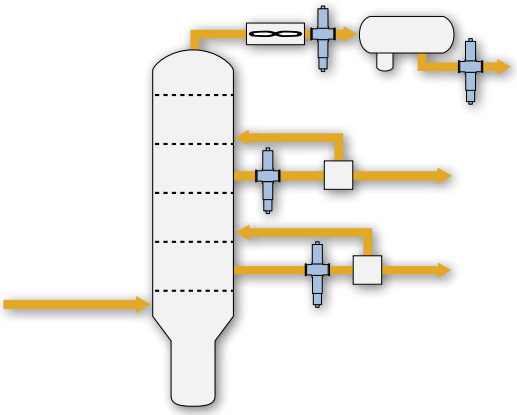
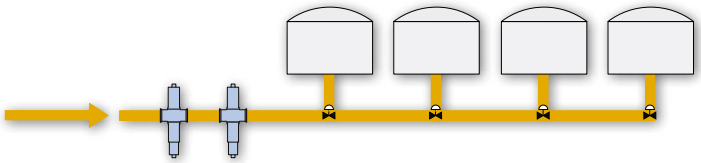
TOP 5

Petrochemical Applications

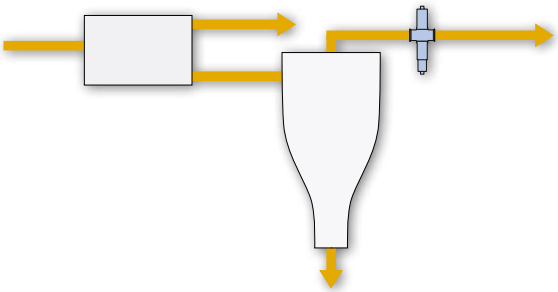
inline control



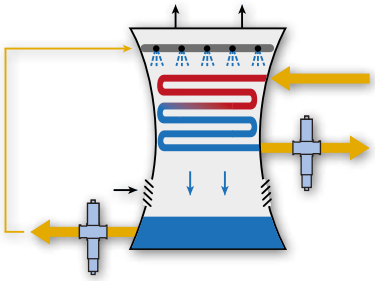
TOP 1 Color of Refined Fuels



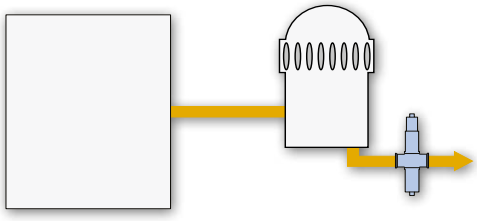
TOP 2 Phase Separation of Refined Fuels



TOP 3 Oil in Produced Water



TOP 4 Condensate and Cooling Water Monitoring



TOP 5 Fuel Analysis: Free Water in Refined Fuels

For over 30 years, optek has focused on measuring process liquids through their interaction with light in facilities all over the world. Although global, optek remains a family owned company with a team of more than 100 qualified, customer-driven professionals.

Our confidence is born from experience. With the expertise of more than 30,000 installations worldwide, our value to the customer resides in providing a superior product that pays back. High quality materials withstand the toughest process conditions including aggressive media, high temperature, and high pressure applications. Cleanability is ensured using high quality wetted materials, superior design, as well as sapphire optical windows.

As a global partner to various industries, optek offers the most advanced technologies including superior signal amplification, inline calibration support, PROFIBUS® PA, FOUNDATION™ Fieldbus and multilingual user interfaces for easy onsite operations.

Our support ensures long term satisfaction with programs such as “SpeedParts” and “SwapRepair” to provide our customers sustainable operations and minimized downtime at the lowest cost of ownership.

Conformity to international (ISO 9001), industry-specific (FM/ATEX approval) or company standards is easily achieved with optek. Wherever process composition is controlled, the name optek has become synonymous with world-class products and support.

Optimize your process with optek inline control.

optek®
inline control

Content

04 Color of Refined Fuels

optek C4000 Photometric Converter

The petroleum refining and petrochemical industries benefit greatly with the use of inline color measurements. Detecting color changes directly in the process stream alerts refinery personnel of immediate process upsets that may affect final product quality.

