Pharmaceutical Industry

INGOLD
Leading Process Analytics

THORNTON
Leading Pure Water Analytics

Process Analytical Solutions for

Optimization of Pharmaceutical Processes

METTLER TOLEDO

METTLER TOLEDO
Commitment to Innovation and Quality

METTLER TOLEDO Group

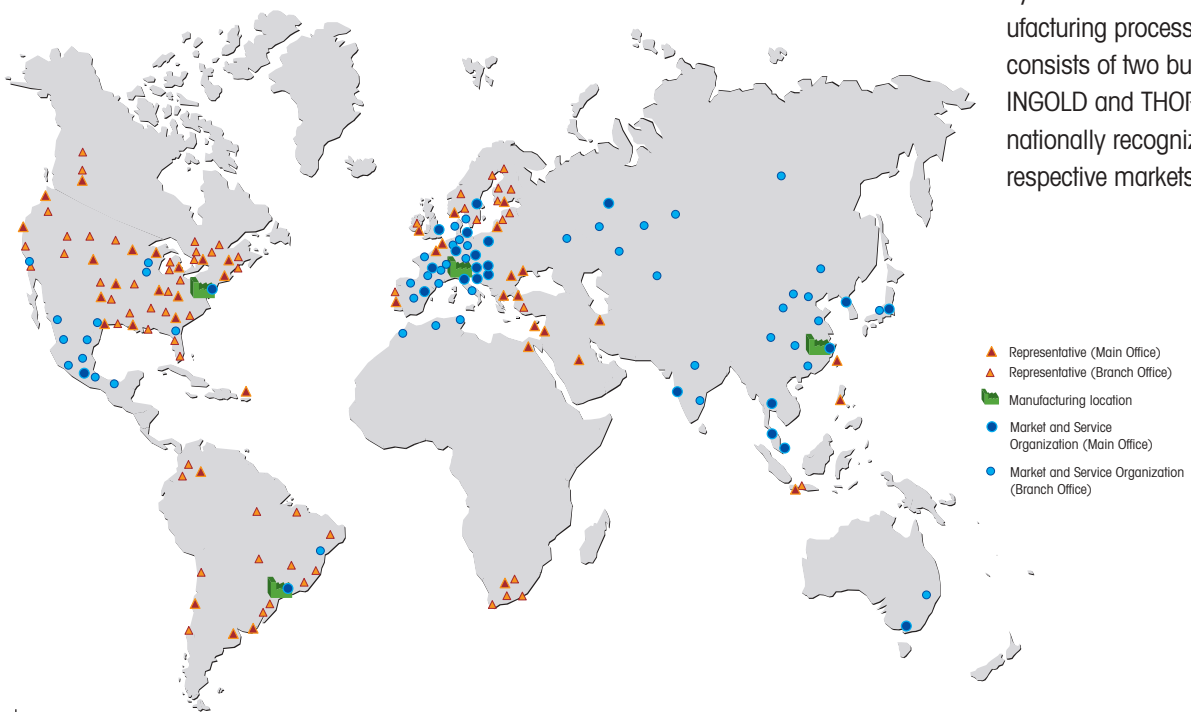
Our organization specializes in providing precision instrument equipment and related services to industrial customers. In 2006, METTLER TOLEDO generated revenues of over US$1.6 billion. The company's stock has been publicly traded on the New York Stock Exchange since 1997.

Worldwide presence
We have a worldwide distributor network and a workforce of more than 8,500 employees. We support our customers in industry by providing comprehensive solutions for each step of their manufacturing processes – extending from receipt of materials throughout all manufacturing stages with in-line process measurement through to final packaging control, logistics and shipping.

METTLER TOLEDO instruments are used in research and development, manufacturing process control and for quality control. The pharmaceutical, biotech, chemical, food and beverage, and cosmetic industries are among the principal users.

Innovation and quality
Our company enjoys an excellent reputation as an innovator demonstrated by the fact that we have increased our R&D expenditure by an average of more than 10% each year for the past five years. We make every effort to achieve the highest level of quality, by applying Total Quality Management at both product and process level, particularly as part of the support we provide to our customers to comply with international guidelines.

Process Analytics Division
Within the METTLER TOLEDO Group, the Process Analytics Division concentrates on in-line analytical system solutions for industrial manufacturing processes. The Division consists of two business units, INGOLD and THORNTON, both internationally recognized leaders in their respective markets and technologies.



INGOLD – Leading Process Analytics

INGOLD has a long track record for innovative high-quality solutions for demanding process analytics applications.

Ingold was founded in 1948 by Dr. Werner Ingold. Today, INGOLD provides the broadest range in-line analytical measurement solutions for industrial processes in the biotechnology, pharmaceutical, chemical and beverage industries. INGOLD offers systems for the measurement parameters pH/ORP, dissolved oxygen (DO), dissolved CO_2, conductivity and turbidity. One of the latest developments involves intelligent in-line sensor management solutions for optimized maintenance management in demanding applications.

THORNTON – Leading Pure Water Analytics

THORNTON is the market leader in ultrapure and pure water analytics, with technology complementing INGOLD's process measurement systems.

