Continuous Monitors for Total VOCs, Total Hydrocarbons, Solvents- (PID/FID) & H2S, SO2, Cl2, CS2, ..(NDUV-NDNIR)

Model 201B Rackmount

Model 201B Wallmount

Introduction

The Model 201-B PID is a flexible and versatile Analyzer. More than three thousand of these photoionization detector (PID) based Analyzers have been sold worldwide for applications ranging from carbon bed breakthrough, leak detection to stack and ambient air monitoring. This is attributed to the rugged and durable design that is characteristic of all PID Analyzers products.

Several years ago, we added the flame ionization detector (FID) to the 201 series product line. Other continuous Analyzers in the 200 series include the Model 202 Infrared (IR), the Model 201B fixed wavelength UV-Near IR Photometer, a thermal conductivity detector (TCD), Model 204 and a Model 210 Paramagnetic Oxygen Analyzer. The addition of these new Analyzers greatly improves the capability and range of process analyzers from PID.

PID Description

The process of photoionization is initiated by the absorption of a photon of ultraviolet radiation energetic enough to ionize a molecule (RH) by the process shown below:

\[ RH + h\nu \rightarrow RH^+ + e^- \]

where \( h\nu \) represents a photon with an energy \( \geq \) the ionization potential of species RH. The ions are collected in an ionization chamber which is adjacent to the lamp and contains an accelerating electrode (biased positively) and a collection electrode where the current is measured. After amplification, the current measured is proportional to concentration. The response measured will be a summation (total) of the hydrocarbons ionized.

FID Description

In the FID, the sample is burned in a hydrogen-air flame and the ions formed from carbon containing compounds are collected by applying a positive potential to the jet and measuring the current at collection electrode just above the flame. After amplification, the current measured is proportional to concentration.

Applications: PID or FID

- Monitoring effluents from chemical, refining, or manufacturing
- Carbon bed breakthrough
- Leak detection- from process equipment
- Non methane Hydrocarbons in Ambient or Stack-FID/Catalyst
- Drying ovens for removing solvents
- Incineration
- THC in ambient or plant ppb levels of VOCs- PID only
- Remediation site monitoring
- Intake air in chemical or manufacturing plants- used to control recirculation of air
- VOC’s in water with optional Sparging system (Model 650) for Total VOCs in water at ppm-ppb levels

Features-

- Automatic Restart- In the event of a power outage, the instrument will automatically restart
- Low cost of ownership- The long lifetime of the analyzer coupled with the minimal level of maintenance results in a low cost of ownership
- Wide operating range with no range changing necessary- 16 Bit ADC
- Push button Automatic calibration; automatically adjusts response
- Autozero for PID; Automatically injects zero gas & adjusts auto zero for FID
- PID- lamp out alarm; FID-flame out-shuts off hydrogen and provides alarm
- RS232 digital output; 0-1 VDC analog output
- Up to 6 dual setpoints that are programmable- can be used to shut down a process, remotely dial a number...
**Specifications**

- **Detectors available:** PID & FID
- **Measurement mode:** Continuous
- **Zero drift:** Automatic compensation; <1% per month
- **Span drift:** Auto cal each 24 hours (with contact closure), may require manual set of span: less than 1% every 24 hours
- **Wide range of response:** from sub ppm on PID to % on the FID
- **Support gases:** PID requires no support gases; FID requires H₂ and zero air
- **Readout:** 5½ digit bright red LED smart panel meter
- **Standard output:** 1 VDC, RS232
- **Enclosure:** Rack (NEMA 2)-
  - Rack: 19” W x 5¼”H x 14”D
  - Weight: 12.2 pounds PID
  - 14 pounds FID
- **Wall (NEMA 4)**
  - 23”W x 21”H x 10”D- PID
  - 27”W x 21”H x 10”D- FID
- **Weight:** - 19 pounds PID
  - 22 pounds FID
- **Power requirements:** 100-240VAC, 1 amp

**Options**

- 4-20 mA output; RS485 output, MODBUS,
- Dual setpoints- Customer Programmable
- Data acquisition and storage using DataWorks software- runs under Windows or Windows NT on a Pentium PC
- **2 point**, Separate Display of Each Sample Point- ideal for inlet/outlet measurements
- **4, 16, 32 point sequencer** (with contact closure to indicate point being sampled), Three line display- Display of Concentration, Sampling Point & Sample Flow (measured by mass flowmeter)
  - X or Z purged for Zone 1 and Zone 2 respectively

**Sampling Systems**

One of the most difficult challenges is to deliver a sample stream saturated with water at an elevated temperature to the analyzer without any change in the composition of the VOC’s or other compounds to be measured. A photo of our sample conditioning system is shown below. For additional information, please contact PID Analyzers.

The system below requires only compressed air for operation and removes all liquid water from the sample. It can be used in a Class I Div 1 area. We also offer heat exchangers and heated sample lines for other types of samples.
**Introduction**

The Model 201 B UV-NIR Absorbance Analyzer is a flexible and versatile non dispersive (ND) Spectroscopic Analyzer. The design is based on ultra stable lamps with single or dual beam optical benches, a detachable sample cell, a photodiode detector and very stable electronics. This Analyzer has a wide dynamic range (from ppb to > percent levels). This rugged and durable design is characteristic of all PID Analyzers products.

**Principle of Operation**

The technique for measuring the concentration depends upon the Lambert Beer Law:

\[ I = I_0 e^{-kx} \]

Where- \( I \) is the measured intensity, \( I_0 \) is the incident intensity, \( k \) is the absorption coefficient, and \( x \) is the pathlength

The instrument consists of a UV source, a fixed path length cell (can be varied for the application), an interference filter and an UV detector.

