Teqwave
The smart and flexible concentration measurement device

Liquid analysis in real time

- Cost-saving – a single sensor (multisensor) for simultaneous measurement of concentration, density, sound velocity and temperature
- Flexible range of application in pipes and vessels: Inline, insertion and portable device versions
- Efficient concentration measurement – over 180 hours saved per year for each measuring point compared to titrations
- Full transparency – constant monitoring of product quality without sampling
- Reliable – robust measurement with long-term stability
- Maintenance-free – no moving parts
- Reliable – constant concentration output thanks to integrated temperature compensation
- High-precision – thanks to precise factory calibration

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The measuring principle

## Concentration and density measurement using surface acoustic waves

The core of the Teqwave multisensors is a new type of "acoustic waveguide" that can be used to measure liquid concentrations with high precision and speed by looking at surface acoustic waves (SAW technology).

Surface acoustic waves – such as Rayleigh or Lamb waves – are high-frequency sound waves. When Teqwave is used, these surface waves are induced by a piezoelectric inter-digital converter and then spread out in the waveguide. A double arrangement with a transducer as the transmitter (A) and another transducer as the receiver (B) allows for a highly precise evaluation of the transmission times and amplitudes of the measured sound waves.

If waves induced in this way make contact with a liquid, then an uncoupling of the waves into the liquid takes place, i.e. what is called a "mode conversion" (wave conversion) subject to the Rayleigh angle. This angle (Θ_R) depends on the ratio of the sound velocity of the surface wave and the liquid.

Using the transit times, the sound velocity and temperature of the liquid can be determined. The measurement of the amplitude curves is simultaneously used to determine the acoustic core impedance as well, and thus the density of the fluid. The combination of all these characteristic values makes it possible to determine the composition and the material concentrations within a mixture of substances.

Spreading of surface acoustic waves in a tube (SAW technology)
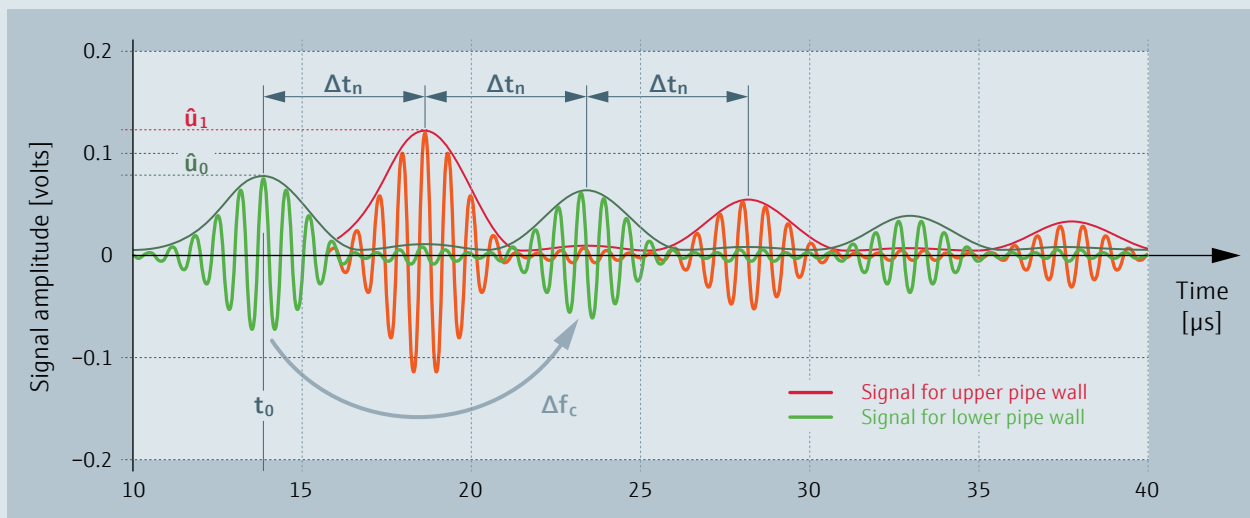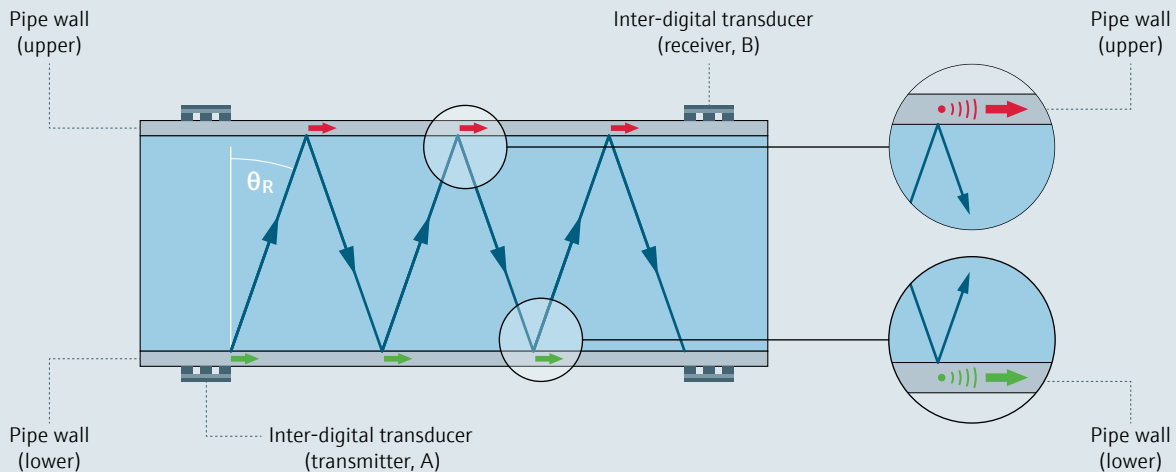
t_0 = transit time · Δt_n = transit time differential · $\hat{u}_1 / \hat{u}_0$ = amplitude ratio · Δf_c = frequency shift

