

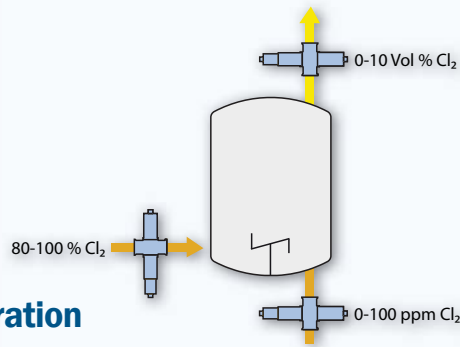
# **TOP 5** **Chemical Applications**



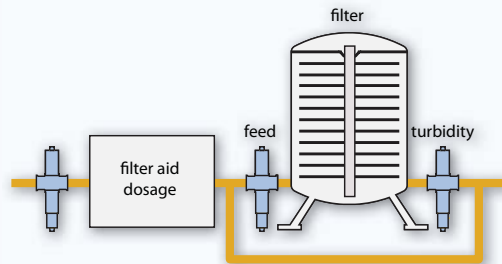
**english**  
deutsch  
español  
portuguese  
русский язык  
中国  
日本語  
français  
italiano



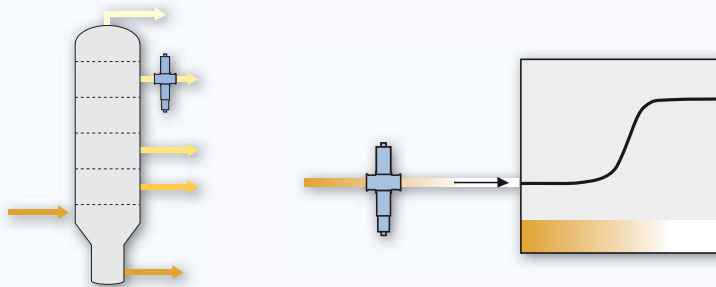
## TOP 1 Halogen Concentration



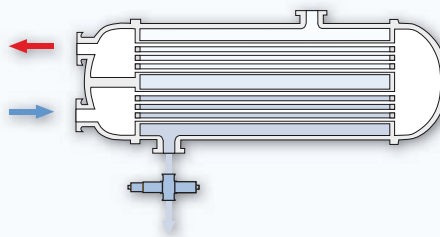
## TOP 2 Filter Control



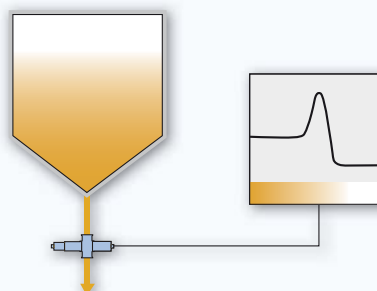
## TOP 3 Color and Concentration



## TOP 4 Condensate and Cooling Water



## TOP 5 Phase Separation



Acetaldehyde  
 Acetone  
 Alcohol, Water in  
 Acrolein  
 Acrylic Acid  
 Activated Carbon  
 Aldehyde  
 Ammoniak  
 Aniline  
 APHA  
 Aromatics  
 ASTM  
 Benzene  
 Benzaldehyde  
 Benzyl Chloride  
 BTEX  
 Bisphenol A  
 Bromine  
 Caffeine  
 Chemical Nickel  
 Chlorine  
 Chlorobenzene  
 Chlorine Dioxide  
 Chlorophyll  
 Chromat  
 Cobalt  
 COD  
 Color  
 Copper  
 Cresol  
 Dichromate  
 Ethylbenzene  
 Fluorine  
 Gardner®  
 Hazen  
 Hydrogen Peroxide  
 Hypochlorite  
 Iodine  
 Iron  
 Ketones  
 Lime Water  
 Latex  
 MDI/MDA  
 Monochloro Benzene (MCB)  
 Naphtalene  
 Nickel  
 Nitrobenzene  
 NO<sub>x</sub>  
 Oil in Water  
 Ozone  
 Palladium  
 Peracetic Acid  
 Permanganate  
 Phenol  
 Phosgene  
 Phthalic Acid  
 Platinum  
 Pyridine  
 Sulfur Dioxide  
 Styrene  
 Suspensions  
 TDA  
 Titanium Dioxide  
 Toluene  
 TOC (SAK 254)  
 Turbidity  
 UV-Absorption  
 Water Concentration  
 Water in Oil  
 Water in Fuel  
 Xylene  
  
 and many more...

