

Case study: Filtration monitoring in the brewing process with turbidity sensor**FOOD**

Efficient and cost-effective monitoring of beer filtration with an ITM-4DW

Reliable and effective filtration is essential for clarity and taste, but also crucial for stability and ultimately the shelf life of beer. Final filtration of the finished product is usually carried out using layer or candle filters, or cross-flow filter systems. To monitor their correct function, many large industrial breweries use special turbidity meters that offer higher measurement accuracy using a two-angle method with 90° and 25°/11°, but they represent a significant cost factor

For small and medium-sized breweries, the ITM-4DW Four-Beam Turbidity Sensor with 90° and 180° measurement angles offers an equally good solution for many applications.

The Application

Large industrial breweries with fully automated processes typically monitor the filter function and, at the same time, the dosage of filter aids made from diatomaceous earth, PVPP, and silica gel using special turbidity sensors with a second measuring angle.

For cost reasons, small and medium-sized breweries often do not use inline monitoring of beer final filtration at all. This is ensured by visual inspection or manual sampling.

In operations of this size, however, the filtration and stabilizing agents are usually mixed in the same dosing vessel, or cross-flow filter systems without diatomaceous earth are used. A second angle is therefore not necessary for pure filter monitoring.

For precisely these breweries and applications, a special test setup has now proven that the ITM-4DW four-beam turbidity sensor can offer equivalent, reliable filtration monitoring at a significantly lower cost.

Advantages in the application



- » **Cost-effective** solution for **operational monitoring** of beer filtration systems
- » **Automated in-line process control** simplifies and improves **product quality control**
- » **Haze increase and filter breakage** are reliably detected and signaled for immediate switchover to recirculation mode
- » **Haze value for alarm** can be easily set by the user
- » **Can be used for layer, candle, and cross-flow filter systems**
- » Four-beam turbidity control with 90° / 180° measurement **complies with critical industry standards such as MEBAK and EBC**

The experimental setup

A test was conducted in collaboration with a brewery in the Netherlands, comparing an ITM-4DW turbidity meter with a competitor's device with 90° and 25° angles.

Various liquids were pumped through a pipe sequentially and the values measured by both sensors were recorded in succession.



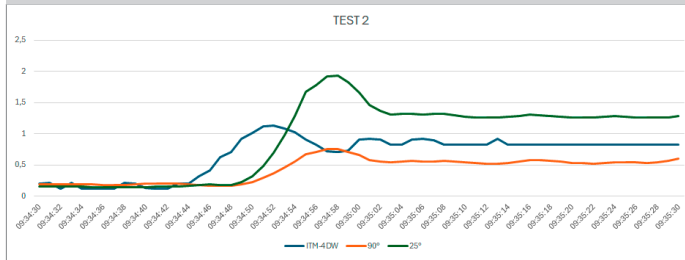
The liquids used were:

- Water
- Water with yeast, various concentrations (test 2)
- Unfiltered beer (test 7)
- Filtered beer (test 8)
- Filtered beer with PVPP, various concentrations (test 9)
- Filtered beer with silica gel and diatomaceous earth, various concentrations (test 16)

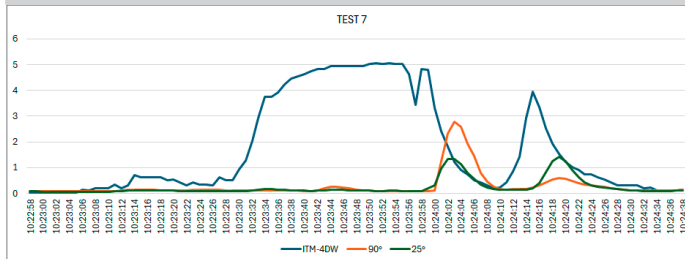
The results

Both sensors responded equally in all tests. In the case of filtered beer (test 8), both show a correct flat line. With each change caused by the addition of yeast, PVPP, or silica gel/diatomaceous earth, both sensors reliably showed a deflection in the measurement curves. Regardless of the particle size, it can therefore be concluded that the ITM-4DW offers a solution for filtration monitoring that is absolutely equivalent to the reference sensor with 90° and 25° angles.

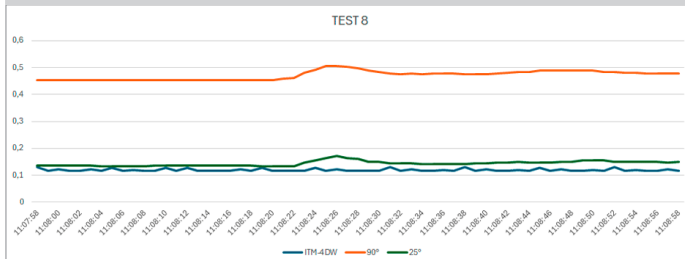
Test 2



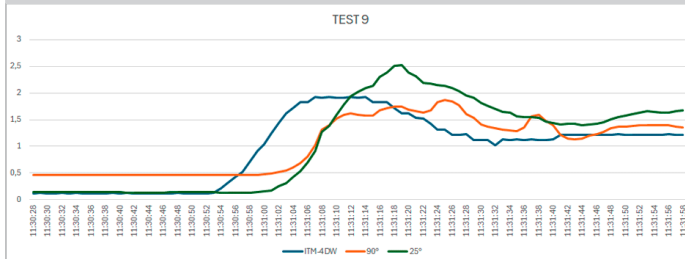
Test 7



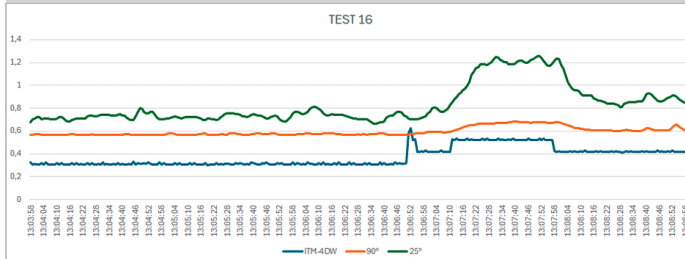
Test 8



Test 9



Test 16



The graphs show the change in the measured values for the ITM-4DW (blue) and for the reference sensor at 90° (orange) and 25° (green). When interpreting the results, it should be noted that the ITM-4 was installed before the reference device and therefore the deflection occurred slightly earlier.

