chemtronic
Waltemode GmbH

Optical or Acoustic

Process measurement of liquids

- Turbidity
- Colour
- Oil in Water
- Water in Oil
- Oil on Water

Ultrasonic Reflection Model AS3/AT3

Ultrasonic- Turbidimeter, Monitek Product Line of Galvanic Applied Sciences Inc.

Model AS3

- **Free of maintenance**
- **Extended calibration interval: Typical 24 month**
- **Process insertion through pipe adapter with ball valve**
- **Insertion/removal without process interruption (max. 5 bar)**
- **Optional available with DIN- or ANSI flanges**
- **Wide span of ranges**
- **Insensitive to colour**
- **Insensitive to coatings**
- **Self cleaning effect due to ultra sonic pulses**
- **No wearing parts**

Description:

The ultrasonic probe model AS3, together with transmitter model AT3, has been specially designed to measure particle concentration in a variety of liquids. According to the application, calibration can be done in multiple ranges and measurement units like EBC, ppm, %, etc.. The measurement system has been designed for continuous operation with long life time. The probe design allows an installation into process pipes, tanks or open channels. Up to a process pressure of 5bar and non critical product, process insertion and removal of the probe can be easily done via a 1“ball valve. Calibration and maintenance ensues without process interruption. Other process connections like flanges, swagelok fittings, etc. are available on request.

Applications:

- Product concentration
- Filtration control
- Oil in condensate
- Oil in water / Water in oil

Operational areas:

- Chemical industry
- Petrochemical industry
- Pulp & Paper
- Power plants

Technical Data:

Line size:	< DN 50 / 2“	Measurement range:	0–10ppm, 0–30000ppm
Process pressure:	maximum PN 40 / ANSI class 300	Reproducibility:	± 1 %
Process temperature:	maximum 80°C / 110°C with air purge	Length of probe pipe:	approx. 300mm
Probe material:	1.4471 / 316SS (other material on request)	Weight:	approx. 3kg
Lens material:	Peek (other material on request)	Protection:	IP65 / NEMA 4X
Gasket material:	typical Kalrez	optional hazardous area:	ATEX Zone I / Zone II

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Principle of measurement: Ultrasonic reflection

- **Intuitive user interface**
- **High reproducibility**
- **Programmable range**
- **Linearization of measurement values**
- **Programmable measurement units (ppm, m/l, %, etc.)**
- **Analogue output: 0/4 – 20mA (isolated)**
- **Four programmable set point relays**
- **Backlit graphic display**

Description:

The transmitter model AT3, together with a probe model AS3, has been specially designed to measure particle concentration in a variety of liquids. The large span of measurement ranges of 0 – 1ppm to 0 – 30000ppm allows a wide range of applications. A user friendly interface provides great assistance in setting up of the instrument. Between two and sixteen samples are required to define a calibration curve for a specific customer application. Calibration can be done in multiple ranges and measurement units like mg/l, %, g/l, ppm, ppb, etc. according to customer specification. The 0/4-20mA output allows transferring the measurement results to an external PLC system.

Applications:

- Product concentration
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Operational areas:

- Chemical industry
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- Pulp & Paper
- Power plants

Technical Data:

Supply voltage:	90 - 260 VAC, 50 - 60 Hz
Power consumption:	maximum 50 VA
Relay capacity:	(48V / 2A) programmable
Analogue output:	0/4 - 20mA isolated / 800Ohm
Display:	Backlit graphic display

Measurement range:	0–10ppm, 0–30000ppm
Reproducibility:	± 1 %
Ambient temperature:	-10°C to 50°C
Enclosure:	1.4301 / IP65 (NEMA 4X)
Dimensions:	440 x 360 x 205 mm / 10 Kg
optional hazardous area:	ATEX Zone I / Zone II

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What does ultrasonic Particle Measurement mean?

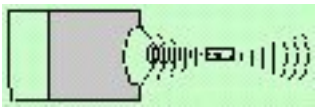
The ultrasonic particle measurement is used to detect non-dissolved (suspended) particles in a liquid, similar to a turbidimeter.
Due to the fact that turbidity is an optical effect, the acoustical method is named as particle or concentration measurement.