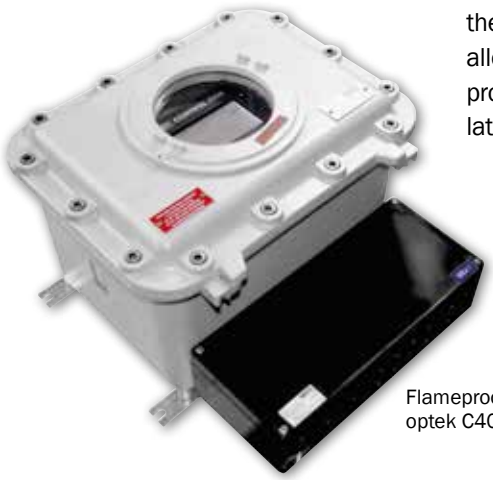
Historically, monitoring color changes was accomplished with a “grab sampling” technique and/or relied on human interpretation comparing samples against ASTM, Saybolt, or other color standards. Today, these measurements are done with precise and reliable inline color sensors from optek.

Refined Hydrocarbons and Color Scales

The petroleum refining and petrochemical industries rely on Saybolt and ASTM color scales (among others) to quantify product quality. ASTM D1500 defines the ASTM color scale (0.0 to 8.0 ASTM) and is used for determining the color of lube oils, heating oils and diesel fuel oils. Product with a faint color below 0.5 ASTM are often defined by the Saybolt color scale. ASTM D156 defines the Saybolt color scale (+30 to -16 Saybolt), and is used for determining the color of gasoline, jet fuel, kerosene, naphtha and NGL.

Fuel Contaminant Monitoring

Often, color changes are a signal for contaminations in fuels. Detecting these contaminants directly inline allows operators to redirect the process for further refining or redistillation.



Flameproof Housing Ex d for optek C4000 Converter

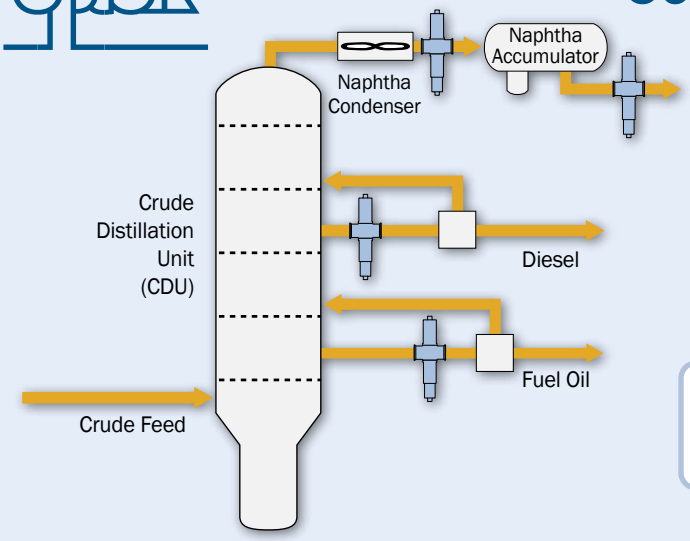
Dual Channel Color Measurement

optek AF26 dual channel sensors compensate for background turbidity or other media constituents automatically using a secondary wavelength. The primary wavelength usually detects color and background turbidity, whereas the secondary wavelength only detects background turbidity or other media constituents. Subtracting the absorption signal of the reference channel from the primary channel gives a compensated signal that is then correlated to any color scale, independent of background interference. Additionally, the reference channel of the AF26 can be monitored independently and outputted as a 4-20 mA signal, allowing operators to gain real-time knowledge of turbidity upsets.

Crude Distillation Unit (CDU) Monitoring

The quality of fractions from the crude distillation unit (CDU) need to be continuously monitored. By installing an optek inline photometer, the refinery maintains peak performance from the column and controls product quality downstream.

Color of Refined Fuels | 05



Typical Measuring Ranges:
- +20 to +30 Saybolt - Naphtha, Gasoline, Jet Fuel, Lt Diesel
- 0-5 ASTM - Heavy Diesel, LVGO, HVGO, Lt Lube Oils

TOP 1

www.optek.com

Naphtha, gasoline, kerosene and jet fuels are the lightest and highest quality hydrocarbons drawn off the top of the distillation column. Because of their low levels of impurities, they normally have a clear visual appearance. Their color is measured using the Saybolt color scale, where acceptable product quality typically measures between +27 to +30 Saybolt. optek's strength here is the ability to customize systems to our customers' requirements. This is accomplished by using application specific wavelengths and OPL's (optical path lengths) to ensure the best possible resolution for the application.