Conclusions for finished product filtration monitoring

The tests carried out clearly confirm that the ITM-4 turbidity sensor, with its very high measurement sensitivity starting at 0 NTU, is a solution that is **equivalent to but significantly less expensive** than the much more expensive dual-angle sensors in many applications.

For breweries that use a **candle or layer filter with diatomaceous earth**, but do not need to measure the PVPP or silica gel dosage for filter media optimization, the ITM-4DW offers a **reliable and extremely accurately programmable monitoring function**. An increase in yeast, diatomaceous earth, PVPP, or silica gel concentration due to a malfunction in the filtration system is measured reliably with high precision and triggered as an alarm.

For breweries that use **cross-flow filtration without diatomaceous earth** as a filtration aid, the ITM-4DW can also be used to create automated process monitoring. Any malfunction is detected, as the corresponding turbidity values also increase in this case and are immediately determined with superior measurement sensitivity. In both applications, the ITM-4DW enables breweries to implement **cost-effective, yet highly accurate and reliable automated inline process monitoring against filter breakthrough**.

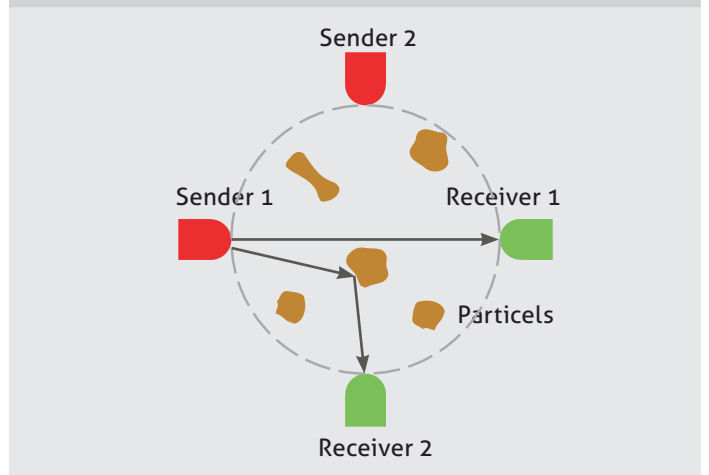
In addition, the measurement technology with a 90°/180° measurement angle ensures complete **compliance with quality standards** (haze monitoring according to EBC/MEBAK). Previously required **random samples or visual inspections** can be **completely eliminated**.

The use of an ITM-4DW can thus reliably counteract **quality reductions and reduced stability and shelf life** in beer.

ITM-4 / GG65



Measurement Principle



ITM-4DW Four-beam turbidity sensor with alternating light method

Specification		
Process connection	Milk pipe DIN 11851 DIN flange Tri-Clamp	DN 25; 40; 50; 65; 80; 100 DN 25; 40; 50; 65; 80; 100 DIN: DN 25; 40; 50; 65; 80; 100 ASME: DN 1"; 1.5"; 2"; 2.5"; 3"; 4"
Materials	Connection head Housing Optics block Optics Window Seal	Stainless steel 1.4305, Ø 89 mm Stainless steel 1.4404 PPSU Sapphire glass PMMA EPDM, FDA-compliant
Temperature ranges	Ambient Process CIP-/SIP-cleaning	-10...+60 °C 0...100 °C to 130 °C / maximum 30 minutes
Operating pressure		Maximum 10 bar
Protection class		IP 69 K (with M12 connector)
Measurement range	NTU EBC	0...5; 10; 20; 50; 100; 200; 500; 1000; 2000; 4000; 5000 0...1; 2; 5; 10; 20; 50; 100; 200; 500; 1000; 1250
Damping in seconds	Adjustable t ₉₀ Time	0; 1; 2; 4; 8; 16; 32; 64; 128 sec.
Accuracy		See the following table "ITM-4 measurement accuracy"
Measurement principle	As per EN 7027	4-beam alternating light
4-beam alternating light	As per EN 7027	860 nm ±60 nm
Display	LCD with backlight	2 x 8-digit
Electrical connection	Cable screw fitting Cable connection Supply voltage	2 x M16 x 1.5 (PG) 2 x M12 connector 1.4305 (optional) 18...36 V DC, maximum 160 mA
Digital inputs	measurement range switching	E1 and E2, PNP, galvanically isolated
Output	Current output Switching output	4...20 mA, galvanically isolated 24 V DC, maximum 100 mA, PNP, short-circuit proof

Accuracy ITM-4				
Measurement range	0...100 NTU 0...25 EBC	101...1000 NTU 26...250 EBC	1001...5000 NTU 251...1250 EBC	Annotation
Resolution	0.1 %	1 %	10 %	display
Reproducibility (with the same process conditions)	±2 %	±3 %	±4 %	of measurement value ±1 resolution step
Absolute accuracy acc. to FNU-formazine-scale	±3 %	±4 %	±6 %	of measurement value ±1 resolution step