Method of Measurement

Equal to a sonar system, the acoustic probe will transfer ultrasonic pulses into the measurement sample. When the acoustic pulses hit particles inside this sample a part of this ultrasonic energy will be reflected as an echo.
The quantity and intensity of these echoes will be detected, evaluated and shown as measurement values.

What do we mean by “Particle”?

In this case, particles are described as pieces, with a different speed of sound as the carrier liquid. This term “particle” not only describes solids as minerals, metals, organic cells, etc., but it also includes components like free oil in water, gas bubbles, etc.. Turbidity caused by colloids, proteins, polymers, etc. will not be detected in a water based solution. These materials consist to a high degree of water and will not show a difference in speed of sound as water.



The ultrasonic pulses hit the particles and will be reflected as echoes.

Comparison of different Measurement Methods

The ultrasonic measurement method is not directly comparable with optical turbidity measurements.
Even in case the same calibration method is used at an optical, as well as at an acoustical instrument, the measured products can show deviating measurement results in this both systems. This deviating behavior is caused by different particle size distributions inside the different samples, compared to the particle size inside the calibration liquid. Depending on particle size distribution, different measurement methods will respond different.

Typical Measurement Units

ppm:	**P**arts **p**er **m**illion
mg/l:	Milligrams per Litre
gr/l:	Grams per Litre
% TSS:	Percent Total Suspended Solids

Please pay attention:

Measurement units based on the Formazin turbidity standard (like e.g. NTU, FTU, FNU, EBC), are typically not used for the acoustical measurement method.
Formazin creates polymer based turbidity without particles (see the above definition of a particle), therefore Formazin will not create acoustic reflections (echoes).

Typical ranges

The ultrasonic measurement system model AS3/AT3 is used for the detection of low, as well as of high particle concentrations. The resolution of the system at lower ranges is at 0,1ppm and better. The maximum range is at approx. 20.000ppm (2 %), higher ranges can be possible depending on product.

When will an ultrasonic particle measurement be used

The ultrasonic particle measurement is used for applications where optical systems will not (or poorly) work.
Another wide range of applications is where systems with extreme low maintenance and extreme high long term stability are required.

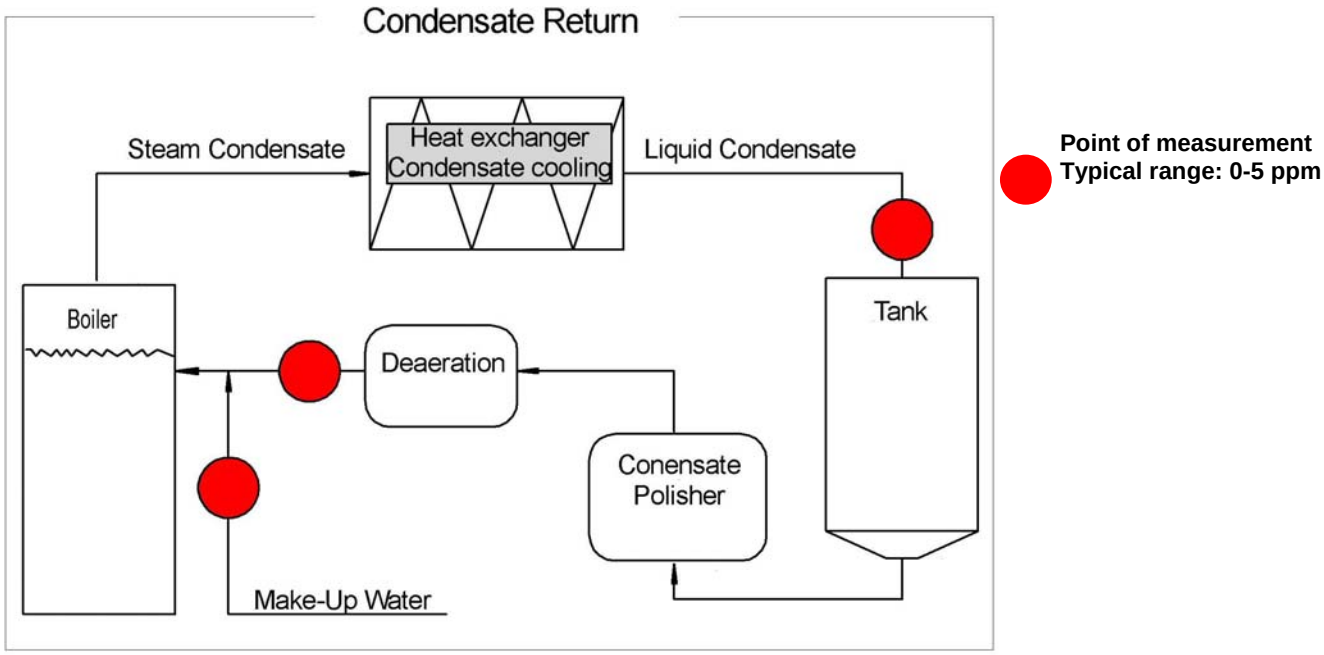
Advantages of an acoustical particle measurement

