

inline control

**TOP 5**

## **Brewery Applications**

**english**

deutsch

español

portuguese

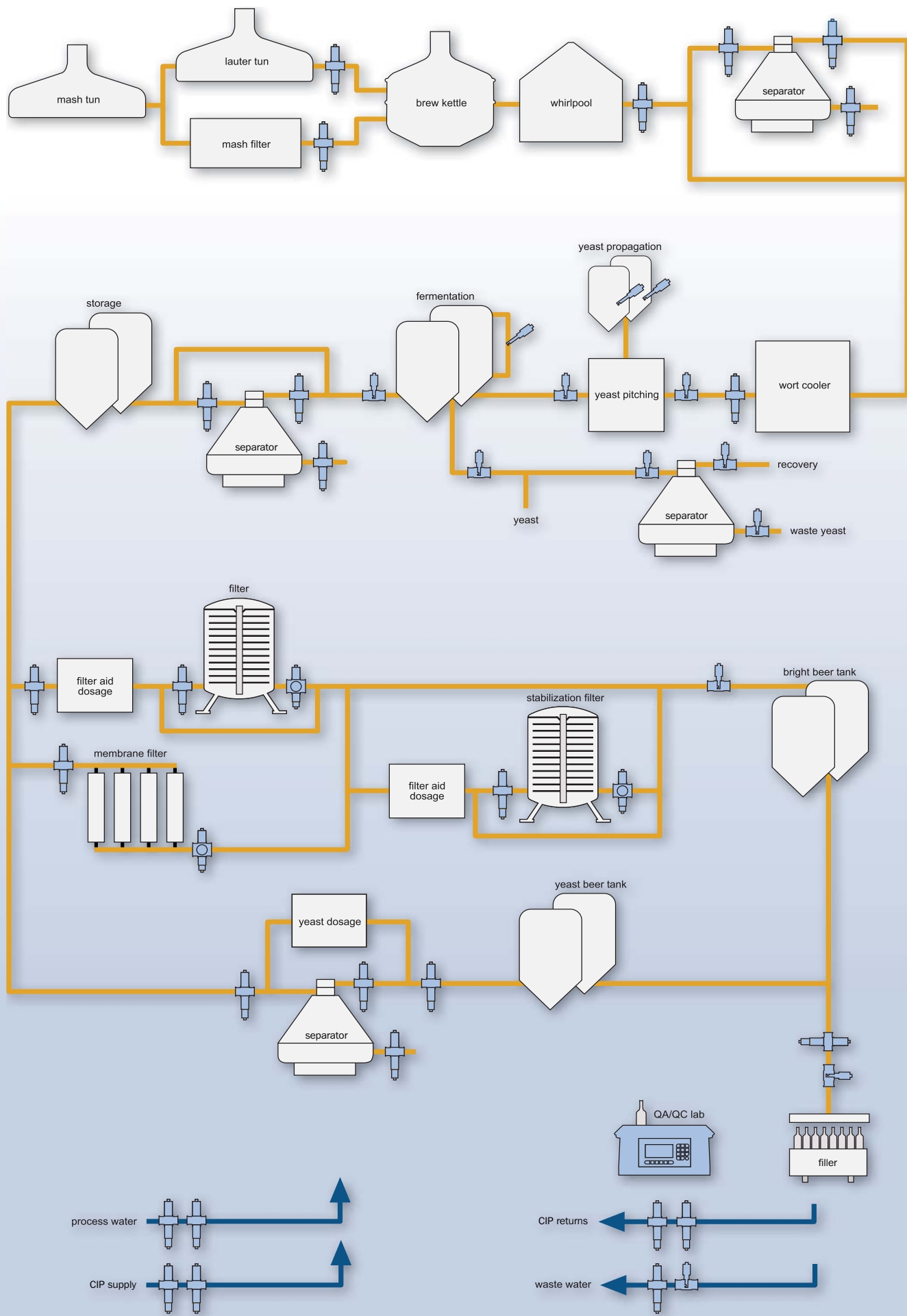
русский язык

中国

日本語

français

italiano





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**In all stages of the brewing process optek photometers help to ensure optimum system performance.**

optek is the world's leading manufacturer of inline photometric process instrumentation. With more than 30,000 installations in various applications and industries, our team provides the best in quality, consulting, support and long term performance, worldwide.

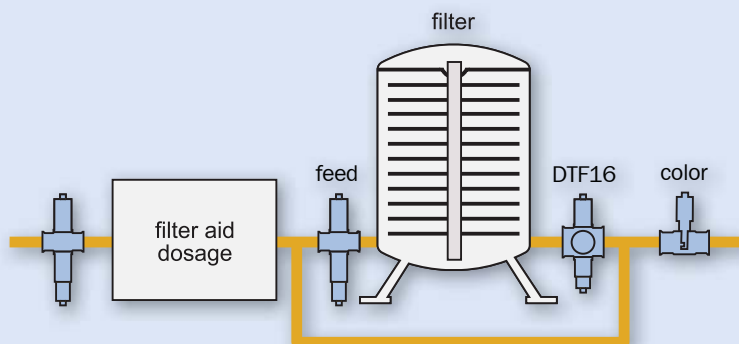
High quality materials are able to withstand the toughest process conditions, including high temperature and high pressure applications. Cleanability is ensured using high quality polished wetted materials, superior hygienic design as well as sapphire optical windows.

