

TYTRONICS® FPA SERIES

A MORE PRACTICAL DEGREE OF
PRECISION PROVIDES REAL ON-LINE RELIABILITY
AND A MEANS FOR
PROCESS CONTROL

FPA 300™

**PROCESS
POTENTIOMETRIC
TITRATOR**
pH/ORP/ISE
TITRATIONS

FPA 400™

**PROCESS
COLORIMETRIC
TITRATOR**
pH INDICATOR/
NON-AQUEOUS/
COMPLEXOMETRIC
TITRATIONS

FPA 800™

**PROCESS
COLORIMETER**
COMPLEXOMETRIC METHODS



FPA SERIES
300/400/800

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FPA 300™ SERIES APPLICATIONS

- ABC Test in Paper Pulping
- Acids
- Boric Acid
- Alkalinity
- Caustic and Carbonate
- Chlorine/Hypochlorite
- Cyanide
- Copper
- Hydrochloric Acid in Pickling Solutions
- Peroxide
- Sulfide in Sour-Gas Treatment
- Sulfuric Acid in Pickling Solutions

FPA 400™ SERIES APPLICATIONS

- Hardness
- Sulfitite
- Acid Value of Organic Solvents
- Acidity or Alkalinity of Fuels
- Bromine number & index
- Mercaptans in fuels

TYTRONICS™

Tytronics™ products are elegantly simple and rugged on-line analyzers, all designed and manufactured to measure the concentration of a chemical component in a liquid. Tytronics™ utilizes four methodologies for on-line analysis: ion selective electrodes (ISE), titration (potentiometric and colorimetric), colorimetry and spectrophotometry. These techniques are available in the FPA series of programmable analyzers.

The Tytronics™ FPA Series are designed for process applications in the chemical and petrochemical industry. These instruments are single stream, and have the flexibility to analyze both low or high concentration ranges. The enclosures of the FPA series may be purged to meet the American Class 1, Division I or II electrical classification, as well as ATEX zone 1 and zone 2 specifications.

TYTRONICS™ FPA 300™/400™ SERIES

The Tytronics™ FPA 300 series delivers simple, reliable and highly cost-effective on-line titration. Acid-base, redox and other analyses are typical applications in a wide variety of industries, including; chemicals, petrochemicals, textiles, metal finishing and pulp & paper.

The Tytronics™ FPA 400™ series is an extension of the proven FPA 300™, adding applications for titrating to a color endpoint. Colorimetric titration offers on-line analytical capability at trace levels in applications such as monitoring plant effluent and municipal water, and environmental analysis in general.

COMPONENTS & ENCLOSURES

Components are contained in two purgeable NEMA-12 enclosures for general purpose installation; conversely, this may be upgraded to NEMA 4 or NEMA 4X and purged for installation in electrically hazardous areas. The sample enters through the fittings at the bottom of the lower enclosure, flowing through the inlet valve and into the sample cell via the manifold. Flow is controlled by the inlet valve and the air vent valve. A peristaltic pump adds reagent, if needed. A precision metering pump adds the titrant until the endpoint is sensed by the electrode or the change in light transmitted through the fiber optic probe. The other peristaltic pump is used to add calibrant.



PRINCIPLES OF OPERATION

The Tytronics™ FPA 300/400™ series instruments have an elegantly simple liquids handling and measurement system, resulting in a very reliable general purpose titrator for the user. The system reliably captures a fresh sample, conditions it and titrates to a fixed endpoint. The on-board computer operates the components, takes readings from the sensor, and calculates and transmits a sample concentration over any of a variety of outputs (e.g. 4-20mA, RS-232).

Sample capture is similar to use of an overflow cup, except that the siphon action drains the sample to a final repeatable level (volume). For the FPA 300™ series, a variety of electrodes are used to sense the end point that is measured potentiometrically. For the FPA 400™ series, the colorimetric end point is sensed by a change in light absorbed by an indicator in the sample at a set wavelength. The light is carried from and returned to the source/detector board in the upper enclosure by fiber optics. In a sample cell, a Kynar probe body sealed with a window protects the fiber optic bundle and fitted with a Hastelloy C polished reflector, which is mounted to return light back through the fiber optics to the detectors.

Analyses are fully automatic in all cases. Through menu-driven programming, the user can easily change the frequency of analysis and calibration, as well as most default values, to improve performance for specific site conditions.

The reaction cell is used both to capture and to analyze the sample. The cell contains no moving parts and is available in a variety of materials.

CALIBRATION may be manually or automatically performed at user-selectable intervals by using a standard.