This instrument operates in the near UV to near IR region (200-1,500 nm). The types of electronic transitions in this region are electronic and for organic molecules involve sigma electrons (unsaturated compounds). The types of electrons are found in C=C (\( \pi^* \) transitions) or C=O (\( N^* \- \pi^* \) transitions) in organic compounds.

**Features-**

- The LED meter displays three parameters (concentration (ppb/ppm/\% ), temperature, and pressure) and will provide an output for a single parameter.
- **Easy to operate**- In the event of a power outage, the instrument will automatically restart
- **Wide operating range** with no range changing necessary- 16 Bit ADC
- **Push button Automatic calibration**; automatically adjusts response
- No span or zero pots; all calibration data stored in RAM
- **Automatic calibration for Absorbance**
- Can be setup to run without a cal gas standard via an absorbance standard
- **UV/Visible/Near IR lamp out alarm**
- **Temperature & Pressure correction**

**Digital Outputs:**
- Standard- RS232 Optional- RS485, Device Net

**Analog Outputs:**
- Standard-0-1 VDC analog output; Optional- 4-20 mA

**UV-NIR ABSORBANCE DETECTORS**
\( \text{NH}_3, \text{Hg, Ozone, H}_2\text{S, SO}_2, \text{Mercaptans, CS}_2, \text{Cl}_2, \text{Br}_2, \text{I}_2, \text{Aromatics, Aldehydes, Ketones} \text{ in air, water & process streams} \)
**Specifications**

**Detectors available:** UV-NIR lamps and detectors from 200-1200 nm

**Measurement mode:** Continuous

**Zero drift:** < 0.1%/day

**Span drift:** < 0.1% FS per week

**Readout:** 5 digit LED smart panel meter with 32 bit arithmetic calculation capability

**Displays:** Concentration, T/°C, and P/atm

**Response time:** 20 sec.

**Flow rate:** 0.5-1.5 LPM

**Operating temperature:** -15-30° C

**Standard output:** 1 VDC, RS232 (print with a serial printer or print to a PC in hyperterminal)

**Programmable Voltage Output:** Analog outputs (0-1VDC or 4-20 mA) can be programmed from the front panel

**Enclosure:** Rack (NEMA 2) - 19" W x 5½"H x 14"D; Weight: 12.2 pounds

**Power requirements:** 100-240VAC, 1.5 amps

**Range:** Depends of application

**Linearity:** 1%

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**UV to NIR Applications**

The Analyzer can be configured for the UV with a mercury lamp with/without interference filters, a cold cathode elemental lamp or a deuterium lamp with interferences filters, and/or a tungsten lamp for visible-NIR with interference filters. Using various combinations of lamps/filters and detectors, a number of different applications are available including the following:

**Applications**

**Air**
- Aromatics, Amines, Aldehydes, Alcohols and Ketones in stack gases
- NH₃, Cl₂, NO, NO₂, H₂S, SO₂, Hg in stack gases or process streams

**Process**
- Solvent purity
- Lower explosive limit

**Water**
- Aromatics, Amines, Aldehydes, Alcohols and Ketones in water
- Chlorine dioxide, or nitrate, and other ions in water
- Metal ion chelates in water

**Additional Enclosures:**

The UV analyzers are available in a standard 19” rack mount enclosure or a NEMA 4 wall mount enclosure. The latter can be X or Z purged to meet Class 1 Div.1 or 2 electrical requirements.
DataWorks

Data Works is PIDs data collection and logging software that can be used with a wide variety of Sensor or Analyzer outputs such as Ethernet, RS485 & 4-20 mA. The latter two outputs are for long distance transmission of data as shown in Table I below. In-plant installations are typically 4-20 mA or RS485 because of the long distances involved 1,000-5,000'.

The software is written in visual C++ as an overlay/interface for various hardware devices. One hardware version used for our Model 201-B, 202, 203, 204, 210, 301B GC, 501 B GC or other manufacturer's instruments that have 4-20 mA outputs or an RS485 output. There is a 12 bit ADC on board with 16 digital input/outputs. The latter can be used to control calibration, diagnostics for the PID Analyzers units. Low and high alarm levels and concentration range can be set in the PC.

Each day at midnight, a new CSV or text file is created and named (by date). These files can be directly imported into EXCEL. The 4-20 mA output from multiple PID Analyzers instruments can be networked as shown below.

Multipoint Sequencer

The 201-B has several multipoint options. The first is a simple 2 point system that can be used to monitor the input and output of a scrubber, carbon bed etc. to determine the efficiency of the system. This 201-B has a two channel display; one for each channel.

The second option is a 4, 8, 12, 16, 24 or 32 point system. This system employs a manifold with a needle valve and a 3 way valve for each channel. This version has a three channel display. One channel is for the concentration, the second is for the channel # and the third is for the sample flow for that channel. The flow is measured with a mass flow sensor. The setpoint for the flow channel can be set to indicate a low flow or blockage for a channel. An alarm can be programmed for each channel in the system. This system provides an inexpensive alternative to a sensor for each point. The cost of maintaining and/or calibrating this single system is considerably less expensive than maintaining a 16 or 24 sensor system.

The multipoint system can be interfaced with DataWorks, a PLC or DCS system that is already at the Plant. Contact PID for additional information on this area.

A three channel display for the multipoint is shown below: