



INGOLD

Leading Process Analytics

With the EasyClean 400, Unplanned Process Interruptions Belong to the Past

Cleaning and calibration systems were installed in a polycarbonate production line in order to enable electrodes to be cleaned and calibrated without having to interrupt the ongoing process. This resulted in a marked increase in both process safety and profitability.

Derivation and use of polycarbonates

Polycarbonates are synthetic polymers belonging to the polyester family and can be formed by the reaction of carbon dioxide and diols or epoxides. They are used to produce injection molded articles, for instance for the automobile and aircraft industries, but also in the production of bullet-resistant glass, medicinal instruments and CDs. Until recently, such modern raw materials were only produced in relatively few countries, such as the USA, Germany and Japan. Recently however, there is growing competition from the Middle East, from where this report originates.

Process requirements

The main process stages in the production of polycarbonate take place in a hazardous

area and under vacuum. The pH value is a critical parameter for control of the process. As this is a continuous process, it cannot be halted. The pH electrode has to be under constant surveillance and must also be able to be controlled remotely.

Process conditions are:

- pH value 10 – 13
- Pressure 1.5 bar
- Temperature approx. 25 °C (77 °F)

Previous measurement concept

The responsible Engineering Company originally installed static measuring points. This meant that measurements were carried out until problems appeared. The plant was then shut down and the electrodes serviced or replaced. Shutting down of the plant is an extremely arduous



METTLER TOLEDO



and time-consuming process, particularly when out of schedule and cannot be planned in advance. For instance, after shutdown, a serviceman has first to check the plant with an oxygen apparatus and a gas detector to monitor for explosive gases, before safety clearance can be given for work activities. This situation has led continually to production losses which otherwise may have been avoidable, and which generated substantial costs.

METTLER TOLEDO Solution

The solution to be offered had therefore to allow cleaning and calibration of the electrode during the ongoing process. We put forward a measuring concept which included a retractable housing with integrated flushing chamber, a modular transmitter with well thought out diagnostic functions and compatible with

Foundation Fieldbus. In order to be able to exploit the outstanding features of the electrode as long and as comprehensively as possible, a cleaning and calibration system of the latest generation was selected for use. The complete measurement system has received approval for use in hazardous areas.

The 3 relative measurement points were each installed with the following measuring solution (see table).

■ pH electrode:	InPro 3250 SG
■ Retractable housing:	Intrac 777 e made of Hastelloy
■ Transmitter:	M 700 with Foundation fieldbus communication module
■ Cleaning and calibration system:	EasyClean 400 Ex (EC 400 Ex)
■ Connection to the PCS (Yokogawa CS 3000) via Foundation fieldbus.	

The EasyClean 400 Ex in action

The cleaning and calibration system EC 400 Ex triggers a cleaning cycle every 6 hours (interval freely adjustable), and a two-point calibration twice a week. This means that the sensor is withdrawn from the process into the flushing chamber of the retractable housing and then cleaned

and calibrated there. On completion of the individual program, the system returns to the normal measuring position. If necessary, compatible cleaning agents can be added to the flushing water. The operational flexibility of this concept enables cleaning processes to be optimized, and offers the possibility to work out a specific solution for the specific process in hand.

Interaction of fieldbus and EasyClean 400 Ex

The measuring system is integrated into a Yokogawa process control system via the factory-wide Foundation Fieldbus network. Process data and system status are continuously transferred to the control room, and ensure optimal performance of the process. In addition, the system integration enables the EasyClean 400 to be fully remote controlled from the central control room. This means that the sensor can be moved into the maintenance position at any time as required (e.g. during service intervals), or calibrated according to need (e.g. for verification).

On the one hand, the customer now has his measuring system constantly under control from the operational point of view, at the same time however helpful diagnostics information is being fed back. For instance, need for maintenance is signaled to the control room if it becomes necessary to refill calibration buffer solution.

Customer benefits

1. Higher yield due to less downtimes.
2. Increased reliability of the pH electrodes and prolonged serviceable life.
3. Reduced maintenance effort and diminished risk of operating error.
4. For the future, EC 400 Ex can be adapted to suit changing process requirements, and can be freely configured by the customer at any time.

www.mt.com/easyclean

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Fig. 1: M 700 transmitter (left) with EC 400 and cleaning solutions. Tubes lead to the housing.



Fig. 2: InTrac 777 e with flushing chamber for automatic cleaning of the pH electrode InPro 3250 SG.



Measurement of Temperature and ORP Efficiently Controls Metal Oxidation Process

Introduction of INGOLD system allows precise detection of addition of oxidizing agent to metal solution during manufacturing route.

