

## Model 4000 Photometric Analyzer

### Superior Benefits

- || High sensitivity, accuracy and repeatability
- || No moving parts
- || High temperature performance
- || Wide range of processes analyzed
- || Simplified sampling process

### Applications

- || Chlorine purity / chlorination processes
- || Flourination processes
- || Phosgenation processes
- || Impurity monitoring
- || Pulp and paper bleaching
- || Turbidity



*Typical Model 4000 Photometric Analyzer with a sampling system*

### The Need

AMETEK Western Research's Model 4000 Photometric Analyzer is the world's choice for reliable, accurate, continuous, online photometry measurement, and the only photometric analyzer on the market with over 40 years of actual field experience in thousands of applications. The analyzer was initially developed to fill various measurement needs within the chemical industry, and later the applications were expanded to include a wide variety of other industries.

It's world-renowned reliability has led to the automation of many process measurements that were previously only possible through laboratory analysis. A partial list of applications is presented on page two. Virtually every industrial sector is using a Model 4000 to monitor and control critical process parameters. Petrochemical, pulp and paper, food processing, chemical, metal refining, oil refining, gas sweetening, power generation,

fertilizer manufacture, film coating, and wastewater treatment are only some of the industries currently utilizing the Model 4000.

The rugged and elegantly simple design of the Model 4000 enables it to provide decades of online service. It is not uncommon for our customers to experience more than 30 years of operational service, even in the harshest of process applications and environmental conditions.

## Direct Measurement

The Model 4000 uses ultraviolet or visible light to measure a wide range of gas and liquid properties. The principle of analysis is the absorption of UV/visible energy within a sample cell. The analyzer detects how much light is attenuated when passing through a fixed volume of sample. The amount of attenuation is directly proportional to the desired measurement. Since the analysis technique is to simply shine the light through the sample cell, sample conditioning is usually limited to keeping the sample in either the gas or liquid phase.

Sample temperatures and pressures present in most processes are not a challenge to the Model 4000. Sample cells and their sealing materials can be configured to handle gases and liquids up to 15 MPag (2200 psig) or 538° C. Sample wetted materials can be selected to handle virtually any chemical. Corrosion-resistant

plastics and metals as well as simple stainless steel are available.

The Model 4000 utilizes a 'split-beam' design that reduces or eliminates measurement errors due to bubbles, particulate, and lamp intensity fluctuations. The split beam allows continuous monitoring of both the measuring wavelength of light as well as a reference wavelength. Because the reference is not affected by the sample, it can be used to detect the presence of bubbles, particulate, and lamp intensity fluctuations. A built-in optical filter allows on-demand verification of analyzer span readings, thereby eliminating the requirement for costly laboratory verification or calibration gases.

There are many benefits to measuring in the UV region. Most common hydrocarbons and water are transparent; therefore, they do not interfere with the measurement of interest. There are also a number of UV light sources available

that emit light in very distinct wavelengths. Through selection and isolation of a wavelength, a measurement can be obtained in a manner that eliminates, or minimizes, the effect of any potentially interfering compounds. This means that the measurements made with the Model 4000 will be accurate, stable, and repeatable.

From the basic analyzer to fully equipped analyzer shelters, AMETEK has built it all. The Model 4000 can be configured for any location across the world, from a general-purpose installation to a NEC Class 1, Division 1 installation for the Middle East to ATEX systems for Siberia. We have the knowledge and ability to meet any on or offshore installation need. The Model 4000 also has CE, CSA, and UL markings signifying its electrical safety and EMI/RFI code compliance.

## Process Chemicals Sampled

The following is a partial listing of chemicals and properties that are commonly monitored using the Model 4000: Aniline, Benzene, Bisphenol A, Carbon Disulfide, Chlorine, Chlorine Dioxide, Color, DMAC, Fluorine, Hydrogen Sulfide, Hydroquinone, Invert Sugar, Iodine, Lignin, MEHQ, Mercury, Nitrogen Trichloride, NOx, Phenol, Phosgene, Sulfur Dioxide, Uranium Hexafluoride, Uranyl Nitrate, Vanadium

The following is a partial listing of chemicals that do not absorb UV or visible light, therefore, it is possible to monitor UV/visible light-absorbing impurities in sample streams of these chemicals.