THORNTON Inc, founded in 1963 by Dr. Richard Thornton, a MIT Professor, has been part of the Process Analytics Division since 2001. THORNTON's leading market position is demonstrated by its innovative analytical instruments and sensors for the parameters resistivity, conductivity, TOC, pH, dissolved oxygen (DO) and ozone. A new, revolutionary Smart TOC sensor integrated with a multiparameter transmitter is highly successful in challenging applications within the pharmaceutical and biotech sectors.

Solutions for the Pharmaceutical Industry

Innovative INGOLD and THORNTON solutions contribute to the optimization of production processes, with innovative measurement technology for:

- accuracy and reliability
- reproducibility
- sterilizable sanitary design
- user-friendliness
- simplified validation procedures-

METTLER TOLEDO continues to develop intelligent and innovative measurement techniques such as in-line TOC and digital pH and DO systems.
Our team of application specialists assists you in:

- sustaining high product quality
- increasing production yields
- lowering maintenance costs

ISM

InPro 3250 i

InPro 6880 i

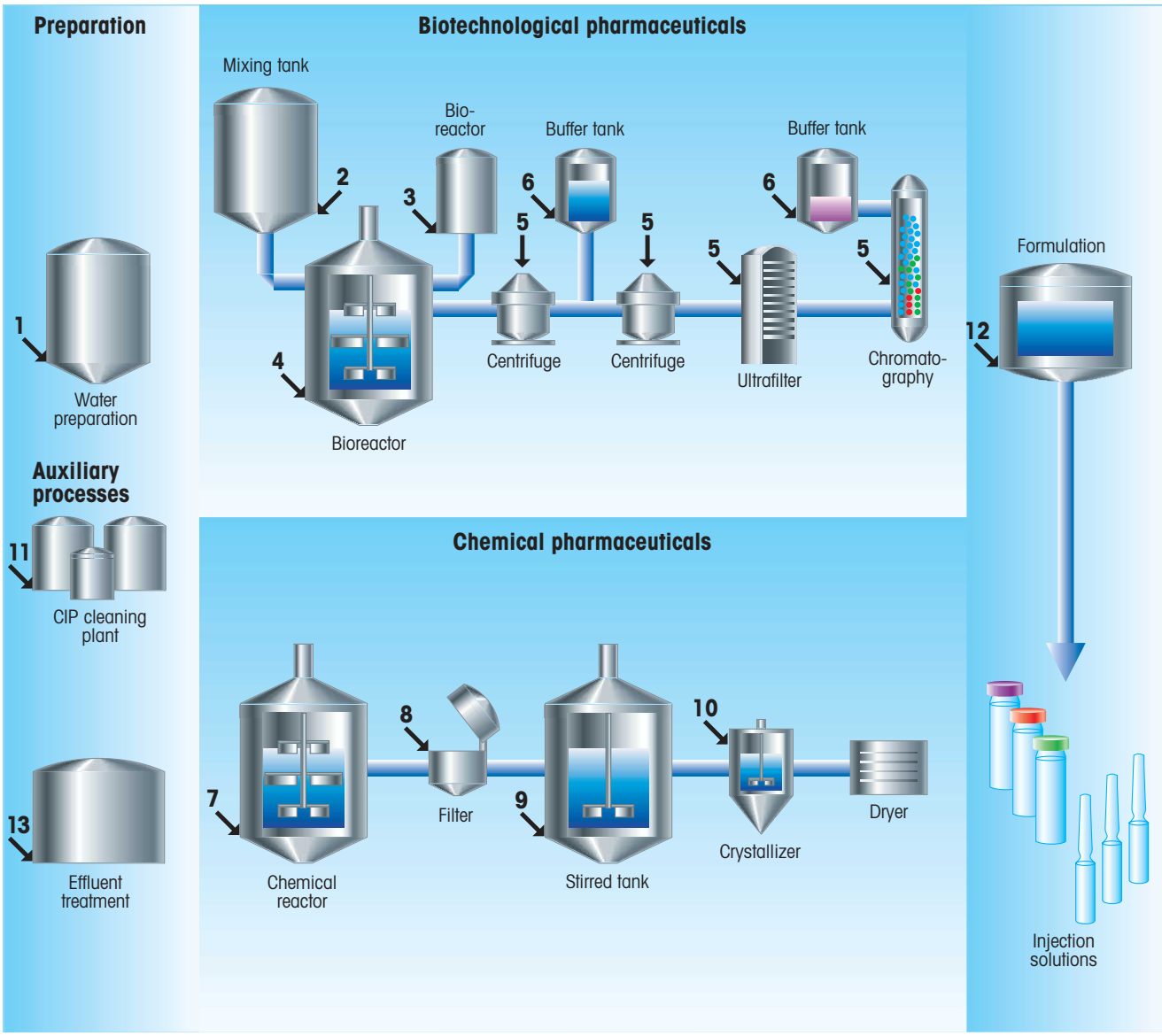
InPro 6850 i

5000TOC sensor

From Raw Material to Final Products

Advantages of METTLER TOLEDO Measurement Technology

The development of pharmaceuticals containing active ingredients (API) produced either by chemical synthesis or in biotechnological processes is extremely costly and time-consuming. METTLER TOLEDO analytical system solutions help to shorten the time to market of these products/drugs, by providing valuable support during the development phase. Subsequently during actual manufacturing, appropriate in-line analytical measurements is used to optimize the overall production process flow in order to achieve reproducible quality and increased yield.



