



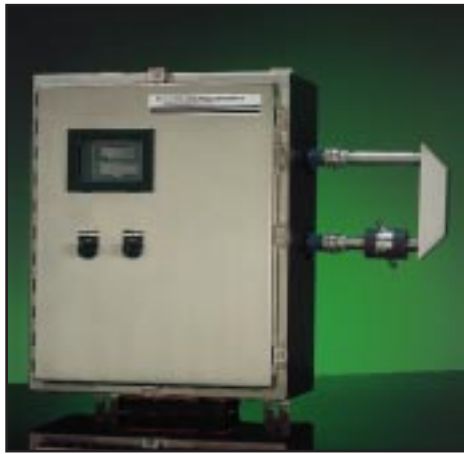
Teledyne Analytical Instruments

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Oil in Water Analyzer System

- *Redesigned with modularity and lower cost in mind*
- *Rack or cabinet mounted*
- *General purpose or explosion proof*

Teledyne's Model 660/661 has been the industry standard in oil-in-water analysis for 30 years. The microprocessor based 6600 / 6610 improves upon our proven analog circuitry and the sample handling system. The new, compact modern design incorporates many new features at a significantly reduced cost. Critical features include:

- Folded optical system optimized for excellent signal-to-noise ratio and stability
- Increased reliability by eliminating many moving parts
- New sonicator homogenizes oil (in-line) in water instantly (less than one second)
- Improved auto-zero filter system prepares zero fluid for calibration and zeroing without long sparging cycle
- Specially developed software with auto calibration features
- Automatic self-cleaning sample cell suitable for high pressure and temperature
- Manual calibrations done easily with collected zero fluid from sample system using the gravity fed reservoir
- Manual or automatic span sensitivity easily checked with internal span flag once field calibrated
- Faster response time
- Modular design configured to meet specific application requirements

The 6600 utilizes the ultraviolet absorption principle to detect and continuously measure oil concentration in water with a reproducibility that exceeds standard laboratory techniques. The automated analysis system includes a single beam, dual wavelength, UV

photometric analyzer that compensates for turbidity, algae, cell window coatings, and other optical attenuation. To assure accuracy, a unique conditioning system delivers a sample representative of the true oil content of the stream. A continuous ultrasonic homogenizer (figure 2) disperses all suspended oil droplets and oil absorbed into foreign matter so the sample, to the analyzer, appears to be uniform and in true solution.

OIL DETECTION AND ANALYSIS

The basic oil detection UV analyzers offered by other manufacturers are single wavelength photometers – a "go / no go" instrument without a sample conditioning system. Teledyne feels these lack the sophistication necessary for reliable oil detection monitoring, preferring a dual wavelength design. Attenuation of energy transmission by turbidity and cell window deposits can then be distinguished from absorption despite the presence of oil. With sample conditioning (figure 1) and automatic zeroing, our analyzers produce a truly representative solution for analysis and can compensate for background absorption found in most oil-in-water applications.

DUAL WAVELENGTH

Recognizing the importance of eliminating the effects of turbidity and inherent electro-optical interferences, Teledyne developed a single sample cell, chopped beam, dual-wavelength photometric analyzer unmatched in reliability and accuracy. The 6600 has been extensively field tested to show excellent correlation with the EPA gravimetric reference method 413.1. The system utilizes optical filters to isolate and make energy measurements at two specific wavelength bands. The UV measuring band (centered at 254 nanometers) is extremely narrow to avoid side-band interference. A reference signal is generated at a selected wavelength region where oil does not absorb significantly. This signal is effected by the aforementioned interference as well as by absorption due to the presence of oil.

Components contributing to total absorption in a typical water effluent sample are shown in figure three. Turbidity and electro-optical interferences are removed by the analyzer's design, and non-oil background is zeroed out. Since both the measuring and reference wavelengths are generated at the end of the transmission system, electro-optical interference (cell window coating, variations in source lamp, aging of detector and other electronics) effects each signal equally. The output signal is obtained by electronically generating the logarithm of the ratio of the measuring signal to the reference signal. Therefore, the output signal, linear with absorption, shows little or no affect from turbidity. Additionally, electro-optical stability is enhanced by the dual wavelength design.

SAMPLE CONDITIONING

Factors associated with undissolved oil and background absorption are eliminated by sample conditioning. The 6600 incorporates conditioning components that prepare the sample so both undissolved and dissolved oils are detected and measured. A new, in-line, high frequency (20 kHz) ultrasonic homogenizer minimizes the size of the oil droplets suspended while dispersing them into a more uniform molecular level in the sample so they can be measured accurately. For any photometric analytical technique measuring oil in water above 20 ppm oil requires this homogenization. Oil absorbed onto the particulate matter in the sample is also dispersed by the homogenizer.