As a global partner to the brewing industry, optek offers the most advanced technologies like superior signal amplification, drift-free zero point & calibration, inline validation support, stray light suppression, PROFIBUS® PA, and multilingual user-interfaces for easy on-site operations. Our support ensures long term satisfaction with programs like "SpeedParts" and "SwapRepair" to provide our customers sustainable operations and minimized downtime at the lowest cost of ownership.

**Optimize your process with optek.**



## 04 | Filter Control – Applications



### Filter Control 11° / 90°

The optek Haze Control / DTF16 relies on a dual angle scattered-light measurement for precise quality control during final filtration independent of color and color changes. Using this sensor downstream of the filter detects filter breakthroughs, preventing “out of spec” product while ensuring product quality and clarity at each filtration step.

### Feed Monitoring

Using an optek AS16-N or AF16-N, the turbidity in the feed line can be monitored, allowing precise feed control while preventing filter clogging or blinding. This additional sensor can be connected to your Haze Control / DTF16 system without need for an additional converter.

### Filter Backwash Optimization

The optek AS16-N or AF16-N used for feed monitoring can also be used to optimize your filter backwash process by measuring the turbidity in the water, saving time, energy and conserving water usage.

### Filter Aid Dosage

Dosage of filter aids like Kieselguhr or PVPP can be controlled with optek absorption or scattered-light sensors. Optimizing filter aid usage reduces costs and at the same time ensures consistent product quality.

### Phase Separation

The Haze Control / DTF16 system may also be paired with an AS16-F or AF16-F to measure the color of your beer. This measurement controls the phase separation between beer and water ensuring faster product change-overs while maintaining product quality and minimizing product losses.

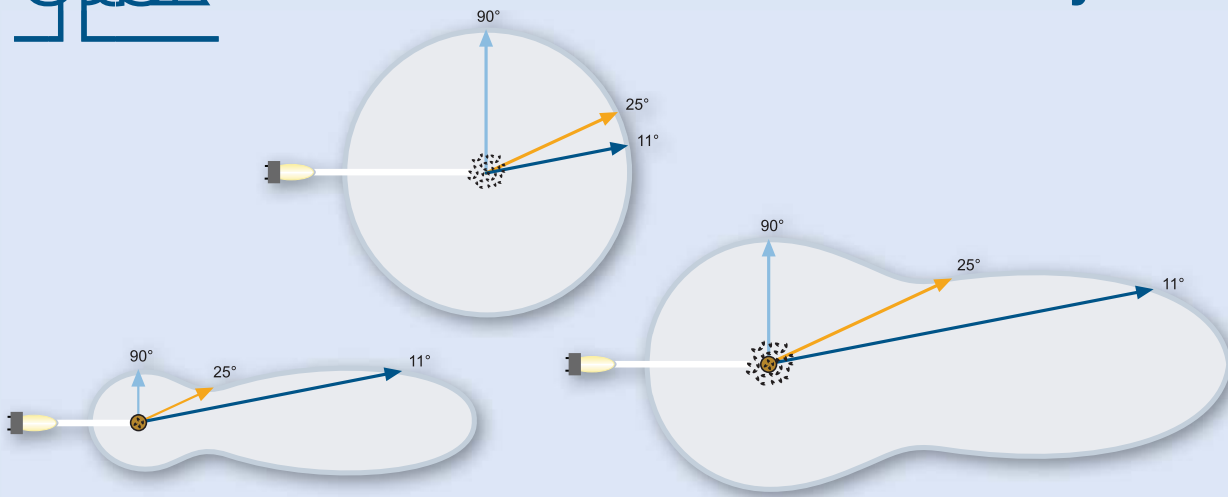
### Filter Setup Monitor

Using the 0° absorption channel of the sensor DTF16, turbidity up to 500 EBC can be measured, allowing you to monitor and control the filter pre-coat cycle. This provides an additional opportunity for filter optimization.



optek Haze Control DTF16





## Why use an 11° measurement?

Forward scattered light is particle size sensitive and its strength is in detecting particles such as yeast, trub and Kieselguhr, efficiently detecting filter breaks and filtrate turbidity caused by particles, even at extremely low concentrations. 11° measurements are very sensitive in this regard and correlate well to actual non-dissolved solids content, essential for proper filtration control and optimization.

## Why is 11° better than the traditional 25° measurement?

Scattered light at 11° is more specific due to a higher signal and will detect abnormal particulate faster without the influence from colloidal material common at 25°. This also aids in the prompt troubleshooting of filtration problems.