Heating oils, gas oils and lubricating oils are heavier hydrocarbons that are darker in appearance and drawn from the middle of the distillation column. Their color is measured using the ASTM color scale, ranging from brightest 0 to darkest 8, where acceptable product quality typically measures between 2 to 5. Using an optek AF26 sensor in conjunction with the C4000 converter, the refinery operator can continuously monitor the color of any refined hydrocarbon in any color scale. This allows for real-time determination of process upsets, short term peaks or inconsistencies can be controlled (e.g., by diverting ''out of spec'' diesel to storage or buffer tanks until it can be mixed with a higher quality diesel) preventing loss of product while maximizing process efficiency.

Contamination Detection

Increased color intensity typically indicates the presence of undesirable contamination resulting from a process upset or a reduction in process efficiency. Upsets generally occur when the heavier hydrocarbon fractions, such as crude, are carried upward with the lighter fractions, resulting in their contamination. If not detected immediately, the contaminated product will feed downstream, damaging plant equipment and reducing CDU efficiencies.

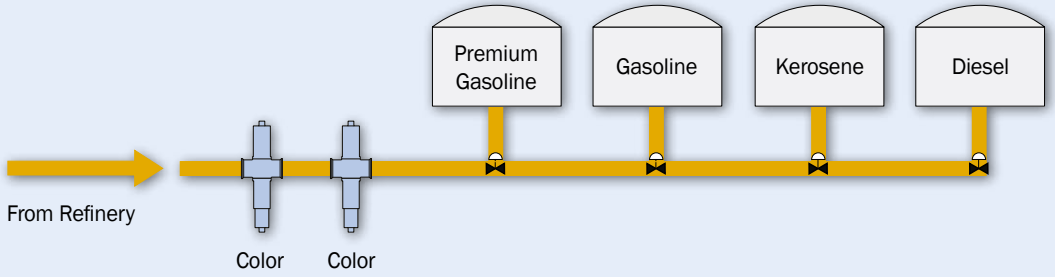
Continuous Monitoring

By installing an optek inline color sensor, the product streams can be continuously monitored in real-time. The AF26 explosion proof sensor will immediately detect color changes caused by upsets or gradual reduction in process efficiency. Even at high pressures and temperatures, these important color measurements are made without the need for sample conditioning.

Typical Applications:
- *Detect crude carryover in refined product cuts off the CDU (crude distillation unit)*
- *Verify sulphur removal efficiency at diesel fuel desulphurization units*
- *Product quality/color verification at NGL (natural gas liquids) custody transfer points*
- *Product quality/color verification at lube oil processing plants*
- *Product quality/color verification of refined fuels after final processing/ before sale*

optek AF26-EX-HT-VB
Dual Channel Absorption Sensor

06 Phase Separation of Refined Fuels



Interface Detection

Using real-time data provided by optek AF26 inline color sensors, pipeline operators are able to cut product or detect product interfaces precisely. This monitoring ensures that fuels are not downgraded by intermixing of low quality products. Throughout the entire production process including terminalling facilities, fuel color can be monitored in order to ensure specifications and minimize product losses.

Refineries often use density measurements to distinguish between the different hydrocarbons in the pipeline. However, with the high value gasoline and premium gasoline products this method is ineffective and color separation is the more effective solution.

Hydrocarbons such as kerosene or diesel are easily distinguishable by their normal colors. whereas gasoline and premium gasoline often have dyes or markers added ensuring that they are more easily distinguishable. The main colors used for dyeing fuels are red, blue, green and yellow. The dual channel AF26 with various wavelength combinations can be configured to distinguish between any of these dyes, even down to low ppm levels.