Since the response of particulate matter as a possible attenuator is automatically neutralized by the optical system and ratioed to zero by the electronics of the photometer, the characteristic absorption of the total oil can be measured. The output signal or meter readout is linearly proportional with total oil concentration.

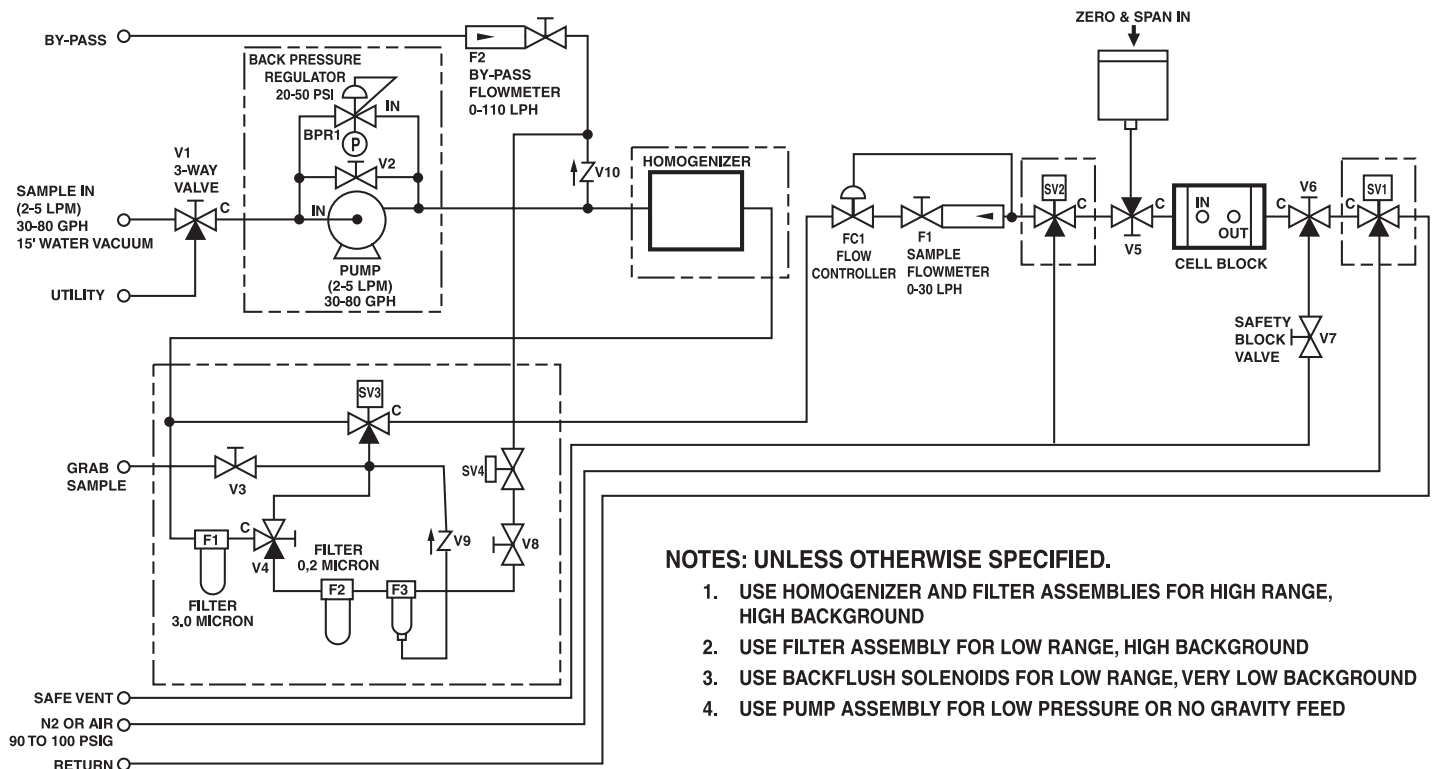
OIL AND GREASE

Many environmental applications (as monitored by regulatory agencies) allow certain minimal levels of dissolved oil to remain in the water measured. The 6600 (when ordered specifically to do so) can monitor for total oil and grease recoverable or be easily switched to monitor the undissolved oil portion only. This minimizes the customer's costly requirement in energy to process water below a minimum oil concentration as dictated by local regulations before out-flowing the water as an effluent.