METTLER TOLEDO supplies complete solutions, from make-up water preparation to formulation of pharmaceutical products, measuring:

- pH / ORP
- Dissolved oxygen
- Gas-phase oxygen
- Dissolved CO_2
- Conductivity / resistivity
- Turbidity
- TOC
- Dissolved ozone

Multistage process via intermediate products

Process		Meas. Position	pH	ORP	DO	O_2 Gas	CO_2	Cond/ res.	Turb	TOC	O_3
Water preparation	general	**1**	•					•	•	•	•
Production: Nutrient	BioPharma	**2**	•								
Production: Starter culture	BioPharma	**3**	•		•						
Fermentation	BioPharma	**4**	•		•		•		•		
Separation	BioPharma	**5**							•		
Buffer production	BioPharma	**6**	•					•			
Chemical synthesis	ChemPharma	**7**	•	•							
Separation / inertization	ChemPharma	**8**				•			•		
Downstream processing	ChemPharma	**9**	•								
Crystallization	ChemPharma	**10**	•						•		
CIP plant	general	**11**	•					•	•		
Formulation	general	**12**	•					•	•	•	•
Wastewater treatment	general	**13**	•	•	•			•	•		

The measurement positions in the table above correspond with the reference numbers in the diagram on Page 4 as well as with the cross-references in the following pages.

Measurement in Water Purification Plants

Make-up Water, Purified Water and Water for Injection (WFI)

Pharmaceutical water measurement requirements have been drastically revised during the last decade. The United States Pharmacopeia has launched global harmonization efforts with the European, Japanese and Chinese Pharmacopeias in order to achieve worldwide harmonization in the requirements for pharmaceutical waters. Mettler-Toledo Thornton participates in global efforts to standardize pharmaceutical water requirements for conductivity, TOC and other attributes.

1 Measurement of conductivity in plants producing pharmaceutical waters

In-line measurement of non-temperature compensated conductivity in Stage 1 according to USP <645> provides real-time information for water quality. In-line measurement eliminates the need for periodic sampling and off-line laboratory tests. Alarms may be set to immediately activate if limit values are exceeded, providing improved plant efficiency control and compliance.

THORNTON conductivity measurement systems provide the highest quality and reliability for pharmaceutical and biotechnology plants when guaranteed compatibility and simplified calibration, validation and verification of a purified water system is a requirement.

METTLER TOLEDO recommends

- **THORNTON Smart conductivity sensors**
  Conductivity sensors in compact and hygienic design for precise measurement results.
- **THORNTON 770MAX transmitter**
  The 770MAX supports up to 4 multi-parameter Smart sensor inputs and its accuracy exceeds USP, EP and JP regulations. The 770MAX includes innovative USP alarm software which allows for complete control capabilities while meeting international regulations.
- **NIST and ASTM traceability**
  Calibration certificates for instruments, calibrators, Smart sensors, and for traceable liquid standards, provided by THORNTON, for the calibration of a conductivity system facilitate verification and validation of the water purification system.

Conductivity sensors

770MAX

Calibrator

Measurement of TOC concentration 1

TOC measurement is clearly defined in USP <643> and EP2.2.44 as a replacement for the laboratory Oxidizable Substances Test. TOC is measured successfully in a wide variety of different water purification processes such as reverse osmosis, deionization or distillation in the preparation of Purified Water, Water for Injection and sterilized packaged waters.

METTLER TOLEDO recommends

- **THORNTON 5000TOC sensor**
  The 5000TOC sensor was developed specifically to meet pharmaceutical water requirements. Low detection limits and rapid continuous measurement fulfill the requirements of the pharmaceutical industry. Fast in-line TOC measurement is possible without additional chemicals.
  The optional System Suitability Test system ensures rapid verification of regulatory compliance of the TOC measurement.
- **THORNTON 770MAX transmitter**
  Two 5000TOC Smart sensors may be connected to the 770MAX transmitter. Two additional measurement channels for any combination of conductivity, dissolved ozone or pH values are also available. 770MAX with multiple inputs, is a cost-effective solution for pure water instrumentation.
- **THORNTON 550TOC analyzer**
  The 550TOC analyzer is a portable system used for in-line TOC measurement with simultaneous display of conductivity or resistivity and temperature, which is in full compliance with global pharmaceutical regulations.
- **THORNTON system suitability and TOC calibration solutions**
  are manufactured by THORNTON staff and delivered "fresh" within 2–3 days of manufacture.

5000TOC sensor

770MAX

550TOC

Measurement of pH value 1

Mettler-Toledo Thornton pH measurement systems include a wide variety of pH sensors which can be used in demanding pure water applications in the pharmaceutical industry. A special sealed flow housing enables outstanding reproducible results, while preventing CO_2 contamination from air.