## Content

### TOP 5 Chemical Applications

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**In many stages of chemical processes, 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.

optek process photometers provide reliable and accurate industrial process control for liquids and gases. Utilizing UV, VIS, NIR and scattered light technology, optek photometers measure inline for continuous processing. Superior materials of construction make optek photometers ideal for applications in high temperature, high pressure, and corrosive process streams.

As a global partner to the chemical industry, optek offers the most advanced technologies such as superior signal amplification, inline calibration accessories, PROFIBUS® PA, and multilingual user interfaces for easy onsite 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**

**optek®**  
inline control

## 04 | Halogen Concentration



optek C4000 Photometric Converter

optek provides high performance inline photometric process analyzers to the chemical industry. Installed at strategic points within the process, (inlet pipes, outlet tubes, in tail gas of reactors or in waste water streams) these analyzers provide an excellent return on investment.

### Chlorine Concentration

Chlorine plays a significant part in the production of chemicals, pharmaceuticals, disinfectants, bleaching agents and insecticides. optek process analyzers provide reliable and repeatable chlorine measurements inline. These chlorine concentration measurements are performed in real-time without the need for hazardous sampling.

Measurements are possible in low and high percent ranges for gaseous phase processes, and ppm levels for liquid phase processes. Available options include high pressure, high temperature, ATEX and FM hazardous area classifications.

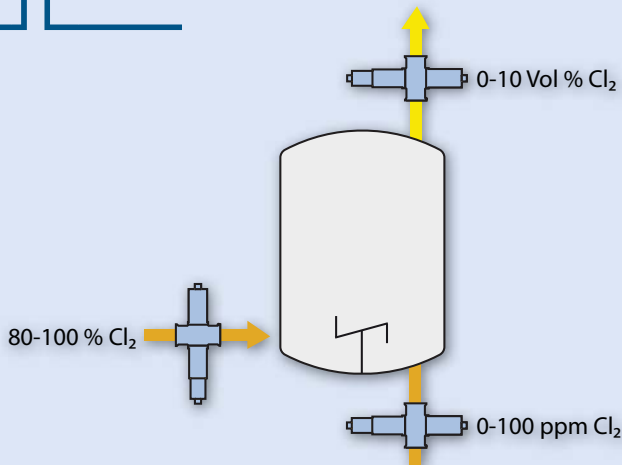
Measurements of other halogens like fluorine, bromine and iodine can also be achieved in gaseous and liquid phases.

### Measurement

optek dual channel sensors compensate for background turbidity or other media constituents automatically using a secondary wavelength. The signals from other instruments measuring temperature or pressure are recommended to be used directly as compensation for the raw gaseous halogen concentration. The optek C4000 converter processes up to two mA-inputs, displaying the compensated signal and transmitting it via four mA-outputs or PROFIBUS® PA.







As shown in the above illustration, the chlorine is measured in the inlet of the reactor to determine the actual concentration. In the exhaust outlet, the chlorine concentration can be monitored in the gaseous phase for legal reasons and to prevent excess emissions to the atmosphere. A sensor installed in a bypass or outlet line determines the actual concentration of the chlorine in the liquid phase. Monitoring these three points ensures the highest process performance, which minimizes product losses and reduces emissions.