## Why use a 90° measurement?

Turbidity measurements at an angle of 90° are highly sensitive to colloids and are used as a quality check for the clarity of the beer. Mistakenly, 90° techniques have been used for process evaluations but do not correlate to actual non-dissolved

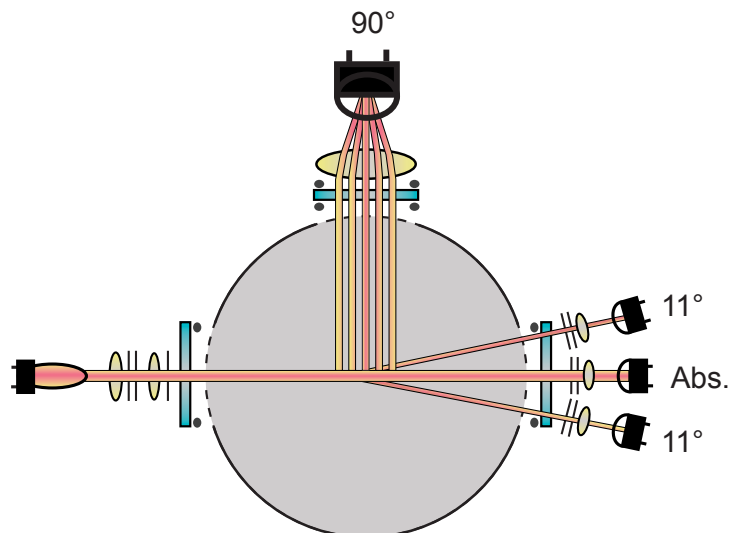
solids content. Modern breweries can now measure this parameter inline and thus provide the ability to release beer automatically.

## Why use a 0° absorption measurement?

Using the 0° absorption channel allows measurements at higher turbidity levels, well beyond the range of the 11° or 90° results, allowing to monitor and control the filter pre-coat cycle as well. This provides an additional opportunity for filter optimization.

## Why is the reading of lab and process sometimes different?

The beer in the pipe is homogeneous, under pressure, and at a constant temperature. In the lab, the samples have time to change, solids may precipitate, and temperature changes will affect the solubility of colloids and with that the measurement. In addition, differences in the optical configurations of the instruments themselves, along with the calibration methods used, have an influence on comparative results.





## 06 | Haze Control – Technology

### Control is Power.

Filtration is one of the most important steps in the brewing process. The optek Haze Control DTF16 allows you to measure and control this crucial process and provides real-time quality assessment. In addition to releasing beer by instrument, there are tremendous opportunities to reduce beer loss, media usage and production costs while increasing filtration capacity and ensuring consistent product quality.

optek DTF16 Process Turbidimeter



### Factory Zero Point

The power behind the optek Haze Control DTF16 is the factory zero point. No longer is a questionable zero media (process water) or offline zero procedure required. Using known technical reference solutions and purest zero media, optek developed a factory calibration and a precise zero point. This drift-free factory zero point eliminates the need for regular zeroing of the instrument saving you time and money and does not depend on the operator. It also ensures that every instrument is base lined identically and precisely. This is invaluable when relying on multiple instrument locations.

### Factory Calibration

Each and every optek Haze Control DTF16 is factory calibrated to EBC standards which correlate to all other stan-

dards currently in use in process plants today. This calibration is stable for the life of the instrument and does not need recalibration, providing a low cost of ownership. This ensures precise, repeatable and reliable measurements across multiple instruments and locations. User selectable units of measure and built in correlation tables provide unrivalled flexibility to the brewery.

### Drift-free by Design

Baseline drift of scattered-light sensors has long been a problematic issue. This is usually caused by unwanted scattered-light, or stray light, from reflections in the sensor assembly from the light source itself, worn artificial coatings, or external light (i.e. sight glasses). This stray light influences the measurement in an unpredictable fashion.

sign does not rely on any coatings and maintains a cleanable, sanitary design. Combine this ingenious design with the legendary optek signal amplification stability, dual beam ratio detectors and advanced Haze Control firmware and you get a drift and calibration-free process turbidity analyzer with excellent long-time performance.

