

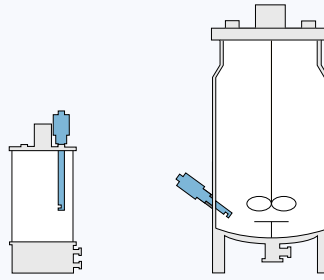
**TOP 5**  
**Biotech**  
**Applications**



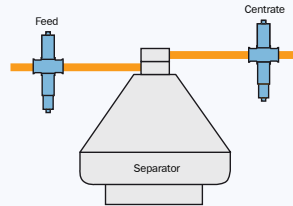
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Русский язык  
中国



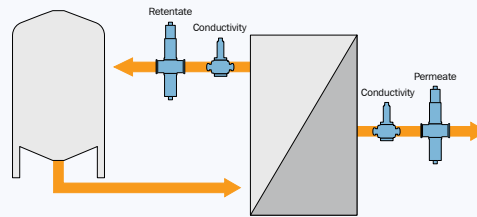
**TOP 1** Fermentation



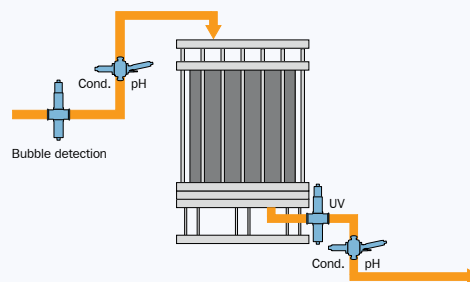
**TOP 2** Centrifuge Control



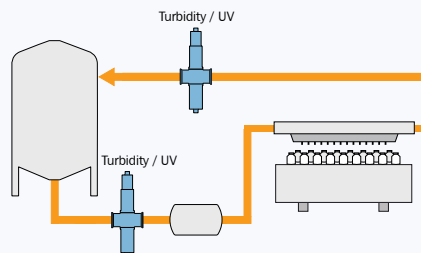
**TOP 3** Ultrafiltration



**TOP 4** Chromatography



**TOP 5** Formulation and Filling





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### TOP 5 Biotech Applications

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**In many stages of biotech 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.

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

As a global partner to the biotech industry, optek offers the most advanced technologies including superior signal amplification, inline calibration support, 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.

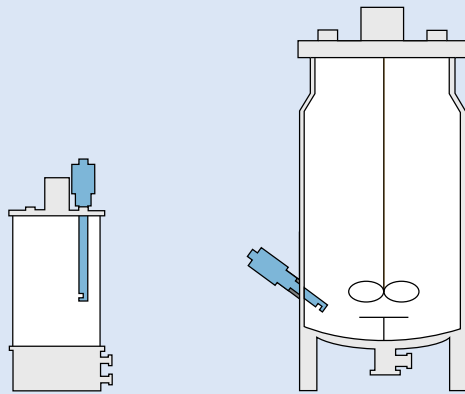
**Optimize your process with optek.**



# 04 | Fermentation

TOP 1

www.optek.com



The optek probe series of bioprocess analyzers were designed specifically to integrate easily into bioreactors and fermenters. These precise systems provide the user with a powerful tool to characterize cell growth in the laboratory and large scale cell culture and fermentation. The real-time biomass concentration is measured as a function of light absorption.

Reliable inprocess measurements greatly reduce sampling time and risk of contamination during offline analysis.

### Lab/Process Development

ASD series probes were developed for smaller scale bioreactors used in R&D and process development areas. They are extremely repeatable and easy to use. Probes come in a variety of optical path lengths to give the best resolution possible.

optek ASD sensors are suitable for CIP/SIP runs and ASD19 type probes are autoclavable. Superior sapphire optics with no seals, gaps or crevices ensure that no contamination occurs.