METTLER TOLEDO recommends

- **THORNTON pH electrode with liquid electrolyte – the pHure sensor**
  This sensor with pre-pressurized, liquid reference electrolyte and the low impedance of the pH-sensitive glass provides exact and reproducible measurement of the pH value in challenging, low conductivity waters.
- **Flow-through housing for pure water**
  Efficiently prevents the ingress of CO_2 into a pure water system.
- **THORNTON M300 transmitter**
  Available as multi-channel and multiparameter instruments with integrated sensor diagnostics, provides reliable monitoring of electrode performance.

pH electrode

M300

Measurement of dissolved ozone concentration 1

Ozone is increasingly used as a highly effective sanitizing agent for pharmaceutical waters. The ozone concentration is measured at the outlet of the storage tank to ensure sufficient disinfection, and after the UV destruction lamp to validate the complete elimination of ozone in the distribution loop. Dissolved ozone levels can be reliably monitored and controlled using a THORNTON ozone measuring system.

METTLER TOLEDO recommends

- **THORNTON ozone sensor**
  Reliable and rugged sensor delivers reproducible feedback data about the status of ozone treatment. The sensor uses a replaceable membrane module, which can be serviced conveniently.
- **THORNTON 770MAX transmitter**
  The "Mix and Match" features of this versatile multiparameter instrument also allows connection of ozone sensors to this multi-input transmitter, therefore providing an economical solution for all pharmaceutical water applications.
- **THORNTON M300 transmitter**
  Value priced multiparameter version for on-the spot configuration of ozone, oxygen, pH/ORP and/or conductivity/resistivity in a two-channel transmitter.

Ozone sensor

770MAX

M300

In-line Measurement of Nutrient and Buffer Solutions

Critical for Batch-to-Batch Consistency

The growth of microorganisms during fermentation depends on the correct composition of the nutrient feed. The pH and conductivity values of the buffer solutions for chromatographic and filtration processes both influence the purity of the active ingredient.

Adjustment of pH value during the production of nutrient solutions 2

Optimal growth conditions are highly pH-dependent. The use of high-accuracy, low-maintenance pH electrodes with pre-pressurized electrolyte ensures a reproducible adjustment of the pH value of the nutrient medium.

Optimal pH and conductivity values during the production of buffer solutions 6

During the separation of proteins and peptides in chromatography, pH and conductivity are key parameters. During the purification of protein fractions, pH buffers with tolerances of ±0.05 to 0.1 pH units and conductivity buffers of ±1 to 2 % are needed. The INGOLD pH and conductivity sensors guarantee high accuracy during chromatography operations.

METTLER TOLEDO recommends

- **pH electrode InPro 3253**
  The pressurized liquid-reference electrolyte and patented diaphragm technology guarantee high accuracy and maximum process reliability.
- **Transmitter M 700**
  The versatile M 700 offers optional dual-channel measurement for 2 independent measurements (pH/pH or pH/conductivity) and communicates with ISM electrodes.
- **Conductivity sensors InPro 7000-VP/InPro 7002-VP**
  Sterilizable, sanitary 2-electrode sensors designed for highest accuracy.
- **Transmitter M300**
  A ¼ DIN version is recommended for panel mounting, 2 channel pH and conductivity measurement for buffer production skids.

InPro 3253

M 700

InPro 7000-VP

M300

Fermentation
When Optimal Conditions are an Absolute Must

GMP-compliant product quality and high productivity call for comprehensive control of the entire production process. Accurate in-line sensors continuously monitor the condition of the culture and provide information for optimal control of the process flow.

Measurement and control of pH values 4

Control of the pH value is central to metabolism activity. Measurement characteristics of the sterilizable and autoclavable INGOLD pH electrodes, such as zero point and slope, are hardly affected by heat sterilization or the culture itself. With the use of sterilizable, high-performance electrodes, growth rates and yields can be reliably maximized.

Contamination protection

Electrode, socket and housing form a system making it impossible for germs to enter the culture. Similarly, no substances can exit uncontrolled from the bioreactor. This system fully meets the hygienic design requirements of EHEDG and the FDA Guidelines relative to material selection and surface roughness.

METTLER TOLEDO recommends

- **pH measurement in bioreactors**
  The pH electrode InPro 3253 offers the highest process reliability and performance due to a pressurized liquid reference electrolyte and special pH glass.
- **Intelligence starts in the head**
  Digital sensors with integrated Intelligent Sensor Management (ISM) offer a combination of highest measurement performance, easy handling, and low operating costs. Advanced diagnostics data provided by digital ISM technology optimizes systematic maintanance management for each individual sensor, which is critical for a safe and dependable reuse in the next batch.
- **Transmitter M 700**
  In conjunction with ISM sensors, the "Plug and Measure" feature enables fast and easy installation. The optional audit trail card, supports compliance with FDA 21 CFR Part 11.
- **Transmitter pH 2100 e**
  Versatile and easy-to-operate transmitter available in 4-wire and 2-wire versions with HART®, PROFIBUS® PA and FOUNDATION fieldbus™ system integration capabilities.

InPro 3253

ISM

M 700

pH 2100 e

Measurement and control of oxygen 4

Aerobic microorganisms can only utilize oxygen in solution. The proven oxygen sensors provide perfect measurement results even after repeated sterilization cycles. The sanitary design facilitates cleaning, and effectively prevents batch-to-batch contamination. Control of the oxygen concentration leads to significant savings in air compressor energy consumption without compromising optimal culture growth conditions.