- No wearing parts
- Free of maintenance
- Long term stability
- Insensitive to coatings on the probe
- Self cleaning effect caused by the ultrasonic energy
- Lowest range approx. 0 – 1ppm
- Highest range approx. 0 – 20,000ppm
- Measurements in black, extreme coloured, opaque liquids
- Measurements in light sensitive liquids
- Not effected by ambient light
- 1” probe technology
- Easy installation in open channels or basins, tanks, etc.
- Easy installation to a pipe, via an 1” ball valve
- Pressure rates up to 600 PSI (40 Bar)
- Max. process temperature 110°C
- Optional use in hazardous area

Typical applications

- **Measurement of oil in condensate.**
  The measurement results are not affected by mineral or oil coatings, high sensitivity against free oil.
- **Measurement of oil in cooling water.**
  The measurement results are not affected by algae growing or oil coatings, high sensitivity against free oil. Possible positive interference caused by particles.
- **Measurement of particles in black ink or other extreme colored liquids**.
  The measurement results are not affected (influenced) by opacity of liquids.
- **Measurement of particles or bubbles in film development liquid**.
  The light sensitive product is not affected (influenced) by the ultrasonic pulses.
- **Selective measurement of yeast cells in beer with additional protein based turbidity.** The measurement results are not affected (influenced) by the proteins inside the beer.
- **Filtration control in industrial applications**

Application Example



Condensate is typically clean water. Condensate return is used as boiler feedwater whenever possible, since it is clean and hot. It takes significantly less energy to reboil condensate return than to use fresh make-up water.
Condensate goes through turbines, pumps, heat exchangers and other equipment. Oil or other contaminants may leak unrecognized into the condensate. These contaminants involve coating, foaming, corrosion and other problems if they reach the boiler. Even if there are no oil leaks, the condensate can become contaminated with iron resulting from an improperly treated piping system or corrosion. This iron will cause high erosion at the turbine blades. Sometimes condensate is cleaned by passing it through polishing filters to remove filterable contaminants, but this is expensive and the measurement system is required for filtration control.

Optical or Acoustic

Two different principles of measurement are typically used for oil and particle monitoring of condensate or feedwater, the classic optical 12°forward scatter turbidity measurement as well as the ultrasonic reflection. Both methods detect even low contaminations (down to ppb level) immediately.

Optical: forward scatter turbidity (model MoniTurb-F / Messenger)
The optical measurement allows very high process temperatures. The sapphire windows of the sensor typically become opaque after some weeks or month of operation, due to mineral coatings. This requires a consistent manual cleaning of the windows in diluted HCL.

Acoustic: Ultrasonic reflection (model AS3 / AT3)
The ultrasonic pulses of the measurement probe are not affected by any coatings. The accruing of mineral coatings is prevented by the ultrasonic cleaning effect additionally. The probe does no have any wearing parts, shows extreme high long term stability and is usually free of maintenance. The design of the probe allows an easy and cost-effective installation. These advantages make the ultrasonic reflection to a perfect technology for this application.