Due to the very aggressive chemical medium, wetted parts of the analyzer are manufactured of corrosion resistant materials like titanium, TFM, sapphire windows and fluoroelastomer O-Rings. These materials are proven to withstand highly corrosive media like wet chlorine in numerous installations.

## Improve Efficiency

Using optek sensors in chemical plants provides real-time monitoring of halogens from high to low concentrations in gaseous and liquid phases.

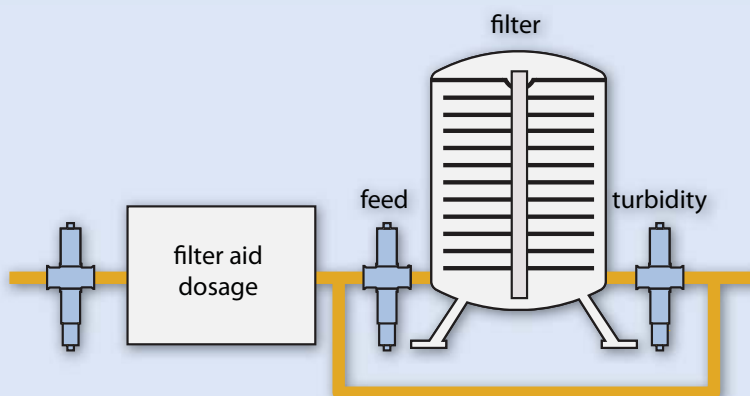
The ability to monitor exhaust gases prevents pollution of the atmosphere while reducing the consumption and excess emissions of chlorine in chlorination reactions.

Controlling the feed rate to the reactor (chlorinator) in a dynamic control loop maximizes production efficiency and minimizes sample preparation costs.



optek AF26-EX Dual Channel Absorption Sensor

## 06 | Filter Control



Many processes require filtration to clarify the product. Filtration proceeds from coarse filtration by means of separators, decanters, or settling tanks to a final polishing by diatomaceous earth (DE) or other precoat media filters.

To control product clarity, a turbidimeter can be installed at the start of the filtration process and in between each filtering step. If product turbidity reaches an unacceptable level, the flow can be automatically recirculated or switched to an alternate filter.

### Effective Filtration

optek photometers can monitor and control filter media dosing to ensure uniform precoat feed. This reduces filter media usage and extends the filter run by dosing only the amount of media necessary for effective filtration. Excessive amounts of filter media reduce the effective filtration time and increase product losses and process downtime.

The use of optek inline sensors greatly reduces the risk of equipment failure and operator error. This avoids costly refiltering, downtime, and poor product quality. optek sensors ensure that proper clarity is achieved before transferring the product to the next process stage.

### Feed Stream

In addition to filtrate monitors, many large-scale processors implement an AF16-N NIR absorption sensor on the precoat side of the filter. This NIR turbidimeter measures total suspended solids in real-time allowing operators to control filter media dosing based on need rather than flow rate. Continuous monitoring of filter media addition allows accurate control of precoat concentration to ensure proper cake thickness and uniformity. This optimizes the use of filter media while extending filter runs. As the precoat media is deposited, filtrate clears up gradually. The moment the sensor detects the filtrate has achieved acceptable clarity, the converter signals the filter controller to switch from precoating to filtering operation.

