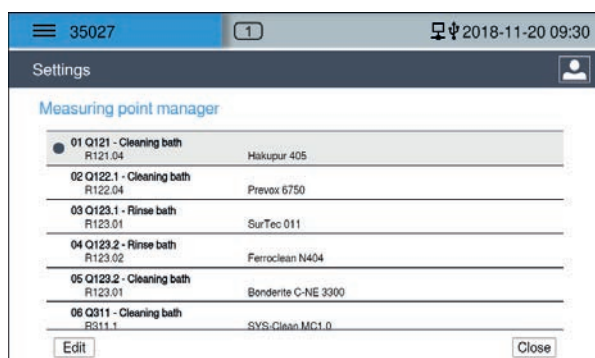
Limit Value Display

In addition to the numeric concentration, density and temperature displaying, the visualizing of limit value ranges is available. That simplifies the monitoring of an approximation to critical values.
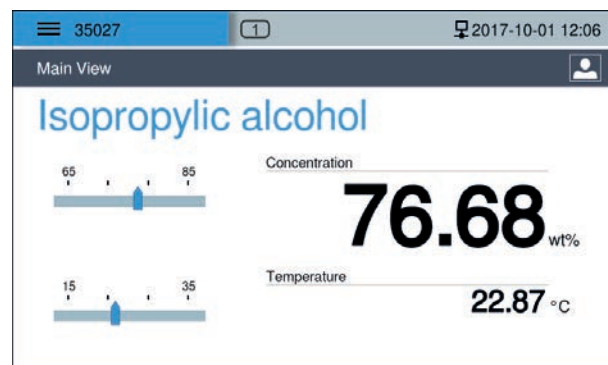
Limit Value Display of the LiquiSonic® Lab Controller

Users can identify the segment in the measuring range where the current value is settled on and get an overview quickly. When approximating the borders of the measuring range, the arrow turns into yellow signaling a warning. A range excess is shown by a red arrow.

2.3 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.

2.3.1 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.

Controller housing 19" 4 HU

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

2.3.2 UMTS Router

With a UMTS router it is possible to operate remotely the LiquiSonic® controller. For this purpose, the controller is connected to the UMTS 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

2.3.3 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).
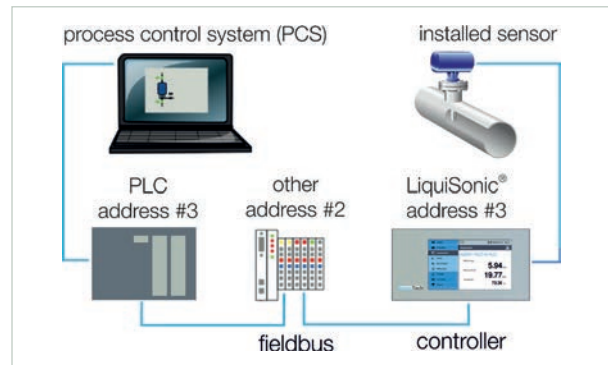
Connection interfaces

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

2.3.4 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 synchronization (NTP),
· e-mail notification (SMTP).

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 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 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 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.

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Views

Main View

Chart

SonicGraph

Messages

Product

Controller

Sensor

Main View   2016-09-20 13:47

System test H$_2$O

Concentration

-0,01

Temperature

SensoTech

liquids, we set the measure.

ovative sensor technology.

curate, 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.

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In liquids, we set the measure.