Johnson Matthey, a specialty chemicals company

Johnson Matthey is a specialty chemicals company focused on its core skills in catalysts, precious metals and specialty chemicals. The group's principal activities include the manufacture of autocatalysts and pollution control systems, catalysts and components for fuel cells, pharmaceutical compounds, process catalysts and specialty chemicals; the refining, fabrication and marketing of precious metals; and the manufacture of colours and coatings for the glass and ceramics industries.

Johnson Matthey's requirement

The Process Catalysts R&D division, based in Billingham in the UK, came to METTLER TOLEDO for a method of following metal oxidation at laboratory scale. They wanted an instrument which was also suitable for use in their pilot plant facility and at full-scale production.

ORP measurement, the solution of METTLER TOLEDO

They had tried to follow the reaction by pH change but found there was only a very small change and we felt that it wouldn't be practical to follow the reaction on a large scale by this method alone. It was suggested that they try ORP measurements using an InPro 3250 SG sensor and the M 700 transmitter and the results showed a significant change in potential as the reaction occurred.

Chosen way convinced Principal research Officer

Sharon Bale, Principal Research Officer at Johnson Matthey, says, "The M 700 transmitter and InPro 3250 SG sensor have aided us immensely to measure the phase changes in metal oxidation compared to following the reaction by pH change. So much so that the equipment is used every week within the laboratory, and due to its success, we now plan to incorporate the method into our manufacturing set up."

The selected products pH/ORP electrode InPro 3250 SG:

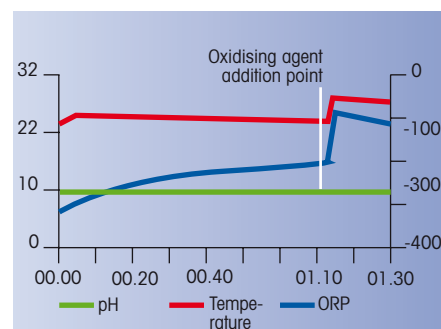
The INGOLD InPro 3250 SG is a pre-pressurised, liquid-filled, low maintenance electrode, ideal for in-line measurements in demanding applications. Its durable design is well suited for harsh chemical process conditions. The sensor measures ORP (via the solution ground) and temperature as well as pH.

M 700 multiparameter transmitter.

The M 700 was chosen for its flexibility and the fact that the built in data recorder could be used in laboratory and pilot plants to record information for subsequent download to PC via the smartmedia card.

Experimental data clearly demonstrate addition of oxidizing agent

The chart shows example data from the experiments recorded via the M 700 transmitter. Significant change in potential occurred when oxidizing agent was added to the metal solution. Temperature as well as ORP rose sharply whereas reaction of the pH value was scarcely recognisable.



www.mt.com/pro-pH

pH Measurement in Harsh Applications – Easier and More Accurate

The InPro 4260 typifies the latest generation of pH electrodes from METTLER TOLEDO. The high-performance polymer electrolyte XEROLYT® EXTRA together with ISM® and advanced sensor diagnostics constitute the key attributes of this electrode model.



InPro 4260i.

Requirement on pH electrodes

When the going gets tough, when confronted with the task of selecting a sensor suitable for a harsh process environment, users typically face the dilemma of a trade-off between high accuracy (but shorter lifetime) and longevity (but poor measurement accuracy). Due to the lack of a better alternative, they often opt for the long-life electrode, accepting a higher degree of maintenance effort to ensure that performance meets a minimum performance level. However, the popular robust gel and polymer electrodes of today are so far developed, that they can readily be used in the harshest applications without any compromise on accuracy.

The solution to prevent diaphragm fouling

The most frequent problem surrounding pH measurement is fouling of the electrode diaphragm and the resulting erroneous measurement readings due to adverse diffusion potentials. A sustainable solution to

this problem is provided by the use of electrodes with polymer electrolyte XEROLYT®.

XEROLYT® EXTRA – for enhanced performance

The latest generation of polymer electrolytes, XEROLYT® EXTRA, builds on the well-established attributes of its legendary predecessors. This newly developed electrolyte overcomes the previous sensitivity towards acids, reduced accuracy and operational limitations caused by higher ionic strengths and varying flow speeds/agitator speeds, as well as susceptibility to some types of solvents.

Endurance tests of XEROLYT® EXTRA by users

Numerous series of user tests were performed with the new polymer under actual operating conditions. Its outstanding characteristics can be summarized as follows: extra-precise, extra-quick, extra-durable and extra-stable!