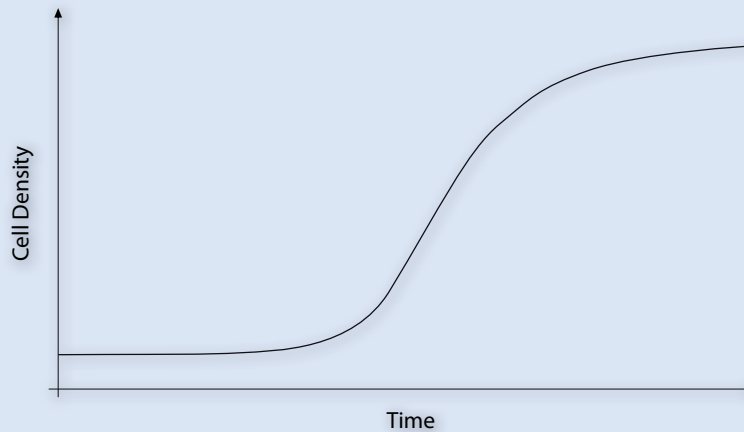
The Fermenter Control converter is specifically designed to integrate easily into existing bioreactors and fermenters. Using input from one or two optek ASD series probes, the Fermenter Control precisely measures cell growth/biomass as a function of Near Infra-red (NIR) absorption. The results are displayed in any laboratory unit, such as OD, AU, cell count, wet or dry weight. Due to the superior principle of NIR absorption, stability and measurement reliability are provided even in systems with a high degree of aeration and agitation.



optek Fermenter Control Converter



optek ASD19-N Single Channel Absorption Probe

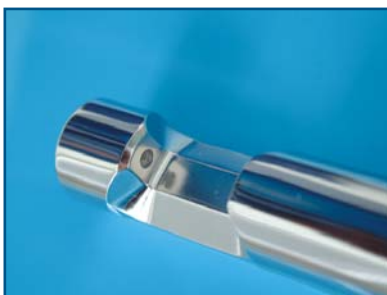


### Production/Manufacturing

AS series probes were developed for large scale reactors. This offering gives the user the same type of probe used in process development for the manufacturing scale. Probes can be supplied with a calibration option when required for production environments.

Depending on point of installation, AS series probes are available with different shaft lengths for installation flexibility. Optional calibration accessories are available for quality control checks before each process run.

The optek C4000 converter can multiplex up to two AS series probes and can be panel mounted or installed in a stainless steel or plastic housing to ensure IP ratings up to IP66. Results are displayed in any unit, such as OD, AU, cell count, wet or dry weight. optek probes are available with a wide selection of optical path lengths, from 1 to 40 mm. Shorter optical paths are typically used for dense fermentations such as bacterial and yeast cultures. Longer paths are used for mammalian cell cultures. This flexibility allows optimal resolution.

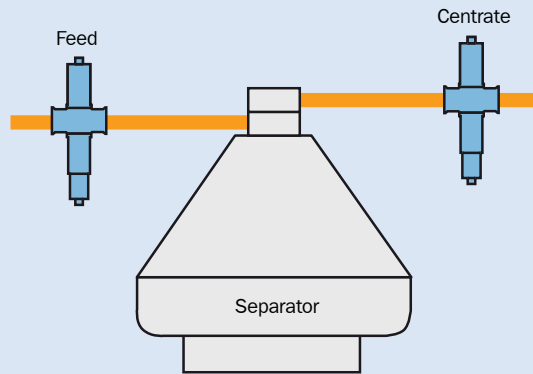


optek AS16-N Single Channel Absorption Probe



optek AS16-VB-N Single Channel Absorption Probe with calibration option

## 06 | Centrifuge Control



When installed at two primary points at the centrifuge, optek inline photometers have proven to greatly improve separation performance, reduce losses and improve product consistency.

### Feed/Inlet

The feed stream sent to a centrifugal separator will often have high variable solids loading. Separation efficiency can be greatly improved by installing an optek AF16-N inline Near Infrared (NIR) sensor in the feed stream prior to the separator. The separator feed rate can then be optimized, based on real-time solids concentration measurements.

At maximum clarity, the separator can be fed with full flow. As the solids concentration increases, the flow can be reduced proportionately, or in fixed steps. This provides optimal separation and throughput without overloading the separator.

### Centrate/Outlet

The separator outlet (centrate) is the most common point of installation for process photometers. Monitoring at this point can help manufacturing maximize the efficiency of the system. Most current systems control discharge based on time parameters set from the previous run.

A more efficient approach is to control the discharge based on need, which can be monitored by the inline sensor. Most installations can reduce frequency of bowl shoots significantly over the run. This increases yield, ensures consistency downstream, reduces mechanical wear, and helps avoid “blinding” of downstream filters.

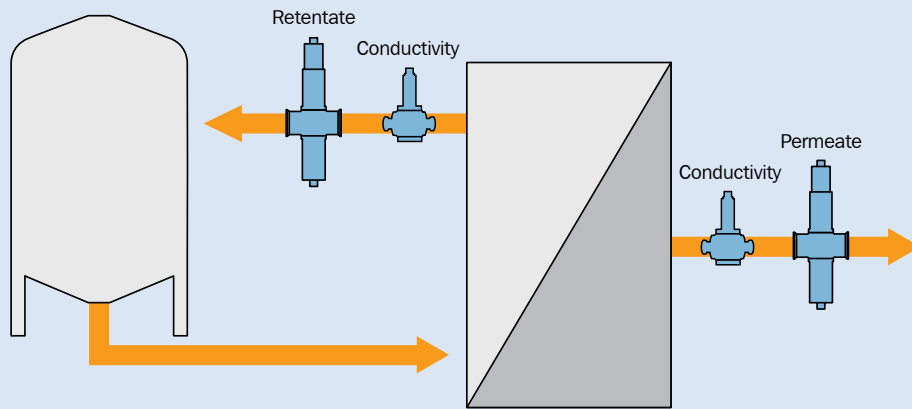
Depending if the expression platform is cell culture or fermentation, different detection techniques are used. Typically for cell culture processing, an optek TF16-N scattered light sensor is installed to ensure immediate detection of lowest concentrations. An optek AF16-N absorption sensor is commonly used for higher density fermentation processing.



optek C4000 Photometric Converter



optek AF16-VB-N Single Channel Absorption Sensor with calibration option



In a typical UF process, two installation points are usually considered.

### Permeate

Using an optek AF45 UV sensor on the permeate stream allows the user to ensure filter integrity, increase throughput and minimize product losses. Identification of trace contaminants in low ppm ranges and detection of filter breakthrough in real-time ensures process consistency, while eliminating sample collection for laboratory analysis.

### Retentate

An optek AF45 or AF46 UV sensor is an ideal way to monitor the concentration of proteins during the filtration process. The sensor is installed in the return line to the recirculation tank. Real-time concentration readings up to high levels can be measured and trended without violating the integrity of the system and without wasting product through sampling.

Process data from inline sensors is collected by the optek C4000 converter. These converters have integral trending for concentration readings.

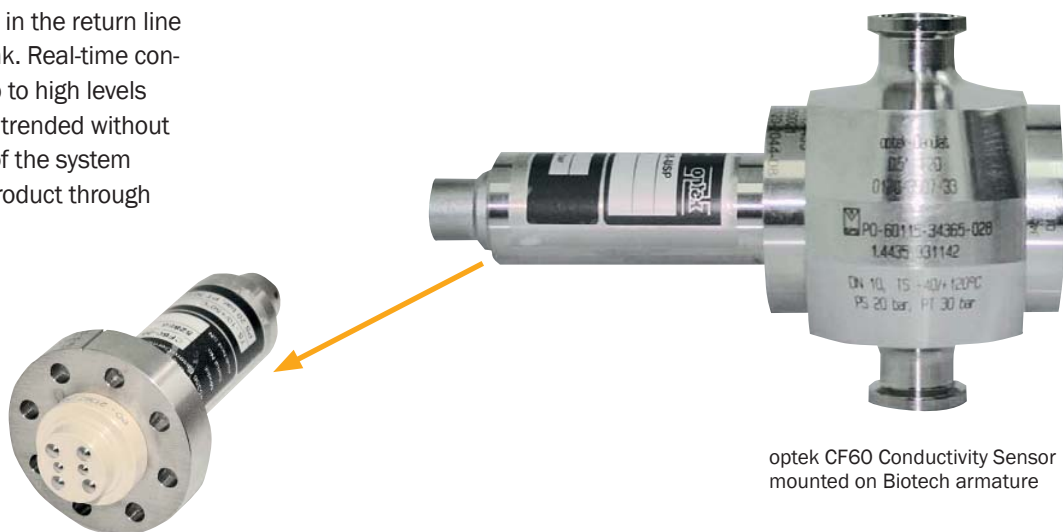
Outputs (mA-Signal or PROFIBUS® PA) from the C4000 converter can be sent to a PLC or plant DCS, or used to actuate valves based on alarm points.

### Conductivity

optek CF60 conductivity sensors can be installed in the permeate or retentate to ensure proper process control. This conductivity sensor features a superior six-electrode, four-pole design. The patented arrangement of the four current electrodes around the two

potential electrodes results in a reliable and precise measurement of a broad conductivity range from 0-100  $\mu\text{S}/\text{cm}$  up to 0-850  $\text{mS}/\text{cm}$ .