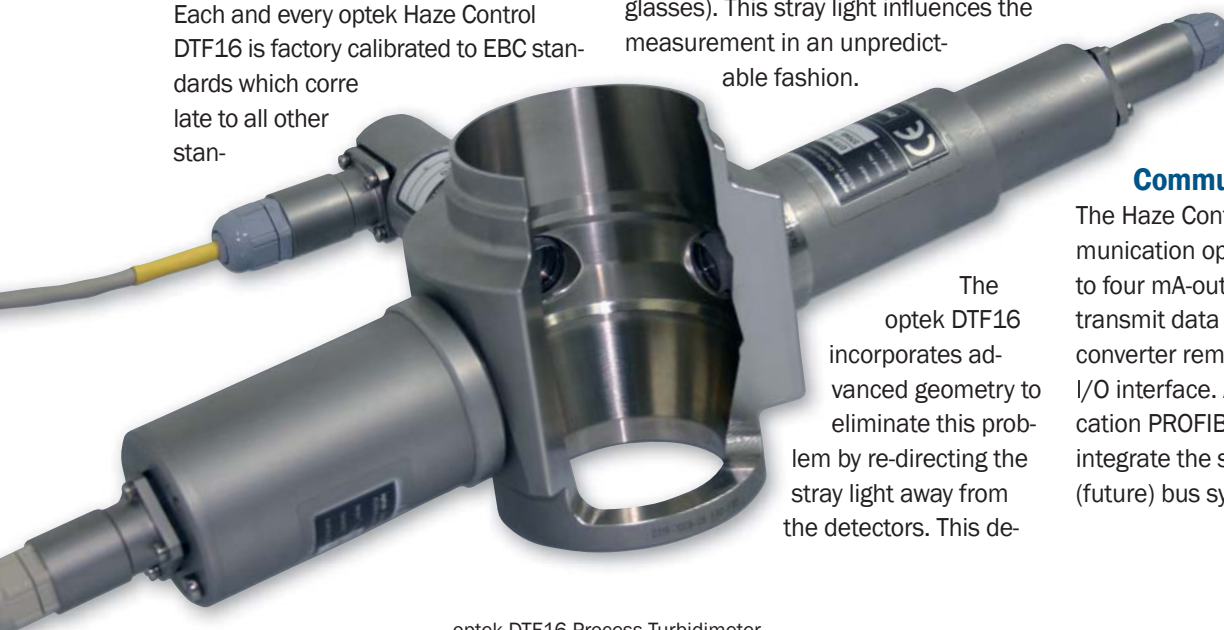
### Information on Demand

Designed for ease of use, the Haze Control software has seven languages to choose from. In addition to the four transmitted results, the Haze Control has a built in data logger providing you with continuous trending. This data can be displayed locally and downloaded to a computer allowing production personnel to review process consistencies or track down any historical problems.

### Communication you need

The Haze Control offers multiple communication options. You can use up to four mA-outputs simultaneously to transmit data or completely control the converter remotely using a standard I/O interface. Also the bus communication PROFIBUS® PA is available to integrate the system optimally in your (future) bus system.

The optek DTF16 incorporates advanced geometry to eliminate this problem by re-directing the stray light away from the detectors. This de-



optek DTF16 Process Turbidimeter

## Haze Control units and ranges

## Range of Measurement Haze Control DTF16

Unit	EBC Correlation	90° side scatter	11° forward scatter	0° absorption
<b>EBC</b>	1	0-25	0-25	0-500
<b>FTU</b>	4 = 1 EBC	0-100	0-100	0-2000
<b>NTU</b>	4 = 1 EBC	0-100	-	-
<b>ASBC-FTU</b>	69 = 1 EBC	0-1725	0-1725	0-34500
<b>Helms</b>	40 = 1 EBC	0-1000	-	-
<b>ppm (DE)</b>	6.4 ≈ 1 EBC*	-	0-200	-






\* non linear correlation

The instrument may be set by the operator to various lower ranges which can be displayed and transmitted simultaneously.

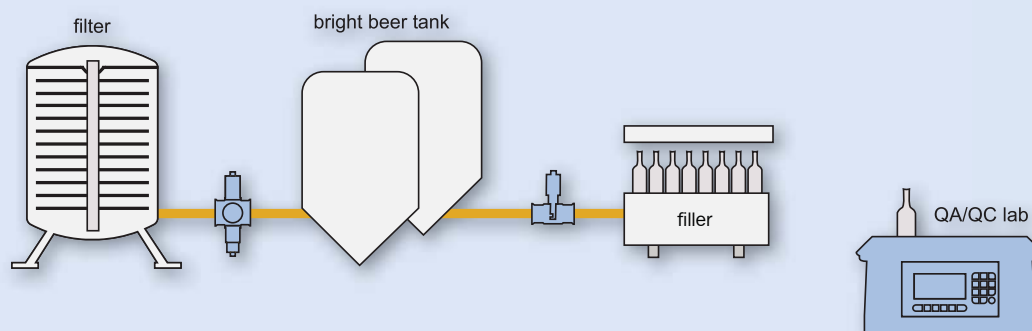
**EBC** = European Brewery Convention  
**FTU** = Formazin Turbidity Units  
**NTU** = Nephelometric Turbidity Units  
**ASBC** = American Society of Brewing Chemists  
**Helms** = Turbidity Unit  
**ppm (DE)** = Parts per Million (Diatomaceous Earth)

## Dry air

With most measuring systems being installed in refrigerated cellars, condensation is likely in and around the sensor. This is addressed by simply supplying dry instrument air to standard purge connections of the DTF16. By pressurizing the internal air space the potential for condensation is eliminated. optek offers air preparation systems to meet your requirements.