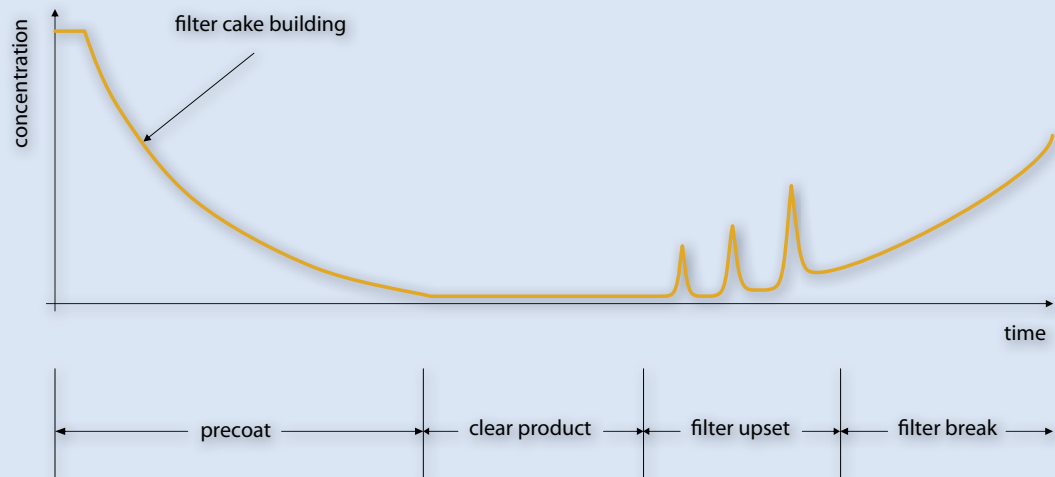
The AF16-N sensor is also used to detect heavy solids carryover from storage tanks or prefiltration failure. Upon reaching the user defined high turbidity level, the filter can be switched to a recycle mode and incoming product is diverted to a settling tank, separator or to be refiltered. This will prevent filter "blinding" and provide extended use of the filter.

### Backwash Optimization

An inline sensor can also be used to optimize filter backwash process by measuring the turbidity in the water, saving time, energy and water usage.

optek C4000 Photometric Converter





## Filtrate Stream

To ensure product quality, it is necessary to measure and control turbidity at the filter outlet. An optek TF16-N scattered light turbidimeter precisely monitors very low concentrations of suspended solids from 0 – 0.5 to 0 – 500 PPM or 0 – 0.2 to 0 – 200 FTU to achieve the desired clarity of the product.

Installing an inline turbidimeter on the filtrate stream allows the automatic diversion of the filtrate to recirculation until the product clarity is improved to an acceptable level. This reduces time and improves filtration performance.

Installed directly inline, optek turbidimeters optimize filter performance and immediately detect filter upsets or breaks. These turbidimeters also greatly reduce or eliminate the amount of sampling and lab analysis performed for quality assurance.

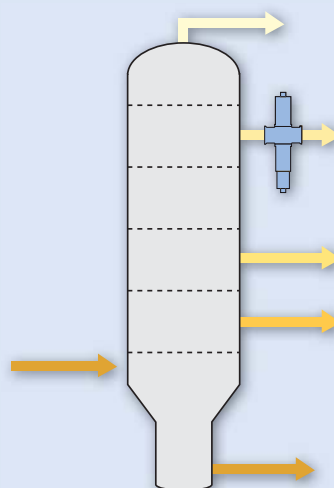
## Quality Control

Proven to be a valuable tool for process control and quality assurance, optek turbidimeters ensure that product clarity is consistently maintained. Reducing product losses, increasing filtration capacity and optimizing the use of filter media are only a few of the benefits optek inline sensors provide.



optek TF16-EX-N Scattered Light Dual Channel Turbidity Sensor

## 08 | Color and Concentration



### Color Measurements

Process color measurements of liquids are critical in maintaining precise process control and meeting product quality specifications. Color changes indicate other process variables such as overheating, dilution ratios, dissolved impurities and finished product appearance. Monitoring color inline using optek photometers enables precise, real-time control of color dosing, color removal, or color avoidance.

Typically, process color measurements are made by taking samples from the process piping and analyzing them in a lab either visually, or using a laboratory analyzer. optek colorimeters can immediately detect color changes in process liquids directly in the pipeline. A focused beam of light passes from the lamp through the process medium and is partially absorbed, changing its intensity. This absorption is wavelength dependent and an indication of the fluid color (i.e. yellowness).