Teqwave – The sensor that thinks right along with you

Comprehensive liquid analysis for maximum process reliability

No matter what industry you work in, you can use Teqwave for reliable liquid analysis in all application areas. Thanks to a single multisensor, which simultaneously measures density, concentrations (up to 3 components), temperature and the sound velocity in various fluids, you always have your processes under control.

Whether you are in the chemical or cleaning industry, the paint or dye industry, the automotive industry or process technology, Teqwave enables reliable in-line measurement of concentrations, as opposed to measuring using titration or a refractometer, which must often be carried out manually in the laboratory and are time consuming and expensive:

- Cleaners (cleaning baths)
- Solvents, corrosion protection oils
- Cooling lubricants
- Hardening fluids, etc.

Four process variables using a single sensor

%

Concentration
Measuring range: 0 to 100%
Accuracy: down to 0.01%

g/cm³

Density
Measuring range: 0.7 to 1.5 g/cm³
Accuracy: ±0.01 g/cm³

m/s

Sound velocity
Measuring range: 600 to 2000 m/s
Accuracy: ±0.1 m/s

°C

Temperature
Measuring range:
0 to 100 °C (32 to 212 °F)
Accuracy: ±0.1 °C (0.18 °F)

Additional order option: Measurement of a second concentration in the carrier fluid

The concentration app

Perfectly coordinated to your process fluid

Using special sound waves, Teqwave generates an acoustic "fingerprint" of liquids and measures the concentration and density of your liquid precisely.