METTLER TOLEDO's new optical oxygen sensor

An oxygen-sensitive layer containing immobilized marker molecules is the "heart" of the optical sensor. These molecules are excited by green light through a chemo-optical fluorescence process, which is proportionally quenched by the amount of oxygen diffusing through the layer. This effect enables the oxygen concentration in the culture medium to be determined.

METTLER TOLEDO recommends

- **For O_2 measurements in bioreactors**
  InPro 6800 is regarded as an industry standard. It is robust, hygienic, and allows rapid exchange of membrane and electrolyte within minutes. The InPro 6850 i also features an innovative 3-electrode system with enhanced drift stability.
- **ISM technology**
  Intelligent Sensor Management makes startup easy, and signals approaching maintenance requirement depending on sensor burden. Pre-calibration is an additional benefit, particularly in the case of large-scale bioreactors.
- **Transmitter M 700**
  The M 700 is a versatile single or dual channel instrument which communicates perfectly with polarographic oxygen sensors.
- **Optical oxygen sensor InPro 6880 i**
  This ISM sensor sets a new standard in bioprocess control. The sensor offers outstanding accuracy, high signal stability and short response times. Optical sensors provide reduced risk of contamination and do not need pre-polarization. The InPro 6880 i sensor is complemented by the O_2 4300 D digital transmitters.


InPro 6800


InPro 6850 i


O_2 4300 D


M 700


InPro 6880 i

Measurement and control of CO_2 value 4

The CO_2 produced by cells accumulates in the medium and can reach critical concentrations. In-situ CO_2 measurement makes it possible to control the CO_2 concentration, resulting in higher yield.

CO_2 sensor as an indirect glucose sensor

Cell culture technology for the production of recombinant proteins has continued to gain importance over recent years. Optimization of important process parameters such as type and concentration of substrate, pH value, CO_2 and O_2 concentration result in increased productivity. In fed-batch operations, dosing of glucose-containing nutrient can be controlled via indirect measurement using the CO_2 sensor.

METTLER TOLEDO recommends

- **CO_2 sensor InPro 5000**
  The InPro 5000 is a sterilizable and reliable sensor based on the Severinghaus principle.
  The modular design allows for short maintenance times.
- **Transmitter CO_2 5100 e**
  On the 5100 e, the CO_2 concentration is displayed as partial pressure and, by taking the temperature into account, as a solubility value.
- **Retractable housing InTrac 797 e**
  With the sterilizable double-chamber housing, it is possible to easily carry out process calibration in the lower chamber using calibration gas containing carbon dioxide, instead of having to gas a large reactor volume with CO_2 containing mixtures.

InPro 5000

CO_2 5100 e

InTrac 797 e

Measurement of cell density 4

In-line measurement of cell density or biomass enables real-time detection of morphological changes in a cell culture. This makes it possible to determine the optimal time for harvesting, and to immediately recognize abnormal conditions.

Correlation of measurement values with laboratory OD measurements

In-line backward scattered light values correlate excellently with off-line OD measurements. In-line turbidity measurement avoids regular grab sampling and laboratory tests.

METTLER TOLEDO turbidity systems display exceptional linearity, even at high cell densities. They can be particularly employed where absorption sensors have long reached their saturation limits.

METTLER TOLEDO recommends

- **InPro 8100/8200**
  These sterilizable turbidity sensors function according to the principle of backward scattered light. They can be used linearly up to very high turbidity concentrations.
- **Turbidity transmitter Trb 8300**
  The Trb 8300 includes a wide range of calibration options. Measurement values can be displayed in a variety of units such as OD (optical density), FTU, NTU, g/l, % and ppm. The multipoint calibration can cover up to 5 measuring points.
- **CaliCap**
  CaliCap is an easy-to-use tool enabling a "dry" sensor check and process calibration in grab samples from bioreactors.

InPro 8100

Trb 8300

CaliCap

Measurements During Cell Separation

When Yield and Purity are Critical

Optimal process control leads to increased efficiency of centrifuges and subsequently to lower yield losses. The processing of clean-cut-separated products of uniform consistency supports reproducibility in the subsequent processing stages.

Turbidity measurement following separation 5

Harvesting involves separation of the cell mass from the liquid phase by means of centrifugation or filtration. Turbidity measurement in the filtrate serves to improve separation efficiency for intercellular products by ensuring that no cells are lost in the liquid phase, for extracellular products by ensuring that cell-free fluid is passed on for further processing.

METTLER TOLEDO offers an innovative solution for optimizing separation processes such as filtration or centrifugation. The flow-through chamber equipped with optical windows fully meets the purity requirements in downstream processing operations.

METTLER TOLEDO recommends

- **Turbidity sensor InPro 8400**
  The InPro 8400 is a robust forward scattered light sensor for installation in the outlet pipe of centrifuges, and is particularly suitable for measurement of very low to medium turbidities.
- **Turbidity transmitter Trb 8300 F/S**
  The Trb 8300 F/S is a versatile transmitter unit, enabling multipoint calibration.