				Communication			
Haze Control	DTF16 11 °/90 °	AS16-N NIR-Absorp.	AS16-F Color	mA-OUT 0/4-20 mA incl. Failsafe	Relays 0-50 V AC 0-75 V DC	mA-IN 0/4-20 mA	Remote-IN 18-29 V DC
HC4301	x	-	-	2	3	-	-
HC4402	x	x	-	4	3	-	-
	x	-	x				
HC4321	x	-	-	2	3	2	7
HC4422	x	x	-	4	3	2	7
	x	-	x				
HC4351	x	x	-	2	3		
HC4452	x	-	x	4	3		

## 08 | Filter Control – From Line to Lab



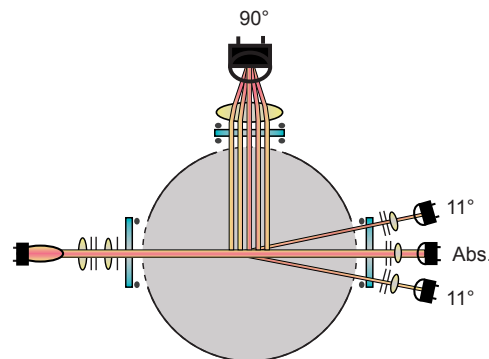
### Line and Lab: One optical design

Two of optek newest products are specifically designed for the beverage industry. The optek DT9011 is an “In the Bottle” bench top turbidimeter. The process sensor DTF16 is intended as a true real-time QA/QC turbidity analyzer that can eliminate lab assessments all together. Both products measure at both a forward scatter angle of  $11^\circ$  as well as the side scatter method of  $90^\circ$ .

Both results are displayed and recorded simultaneously. The measurement signals of the laboratory system match the optek DTF16 series inline turbidimeters, allowing validation of process readings to the lab. The  $90^\circ$  angle provides the colloidal haze measurement for clarity assessment. Either angle can be read in EBC or FTU. The  $11^\circ$  angle can be read in ppm or ASBC and at the  $90^\circ$  angle Helms or NTU units are also possible. Measuring at both angles provides lab personnel with considerably more data when analyzing finished beer turbidity.

The  $11^\circ$  forward angle is very sensitive to particle size so it is an indicator of abnormal particulate such as Kieselguhr and yeast. In addition it correlates very well to actual non-dissolved content while the  $90^\circ$  side-scatter angle provides sensitivity to colloids and haze. Using the  $11^\circ$  forward scatter angle is more specific than  $25^\circ$  and eliminates false high readings due to haze, because it is nearly independent of colloidal turbidity. Any filtration issues, whether recipe, process or equipment related can now be diagnosed much easier by knowing the nature of the turbidity constituents.

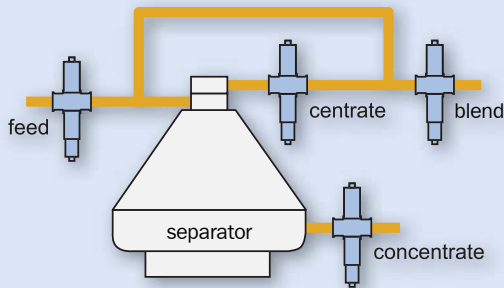
Using the optek DT9011 the sample is placed in a water bath and measured 250 times during one rotation, followed by advanced data analysis. This eliminates the effects of bottle color and shape, as well as scratches, seams and other imperfections in the sample bottle.



optek Haze Control DT9011  
Laboratory Turbidimeter







## Outlet (Centrate) Control

Centrifugal separators equipped with a NIR absorption based photometer AF16-N or AS16-N on the outlet, can eliminate needless discharges and initiate them only when solids (yeast) carry-over is detected in the centrate stream. Counting the frequency of these discharges is an indicator of incoming solids loads, which can be used to adjust the flow rate to allow maximum separation performance in high load conditions, and allows maximum throughput at low load conditions. Optionally, a scattered light sensor TF16-N can be installed instead of a NIR absorption sensor to ensure lowest measuring ranges, this obviously depends on the application.

## Feed Control

Adding a second NIR absorption based photometer AF16-N or AS16-N to the feed line, and measuring incoming loads directly, allows immediate response to varying process conditions, including diverting high solids slugs to prevent plugging up a separator bowl. One mishap like this costs more than the analyzers used to prevent it. Of course proper beer/yeast interface detection upstream will also prevent unacceptably high solids loads from shutting down a separator. In some breweries, clarified streams are bright enough for release. In this case a scattered light sensor TF16-N would be used for turbidity QA as well as for separator control.

optek C4000 Photometric Converter

yeast back into the clarified process stream. With this instrumentation constant beer quality can be ensured. Control the turbidity inline without the need for sample taking and manual dosing and save time and money.

## Concentrate Control

The concentrate stream of a separator can be equipped with a NIR absorption based photometer AS16-N or AF16-N using a very short optical path length to accurately correlate absorption measurements directly to weight-percent. This enables yield measurement and control of product quality.