For any fluid that has not yet been added to our database, we will create a custom fingerprint for you in our calibration lab.
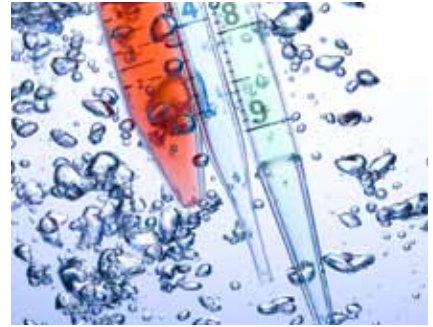
In addition, Teqwave can continue to "learn." If you want to measure more fluids, new "concentration apps" can be added to Teqwave at any time, broadening its spectrum of application. Simply add a new app and Teqwave will know exactly which parameters to take into account when carrying out your specific measurement.
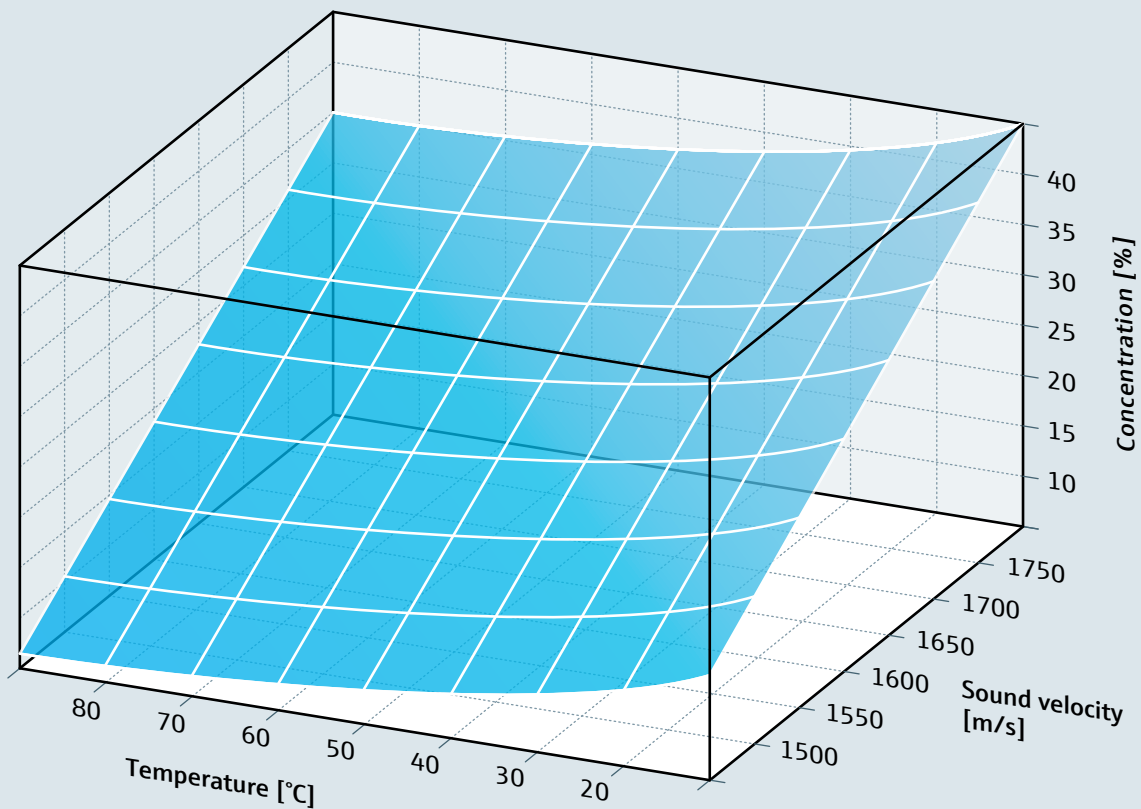

Parts cleaning

Cutting fluids

Bath contamination

Liquid-specific dependency of various fluid properties (example)

Teqwave software

For the visualization of your measured data

You can use the Teqwave software packages not only to custom-configure your measuring points via personal computer but to visualize measured data and monitor your process optimally.

Teqwave Viewer

- Display of current measured values
- Graphical depiction of two measuring variables
- Configuration of the analog interfaces
- Changing between multiple transmitters
- Language settings: German, English, French
- App uploading

Teqwave Mobile Viewer

- Read out, display, delete and export measurement data stored in the transmitter
- Create a report of stored measurement data
- Read out and report results of a function test
- Set the operating language of the transmitter
- Set new measuring points
- Set and save device configurations (configuration manager)

Teqwave Viewer (with data download)

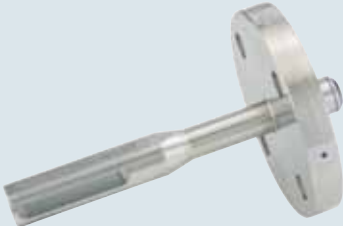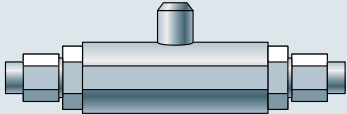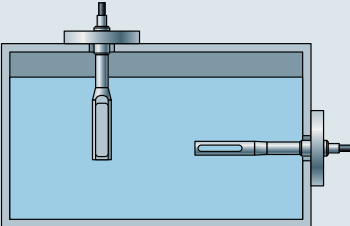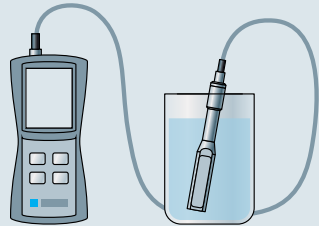With the following additional functions compared to the Teqwave Viewer package:

- Readout of the stored measured values on the internal memory in the transmitter with touch screen or LED status indication
- Visualization of the measured values from the memory
- Measured value recording: Documentation of all measured variables
- Export function as a CSV file

Visualization of concentration and temperature over time

Your custom measuring system

Sensors

Teqwave F	Teqwave I	Teqwave T
Inline sensor For continuous liquid monitoring directly in pipes	**Insertion sensor** For continuous liquid monitoring in vessels or large pipes	**Mobile sensor** Portable device for temporary liquid monitoring at various measuring points
Nominal diameters DN 8 ($^3/_8$"), DN 15 (½"), DN 25 (1")	**Insertion length** 180 mm, 500 mm	**Housing material (sensor)** Stainless steel V4A 1.4571
Process connection External thread, internal thread, flange	**Process connection** External thread, flange	**Ambient temperature** 0 to 50 °C (32 to 122 °F)
Housing material (sensor) Stainless steel V4A 1.4571 (316 Ti)	**Housing material (sensor)** Stainless steel V4A 1.4571 (316 Ti)	**Housing material (sensor)** Stainless steel V4A 1.4571 (316 Ti)
Process temperature 0 to 100 °C (32 to 212 °F)	**Process temperature** 0 to 100 °C (32 to 212 °F)	**Process temperature** 0 to 100 °C (32 to 212 °F)
Process pressure Max. 16 bar at 20 °C (232 psi at 68 °F)	**Process pressure** Max. 16 bar at 20 °C (232 psi at 68 °F)	–
Degree of protection IP68 (when cable is plugged in) IP66 (without cable connector)	**Degree of protection** IP68 (when cable is plugged in) IP66 (without cable connector)	**Degree of protection** IP68 (when cable is plugged in) IP66 (without cable connector)
Maximum measured error • Concentration: down to ±0.01% • Density: ±0.01 g/cm³ • Temperature: ±0.1 °C (0.18 °F)	**Maximum measured error** • Concentration: down to ±0.01% • Density: ±0.01 g/cm³ • Temperature: ±0.1 °C (0.18 °F)	**Maximum measured error** • Concentration: down to ±0.01% • Temperature: ±0.1 °C (0.18 °F)
Transmitter • With touch screen • With LED status indication		**Transmitter** • Portable transmitter

Transmitters

With touch screen	With LED status indication	Portable transmitter

- With clear graphic-capable display (3.5" TFT)
- Touch control operation
- Interfaces: Current output 4 to 20 mA, voltage output (0 to 10 V), Ethernet (Modbus TCP)
- Switch output: Relay contact (max. AC/DC 50 V, 1 A)
- Memory: 2 GB (internal)
- Degree of protection: IP50
- Ambient temperature: 0 to 50 °C (32 to 122 °F)
- Energy supply: DC 24 V (18 to 36 V)
- Connecting cable length: 1 meter, 2 meters, 5 meters and 10 meters

- Featuring LED status displays (supply, errors, sensor function)
- Interfaces: Current output 4 to 20 mA, voltage output (0 to 10 V), Ethernet (Modbus protocol)
- Switch output: Relay contact (max. AC/DC 50 V, 1 A)
- Memory: 2 GB (internal)
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- Ambient temperature: 0 to 50 °C (32 to 122 °F)
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- Connecting cable length: 1 meter, 2 meters, 5 meters and 10 meters

- With clear graphic-capable display
- 4 operating buttons: Select measuring point, Start measurement, Save measurement, Back button
- Memory: max. 3000 measured values per measuring point (for max. 5 measuring points)
- Interfaces: USB B-connection, 8 poles (for connection to a laptop or PC)
- Degree of protection: IP65
- Ambient temperature: 0 to 40 °C (32 to 104 °F)
- Energy supply: Lithium ion battery (capacitance: 2300 mAh), chargeable using USB interface in accordance with the standard BCv1.2 (5 V, 1 A)
- Connecting cable length (to the sensor): 1.5 meters

The Teqwave measuring system fulfills the EMC requirements according to IEC/EN 61326.
It also conforms to the requirements of the EU and ACMA directives and thus carries the $C\epsilon$ and the ⚠ mark.

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