Dyeing of Fuels

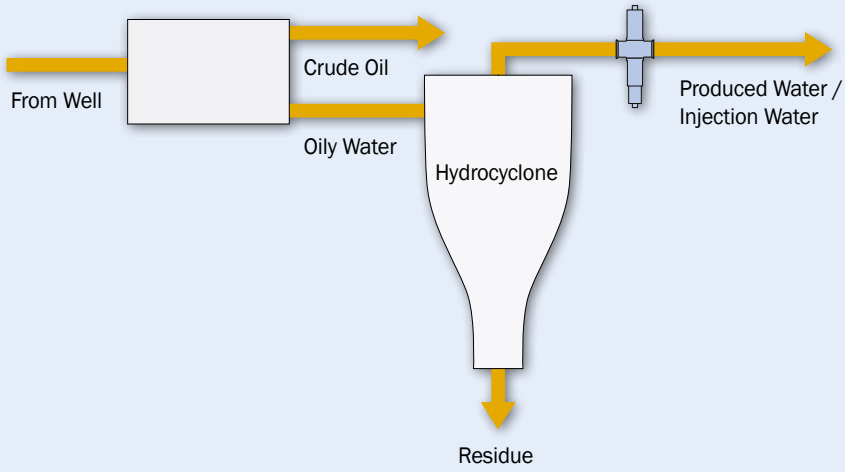
In some countries it is required by law to add dye to low- taxed fuels in order to distinguish them from the higher-taxed fuels. Aviation fuel is dyed both for tax and safety reasons and some companies will dye fuel to prevent theft. Amounts of dye added vary, but ranges are usually between 2mg/l to 10mg/l. Precise dosage of these dyes can be controlled with the optek AF26 colorimeter ensuring consistant product quality.

Automation

An optek C4000 converter transmits measurement signals to the PLC or plant DCS using up to four mA-outputs. Remote signals from the PLC or plant DCS can be sent to the C4000 converter to zero the instrument or to make product changes. Additionally, PROFIBUS® PA or FOUNDATION™ Fieldbus communication is available for advanced control systems.

optek AF26-EX-VB
Dual Channel Absorption Sensor
with Calibration Adapter

Oil in Produced Water | 07



TOP 3

Produced Water

When crude oil and natural gas are extracted from the ground, undesirable constituents such as water, sand, and other contaminants are also extracted. These constituents are separated over several processes, and the water portion of the separation is known as produced water. Produced water will contain some level of hydrocarbons that must be further separated before it can be disposed of or used in subsequent operations. To conform to strict environmental standards and to improve produced water management, it is important to monitor the water quality at various points in the separation process. optek inline photometers can be used to monitor this process on production platforms or land based water treatment sites.

Oil in Produced Water Separation

optek oil in water sensors are typically installed after final filtration or separation to monitor both the efficiency of the process and to verify the filtrate meets accepted environmental standards.

Measurement

optek TF16-N sensors can detect very low levels of oil using scattered light technology. Because this technology is much more sensitive to oil droplets in water, it is the preferred monitoring technique compared to absorption based technology. Furthermore, optek inline sensors meet all area classifications of the production unit and can be supplied with ATEX, FM or IECEx certifications.

Offshore Water Quality Monitoring

Water injection is used by offshore installations to achieve maximum oil recovery from the oil well. The produced water from these installations if treated can be reused or returned to the sea, providing environmental limits are met.

By installing an optek TF16-N oil in water sensor on an offshore FPSO (floating production storage and offloading) installation, the produced water once treated is reused for injection, sanitation use on the FPSO or is stored until needed, reducing water usage.

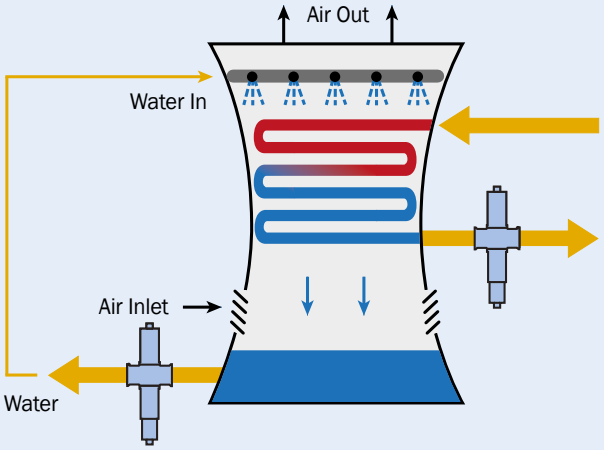
Typical Applications:

- *Measure oil in water content at produced water processing plants*
- *Monitor oil in injection water*
- *Detect oil in discharge water*
- *Measure oil in water content of tanker ship ballast water*

optek C4000 Photometric Converter

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

08 | Condensate and Cooling Water Monitoring



Typical Measuring Ranges:
- 0 - 50 ppm - Oil in Water
- 0 - 100 ppm - Non Dissolved Hydrocarbons in Water

Heat Exchanger Leak Detection

Heat exchanger leak detection is an important measurement 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 sensors can easily detect trace contamination in heat exchanger cooling, heating and reclaim lines (e.g., preventing oil build up on the heat exchanger plates, resulting in a less efficient cooling process or inefficient heat transfer in the heating process, increasing energy costs).

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.

Condensate

optek photometers can monitor condensate streams to determine if they are free from contaminants, allowing it to be reused for boiler feed or other processes. This has proven to be an extremely beneficial process improvement, reducing water usage, treatment chemicals, and wastewater costs.

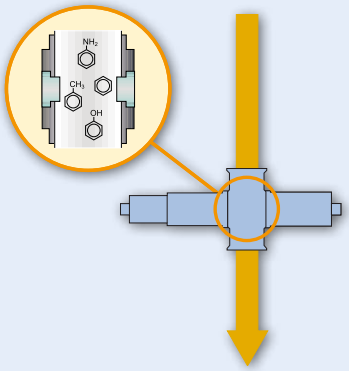
Carryover

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 contains undissolved oil or solids, an optek TF16-N scattered light turbidimeter can detect the total contamination present. By measuring in the Near Infrared (NIR) the measurement will not be affected by color or color changes.

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

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



Aromatics Detection

At times the leaked medium in condensate and cooling water comes from a group of hydrocarbons called aromatics. Aromatics have a unique property which makes them absorb ultraviolet (UV) light very well, allowing optek to monitor for their presence to very low ppm levels. The most common aromatic is benzene, but others include toluene, phenol, aniline and xylene. Often, the presence of these aromatics are an undesirable consequence and need to be removed because of health or environmental concerns. Using real-time monitoring for the presence of aromatics in liquid streams allows plants to control product manufacture, increase product quality and ensure environmental compliance.

UV- Absorption Monitoring

optek has two UV absorption sensors which can make these measurements. In process streams containing background turbidity, a dual wavelength AF46 is used where one wavelength is used to detect the aromatic and the second wavelength is used to detect background turbidity. By determining the difference in the photocurrent of these two wavelengths, the amount of aromatic can be determined. In clean process streams a single wavelength AF45 is used where the aromatic is detected without the need for background compensation.

Regardless of the particular process conditions, optek has a solution for aromatic hydrocarbon detection by UV absorption.

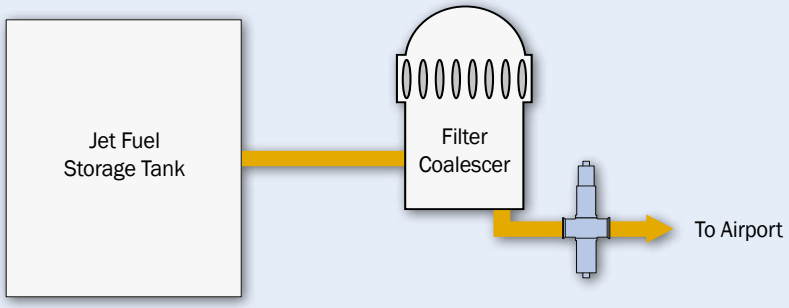
Typical Applications:

- *Monitor wastewater streams for aromatic content (environmental)*
- *Monitor refined hydrocarbon streams for benzene content*
- *Monitor potable water for aromatic content*

optek C4000 Photometric Converter

optek AF46-EX-HT-VB Dual Channel
UV Absorption Sensor
with Calibration Adapter

10 | Fuel Analysis: Free Water in Refined Fuels



Typical Measuring Ranges:
- 0 - 15 ppm for Jet Fuel
- 0 - 50 ppm for Gasoline
- 0 - 100 ppm for Diesel

Refined Fuels Analysis

Fuel analysis is a very important part of the refining process. By continuously monitoring free water and suspended solids in refined fuels, operators can immediately detect inefficiencies or failures in filters, coalescers or separators and identify the presence of possible contamination from other sources.