InPro 8400

Trb 8300 F/S

Final pH Value and Turbidity Control
Important Criteria for Final Inspection

Adjustment of the pH value and ampoule filling are the two final process stages in the production of injection solutions. Reproducibility and comparability with final off-line inspection tests are critical for the in-line release of a batch.

Measurement of the pH value during manufacture of injection solutions

12

In the production of injection solutions, the active ingredient is dissolved in injection water, and the exact required final pH value is adjusted through the addition of a base solution.

Turbidity measurement during the filling of suspensions into ampoules

The turbidity sensor continuously measures the suspended particle concentration and ensures that the suspension flows back into the mixing vessel if the predefined tolerance value is not maintained.

METTLER TOLEDO offers an extremely precise and rapid-response pH electrode for the critical adjustment of the pH value of injection solutions.

METTLER TOLEDO recommends

- **pH electrode InPro 3250**
  The InPro 3250 is the compelling choice when accuracy and rapid response are crucial.
- **pH transmitter 2100 e**
  The pH 2100 e includes an integrated PID controller for control of the dosing pump.
- **Turbidity sensor InPro 8200**
  Unique backscattered light sensor with smooth surface structure which significantly reduces maintenance efforts.
- **Turbidity transmitter Trb 8300**
  Intuitive operator menu guidance enables time saving installation and configuration.

InPro 3250

pH 2100 e

InPro 8200

Trb 8300

Measurements in a Chemical Reactor

Special Chemical Processes Under cGMP Conditions

Active substances are synthesized with a variety of different intermediate products. Quality and yield of the intermediate and end products can be greatly improved by high performance in-line analytics solutions, fully consistent with the PAT initiative of the FDA.

pH and ORP measurement during a synthesis stage 7

In some synthesis stages, such as in the formation of an organic acid salt or in esterification, the pH value is a critical process parameter.

The glass-lined steel reactor

In this widely used type of reactor, which is the workhorse in the synthesis of active substances, the sensors are often inserted through the top. Robust insertion housings in hazardous area protected design provide reliable in-line process analysis.

METTLER TOLEDO offers optimal pH measurements systems for practically all types of process conditions in chemical synthesis operations.

METTLER TOLEDO recommends

- **pH electrode InPro 2000 – "The problem solver"**
  The InPro 2000 allows accurate and reliable pH measurement, even in the presence of organic solvents and aggressive gases.
- **pH electrode InPro 4800**
  The InPro 4800 can be used under the harshest conditions and, as SG version, also applied as a combined pH/ORP electrode.
- **Digital pH electrode with ISM**
  The digital pH electrode InPro 4800 i offers digitally undisturbed transfer of measurement values and diagnostics data. Installation is easy with the "Plug and Measure" feature and advanced diagnostics functions support optimal decisions on whether an electrode can be safely reused in the next batch, thus resulting in cost savings and higher process reliability.
- **pH transmitter 2100 e**
  The pH 2100 e is reliable and easy to operate. It is available in a 2- or 4-wire versions and features ATEX, FM and CSA approvals. Connection to process control systems is available via HART, PROFIBUS PA or FOUNDATION fieldbus.

InPro 2000

InPro 4800

InPro 4800 i

pH 2100 e

In-line Measurement
of Turbidity and Oxygen Helps to Save Costs

In-line turbidity measurement enables changes in suspension characteristics to be easily followed and controlled, resulting in increased process efficiency. In-line measurement of O_2 in the headspace of centrifuges or storage tanks reduces explosion risk and consequently also the overall monitoring effort.

Turbidity measurement during crystallization and precipitation of dissolved solids **8/9/10**

Using in-line turbidity measurement, the cloud point can be reproducibly detected and crystallization and precipitation processes optimally controlled. Optimal crystal size distribution enables short filtration and washing times, resulting in shorter process cycles and improved product quality.

Measurement of oxygen concentration during nitrogen blanketing

In-line O_2 measurement in the gas phase, without gas sampling, enables the flow of inert gas to be controlled so that the critical oxygen concentration is always reliably below the threshold value. Such control system results in significant savings in inert gas consumption.

METTLER TOLEDO recommends

- **Turbidity sensor InPro 8200 for measurements during precipitation and crystallization**
  The InPro 8200 is a rugged backward scattered light sensor for use in crystallizers and stirred tanks. It is available as a 1- or 2-fiber sensor in different materials.
- **Turbidity transmitter Trb 8300**
  A wide range of control functions for optimization of the crystallization process, such as dosing of seed crystals or progression through temperature profiles is available.
- **InPro 6800 Gas**
  InPro 6800 Gas is an oxygen sensor with pressure-resistant membrane module, specially developed for measurements in gas.
- **Transmitter M 700**
  The transmitter M 700 in combination with the module O_2 Gas enables straightforward pressure compensation.
- **InTrac 777 e**
  The retractable housing InTrac 777 e enables periodic check of the oxygen sensor.

InPro 8200

Trb 8300

InPro 6800

M 700

InTrac 777 e

Measurements in CIP Equipment
and Purification Processes

In pharmaceutical processes, the purity of any working media passing between reactors and tanks during the various process stages must be guaranteed, and only uncontaminated end products can be delivered for final packaging. In-line systems help to monitor and optimize the cleaning processes involved.