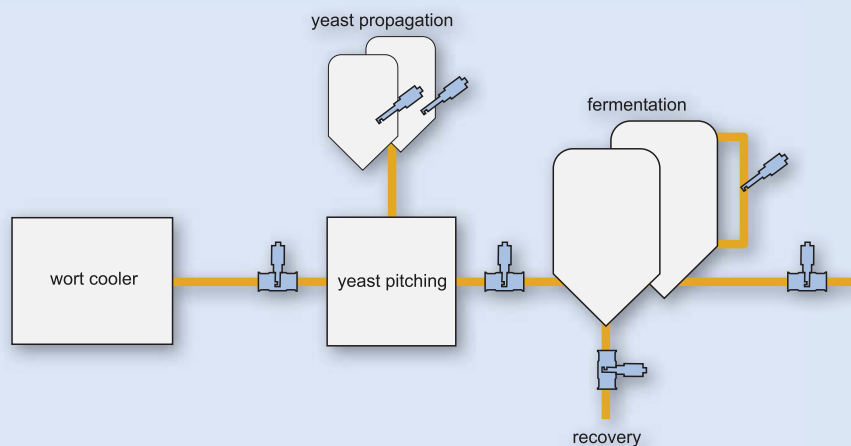
## Bypass Blend Control

In some cases a scattered light sensor TF16-N instead of a NIR absorption based photometer AF16-N or AS16-N can be useful for yeast concentration control. A bypass line is used to dose a certain amount of unfiltered beer or



optek AF16 Single Channel Absorption Sensor

## 10 | Yeast Management



### Yeast Pitching

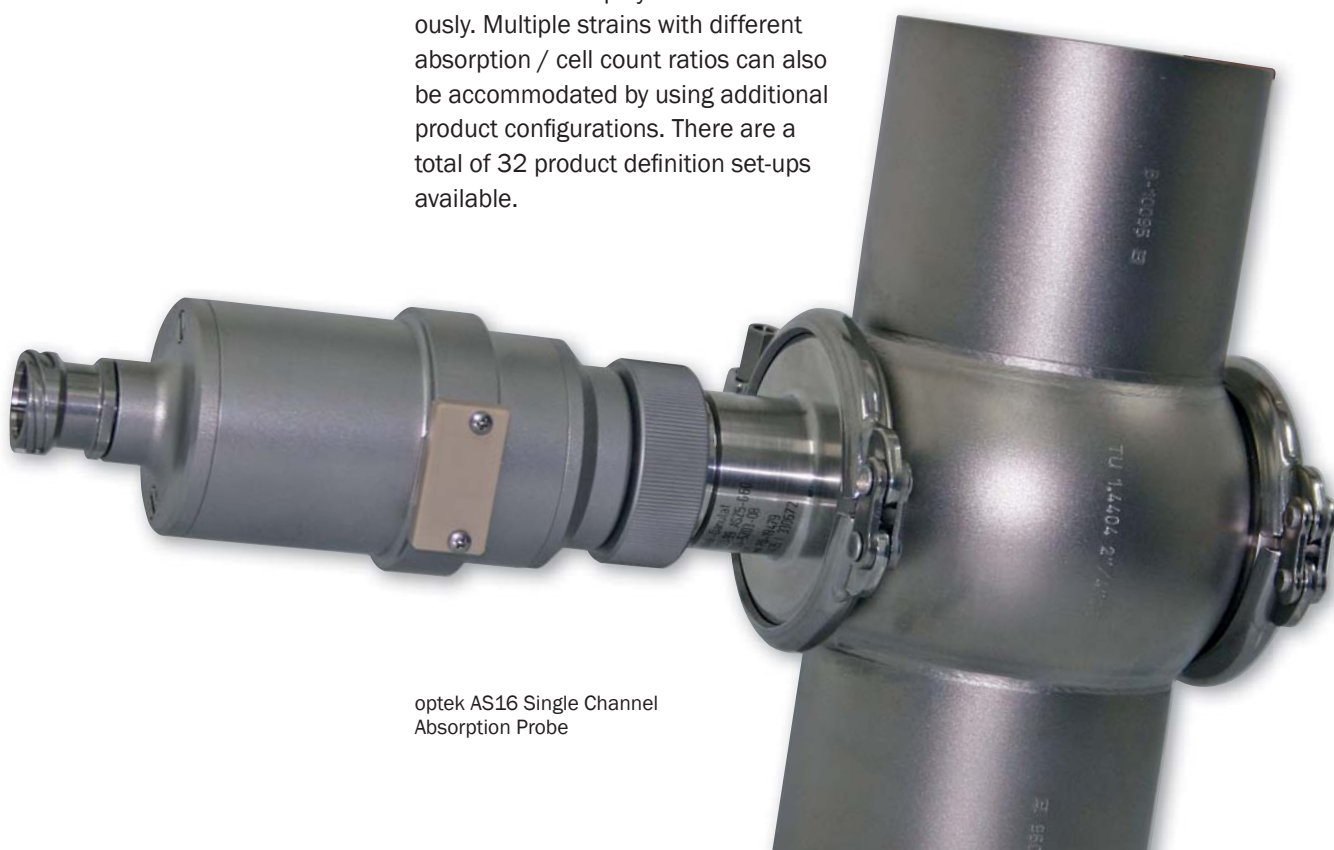
Yeast dosing can be done precisely, and inexpensively using a technique called differential NIR absorption. This method uses two sensors. The first or upstream sensor is a single channel, NIR absorption based photometer AS16-N used to “baseline” the wort turbidity.

