

# Real-Time UV / VIS / NIR Process Analysis Made Simple

*Improve product quality  
while reducing operating costs*



**TELEDYNE ANALYTICAL INSTRUMENTS**

# Low Cost UV, VIS, and NIR Photometric Transmitters

Teledyne offers low cost, fiber optic-based, UV, VIS and NIR photometric transmitters for industrial labs and process environments. The transmitters incorporate state-of-the-art electronics connected to fiber optic based in-situ probes or extractive flow cells. A variety of lamps, detectors, and fiber optic accessories makes Teledyne the best choice for your in-situ, at-line, and extractive photometric applications.

PHOTO-X



## Defining the Problem

UV-VIS-NIR applications have traditionally been performed with expensive, full spectrum instruments requiring complex software and computers to interface with the hardware. In addition, maintenance of calibration models requires sophisticated personnel to adjust for feed stock and / or software and computer upgrades.

## The Teledyne Solution

Teledyne has introduced a family of fiber optic based photometric transmitters that are application specific, simple to use, and cost effective. Based on significant experience in the design and manufacturing of photometric instruments, the Photo-X series now offers the industry a customized “build your own” approach to on-line, UV-VIS or NIR applications.

## Photometric Transmitter

The photometric transmitter can be manufactured according to a specific application requirement. Through our “build your own” program, the client can customize the components that are integrated into the transmitter. Customers now have options to select from in a menu style ordering guide to construct their personalized Photo-X.

The menu includes:

**Lamps:** To cover all application regions of the spectrum, we offer both internal and external lamps. Internal lamps can be packaged along with the Photo-X.

**Detectors:** To have sensitivity in the region of interest, Teledyne can match the spectral output of the lamp with the most efficient detector for the intended application. Detectors used are PMT, Si, InGaAs, and PbS.

**Packaging:** Through our systems integration group, we can package the transmitter for general purpose and hazardous environments.

**Fiber Optic Accessories:** Safely interfacing to a process stream is a very important consideration when monitoring in industrial environments. Teledyne can offer extractive fiber optic flow cells that range in path length from 0.02 mm to over a meter in length, and in-situ probes that can take pressures up to 10,000 psig and temperatures up to 315°C.

**Window Fouling Circuit:** The Photo-X series provides a local indication that the windows are fouling. The local LED lights up when the reference signal has deviated by a customer established set point.

**Calibration:** All Photo-X products can be supplied with an optional automatic / manual span filter that attenuates the measuring beam by a fixed amount every time it is introduced. This method is called calibration by standard addition and employs a reference filter (NBS or NIST traceable) to give a reproducible response when the filter is placed into the measuring beam.

**Outputs:** Scalable 4-20mA, local digital display, and local indication of instrument status are common outputs for all Photo-X transmitters.

## Where the Photo-X Series can be used

- Fermentation
- Pharmaceutical plants
- Pulp & Paper plants
- Off Shore Platforms
- Chemical plants
- Petrochemical / Refineries

# Optical Interface Couplers

## Collimated Lens Assemblies

Teledyne offers high quality Optical Interface Couplers (OICs) for fiber optic based Photometric and Spectrophotometric analyzers. When used with a fiber optic based light source (Du, Xe, Tungsten, or LED) and fiber optic cable, the OIC will transform the dispersed light into a collimated beam that can traverse liquids, gases, or solids.

### Organization

Teledyne provides the lab and process industry with exceptional tools to measure various gas, liquid, or solid parameters. We provide the CPI industry with OICs and other optical tools used to manage light energy from source to detector.

### OIC Applications

In process applications, OICs are used with flow cells as a sample interface. In a flow cell, a small portion of the liquid or gaseous chemical stream is extracted from the main line and directed in a bypass loop through the flow cell before returning to the process stream.

Collimating optics directs the light from the photometer or spectrometer through the length of the flow cell and collects the light at the distal end. Light then returns to the spectrometer via the fiber optics.



3/8", 1/2" and 3/4" OICs with replaceable windows

The OICs can be configured to monitor in the UV, VIS, or NIR regions of the spectrum, and can be supplied in 316 SS, Ti, or Hastelloy materials. Windows offered are either quartz or sapphire. Temperature limits of the OICs are -40 to 350° C and the OICs can withstand pressures up to 10,000 psig.



Fluorescence, Cross, and T-Flow cells with OICs

Flow cells are matched to the chemical environment they will encounter and are available in a range of optical path lengths. Flow cells may also be configured as fluorescence detectors, by placing an additional fiber input at 90° to the transmission path.

### Custom Designs

Some applications require special designs. Teledyne will consider designing special optical assemblies for customers. Purged OICs or flange mounted / vacuum OICs are examples of custom work.



Flange mounted for high vacuum service



Purged OICs for environmental safety applications

# Menu Category Descriptions

## Lamps

Pick the lamp that provides the wavelength range needed for the application.

### Xenon Flash Lamp

1. UV - VIS
2. 200 - 650nm

### LED

1. VIS - NIR
2. 390 - 950nm at discrete wavelengths

### Tungsten

1. VIS - NIR
2. 400 - 2200nm

## Detectors

Choose the detector that gives the best wavelength response for the application.

### PMT

1. UV - VIS
2. 200 - 850nm

### Silicon

1. UV - NIR
2. 250 - 1050nm

### InGaAs

1. NIR
2. 900 - 1650nm

### PbS

1. NIR - IR
2. 1 - 4.5 microns

## Form

Decide what optical bench best suits the budget and application parameters.