Measurement of conductivity and pH values in CIP and purification processes 1/11

When increasing the concentration of caustic solutions in CIP staple tanks and for separation of the cleaning solutions in return pipes, conductivity measurement systems are essential for reliable process control. The compact sensors can be easily installed in pipes with narrow cross-sections. The new pH and conductivity transmitters offer an intuitive user interface and straightforward installation.

METTLER TOLEDO systems facilitate initial instruction and training of personnel. Our pH electrodes are particularly cost-efficient due to their long operational life.

METTLER TOLEDO recommends

- **Conductivity sensor InPro 7108**
  The InPro 7108 with compact and sanitary design delivers reliable measurement results.
- **pH electrode InPro 3250**
  The InPro 3250 is outstanding for its long operational life and precise measurement due to the unique combination of a self-cleaning reference system and a special membrane glass.
- **Transmitter M300**
  The M300 is a reliable, user-friendly and cost-efficient transmitter. Optional dual-channel measurement reduces investment and installation costs.

InPro 7108

InPro 3250

M300

Reliable Measurement
in Effluent Treatment Processes

Fouling of sensors in wastewater leads to erroneous measurement results and can even result in loop failure. METTLER TOLEDO sensors are robust and provide reliable measurement values even in heavily contaminated media.

Measurement of pH, DO, conductivity and suspended solids during effluent treatment. 13

Effective, automated cleaning of the sensors improves measurement reliability and prolongs the operational life of the sensors.

METTLER TOLEDO offers an efficient cleaning system for pH, dissolved oxygen and suspended solids sensors, thereby relieving the burden on maintenance personnel and reducing operating costs. Conductivity can be measured using an inductive sensor which will withstand harsh environments.

METTLER TOLEDO recommends

- **EasyClean 100/InDip 550**
  The EasyClean 100 and InDip 550 are suitable for installation in open basins and channels. Efficient sensor cleaning at application-specific intervals provides assurance of high operational reliability with minimal costs for maintenance and spare parts.
- **pH, O_2, conductivity, suspended solids**
  A variety of inexpensive sensor models in METTLER TOLEDO quality provide reliable measurement performance.
- **M300 transmitter**
  M300 is a reliable transmitter series with solid measurement performance, ideally suited for single and dual channel effluent measurement.

EasyClean 100 InDip 550

For pH: InPro 4010

For O_2: InPro 6050

For turbidity: InPro 8050

For conductivity: InPro 7250

M300

Service Offerings Covering our Products
for End Users and Project Engineers at EPCs

ServiceXXL embraces the complete range of service offerings provided by INGOLD and THORNTON. We offer an attractive range of services to customers, from product guidance, over installation through to service contracts for re-calibration and SST services.

ServiceXXL®
Tailored Services

ServiceXXL –
the high-level METTLER TOLEDO service concept
Our comprehensive sales consulting and technical services have established us as a competent partner for our customers everywhere around the world. Many global manufacturing companies rely on our competence and our long-standing experience.

Services offering
We offer attractive services to customers, ranging from product guidance, over installation through to service contracts. For the pharmaceutical Industry we provide, amongst others, the following services:

Service

- **Repair work at service depot**
- **Sensor refurbishment**
- **Installation/commissioning**
- **Training/seminars**
- **Maintenance contracts**
- **Factory re-calibration**
- **Calibration standard solutions**
- **On-site qualification/verification**
- **Quality documentation**
- **Validation support**
- **Support in compiling SOPs**
- **SST (System Suitability Test) for TOC**

Distribution network
Based on several global production sites, with more than 40 market organizations and numerous international sales offices, METTLER TOLEDO maintains a worldwide distribution network and is always close to its customers.

On-line support for the pharmaceutical industry
METTLER TOLEDO offers the pharmaceutical industry a wealth of specific information on www.mt.com/pharma, where you will find applications and useful information on our process analytics solutions.

Plant engineering and system integration
Time is money. Our detailed technical product documentation together with local support during specification, installation and commissioning contribute to on-schedule project realization.

Asset Management and Plant Maintenance
With HART®, FOUNDATION Fieldbus™ and PROFIBUS®

Open fieldbus integration of your process analytical measurement technology into your control system via digital fieldbus technology.

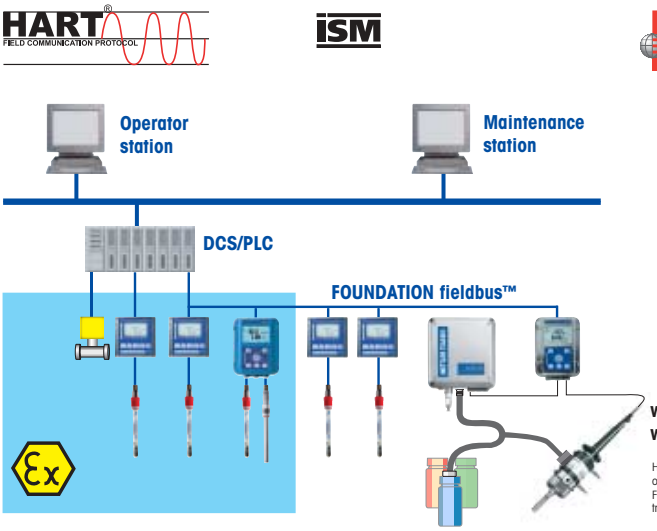
Open fieldbus protocols such as HART®, FOUNDATION fieldbus™ and PROFIBUS® are currently regarded as standard in the process industry. Only fieldbus technology enables full use of the functional advantages of digital communication to be able to achieve improved resolution of measured values, intelligent instrument diagnostics and new control strategies.