This sensor often can double as a whirlpool outlet monitor, or a cold break monitor, depending on its location in the brewhouse. The downstream sensor AS16-N would be located after the yeast injection point, prior to any air injection. This sensor measures the combined yeast and wort stream. Simply subtract the baseline result from the combined stream result to get pure injected yeast content.

With a simple comparison to the lab, the correlation to cell count can be programmed directly in the C4000 converter and displayed simultaneously. Multiple strains with different absorption / cell count ratios can also be accommodated by using additional product configurations. There are a total of 32 product definition set-ups available.

### Correlation of Absorption to million cells / mL

NIR absorbance is directly proportional to the concentration based on Lambert-Beer's Law. Correlations to cell count are easily done with any repeatable laboratory method. Multiple product functions in the C4000 allows multiple correlations for different yeast strains if required.



optek AS16 Single Channel Absorption Probe



optek C4000 Photometric Converter

## Fermentation

In fermenting, AS16-N probes have the unique ability of mounting directly in the fermentation vessel or directly in a bypass line via different adaptors. Properly located, the entire fermentation cycle can be monitored in real-time, allowing optimization of the process. Tanks can be released automatically rather than waiting hours for lab samples to indicate proper flocculation. Feedback on any recipe influences of yeast cell growth can also be seen. In larger cellars, saving 6-10 hours per fermentation cycle can add up quickly, adding valuable fermentation capacity, without adding a single fermenter.

## Beer / Yeast Interface, Yeast Recovery

Many breweries are using large vertical fermenters or multi-purpose tanks. One of the main advantages of these tanks is avoiding extra product transfers. However, settled yeast must be removed. A turbidity sensor is installed

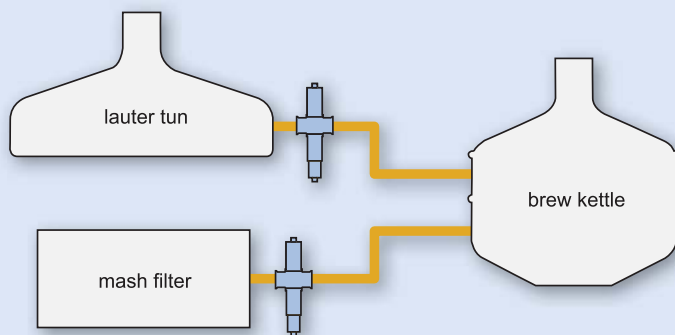
in the tank outlet, or in the recovered or spent yeast line. When the yeast is removed from the beer the turbidimeter will determine the interface between the yeast and beer. In the past this was accomplished by time / volume or visual inspection. Since the set points are adjustable the optimal cut-off level can be obtained to provide the most efficient operation. This reduces product loss and provides a more uniform product for filtration.

Beer / yeast interface, yeast recovery also typically uses the AS16-N inline sensor. However, for basic interface applications, where the interface detection is the only objective, optek offers a lower cost probe style sensor in the AS56-N. Its lower power lamp module also allows for up to four AS56-N series probes to be multiplexed in one C4000 based system, thus making the measurement point cost even more attractive.



optek AS16-N Single Channel Absorption Probe

## 12 | Brewhouse Turbidity



### Wort Clarity Monitoring

Lauter tun run-off clarity has traditionally been a hands-on monitoring operation performed by brewery personnel; however, this is now commonly done with a scattered-light based photometer TF16-N.

The measuring ranges depend on the clarity levels reached and on measurement expectations. This instrument continuously monitors solids concentrations in the extract stream to automatically indicate a switch to flow forward to the brew kettle when the desired clarity level is reached.

More importantly, it can automatically react to any husk bed upsets, or elevated solids concentrations due to bed cuts. Depending on the normal clarity levels achieved, this measurement result can also be correlated to % TSS (total suspended solids), which can then be combined with flow data to create a % TSS - flow weighted average. Control of this stage of the process offers predictable downstream solids content for both operational efficiency, and flavor / clarity stability.

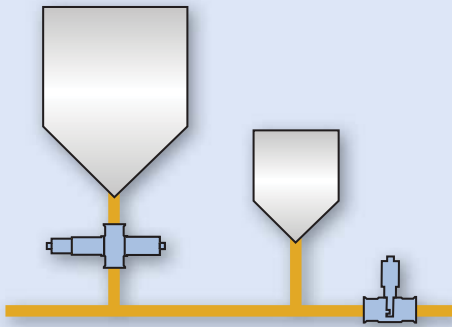
### Mash Filter Monitoring

Using a mash filter for clarifying the wort makes the turbidity measurement even more important. Achieve better product quality by decreasing product losses and improving filter lifetime. Filter breaks can be immediately detected using a scattered light based photometer, type TF16-N to monitor very low particle concentrations precisely up to a broad turbidity range using the absorption signal simultaneously. Automated alarms will signal a breakthrough. Filter set-up time & CIP cycle duration can also be optimized.

optek TF16-N Scattered Light  
Dual Channel Turbidity Sensor







optek AF26 Dual Channel Absorption Sensor



optek AS16-F Single Channel Absorption Probe

## Beer Color is Important

The use of precision color sensors before the fillers can provide color dosing control and quality control based on specific color aspects of the brands. Single or dual beam colorimeters configured to monitor to specific visible wavelengths can offer continuous inline monitoring to minimize sampling and lab analysis. A consistent visual impression for the end customers is as important as the possibility for product identification.