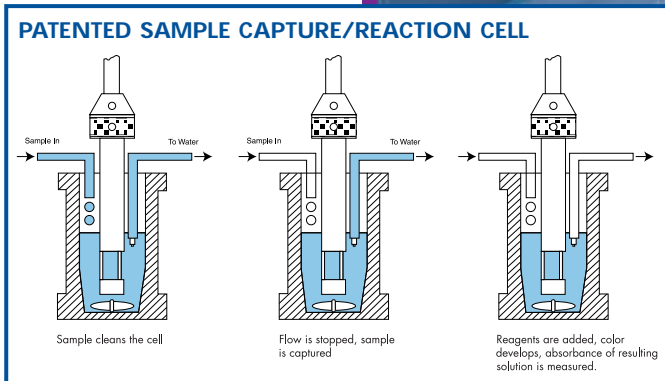
COST/PERFORMANCE - Economic return is exceptional with the Tytronics® FPA 300/400™ series. Payback is usually less than nine months through lower chemical use, greater operating efficiencies and reduced seconds/rework. Productivity increases with the automation of routine analyses and an increase in the frequency of analysis, all done at the sample point.

THEORY OF OPERATION

A reaction cell is used both to capture and to analyze the sample.

A dipping colorimetric probe is mounted in the reaction cell to measure the absorbance of the resulting solution.

The reaction cell contains no moving parts, except for the magnetic stirrer, and is available in various materials (an acrylic cell is standard) All sample and reagent lines are 1/4". Mixing is accomplished through the use of a magnetic Teflon™ coated stir bar. Fiberoptics are used to transmit light to and from the reaction cell. The light source is a tungsten filament which provides a continuum in the visible and NIR region. The fiberoptics bundle of the return path is bifurcated to facilitate the dual wavelength operation.



BATCH SAMPLING TECHNIQUE

This technique allows the use of 0.25" tubing for sample and reagent lines so small amounts of solids will not affect instrument performance. There are no mixing coils to clog. Sample size can be varied between 0.3 ml to 100 ml. Reagent volumes are selected to optimize for a particular concentration range of measurement, This flexibility in sample and reagent volumes allows for the instrument to be configured to measure sample concentration in the % wt region as well as ppb levels. Analyses are only performed as frequently as required, thus minimizing reagent consumption. Reagents are non-proprietary and may be prepared by the plant or a local chemical laboratory for lower operating costs.

DIPPING COLORIMETRIC PROBE

A dipping colorimetric probe is used to measure the absorbance of the solution after reaction of sample and reagents. The probe is cleaned and rinsed between analyses, thus eliminating the problems of optics fouling. The probe is constructed of Kynar or Hastelloy C and the reflector is always Hastelloy C; this ensures excellent chemical resistance characteristics. The probe can be supplied in two different path lengths, 2cm and 4cm.

OPTICS DESIGNED FOR MAXIMUM STABILITY

The optics are designed with a dual wavelength configuration. One of the wavelengths is characteristic of the analysis being performed and the second is a reference wavelength.

The use of a reference wavelength allows for correction of sample turbidity and lamp aging. The instrument may be programmed to perform an autoblack step before the final color development and thus compensate for sample background color. Because of these features, weekly instrument calibration is sufficient. Calibration is automatically performed to insure instrument accuracy.

MODULAR DESIGN FOR EASE OF MAINTENANCE

Fluidic and electronic hardware is designed in modules for rapid and simple servicing. Each fluidic component is mounted on a panel for simple removal and replacement. Similarly, each circuit board provides a logical group of functions for rapid isolation of problems.

EASE OF OPERATION

A person with little chemical background may use the analyzer with minimal training.

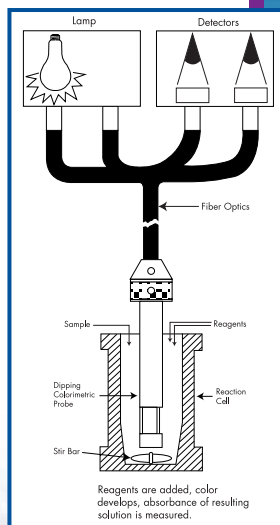
Set-up: The user need only know the analytical method and range of sample concentration. Step-by-step instructions are displayed to guide the operator through each procedure. Alternatively, the user may change the analytical parameters such as reagent volumes and reaction times to optimize the instrument for a particular application.

Diagnostics: May be accessed with a diagnostic key to verify operation of selected components and to review results such as the last 24 analyses & the last 10 calibrations.

The single key-accessible set-up menu may be used to review and reset all operating and analytical parameters.

A PRACTICAL ALTERNATIVE TO CONTINUOUS FLOW-THROUGH COLORIMETERS

With these features, engineers can choose this type of on-line colorimeter with plant operation and optimization in mind; uptime greater than 98%, low maintenance - 0.5 hour/week, low reagent consumption and ease of use.