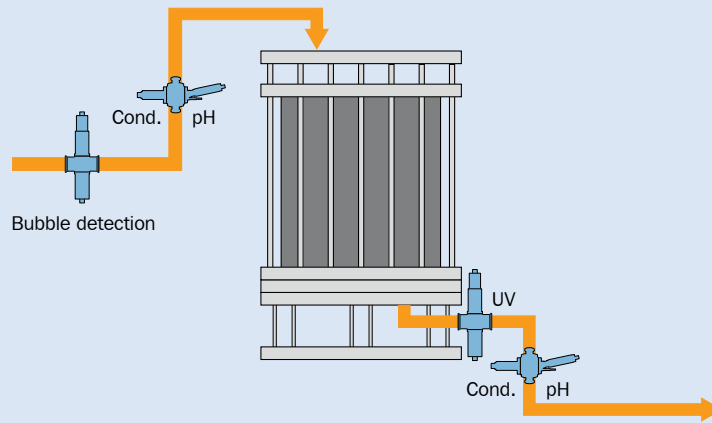
This unique design also provides greatly reduced sensitivity to sensor fouling and polarization. Designed for ultra-sterility, the six electrodes are sealed in the FDA/USP Class VI compliant PEEK sensor tip without the use of O-Rings or epoxies.



optek CF60 Conductivity Sensor mounted on Biotech armature

Patented six-electrode four-pole conductivity sensor

## 08 | Chromatography



Protein purification in biotechnology usually requires one or more liquid chromatography steps during downstream processing.

optek inline photometric and electrochemical sensors are designed specifically for real-time measurement and control. This improves chromatographic separations, generating consistent and repeatable data to allow more discrete pooling criteria for maximizing yields and improving quality.

### Pre-Column Process Measurements - Bubble Detection/Conductivity/pH

An optek TF16-N scattered light turbidity sensor installed in the column feed stream provides immediate and extremely reliable detection of process disturbances to avoid damage to column media and ensure consistent separation. Inline CF60 conductivity sensor which includes a temperature sensor and PF12 pH sensor give real-time measurements of conductivity, temperature and pH.

### Post-Column Chromatography Monitoring

During purification, accurate, reliable and repeatable post-column measurement is necessary to ensure accurate pooling to maximize yields and protein/DNA fraction purity.

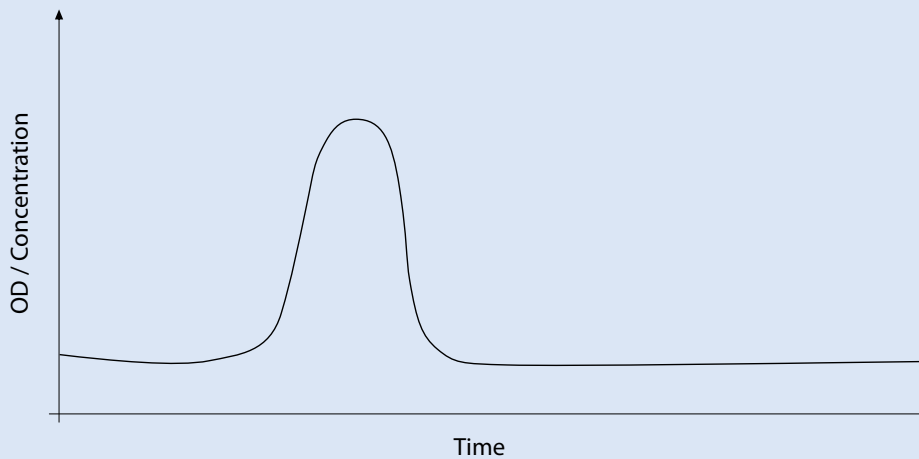
Mounted directly inline in the column outlet stream, an optek single wavelength AF45 or dual wavelength AF46 UV sensor can improve the efficiency of the separation process. This ensures product purity and greatly reduces offline testing and manual analysis.

A NIST-traceable filter package allows users to calibrate the sensors inline in a quick, repeatable manner. See page 12 for further details.