Changes in color are detected by the sensor and converted to a signal reading. Using the C4000 converter, the measured value is easily correlated to any required unit, such as APHA/HAZEN, Saybolt, ASTM, or others. The converter displays the measurement locally, and transmits the signal to a PLC or DCS using analog outputs or PROFIBUS® PA.

### Concentration Measurement

The measurement is represented in Concentration Units (CU) at a given wavelength and relates to the concentration of the constituents in question that interact with the light.

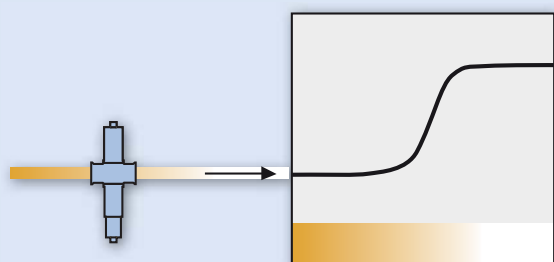
### Process Optimization

The detection of impurities, reduction of product losses, and the real-time assurance of product quality can be obtained by the use of inline colorimeters. In addition, these analyzers greatly reduce laboratory and production costs, eliminate human error and prevent environmental contamination.



optek AF26-EX-HT Dual Channel Absorption Sensor





## Typical Applications

Color scales (APHA/HAZEN/Pt-Co, ASTM, Saybolt, Gardner®, and other scales)
Chlorine dioxide
Transition metals (nickel, copper, chromium, iron, cobalt, manganese)
Color dosing and decolorization control
Leak detection/carryover
Product interface and dosing/blending control
Distillation control
Quality control in solvents (APHA/HAZEN/Pt-Co, ppm iron)
Concentration measurements of colored additives and catalysts (i.e. iron in HCl)
Galvanic plating operations (nickel plating)
Copper sulfite
Water/solvent ratio measurement
Hypochlorite

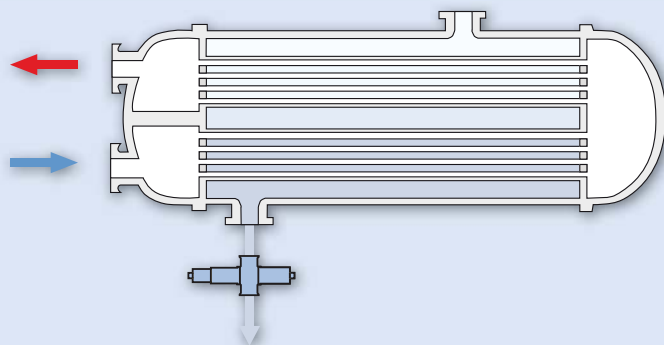
optek C4000 Photometric Converter



## C4000 Benefits

Lifetime factory calibration for scattered light sensors
Process control functions via Remote or PROFIBUS® PA
Integrated data logger for quality control
Secondary zero for additional offset and slope function
User defined units (i.e. APHA, Hazen, Saybolt, Gardner®, ASTM, etc.)
7 menu languages selectable: German, English, French, Dutch, Spanish, Portuguese and Russian
Flameproof housing available

## 10 | Condensate and Cooling Water



### Heat Exchanger Leak Detection

Heat exchanger leak detection is an important standard application for many processors. Companies in all industries increasingly demand the measurement of oils, aromatics, or undissolved hydrocarbons in the ppm range. For this purpose, optek inline photometers have been proven worldwide as a reliable solution.

Trace oil in water detection provides advanced warning of oil contamination in water or condensate streams. optek TF16-N scattered light turbidimeters can easily detect trace contamination in heat exchanger cooling, heating and reclaim lines.

By using optek photometers in heat exchanger cooling/heating lines, a pinhole leak can be detected and repairs can be made before an expensive breakdown occurs. Also, operating costs are reduced because heat exchanger maintenance can be scheduled to minimize process downtime. This ensures proper operation of the heat exchanger and reduces the risk of bacterial growth in the heating/cooling system.