InPro 4260 with Intelligent Sensor Management (ISM)

All ISM (Intelligent Sensor Management) electronics are incorporated in the head of the electrode and full digital communication ensures reliable transfer of the measured values and sensor data to the transmitter. ISM provides a range of outstanding features including easier handling and more efficient maintenance:

- online monitoring of pH glass impedance and reference electrode
- calibration and adjustment in the laboratory under optimal conditions
- rapid start-up (automatic sensor recognition)
- advanced sensor diagnostics with predictive maintenance features
- recording of the complete sensor history for GxP-conform documentation (FDA 21 CFR Part 11)
- sensor wear monitor and indication of operating status (CIP/SIP counter, sensor exchange)

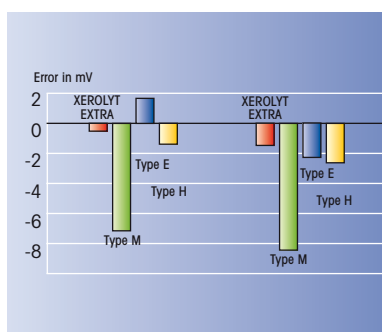


Fig. 1: Zero point errors by exposure to toluene at 80 °C/176 °F.

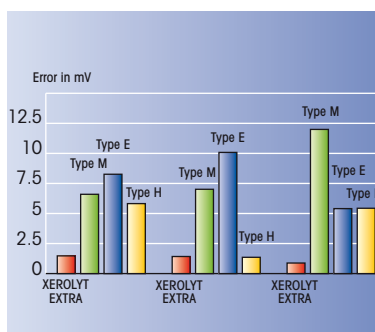


Fig. 2: Measurement errors at high salt content.

www.mt.com/pro-ISM

www.mt.com/pro-pH

Improve your Process Further with Digital Sensors and ISM Technology

In many ways, sensors are at the heart of your process quality. Highly performing and reliable equipment can lead to significantly lower operation costs. With a bad choice of sensors however, high maintenance costs and process downtimes are the all too obvious consequences.

A logical evolution

Many years of experience in the field of industrial measurement systems form the basis of METTLER TOLEDO's competence. Now with its ground-breaking ISM technology, it combines these years of experience with digital technology and processing power for advanced sensor diagnostics.

The digital ISM solution

Specific to the new line of ISM sensors is that signal processing takes place within the sensor head itself. Digitalizing the signal where the sensing element is a logical idea, because low impedance signal transmission is much less prone to electrochemical interferences.

ISM means efficient maintenance

Next to its digital signal, each ISM sensor continuously perform its own "health check" and monitors such critical parameters as reference impedance for pH on-line. By doing so, it can alert the user of a possible junction blockage, allowing him time to take preventive measures. This is to just an example of what ISM is able to do for better process control. Across the world, ISM technology has clearly demonstrated its usefulness in hundreds of successful applications.

The following digital sensors with ISM technology are currently available:

Dissolved and Gaseous Oxygen sensors:

- InPro 6850 i
- InPro 6950 i

pH electrodes:

- InPro 3250 i
- InPro 4260 i
- InPro 4800 i

Feature overview for all digital ISM electrodes and sensors:

- Same sensor performance as analog sensors
- Digital K8S connector
- "Plug and Measure" functionality
- Advanced sensor diagnostics
- Predictive maintenance functions
- Wear monitor
- CIP/SIP counter
- ATEX, FM compatible (pending)

▶ www.mt.com/pro-ISM

▶ www.mt.com/pro-pH

▶ www.mt.com/DO



InPro 3250 i.



InPro 4260 i.



InPro 4800 i.



InPro 6850 i.



InPro 6950 i.



M300 – the new Transmitter Series for Reliable and Versatile Measurements

The M300 transmitter series for pH/ORP, oxygen and conductivity measurements combine robustness and ease of use. High versatility and reliability make this instrument the ideal choice for a wide range of basic utility and wastewater applications.

M300 – a multiparameter transmitter

The new M300 transmitter line has been designed to measure pH, conductivity and dissolved oxygen. Besides a single channel unit there is also a dual channel version available with multi-parameter capability. A large, 4 line backlit display with menus in 5 languages simplifies the installation and configuration of these instruments. The transmitters feature a USB port for ease of configuration, data logging and downloading software upgrades.

M300 – the right choice for wastewater applications

The M300 transmitter represents a unique solution for wastewater applications where reliability and robustness are key. In the multi-parameter version, the user can set the two channels to any combination of the parameters pH, oxygen, and conductivity in the field. This flexibility plus a

universal power supply enable diverse installation requirements to be covered with the same physical transmitter.



Fig. 1: Well legible, backlit display.