## Representative Gases, Vapors and Liquid that Do Not Absorb Visible or UV Radiation

Inorganics	Saturated Straight-Chain Hydrocarbons	Unsaturated Straight-Chain Hydrocarbons	Lower Alcohols
Argon, Carbon Dioxide, Carbon Monoxide, Helium, Hydrochloric Acid, Hydrogen, Hydrogen Cyanide, Krypton, Neon, Nitrogen, Oxygen, Water, Xenon	Butane, Ethane, Methane, Propane	Acetylene, Ethylene, Propylene	Ethanol, Methanol, n-Butanol, n-Propanol

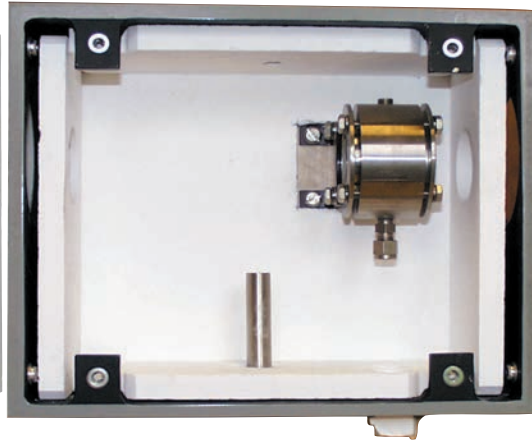
## The Following Do Not Absorb at 254nm or at Higher Wavelengths

Chlorides	Acids	Inorganics	Lower Alcohols	Esters	Ethers
Ethylene chlorohydrin, Ethyl chloride, Ethylene dichloride, Methyl chloride, Methylene dichloride, Vinyl chloride, Chloroform	Acetic, Butyric, Propionic	Carbonyl Sulfide	Ethylene glycol, i-Butanol, i-Propanol	Butyl acetate, Cellosolve, Dimethyl sulfate, Ethyl acetate, 2-Ethyl butyl acetate, Methyl cellosolve, Vinyl acetate	All