### Fiber Optic\*

1. Use of fiber optic cables to transmit and receive light to and from lamps and detectors

### Non-Fiber Optic\*

1. Source energy is sent directly across a straight path flow cell.

\* Either form can be supplied with a span filter. The span filter can be NIST traceable reference.

## Packaging

Selection is based on the area classification and/or plant designation.

### None

1. Customer will package system or supply to outside contractor for packaging

### General purpose\*

1. NEMA-4X
2. NEMA-4X with rotameter purge

### Classified area\*

1. Class I, Div 2 purge
2. Class I, Div 2 purge
3. NEMA-7

\* Teledyne will provide engineering in the form of Layout, SHS, and/or packaging of electronic components with third party products.

## Accessories

Select the best sample interface for the application.

### Extractive Flow Cells

1. Cross
2. T-cell
3. Micro-cross
4. Fluorescence
5. Long path (please specify length)

### Options

Can be supplied with or without fibers, special thermally managed heated designs, and special materials.

### In-Situ Probes

1. Transmission
2. ATR
3. Diffuse reflectance
4. Fluorescence

### Options

All in-situ probes can be supplied with an automatic insertion / retraction device used to clean or calibrate the probe.

## Cable (Fiber Optic)

Decide on the type and length of fiber needed for the application.

### Fiber Optic Cable

0. None
1. 2M
2. 3M
3. 5M
4. 10M
5. 20M
6. 30M
7. 50M
8. Other

\* Please specify either Lo or Hi Hydroxyl fiber

### Non-Solarizable UV

0. None
1. 2M
2. 3M
3. 5M
4. 10M
5. 20M
6. 30M
7. 50M
8. Other

## Notes

1. Flash lamps and LEDs cannot be paired with InGaAs or PbS detectors. All other permutations are permissible.

2. Wavelength selection is via bandpass filters; customer to provide specific values for measure and reference wavelengths.

3. Application engineering is required for all system designs prior to receipt of order. Please consult with the factory or your local TAI sales outlet for further assistance.

## Industries Served:

**Pulp & Paper**  
**Bio-Tech / Pharmaceuticals**  
**Chemical / Petrochemical**  
**Water Quality**



# Fiber Optic Probes for Process Applications

Teledyne offers probes which reflect the demanding conditions in chemical, petrochemical, pulp & paper, and pharmaceutical industries. Our standard designs will withstand 10,000 psig and 300° C process conditions. Working in the UV-VIS or NIR regions of the spectrum, these probes are used when extractive sampling strategies are either environmentally or economically cost prohibitive.

## Front Surface Fluorescence Probe



### Theory of Operation

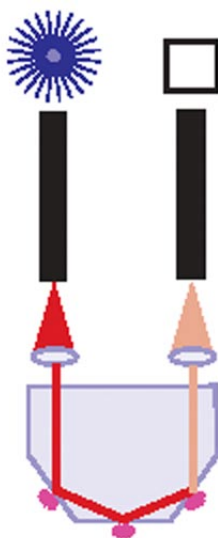
Excitation energy from a source is fed into multiple fibers that cause the target compounds to emit light at longer wavelengths. The emission energy is collected by a fiber optic cable which carries the emission energy back to a pair of detectors. The emission signal is not affected by reabsorption of the sample or scatter due to entrained particles in the stream.

### Applications

Typical applications for the in-situ Front Surface Fluorescence probe are:

- Oil-in-Water / Oil Separators
- Detection of active ingredients in cleaning solutions
- Algae growth in cooling towers
- Dye markers in fuels
- Optical brighteners
- Bioprocessing and viable cell growth

## ATR Probe



### Theory of Operation

When two media with different refractive indices ( $n_1$  and  $n_2$ ) contact at an interface the sample absorbs some of the energy, as it exceeds the critical angle a Beer-Lambert-like measurement is made.

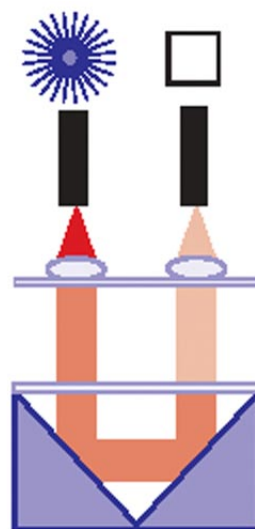
Our 3-bounce ATR probe can also be used in a nontraditional or “leaky” mode to measure high refractive index materials that form on the surface of the crystal.

### Applications

Typical applications for the in-situ ATR probe are direct reading (no dilution of sample) of high concentration applications such as:

- Inks & Dyes
- Detection of Carbon Black
- Asphaltenes in crude oil
- Surface deposition

## Transmission Probe



### Theory of Operation

The transmission probe is a double pass probe that sends light energy from a source through the sample by folding the beam 180° back via a protected reflector. The amount of transmitted/absorbed light is measured by the detectors, read out locally, and a retransmitted 4-20mA output proportional to concentration is supplied.

Transmission probes have traditionally been favored over transfection probes because of their increased linearity.

### Applications

Typical applications for the in-situ Transmission probe are:

- Color of process stream
- Presence or absence of analyte
- Scatter by particles

# ***Built for Reliability and Performance***

## **TELEDYNE ANALYTICAL INSTRUMENTS**

A Teledyne Technologies Company

16830 Chestnut Street

City of Industry, California 91748, USA

TEL: 626-934-1500 FAX: 626-934-1651

TOLL FREE: 888-789-8168

Visit our website at: [www.teledyne-ai.com](http://www.teledyne-ai.com)

### **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.