COMPENSATION FOR BACKGROUND

Many applications require compensation for background absorption due to the presence of non-oil organic and inorganic compounds that absorb UV energy. Furthermore, the concentration of these compounds will likely fluctuate, specifically in applications with multiple non-oil organics and inorganic compounds present in the background. In order to obtain an analysis specific to oil, the background absorption contributed by these compounds must be eliminated and zeroed out. The 6600 does exactly this.

FIGURE 1

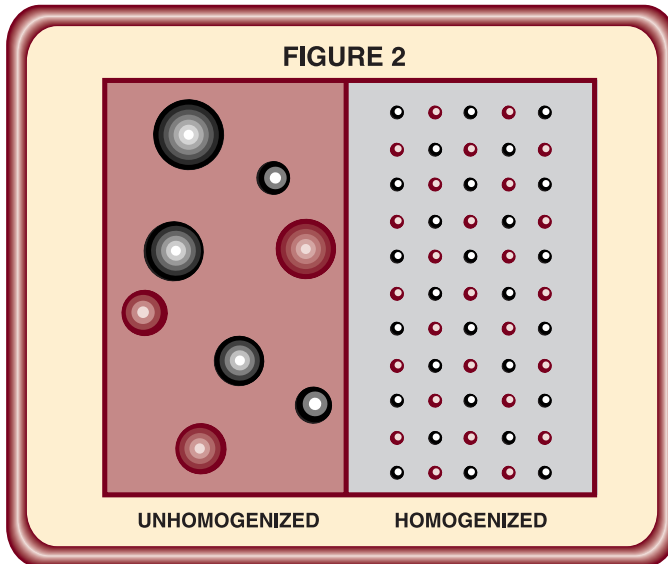


Sample Conditioning System – A sample is fed through a V1 sample / utility valve, then through a split tee; one side as a bypass loop, the other through an inline ultrasonic homogenizer. This disperses any oil in the sample before measurement including small or large oil droplets and oil absorbed on foreign particles. A portion of the stream is conditioned to remove all oil, both dissolved and undissolved, without altering the background (boiler additives or other inorganic compounds.) When this portion is delivered to the analyzer (through SV3), the analyzer subtracts the background from the total and reads out total oil only. The analyzer is manually calibrated with a known standard on a one time basis through the indicated zero and span inlet reservoir. The specially designed sample cell can interface with process fluids up to 150 psig and 120°C (248°F)

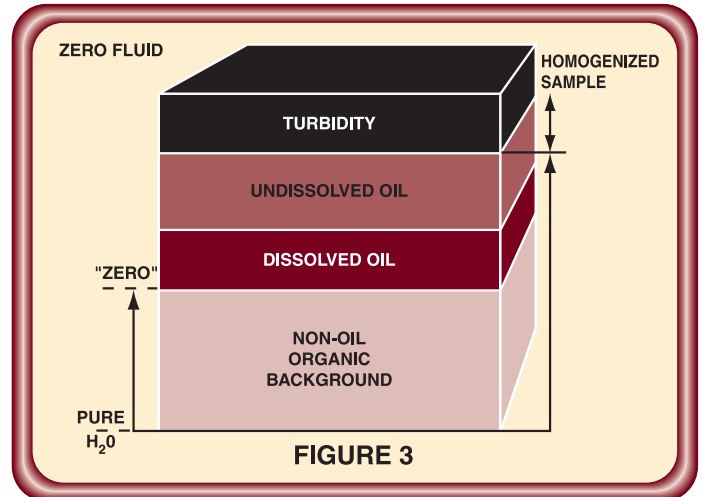
AUTOMATIC ZERO MODE

The 6600 offers an automatic zeroing feature, permitting a continuous analysis specific for oil without interference. The zeroing mode technique (application dependent) is accomplished by the automatic preparation (filtering) and periodic analysis of an oil-free fluid which contains the compounds contributing to background absorption. When this fluid is analyzed, the background absorption is measured and then zeroed out. The cycle is automatically repeated once

each hour to update the oil analysis by correcting for fluctuations. This allows for a more accurate analysis of oil and grease content specifically separated from other non-oil organics that many times are also present in effluents. For very clean processes like steam or boiler return condensates, only oil free nitrogen (N₂) gas or air can be used for electro-optical energy background variations such as from normal source or detector anomalies over time.