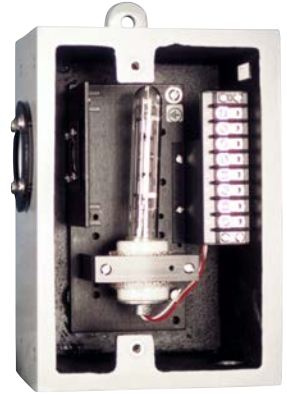
BASIC MODEL 4000: A Modular Design



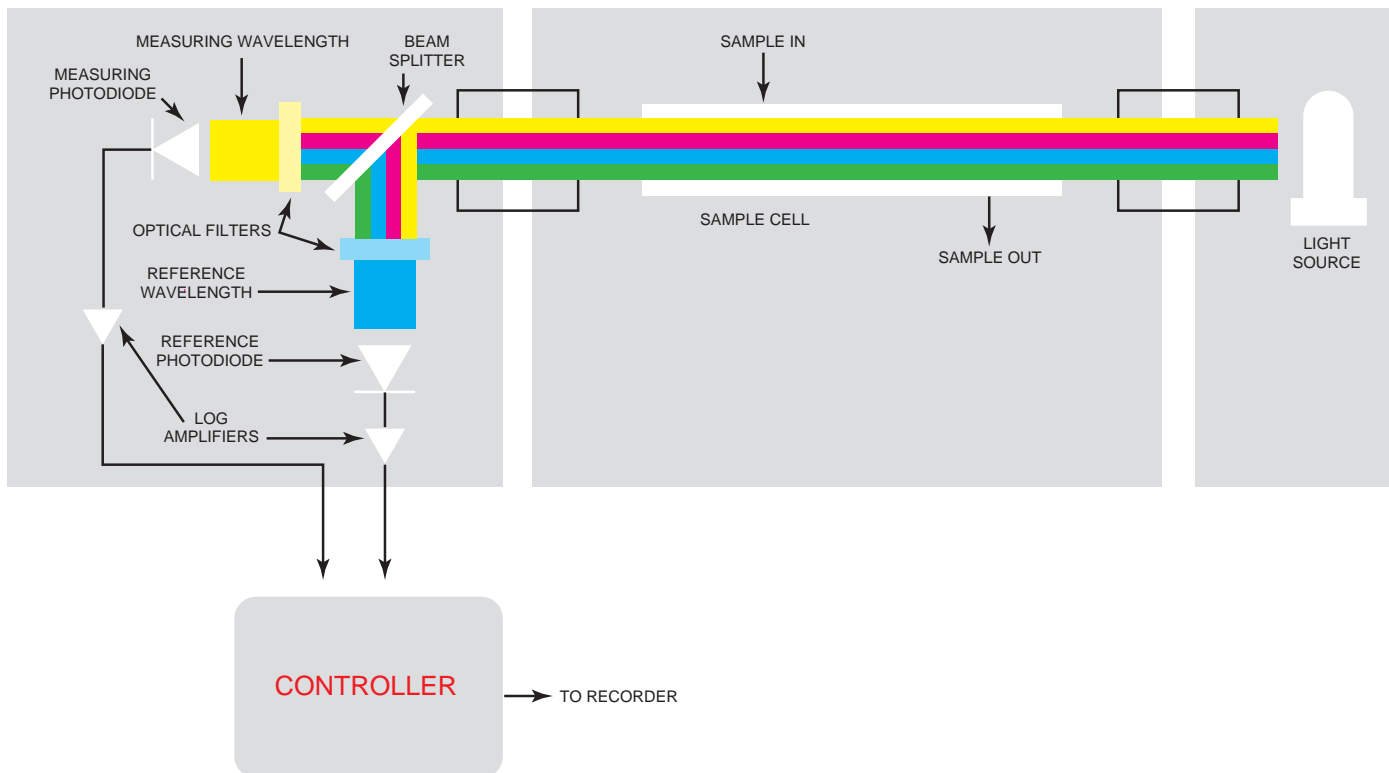
PHOTOMETER HOUSING



SAMPLE HOUSING



LAMP HOUSING



# Model 4000 Photometric Analyzer

## Performance Specifications

(Based on factory calibration and customer stream data)

**Speed of Response:** Standard photometer response less than 1 second. Total response depends on sampling system.

**Output:** Linear with concentration; adjustable

**Standard Output:** Linear with concentration; adjustable

**Photometric Precision\***  
±0.5% full scale

**Photometric Accuracy\***  
±1% full scale

**Zero Drift:\*** Less than 1% full scale in 24 hours for most applications

**Noise Level:** Typically less than 0.5%

**Absorbance Span Ranges:** 0.05 to 3.0 absorbance units

**Wavelength Ranges**  
4 to 975 nanometers

**Standard Lamps:** Metal-vapor discharge or tungsten filament light sources

**Standard Detector:** Photodiodes

**Calibration:** Optical filter and/or standard samples

**Zero Standardization:** Manual or automatic

**Sample Temperature Range:\*** Up to 538°C (1000°F)

**Maximum Allowable Pressure:\*** 350 kPa (50 psi) gauge standard; up to 15 MPa (2200 psi) gauge available.

**Typical Flow Rates**  
Gas: 2.5 L/min  
Liquid: 100 mL/min

**Cell Construction:** Standard body material is 304 stainless steel, other materials available; standard windows are quartz.

**Pathlengths:** 0.05 to 1000 mm (0.002 to 40 in.) standard; other lengths available. Cell pathlength established at factory.

**Operating Environment:**  
-7° to 52° C (20° to 125° F)  
90% RH maximum, noncondensing  
IEC Pollution Degree 2  
Maximum elevation: 2000 m (6560 ft.)

**Electrical Classifications:**  
NEC/CEC Class I, Division 2,  
Groups A, B, C, D, T6 to T4  
CE

**Allowable Line Voltage Variation:**  
95 to 130 volts, 50/60 Hz  
190 to 260 volts, 50/60 Hz

**Power Requirement:** Typically less than 300 W. Also refer to Customer Drawing (CD) Package and 4000 Controller Supplement.

**Dimensions (LxWxD):**  
700 x 900 x 300 cm

**Weight:** 42.5 kg

**Standard Model:** Housings for lamp, sample cell, and photometer are separate units of cast aluminum with gasketed covers. Power supply housing (a painted steel NEMA 1 general-purpose enclosure) and controller are designed for panel mounting and are suitable for control room installations. The controller is also available in rack, surface, and NEMA 4X configurations.

**Explosion Proof Model (optional):** The analyzer field unit is designed for use in Class I, Division 1, Group C, D or certified to ATEX II 2 G EEx de ma IIC T6 to T3. The 4000 Controller may be supplied in an ATEX II 2 G EEx d IIC T6 enclosure on special order. The power supply is only suitable for non-hazardous and Class I, Division 2 area installations.

**Options Available:** Hundreds of options are available, depending on your needs. The basic sample system can be augmented to fit your particular process requirements.

\* Typical for most applications.



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One of a family of innovative process analyzer solutions from AMETEK Process Instruments.  
Specifications subject to change without notice.

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