METTLER TOLEDO integration with HART®, FOUNDATION fieldbus™ and PROFIBUS®

These standardized communication protocols allow a central overview of the whole plant network. In addition, they offer the opportunity of comfortable instrument configuration and a higher level of process information to improve the plant performance. Field process instrumentation thus become an integral part of the control and operation level. This technology is the optimized and continuously available interface for your plant management and maintenance planning.

Integrated device descriptions

Our intelligent analytical instruments include electronic device descriptions (DD) for various process instrument configuration software tools to support a seamless integration into the control and engineering level.



www.hartcomm.com
www.fieldbus.org

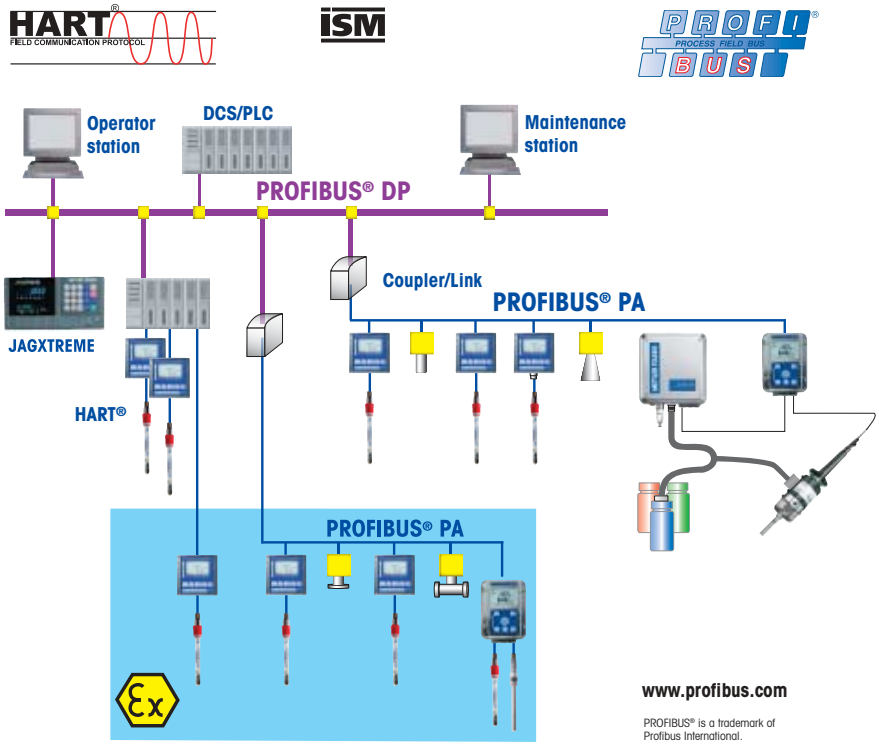
Fieldbus Communication in connection with 21 CFR Part 11, Asset Management und Predictive Maintenance

By applying HART®, FOUNDATION fieldbus™ or PROFIBUS® your efforts to comply with FDA requirements 21 CFR Part 11 will be minimized. You will find that FDA conformity is already included in available products and systems.

The use of Asset Management and Predictive Maintenance is an important issue for improvements in plant management. The fieldbus technology of HART, FOUNDATION fieldbus and PROFIBUS supports the relevant requirements in an as yet unprecedented way.

METTLER TOLEDO recommends

- **Transmitters for pH/ORP, dissolved oxygen, conductivity**
  These transmitter families are available for a versatile and complete integration in HART, FOUNDATION fieldbus and PROFIBUS PA networks.
- **EasyClean 400**
  The cleaning and calibration system EasyClean 400 is available for an easy integration in FOUNDATION fieldbus as well as PROFIBUS PA networks.
- **ISM technology**
  Our ISM technology ideally supports the vertical integration of diagnostics information into the process control environement. A full integration of the two diagnostic process parameters "sensor wear monitor" and the "adaptive calibration timer" enables optimal maintenance planning.



www.profibus.com

PROFIBUS® is a trademark of Profibus International.

Get On-line Support
via www.mt.com/pro

Visit our website at any time for fast and competent information. The very latest, updated product and support documentation is available in many different languages.

Support center with easy and free download
- Declaration of conformity
- Certificates
- Description of equipment
- User manuals/data sheets

For on-line access click on
- Contact us
- Request more information
- Get a quote

Country-specific information
- Select country/area to get access to your local support

Search functionality
- Enter keyword to find requested information

Find and download product and application documents
- Product News
- Industry Newsletters
- Application News

www.mt.com/pro

Visit for more information

Sales and service:

Mettler-Toledo AG
Process Analytics
CH-8902 Urdorf, Switzerland
Phone +41 44 729 62 11
Fax +41 44 729 66 36

Management System certified according to ISO 9001 / ISO 14001