### Condensate

optek photometers ensure that condensate is free from contaminants allowing it to be reused for boiler feed or other processes. This has proven to be an extremely beneficial process improvement, protecting equipment and reducing water usage, treatment chemicals, and wastewater costs.

### Carryover

There is a chance of carryover in any area where water is used to heat or cool the process stream. An optek inline photometer is an excellent tool for immediate detection of process contaminants.

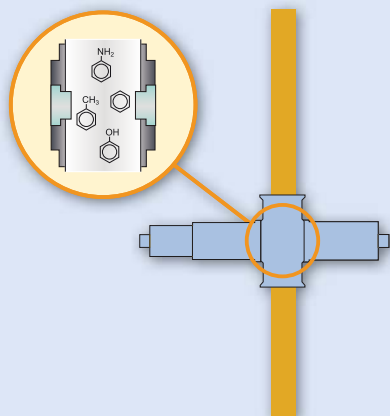
In applications where the process stream consists of undissolved oil or solids, an optek TF16-N scattered light turbidimeter can detect the total particle content. By measuring in the Near Infrared (NIR) the measurement will not be affected by color or color changes.



optek TF16-EX-HT-N  
Scattered Light Dual Channel  
Turbidity Sensor



optek Stainless Steel Housing  
with C4000 Converter



Detecting contamination in other ways, such as UV or color (yellowness) may also be advantageous for dissolved hydrocarbons, oils or aromatics. This is especially true for processors who are reusing condensate or reboiler to conserve energy, water and chemical usage.

## Inline Monitoring

Using continuous inline sensors, carryover can be detected and isolated before complete failure occurs. optek process photometers help to protect the process and get the most out of valuable utilities. Easy to install and implement, optek photometers provide a rapid return on investment.

Protection of equipment and the detection of leaks or carryover are possible using optek process photometers. Additionally, the reduction of water usage, contamination risks, heat exchanger downtime, and energy consumption are just a few of the benefits using optek inline sensors.

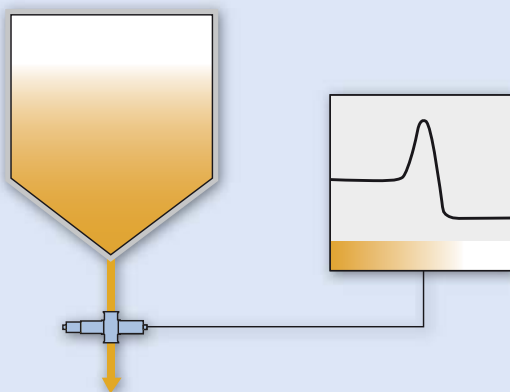


optek C4000 Photometric Converter



optek AF46-EX-HT Dual Channel UV Absorption Sensor

## 12 | Phase Separation



The extraction of high-cost products from an aqueous layer to an organic layer (or vice versa), or salting-in/salting-out processes, are very common and important procedures in the chemical industry.

### Monitor Phase Separations

After settling of the mixture occurs in a batch reactor, the aqueous phase is separated from the organic phase. This process can be monitored easily with an optek AF26 dual channel absorption sensor at the reactor outlet to ensure separation with high precision. Each liquid phase shows differences in absorbing light. This technique allows optimization of separation processes and at the same time minimizes product loss and realizes significant cost savings.

### Automation

optek AF16 or AF26 sensors reduce costs by measuring color or turbidity directly in the process line. There is no need for sight glass monitoring by production personnel, in turn eliminating losses due to manually switching valves and human error.