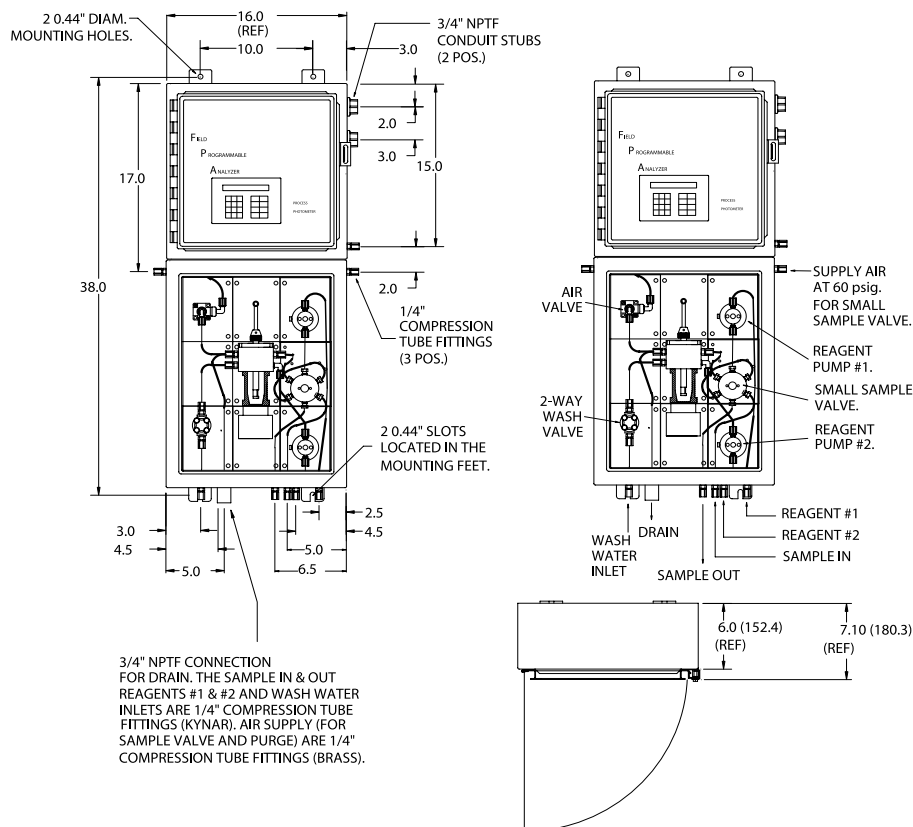


FPA 800™ SERIES APPLICATIONS

- Aluminum
- Ammonia in Waste Water
- Ammonia in Boiler Water
- Calcium & Magnesium in Brine
- Chlorine/Hypochlorite in Chemical Processing
- Chromium (VI) in Effluent Water
- Copper
- Free Cyanide in Effluent Water
- Hardness in Brine
- Hardness in Ultrapure Water
- Iron
- Phosphate
- Silica
- Total Chromium
- Zinc

FPA 800

TYTRONICS™ FPA SERIES DIMENSIONS



FPA SERIES™ PRODUCT SPECIFICATIONS:

Sample Conditions Sample inlet/outlet: Drain: Temperature: Pressure: Flow Rate: Suspended Solids:	FPA Series™ 1/4" O.D. tubing 3/4" MNPT 10 to 70°C 2 to 40 psig (ideally set to 20 psi) 100 mL/min to 500 mL/min 2% maximum with .050" maximum size
Analysis Reproducibility: Analysis Time: Calibration: Chemical Consumption:	+/- 2% of reading Min. of 2 minutes, dependent on analysis Automatic and fully programmable Typical: Reagent 8 liters/month Standard 2 liters/month
Signal Output	Isolated 4-20 mA (1K Ohms load maximum) Bi-directional RS-232C (optional) Two N.O. relays with programmable functions (e.g., alarms, off-line condition, results ready) Programmable digital outputs for alarms Digital inputs for remote control
System Requirements Power: Mounting: Environment: Dimensions: Weight: Purge Fittings:	50/60 Hz, 95-265V AC (must specify voltage) Wall or panel mount Temperature 5 to 45°C (use Vortex cooler above 45°C) Humidity 5 to 95 % non-condensing FPA Series height 38" width 16", depth 9" 90 pounds available for both enclosures

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DESIGN FEATURES

FPA SERIES™ DESIGN FEATURES

Flow through reaction cell for:

- Simplified sampling
- Higher reliability (95% uptime)
- 1% volume reproducibility
- Fewer moving parts

Modular design for:

- Ease of use
- Reduced down time

Microprocessor-based electronics with standard outputs for:

- Easy interface to computer
- Wide system compatibility

Potentiometric analyses:

- pH, ORP and ISE endpoints
- Simple, well-proven sensors

Colorimetric analyses:

- Uses fiber-optic probe
- Dual wavelength measurement

Simple operating concept for:

- Minimum operator attention
- Short training time
- Rapid installation