These hydrocarbon streams can be monitored in real-time under process conditions to determine if and how much free water is present, down to the ppm levels. This allows operators a unique ability to monitor product manufacture, increase product quality, and reduce critical refueling with contaminated product.

Dual Channel Scattered Light Free Water Monitoring

Quantifying the free water content in refined fuels down to low ppm levels is essential. The optek TF-16-N Scattered light sensor uses light in the Near Infrared (NIR) range which is unaffected by color or color changes. Since free water droplets in hydrocarbons tend to be spherical, they scatter light very efficiently, giving a high degree of consistency when determining how much free water is present in the hydrocarbon.

Fuel Filtering/Coalescing Contamination

Water and suspended solids are removed during the production, transportation and loading of fuel. Despite these process controls, potential contamination sources still exist. An optek TF16-N scattered light turbidity sensor installed after a filter or coalescer immediately detects a failure or filter break. Contaminated fuel can then be diverted into a holding tank for further processing while uncontaminated fuel is moved down the process.

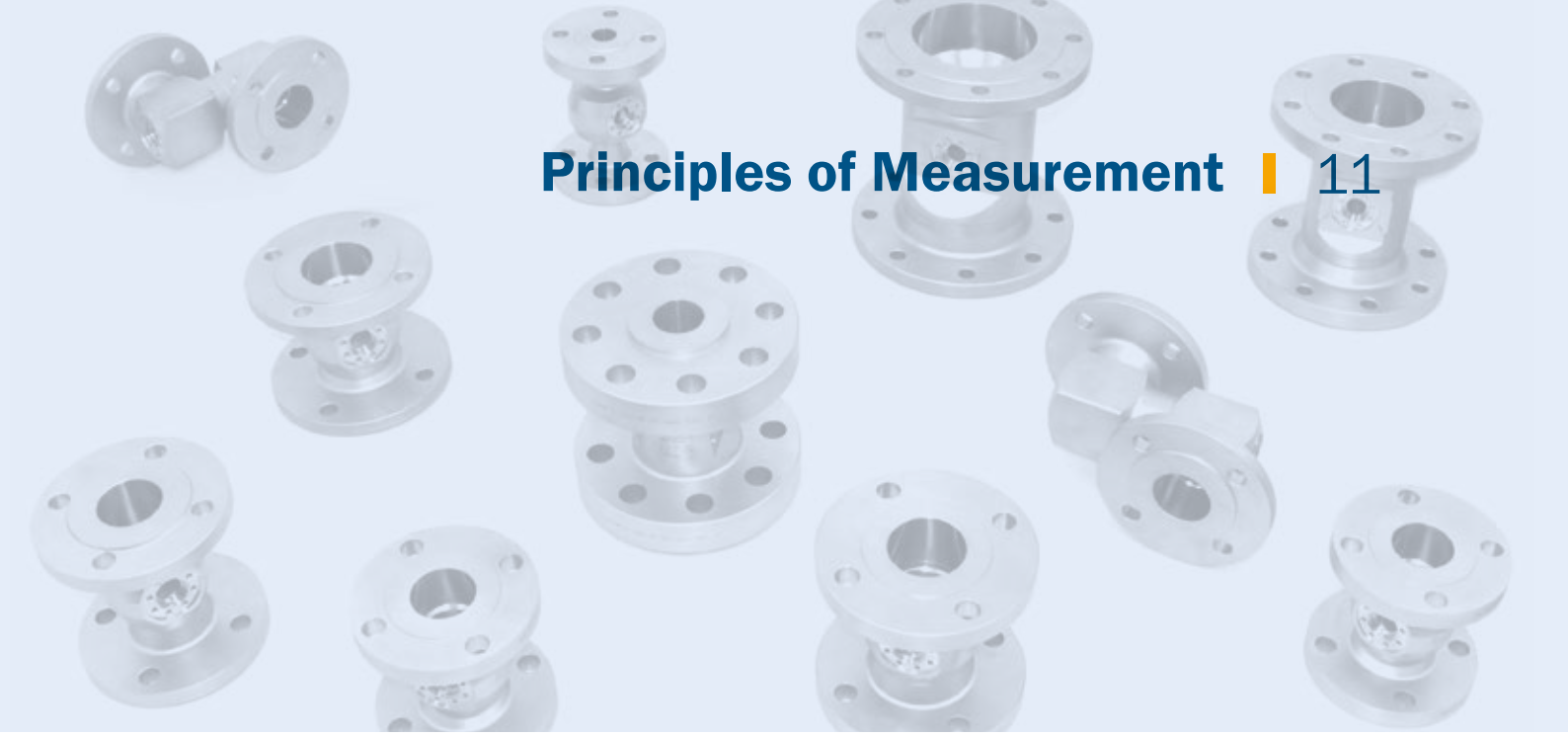
Water in Jet Fuel Detection

Free water in jet fuel comes from numerous different sources. Nominal limits for free water in jet fuel are typically in the range from 0-15 ppm (DE) while other fuels may tolerate larger ranges. An optek TF16-N scattered light turbidity sensor will immediately detect these low level contaminations. This important inline measurement is accomplished in real-time and designed for harsh and hazardous area classifications.

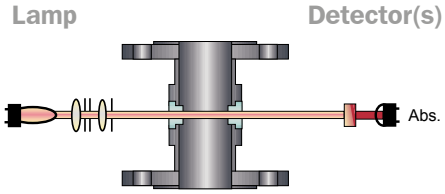