## Wort Color

Wort color is also measured using absorption. However, beer color is measured using visible light (VIS) at 430 nm. In the brewhouse this poses a problem as background turbidity (solids) will also absorb light at 430 nm. To compensate for this with optek you can measure at two wavelengths, one at 430 nm and a reference wavelength in the NIR (Near Infrared).

Subtracting the absorbance signal of the reference channel from the primary, visible channel signal gives a pure color measurement. This result is then correlated to ASBC or EBC, using

the software features of the C4000 photometric converter.

The optek sensor AF26, dual channel absorption based photometer, is ideal for this application. Simultaneously, the reference channel can monitor trub and cold break if the AF26 is strategically located after the wort cooler.

## Color Dosing

The color of some beers will be adjusted using i.e. malt extract or rye malt beer. Dosage can be controlled using an optek sensor. The color of the beer is measured and automated signals i.e. relays can be used to trigger pumps to start dosing the color into the beer stream. After the dosage, the color can be verified by a secondary sensor. Color of dark and bright beers, as well as the color of high gravity beer after blending can be controlled.

## Interface Detection / Phase Separation

Precise process interface detection with a single channel VIS absorption based photometer (optek AS56-F or AF56-F) is the easiest and least expensive technique available to brewers today to reduce product losses. In a large brewery, the sheer number of change-over operations can cost the brewer thousands of hectoliters of product and by-products each week. In today's economy, recovering this

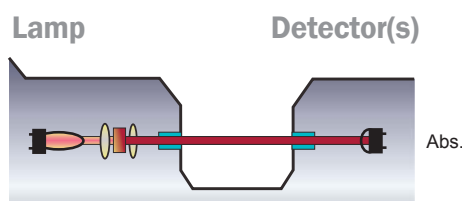
product is essential to maintain a profitable business; however the costs go beyond the product alone. Water as the push-out medium is also a commodity and has an inherent cost to procure and treat. Product and water, along with yeast, going needlessly down the drain are a large contributor to plant effluent and the costs to treat it. Local municipalities may also be involved; applying charges to the volume of effluent and even fines if solids load or BOD limits are exceeded. Gaining control of plant interface functions not only makes sense, it's also environmentally friendly.



## 14 | Principles of Measurement

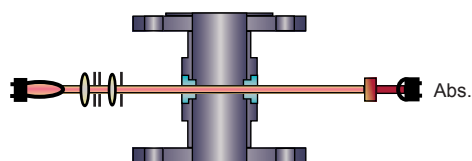
### Probe AS16 / AS56

VIS- and NIR-Absorption,  
Single Channel Concentration and  
Color Measurement



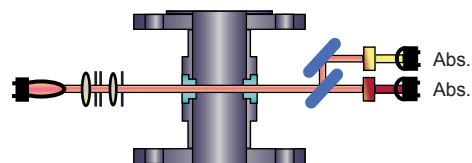
### Sensor AF16

VIS- and NIR-Absorption,  
Single Channel Concentration and  
Color Measurement



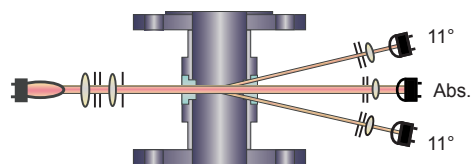
### Sensor AF26

VIS-Absorption,  
Dual Channel Color Measurement with  
Turbidity Compensation



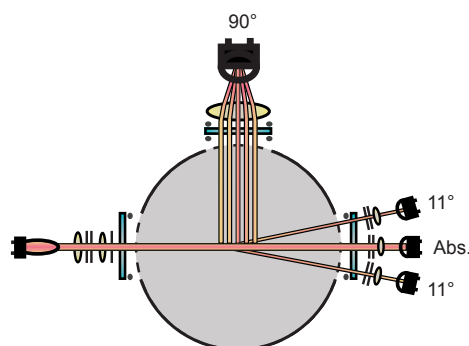
### Sensor TF16

11° Scattered Light and NIR-Absorption  
dual channel turbidity measurement



### Sensor DTF16

Triple Beam Scattered-light Optical Design  
11° / 90° Scattered-light  
with Light Compensation and additional  
Absorption Measurement for high  
concentration





### optek Advantage: Control is Power

Today, more than ever, the need for process optimization, product recovery, cost reduction, and reduced waste is the key to a successful business. Real-time data from reliable process scale analyzers from optek is essential to gain complete process control, realize optimization potential and ensure profitability.

**A brewery can't manage what it doesn't measure.**



### ... and above all else:

Thank you for brewing!  
Here at optek we are all your customers too!



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