Features, designed according to industry requirements

The hallmark of a modern measurement system should be the useability of its hardware combined with an intuitive, self-explanatory user interface, enabling the complete system to be set-up and operated without any prolonged study of operating manuals or costly personnel training. The information shown on the display should be well legible and easy to understand. In addition, permanent monitoring of higher-maintenance pH electrodes via integrated diagnostic functions must provide a continuous flow of information on the actual operational status of the electrode, so that in the event of failure, the situation can be rectified within the shortest time possible. Likewise, the time needed for maintenance and calibration should be reduced to an absolute mini-

mum through clear user prompting by the transmitter. These important points were all implemented in the development of the M300 Transmitter Line. Some highlights are described in more detail in the following paragraph.

M300 Transmitter Line Hardware

All transmitters— $\frac{1}{2}$ or $\frac{1}{4}$ DIN—are equipped with a variable power adapter to allow operation at 20 to 30 VDC or at 100 to 240 VAC. Two different measurement values shown on the backlit display are well legible from a distance of 3-5 m. The attractively priced, multichannel version is freely configurable for parallel operation with pH and/or conductivity sensors. A specially developed “Quick Setup” routine for startup guarantees error-free, basic configuration. The menu logic, both





for pH and conductivity units, is self-explanatory and available in five languages. The transmitter is fitted with a USB interface so that it can also be easily, safely and quickly configured via a PC or Notebook.

PID Controller

The Transmitter M300 is equipped with a PID controller for rapid control of extreme values as well as for exact control of values near to the set points. In practice, this allows saving in dosing amounts, increase in yield, and a lowering of overall costs.

Maintenance and calibration

The continuously operating diagnostics function constantly provides information about the sensor status and, where necessary, displays which maintenance work is to be carried. When calibrating the electrode, the automatic buffer recognition considerably shortens servicing time.

► www.mt.com/transmitter



What is important to know

Outstanding features of the M300	Technical advantages	Your benefits
Dual-channel option, user-configurable	One transmitter for two measuring points	<ul style="list-style-type: none"> ■ Saves costs ■ High versatility
Universal power supply	Country-independent voltages and frequencies	<ul style="list-style-type: none"> ■ Ease of use
Large backlit, high-contrast display	Easily readable display under unfavorable light conditions	<ul style="list-style-type: none"> ■ Excellent reading comfort reduces handling errors
Two-value display plus two text lines	More information available at a glance	<ul style="list-style-type: none"> ■ Easy-to-understand instructions
Quick setup menu	Easy commissioning and installation	<ul style="list-style-type: none"> ■ Saves time
Removable terminal plugs	Easy component exchange	<ul style="list-style-type: none"> ■ Simplifies maintenance
USB interface	On-site firmware upgrade and commissioning	<ul style="list-style-type: none"> ■ Asset protection
Basic diagnostics	Enhanced sensor monitoring	<ul style="list-style-type: none"> ■ Optimizes sensor maintenance and reduces downtimes
Two-level password protection	Safety level adapted to specific task	<ul style="list-style-type: none"> ■ Protection against unauthorized handling enhances overall operational safety
Five menu languages	Easy operation for wide user group	<ul style="list-style-type: none"> ■ Less handling errors result in improved operational safety
PID controller	Accurate process control	<ul style="list-style-type: none"> ■ More efficient dosing of reagents improves yield
Data logging USB port	Allows on-site process troubleshooting	<ul style="list-style-type: none"> ■ Easy data access provides transparency
Two or four current outputs	For easy integration into the process	<ul style="list-style-type: none"> ■ Higher yield ■ Cost savings
Hold control input	For master-slave operation with EC 100/150/200	<ul style="list-style-type: none"> ■ Enhanced application coverage

Open Fieldbus Protocols support Asset Management and Plant Maintenance

Open fieldbus technology like HART®, FOUNDATION™ Fieldbus and PROFIBUS® enables the full use of METTLER TOLEDO functional advantages on digital communication:

- improved resolution of measured values,
- intelligent sensor diagnostics and instrument parameter settings
- comfortable instrument configuration out of a central station,
- higher level of process data to improve the plant conditions,
- availability of additional process values to be easily integrated into the control system

Our intelligent analytical instruments are equipped with electronic device descriptions (DD) for various process instrument configuration software tools.

 www.mt.com/pro-service

METTLER TOLEDO recommends

- Transmitters for pH/ORP, dissolved oxygen and conductivity

Two transmitter lines for integration in HART®, FOUNDATION™ Fieldbus and PROFIBUS® PA networks.

- EasyClean 400

The cleaning and calibration system EC 400 for an easy integration in FOUNDATION™ Fieldbus and PROFIBUS® PA networks.

- ISM technology

Integration of sensor diagnostic information into the process control environment – “sensor wear monitor” and “adaptive calibration timer” for optimal maintenance planning.



Mettler-Toledo AG
Process Analytics
Im Hackacker 15
CH-8902 Urdorf, Switzerland

Your METTLER TOLEDO contact:

www.mt.com/pro

Visit for more information