Typical Applications:

- *Monitor free water content in refined product cuts off the CDU (crude distillation unit)*
- *Monitor free water in transportation fuels (airport refueling, distribution terminals, military refueling skids)*
- *Monitor free water in lube oils*
- *Monitor free water in bunker oils onboard ships*
- *Monitor free water content during product manufacture (cyclohexane, isopropylene etc.)*

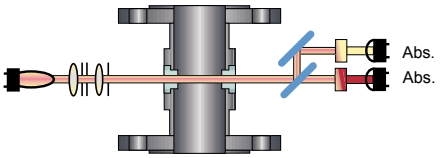
optek TF16-EX-N Scattered Light
Dual Channel Turbidity Sensor



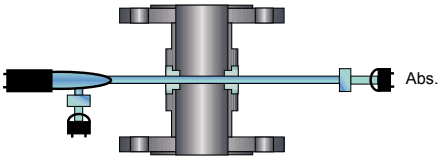
Sensor AF16
VIS- and NIR-Absorption,
single channel concentration and
color measurement



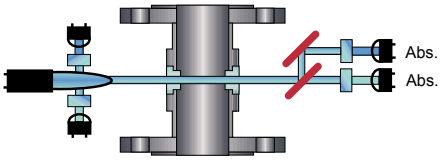
Sensor AF26
VIS-Absorption,
dual channel color measurement with
turbidity compensation



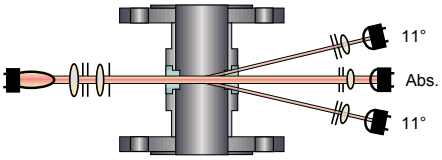
Sensor AF45
UV-Absorption, single channel concentration
measurement with compensation of lamp
intensity



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



See our various product and application brochures for further details

12 Contact

inline control

Germany
optek-Danulat GmbH
Emscherbruchallee 2
45356 Essen / Germany
Phone: +49 201 63409 0
E-Mail: info@optek.de

USA
optek-Danulat Inc.
N118 W18748 Bunsen Drive
Germantown WI 53022 / USA
Phone: +1 262 437 3600
Toll free call: +1 800 371 4288
E-Mail: info@optek.com

Singapore
optek-Danulat Pte. Ltd.
25 Int'l Business Park
#02-09 German Centre
Singapore 609916
Phone: +65 6562 8292
E-Mail: info@optek.com.sg

China
optek-Danulat Shanghai Co., Ltd.
Room 718 Building 1
No.88 Keyuan Road
Pudong Zhangjiang
Shanghai, China 201203
Phone: +86 21 2898 6326
E-Mail: info@optek-danulat.com.cn

中国
优培德在线测量设备（上海）有限公司
上海张江科苑路88号德国中心718室 邮编:201203
电话:+86-21-28986326
E-Mail: info@optek-danulat.com.cn

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