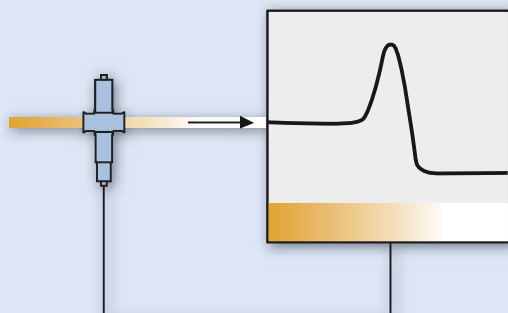


optek AF26 Dual Channel Absorption Sensor



optek C4000 Photometric Converter





## Increase Product Quality

Product losses are no longer an issue when detecting different phases inline. Faster product changeovers are possible with continuous optek inline measurements. Fast response time and use of relays for automatic diversion ensures product quality and improves process control.

optek offers a customized solution based on your process media and automation requirements. optek also manages phase separations in a wide range of wavelengths, from Ultraviolet (UV) to Visible (VIS) and Near Infrared (NIR). Precise, real-time measurements are made inline with optional Ex-proof sensors.

The water phase can be detected reliably, ensuring a separation that is independent of the composition of the organic phase.

optek inline sensors detect the most subtle changes in your process so the appropriate action can be made by the control system. Enabling the data logger feature in the C4000 converter allows plants to collect real-time process data for QA/QC. Monitoring phase separations inline and in real-time with optek sensors provides a rapid return on investment.



optek C4000 Photometric Converter

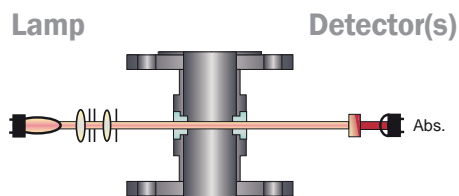


optek Calibration Accessories (NIST-traceable)

## 14 | Principles of Measurement

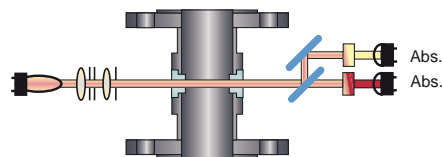
### Sensor AF16

VIS- and NIR-Absorption,  
single channel concentration and  
color measurement



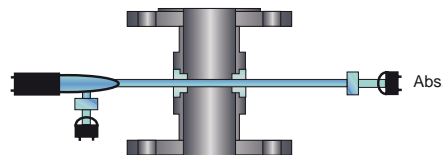
### Sensor AF26

VIS-Absorption,  
dual channel color measurement with  
turbidity compensation



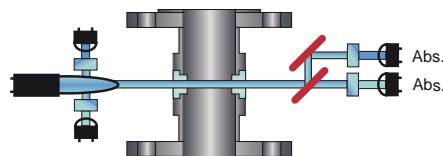
### Sensor AF45

UV-Absorption, single channel concentration  
measurement with compensation of  
lamp intensity



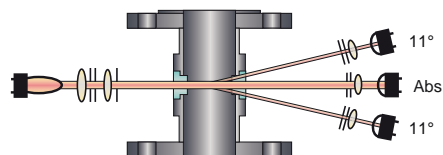
### Sensor AF46

UV-Absorption, dual channel concentration  
measurement with compensation of  
lamp intensity



### Sensor TF16

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





## Additional Benefits | 15



### Technical Aspects

Temperatures up to 240 °C (464 °F)  
Pressures up to 325 bar (4713 psi)  
Line size 1/4" to 6"  
FM and ATEX approved for hazardous locations  
Optical path length (OPL) from 1 to 1000 mm (depending on sensor)  
High resistivity materials to withstand the harshest process environments  
Reference filter for inprocess "calibration" checks (NIST-traceable)  
Universal C4000 converter for all optek sensors (up to two sensors with one converter)  
Configurable software allows easy correlation to almost any unit of measure (ppm, %, mg/L, APHA / HAZEN / Pt-Co, Saybolt, Gardner®, ASTM, etc.)  
PROFIBUS® PA available  
Certification ISO 9001:2008, ATEX, FM, PED, CE, HPO



Flameproof housing Ex d for optek C4000 converter



Interested in Foundation Fieldbus Applications?

Just ask optek!



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