Additionally, optek offers the patented six-electrode four-pole conductivity sensor CF60 and pH sensor PF12 both mounted in one optimized flow cell with low holdup volume. A wide measuring range of 0-100  $\mu\text{S}/\text{cm}$  to 0-850  $\text{mS}/\text{cm}$  allows monitoring transitions between buffers and control of the cleaning process, while sensor PF12 is used for adjustment of the gel packing by means of the pH value. Additionally, equilibration methods are monitored and column integrity is ensured.



optek AF46 Dual Channel UV Absorption Sensor



### Dual wavelength

The primary wavelength measures concentration of protein at i.e. 280 nm for pooling purposes. Using the secondary wavelength measuring i.e. at 300 nm simultaneously, this signal is used to achieve readings even at the highest concentration ranges.

Measurements at the wavelengths 254/280 provide readings to assess purity level and nucleic acid (DNA/RNA) contamination of protein.

Due to the modularity of optek inline sensors, different optical path lengths (OPL) are possible. Depending on the concentration range needed, the OPL is specified to achieve the highest repeatability and linearity.

### Sanitary design

Specially designed for biotech processes, single crystal type 3 sapphire windows, high quality O-Ring material (USP Class VI), and lowest holdup volumes ensure optimal cleanability and sterilization while minimizing possible contaminations.

Electropolished stainless steel sensor bodies with standard surface roughness of Ra < 0.4  $\mu\text{m}$  together with sanitary fittings (i.e. Clamp TC L14 AM7) ensure production within the highest industry standards.



optek CF60 Conductivity Sensor and PF12 pH Electrode Adapter mounted on Biotech armature

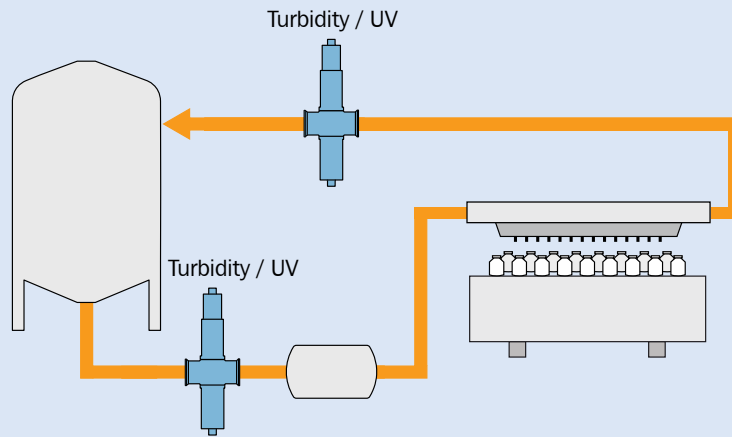


optek C4000 Photometric Converter



optek AF45-VB Single Channel UV-Absorption Sensor with calibration option

# 10 | Formulation and Filling



Formulation and filling areas can see inconsistencies due to mixers, tank levels, pump cycling, pH and temperature variations, and even lab variances. optek sensors can help operators and quality areas get a live view of inconsistencies, and either make changes to help meet acceptance windows, or stop a non-conforming product lot from going forward. This will help in avoiding additional costs when there is knowledge that the lot has failed.

Installing optek sensors inline can help to improve consistency, conformity and productivity. Sensors are either installed directly in tanks or in feed or outlet process streams, as well as at the filling stations for verification. Depending on the product, optek inline sensors can monitor for turbidity, color, dilution target, or even opalescence in biologics.

Providing quality with a live data record for the entire batch leads to optimal QA/QC for documentation and process understanding.

### Turbidity

Many products have a base turbidity that relates to the product concentration. optek turbidity sensors are extremely accurate in low concentration ranges, while also having a wide dynamic range accommodated for high concentration ranges.



optek Stainless Steel Housing with C4000 Converter



optek TF16-N Scattered Light Dual Channel Turbidity Sensor

### Dilutions

Certain products that contain turbidity will be diluted to attain the proper target dosage. optek inline sensors monitor the transition and verify that the target dosage is being met before going to the fill stations.

### Opalescence/Haze

Certain biologics that are stored in a vessel prior to going to filling stations acquire a phenomenon called “opalescence.” This usually is a non-desired effect caused by temperature drift. It is mostly aesthetic in nature, and usually does not affect potency of the drug. However, certain companies will disqualify production lots due to the undesired effect. optek UV or scattered light sensors are able to monitor opalescence occurring on a small scale. This alerts the operators immediately preventing product losses while ensuring product quality.