Homogenizer Function – The effect of homogenization on the sample is illustrated above. Both the particulate oil and the compounds representing turbidity are of random size. Homogenization causes the oil droplets to be dispersed to such a particle size that, to the analyzer, they appear to be in true solution. Oil absorbed upon or contained within the portion represented by turbidity is also placed into solution along with the particulate oil. Turbidity has no characteristic absorption and is ratioed to zero by the analyzer.



Fractions contributing to total absorption in typical water effluent – The homogenized sample contains all components of the effluent stream. The UV analyzer measures the stream fractions as non-oil background, dissolved oil, and non-dissolved oil. Turbidity will be ratioed out and give no reading. The analyzer will measure the zero fluid as the non-oil fraction. Turbidity and oil have been removed from the zero fluid by coarse and ultra-fine filtering. Coarse filtering removes the non-dissolved oil, while ultra-fine filtering removes the lighter dissolved oils. During the zero cycle, the analyzer is automatically adjusted to read zero. The non-oil UV absorbing background is subtracted from the total UV reading.

APPLICATIONS

- Pollution abatement programs involving effluents from refineries, chemical / petrochemical plants, oil fields, steel mills, automotive production, food processing, and other industries
- Offshore drilling platforms, produced water, oil field water flooding, steam injection operations
- On-board shipping (fast analysis required < 10 seconds)
- On-shore deballasting discharges and ballast treatment facilities
- Boiler return, feedwater, steam condensate, cooling water, leak detection
- Monitoring of airport runoff, municipal water treatment plants
- Wastewater and sewage treatment plants
- Process stream monitoring
- Aromatic hydrocarbons like benzene, toluene, styrene, xylenes in water

FEATURES

- Specific to oil (correlates to EPA 413.1)
- Microprocessor based electronics
- Auto calibration
- Remotely initiated cal / zero via customer supplied 24 Vdc signal
- Self-diagnostics with Form C relay contacts
- Ratio measurement
- Continuous measurement
- Total oil readout standard, undissolved oil readout possible (with autozero filtering option)
- Integral alarms
- Self-cleaning cell
- Automatic turbidity compensation
- Full duplex RS-232 communication link
- Process pressure up to 150 PSIG (higher pressure possible, application dependent)
- Sample temperature to 120°C (higher temperatures possible, application dependent)
- Response time under 5 seconds possible (application dependent)
- NEMA-4x (stainless steel standard) mounted control unit

OIL IN WATER ANALYZER SYSTEM • SERIES 6600-6610

SPECIFICATIONS

Range:	0-10 ppm up to 0-200 ppm oil in water (application dependent)
Noise:	Less than 1% of full scale
Zero drift:	Corrected by automatic zero
Accuracy:	Dependent upon variability of oil composition; $\pm 2\%$ of full scale when calibrated against same oil as being analyzed
Reproducibility:	$\pm 1\%$ of full scale or better
Linearity:	$\pm 1\%$ of full scale or better
Power requirements:	115 Vac 50/60 Hz; 230 Vac, 50/60Hz (specify)
Ambient temperature:	0 to 50°C; may be heated or cooled to operate in other temperatures
Sample temperature:	1 to 120°C, nominal (non-freezing), lower temperatures possible with salt waters
Sample pressure:	0 to 150 PSIG (an optional pump can be supplied when no gravity feed or sample pressure is available)
Signal output:	Analytical measurement, 0-1 Vdc and isolated 4-20 mAdc
Alarms:	Dual fully adjustable concentration alarm set points with programmable relay function. Form C contacts, 3A resistive; self-diagnostics with Form C failure alarm contact
Data lines:	Bi-directional RS-232C serial interface
Readout:	Two line alphanumeric vacuum florescent display

OPTIONAL MODULES

- Homogenizer Module – A high frequency (20 kHz) ultrasonic homogenizer is used to minimize the size of the oil droplets while dispensing them in the sample so they can be measured accurately. Measuring samples above 20 ppm typically require this module.
- Filter Assembly Module – required for applications with high background interference
- Pump Module – required for applications with low pressure or no gravity feed
- Purge Module – Z purge unit or X purge unit

CONFIGURATIONS

- General purpose
- Class I, Div. II, Groups B, C & D
- Class I, Div. I, Groups B, C & D
- CE mark, CENELEC certified (pending)



0-10 ppm oil-in-water monitoring system for boiler / steam condensate application

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Warranty

Instrument is warranted for 1 year against defects in material or workmanship

NOTE: Specifications and features will vary with application. The above are established and validated during design, but are not to be construed as test criteria for every product. All specifications and features are subject to change without notice.