All of the sensors listed come complete with all certifications for manufacturing areas.



optek C4000 Photometric Converter



optek AF45-VB Single Channel UV Absorption Sensor with calibration option

## 12 | Calibration



optek calibration accessories have been specially designed for non-intrusive calibration and verification of optek UV sensors AF45 and AF46.

The unique Calibration Cuvette enables product calibration without need to interfere with the process line.

It allows users to create a correlation of absorption signals to the concentration of product or an equivalent substance, creating an easy link from lab to process.

Three series of solid filters are available to ensure confidence in your measurements. The UV-L filter series is used to calibrate photometric accuracy and linearity. The UV-B filter series verifies integral blocking and the UV-S filter series tests for long term stability of the sensor.

All optek filters ship with NIST-traceable certification. optek is equipped with an extremely high quality NIST-traceable calibrated spectrophotometer assuring quality and quick turn around time for recertification of filters.



optek calibration accessories



High-end spectrophotometer in optek calibration laboratory



**UV Sensors**

**Calibration Cuvette**

Non-intrusive product calibration, establish calibration curves (linearization functions) for product or model substance



**Calibration Filters UV-L**

Nominal Absorption: 0.45, 0.9, 1.8 and 2.4  
Purpose: Verify Photometric Accuracy and Linearity

**Calibration Filter UV-B**

Nominal Absorption: > 3  
Purpose: Verify Integral Blocking

**Calibration Filters UV-S**

Nominal Absorption: Application specific  
Purpose: Test for long term Spectral Stability



**Calibration Case**

Holds up to 7 Calibration filters, includes brush

**NIR-Absorption Sensors**

Calibration filters are available with different nominal absorption values for both inline and probe versions of NIR-Absorption Sensors. They can be used to test performance prior to production runs.

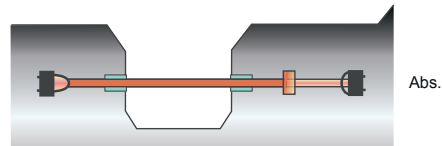


# 14 Principles of Measurement



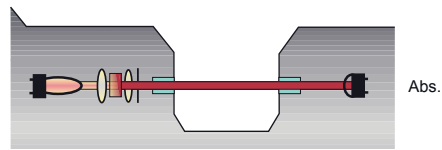
## Sensor ASD19/ASD25

NIR-Absorption,  
single channel concentration  
measurement



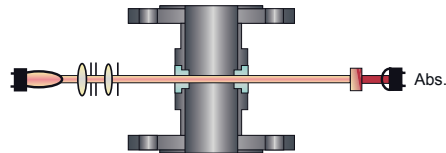
## Sensor AS16

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



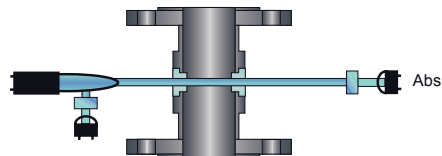
## Sensor AF16

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



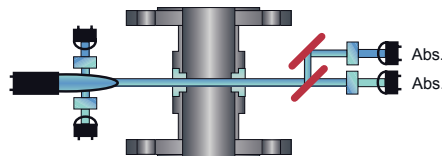
## Sensor AF45

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



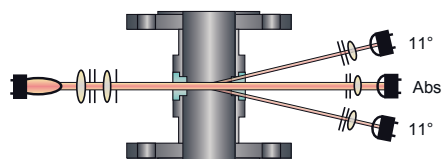
## Sensor AF46

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



## Sensor TF16

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





optek offers superior sanitary sensor bodies for inline applications.

### GEOMETRY FEATURES:

#### Clamp TC L14 AM7:

0,25" – 3,0" (DN08 – DN80)

#### Designed according to PED:

pressure tested, window rings with 8 screws

#### Special type 3 windows:

minimal gap, minimal tolerance

### SANITARY DESIGN & CLEANABILITY:

#### High quality stainless steel:

1.4435, BN2, dF < 0,5%

#### Solid block:

no seams, no welds, minimal holdup volume, self draining, no fouling

#### Wetted materials:

Ra < 0,4 µm, electro-polished

### AVAILABLE CERTIFICATES:

3.1 optek inspection certificate for armature

3.1 material inspection certificate

3A certificate

FDA certificate USP Class VI

optek Systems are also available with Explosion proof and PROFIBUS® PA.



Flameproof housing Ex d for optek C4000 converter

Interested in Foundation Fieldbus Applications?

Just ask optek!



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