Sugar Starch & Yeast
Perspectives in Liquid Process Analytics

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News

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Leading Process Analytics

200 % Improvement in Sensor Lifetime at German Bioethanol Plant

Producing bioethanol is no easy task. Controlling pH during production is vital but it is a tough environment for pH sensors. For a European producer, switching to a METTLER TOLEDO solution has significantly increased sensor lifetime.

Bioethanol production is growing

In these times of dwindling fossil resources, the search for an alternative fuel energy source is growing in importance. Bioethanol is proving to be a very promising candidate as the alternative fuel of choice. Today, fuel can contain up to 85 % bioethanol in some countries. In 2012, fuel ethanol production across Europe was approximately 4.5 billion liters. That is equivalent to 16 million barrels of crude oil.

Major German producer

Founded in 2006 in Mannheim, Germany, CropEnergies AG (a member of the Südzucker Group) is one of the largest European producers of bioethanol for fuel applications. Its production plants in Germany, Belgium, Britain, and France have a total annual production capacity of 1.2 million m³ of bioethanol from sugar beet and grain.

In Zeitz, in the middle of one of Germany's principal wheat-growing regions, CropEnergies Bioethanol GmbH operates one of the largest and most modern bioethanol production facilities in Europe, with a capacity of 360,000 m³ bioethanol per year. The raw materials used include various cereals such as wheat, barley, corn and triticale, and intermediate products from sugar production (e.g., sugar syrups). Since October 2010, bioethanol production at the Zeitz facility has been certified as sustainable.

In a well-defined production process, the raw materials are prepared and mashed

METTLER TOLEDO

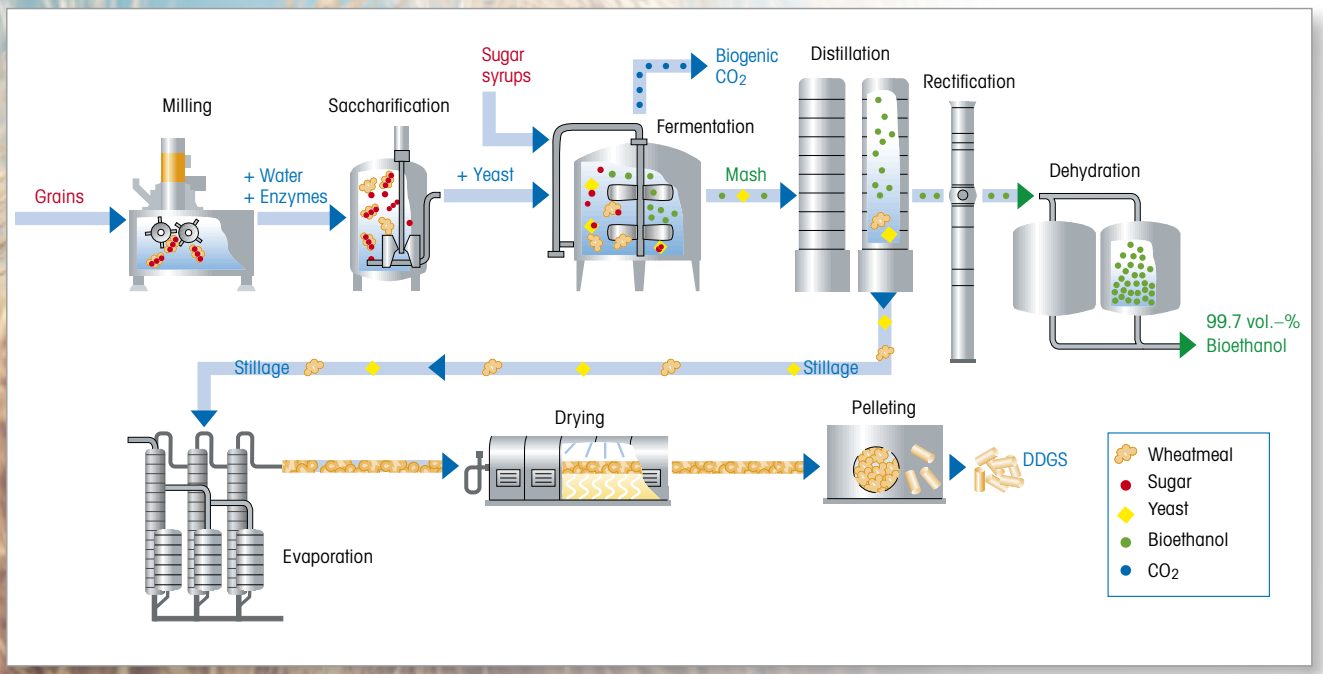

Figure 1: Schematic representation of bioethanol production (Source: CropEnergies).

with the help of enzymes and water. This is the basis for the subsequent fermentation with yeasts that produce the valuable bioethanol from the sugar.

pH measurement is essential

The production of bioethanol involves a complex interplay of individual process steps that create energy-rich fuel only by meticulous control of many variables. One of the most important variables in the whole operation is pH level, which is why numerous pH measuring points are set up along the production process.

In-line sensors for monitoring pH are subjected to heavy loads because, in addition to some extreme process conditions, the sensors are also exposed to high temperature cleaning cycles (CIP). The combined impact of these on the life of pH sensors was so strong that the first sensors used at the Zeitz facility had a lifetime of only about a month.

ISM®

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The advantages of Intelligent Sensor Management

Because of the costs involved in frequent sensor exchange, CropEnergies has now switched to METTLER TOLEDO InPro 4800 i pH sensors with Intelligent Sensor Management (ISM®) technology. ISM combines highly robust digital signal transfer from sensor to transmitter with simple maintenance and comprehensive sensor diagnostic data. The advantages offered by pH sensors with ISM are used extensively in operations at the Zeitz production plant.

No need for bypass lines

The ISM pH sensors are introduced into pipes and fermenters via pneumatically operated InTrac housings. These allow access to the sensors at any time without interrupting the ongoing operation and without leakage of process fluid. Bypass lines that were used to carry out maintenance on the previous sensors are therefore no longer needed.

Continuous monitoring of sensor "health"

Sensor condition is constantly assessed while an ISM sensor is connected to the accompanying M400 transmitter. This valuable data is sent to the process control system for real-time remote monitoring. Consequently, extremely precise planning of maintenance for each individual measurement point is possible. This prevents any unnecessary time and effort spent on sensor maintenance and therefore reduces costs.

When sensor maintenance or exchange is required, probes that have been precalibrated in the laboratory using the iSense software tool can be quickly swapped at the measurement point.

Figure 2: pH measurement point in the process. The sensor is installed with a pneumatic InTrac housing in the pipeline, so no bypass lines are required.

For this purpose, sensor information (calibration history, number of CIP cycles, etc.) is stored in the sensor itself and is read and recorded in a sensor database on iSense. Predictive diagnostics tools on the software evaluate a sensor when it is connected and recommend any corrective actions that are required.

No configuration at the transmitter

The proactive maintenance possibilities of ISM are not only available on a computer, but also on each transmitter for every pH system. Therefore, as an alternative, sensors can also be calibrated, adjusted, and evaluated at the measurement point. Upon connection ISM sensors are automatically detected by the transmitter and are ready to use directly for measurement (Plug and Measure feature), which means subsequent configuration on the transmitter is not necessary.

Sensor lifetime more than tripled

Thanks to METTLER TOLEDO's ISM pH measurement solution, the lifetime of pH sensors at the Zeitz facility has increased from the original 1 month to 3 – 4 months. And due to the very positive experience with the METTLER TOLEDO solution, CropEnergies says installation of further ISM systems is very likely.

Discover more about ISM at:

► **www.mt.com/ISM-sugar-starch**

Protecting Turbines
with Low Maintenance Sodium and Silica Analyzers

To shield turbines from corrosion and scaling, sodium and silica in the power cycle must be maintained at negligible levels. Determining contamination at low ppb levels requires highly capable equipment. METTLER TOLEDO Thornton's sodium and silica analyzers combine accuracy and reliability with low maintenance.

Brazilian co-generation company

Economic development in Brazil is resulting in an ever-increasing requirement for energy and fuel. Some of this demand is being met by a major sugar company who uses part of their crop to produce 2 billion liters of ethanol annually, and through co-generation supplies the country's electricity grid with 1.5 million MWh.

Minimizing downtime to repair corrosion and clean deposition from turbines and piping is vital to co-generation efficiency, so the company maintains tight control of water and steam condensate quality. In a mill near the state of São Paulo, sodium and silica are closely monitored to indicate the level of water purity.

Consequences of sodium and silica contamination

Any sodium present in the steam cycle becomes highly concentrated in the condensate that accumulates on low pressure turbine blades or in crevices of other components. Caustic gouging in boiler tubes is another area of concern. In cooling water, sodium contributes to condenser leaks.

Silica volatilizes with steam and deposits on high pressure turbine blades. Even a modest thickness of silicate reduces capacity, lowers efficiency, and can cause imbalance. Silica also contributes to deposits on heat exchange surfaces and reduces thermal efficiency in other parts of the plant.

Sodium is detectable via conductivity, but not at the sensitivity required to monitor small condenser leaks (a rise in sodium of 0.2 ppb would increase conductivity by only 0.001 µS/cm). Silica has negligible conductivity and cannot be reliably detected using conductivity measurements. Dependable sodium and silica measurement at low ppb levels requires highly specialized analyzers.

Advanced sodium and silica analyzers

METTLER TOLEDO Thornton's 2300Na Sodium and 2800Si Silica Analyzers combine industry-proven technology with innovative design to provide assurance of water purity in power cycle chemistry applications.

The 2300Na Analyzer determines sodium levels by first conditioning the sample to prevent hydrogen ion interference by controlling the input flow and the pH, then uses a sodium ion-selective sensor to precisely determine sodium levels.

The analyzer possesses a very wide measurement range of 0.001 to 100,000 ppb and has a rapid refresh rate of one measurement per second. Fully automatic calibration ensures reliable operation and saves operator time. Convenient grab sample measurement for additional samples from other areas of the plant is also possible.

2800Si Silica Analyzer

- Fully automatic, unattended calibration – provides excellent repeatability and saves operator time
- Automatic zeroing with every measurement – ensures measurement stability
- Large reagent containers enable a long service interval – reducing maintenance

▶ **www.mt.com/Thornton-silica**

2300Na Sodium Analyzer

- Fully automatic, unattended calibration ensures reliable operation and saves time
- Reagent addition confirmation by pH Check to safeguard consistent measurement results
- Four analog outputs for sodium, adjusted pH and temperature with choice of scaling to enable full integration into data acquisition or control system

▶ **www.mt.com/Thornton-sodium**

For silica determination the 2800Si Analyzer employs the colorimetric method, which involves adding reagents and then measuring the color change in the sample. The analyzer features automatic zeroing before each measurement, plus automatic sample conditioning and calibration. Similar to the 2300Na, the 2800Si also allows measurements directly from the process or samples collected at other points.

On-line analyzers match lab measurements

Impressed with the features of the analyzers, the plant installed one of each in their laboratory and for a period compared the results from the units with those of laboratory equipment. Both analyzers showed excellent correlation with lab results.

After an additional 60 days of testing the analyzers in real plant conditions, plant technicians had the highest confidence in their results and stopped obtaining secondary sodium and silica lab measurements.

Turbine protection assurance

Our customer is very impressed by the analyzers' measurement accuracy and they are more than satisfied with their low maintenance requirement which frees technicians from routine maintenance. The sensitivity and reliability of the 2300Na and 2800Si are providing the plant with assurance that their turbines are thoroughly protected.

Now for All Major Bus Networks
the M400 Transmitter

By enabling real-time monitoring of sensor assets, fieldbus networks can add long-term value to production facilities. With the M400 series of multi-parameter transmitters, advanced sensor diagnostics information is available over HART®, FOUNDATION fieldbus™ and now PROFIBUS® PA; helping to improve process reliability and safety, and lowering operating costs.

Fieldbuses are prolific

The adoption of fieldbuses in the world of automation continues to grow rapidly across all process industries. It is a very well accepted technology and is installed by all major manufacturers worldwide.

Benefits including reduced wiring and installation costs are obvious. Less apparent are the long-term advantages of fieldbus networks that become clear many months after a facility has been commissioned. According to research by the ARC Advisory Group, the greatest benefits of fieldbus networks are realized in relation to maintenance and operation. This means fieldbuses themselves are often not a lasting cost-saver directly, but merely allow a higher level of asset management that can significantly reduce operating costs.

As an example, a fieldbus can simplify the collection of device data for Plant Asset Management systems that track the condition of the connected field devices and sensors. METTLER TOLEDO, as a manufacturer of intelligent sensors and transmitters, rose to the challenge of providing real-time information on the installed sensor base.

Remote diagnostics avoid needless maintenance trips

We fulfill this requirement with our unique Intelligent Sensor Management (ISM®) technology. Contrary to conventional analog sensors, digital ISM sensors offer flexible integration of key diagnostics data into control systems for remote monitoring. Besides the transmission of the process variables via common communication protocols, sensor identification as well as the diagnostics can be directly accessed via control systems or standard asset management tools. Due to this direct access to information on fieldbus instruments, unnecessary trips to the field can be avoided.

M400 – a common platform for all applications

Our successful M400 transmitter series exemplifies our commitment to continuous improvement in order to meet customer requirements, especially in the area of digital communication.

The M400 is already available with HART and FOUNDATION fieldbus communication protocols. Now, we have completed the portfolio with the introduction of our PROFIBUS PA version.

Across all process industries the M400 provides excellent reliability and reduced total cost of ownership by offering diagnostic utilities and a wide range of communication capabilities.

Find out more at:
▶ **www.mt.com/M400**

ISM®
HART COMMUNICATION PROTOCOL
Fieldbus Foundation
PROFIBUS

Highlights of the M400 PA

- PROFIBUS PA communication
- Covers wide range of parameters including (optical) dissolved oxygen
- Multi-parameter capability reduces inventory
- Mixed mode for easy transition from analog to ISM technology
- Available approvals for hazardous area use: NEPSI, ATEX/IECEx Zone 1

Lower Measurement Point Costs
with Automatic Sensor Cleaning

Process conditions in sugar, starch and yeast production are often demanding environments for process analytical sensors. EasyClean 350 e is a robust and fully proven automated sensor cleaning and calibration system that helps keep sensors operating at their best and increases sensor lifetime by up to 30 %.

Longer sensor lifetime

For measurements in aggressive media at high pressures and temperatures, sensor life can be increased significantly through automatic cleaning and calibration. Furthermore, with an automatic system it is possible to insert the sensor into the process only when measurement is required. For the rest of the time the sensor can be stored securely in the flushing chamber of the housing.

Reduced maintenance costs

The EasyClean 350 e cleaning and calibration system allows you to effectively reduce the maintenance costs of measurement points while also increasing operational safety. You therefore achieve a safer work environment and improve the effectiveness of measurement points. The unit's extremely compact and sturdy construction ensures safe application in the presence of aggressive cleaning chemicals and high temperatures. EasyClean 350 e delivers longer sensor lifetime and more reliable measurement values, even in the most demanding applications.

Benefits of the EasyClean 350 e

- Minimum maintenance costs through fully automatic cleaning and calibration of the sensor
- User-friendly operation of predefined flushing, cleaning, and calibration programs
- Program optimization via adjustable software parameters
- Easy installation thanks to compact design and simple integration into process control systems
- Extremely durable components ensure reliable operation in the most demanding applications

Find out more at:

▶ **www.mt.com/EasyClean**

EasyClean 350 e sensor cleaning and calibration system

Stop Wasting Time
Prevent Unnecessary Maintenance

Every minute spent repairing your vehicle scale is lost production time. POWERCELL® PDX® load cells protect your profits by keeping service to a minimum. In addition to providing unmatched reliability, they dramatically reduce the time it takes to carry out troubleshooting and replacement work in case something goes wrong.

When it comes to preventing problems, POWERCELL® PDX® load cells help quickly to identify the problem, locate the problem and make solving it faster and easier than ever. A POWERCELL PDX load cell network eliminates troublesome junction boxes and uses a built-in predictive diagnostics system to monitor network health.

Load cell replacement

Vehicle scales are often used in harsh environments, where there are many ways to damage a load cell. Every minute your scale is shut down to replace a damaged load cell can mean lost business. POWERCELL PDX load cells help you avoid those losses by speeding up the replacement process every step of the way.

Firstly, the predictive diagnostics system identifies the problem load cell quickly. In fact, it can alert you the instant a load cell is damaged. Other load cell systems often continue producing costly weighing errors for months before you notice something is wrong. Even then, time-consuming tests might be needed to locate the problem load cell.

With POWERCELL PDX load cells, the predictive diagnostics system tells the service technician exactly which load cell needs to be replaced.

Secondly, replacing a POWERCELL PDX load cell is a quick and easy job. Just disconnect the cables, jack up the scale, and remove the load cell. Then connect the cables to the new load cell, position it in the receiver, and lower the scale. Replacing other types of load cells can take much longer. Even the simplest analog system requires extra work, such as opening the junction box, routing the load cell cable, and wiring the cable to the terminals inside the junction box.

And finally, a POWERCELL PDX network requires very little setup. Just use the scale terminal's simple addressing procedure. In most cases, no adjustments are needed, so the scale is ready to weigh. If local weights and measures regulations require calibration, the job can be done in about an hour. Compare that with conventional load cells, which require numerous readjustments and can easily take a full day to calibrate.

Cable replacement

POWERCELL PDX load cells use cables with quick-locking connectors that make replacement a snap. Just turn the connector slightly and remove it from the load cell. Plug the new cable's connector into the load cell and turn it until it clicks into place. The watertight connection seals the network to IP 68 standards. As soon as the new cable is connected, the scale is ready to weigh. No recalibration is needed.

The POWERCELL PDX load cell network combines unequalled reliability with easy troubleshooting and replacement.

Most other load cells have permanently attached cables. If a cable is damaged, you need to replace both the cable and the load cell. Instead of a simple cable replacement, you are faced with time-consuming recalibration and the extra downtime it requires.

Junction box replacement

Since a POWERCELL PDX load cell network has no junction boxes, there's nothing to replace. That is not the case with conventional load cell systems. They all use some type of junction box, totalizer, or sectional controller to combine the load cell signals. Not only are these components the most frequent cause of vehicle scale failures, they are also difficult to troubleshoot. Once you have found the problem junction box, replacing it means disconnecting the wires for each load cell and for adjacent junction boxes. After the junction box has been replaced, recalibration is required.

Replacing a conventional load cell, cable, or junction box requires time-consuming recalibration with heavy test weights.

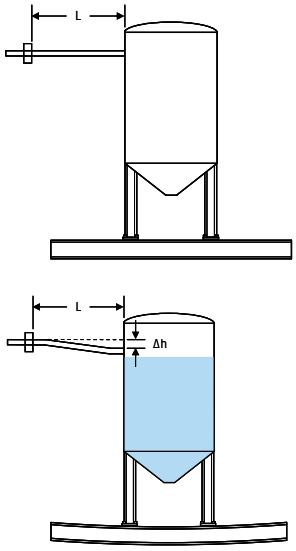
The biggest problem is moisture, and there are plenty of ways for it to enter a junction box. Most junction boxes have five or more openings for cables, with connectors that are tightened by hand. The lids are fastened with screws, so again you rely on hand tightening to seal out moisture.

Stop wasting valuable time on repairs and recalibration. The POWERCELL PDX load cell network combines unequalled reliability with quick and easy service to keep your vehicle scale up and running.

► **www.mt.com/powercell**

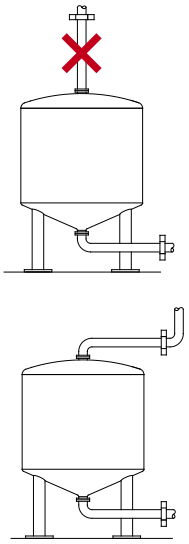
Increase Accuracy
with Correct Piping Connections

Gravimetric level control for tanks is one of the most accurate inventory control methods available. However, piping connections to the tank must be designed to minimize unwanted forces that can cause inaccurate weighing results. Consider the following guidelines when designing a tank weighing system.



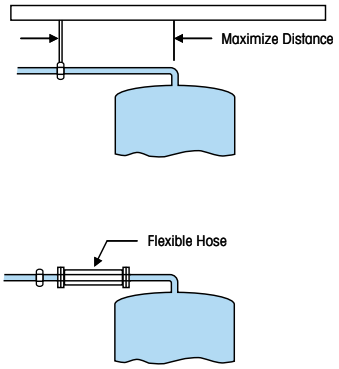
Support structure

A tank scale deflects downwards as load is applied to it. Make sure the tank's support structure deflects as little as possible. That will decrease the amount of deflection in the piping and reduce undesirable vertical forces. Use pipe with the smallest diameter and lightest gauge possible. That will make the piping more flexible.



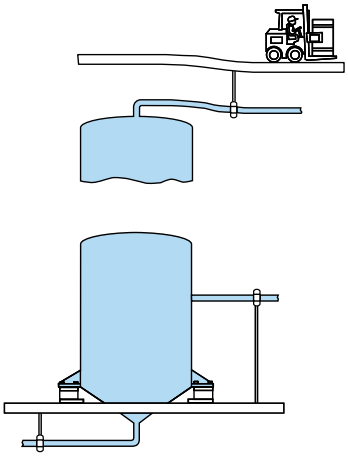
Pipe orientation

Run all pipes horizontally from the tank so that the tank is not suspended by the piping. Pipes may leave the tank vertically or at any angle to the horizontal but must turn and run horizontally before they are supported. Minimize the number of pipes connected to the tank scale by, for example, first connecting them in a manifold with a single horizontal connection to the scale.



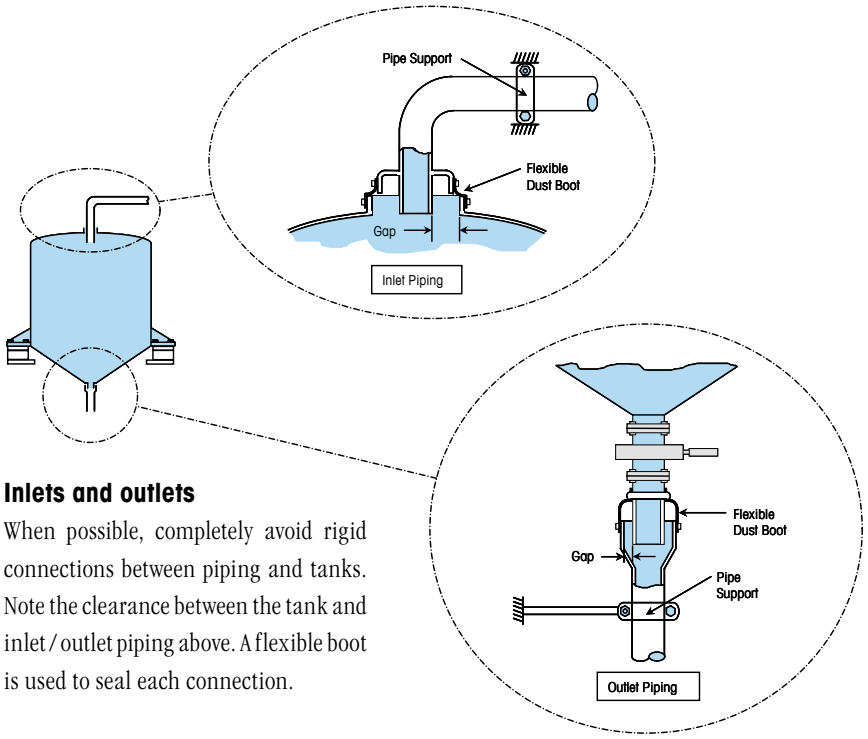
Location of rigid support

Locate the first rigid support for the piping as far away from the tank as possible. That will make the piping more flexible. Use a section of flexible piping or lateral movement expansion joints fitted horizontally as the final connection to the tank scale to further decrease unwanted forces when the tank deflects.



Attachment of support

Do not attach piping to supports for a mezzanine, upper floor, or other structure that deflects independently of the tank. If possible attach piping to the tank's support structure so that the piping moves along with the tank.



Inlets and outlets

When possible, completely avoid rigid connections between piping and tanks. Note the clearance between the tank and inlet / outlet piping above. A flexible boot is used to seal each connection.

Webinar

Learn About Accurate Tank Weighing

► **www.mt.com/webinar-ind-tank-weighing**

Testing Moisture in Sugar
Easy and Error-free

Moisture content is critical to the quality of sugar. The standard reference method for determining moisture in sugar is loss on drying. However, this time-consuming process must be carried out with the utmost care in order to avoid the many potential sources of error. One Click™ Loss on Drying, powered by LabX software, simplifies the procedure by offering intelligent sample handling, eliminating transcription errors and performing all calculations automatically.

The International Commission for Uniform Methods of Sugar Analysis (ICUMSA) defines method GS 2 / 1 / 3 / 9 – 15 (2005) for determining moisture content in sugar by loss on drying. The traditional way for carrying out this method can involve several typical sources of error, including manual data entry, transcription of results, crucible identification and calculation errors. These difficulties are compounded when several sample series are being analysed simultaneously.

LabX – user guidance

LabX software supports users throughout the entire loss on drying process and addresses all the above critical error points. LabX is installed on a network PC or server and is connected to an Excellence XP or XS Balance. The in-built application, One Click™ Loss on Drying, can be customized to match individual process requirements and is started directly from the balance with the One Click™ shortcut on the touchscreen display. LabX provides step-by-step instructions on the display so users can be sure that their method is being followed precisely.

LabX – automatic calculations and documentation

The user enters the number of samples and LabX automatically prints the barcode labels used to uniquely identify each crucible throughout the process. When the barcodes are scanned, LabX automatically records the sample weight against the correct crucible ID. Even after pausing the application for drying and cooling, error-free crucible identification, via barcoding, makes back-weighing the samples easy. LabX automatically records all weights and calculates weight loss. The moisture content percentage is displayed on the balance where a green or red screen clearly indicates if the sample has passed or failed according to defined process tolerances. The intelligent task management functionalities of LabX also make it easy to run several sample series simultaneously. A customized report can be printed out at any time and can even be printed automatically as part of the process. Data is stored safely in the LabX database for future use, such as for auditing.

LabX – assists compliance

International guidelines state that the moisture content of white sugar should not exceed 0.06 % (e.g. the EU sugar policy Commission Regulation (EC) No 1262 / 2001). LabX offers an easy, secure and error-free way of performing moisture analyses using the oven drying reference method and plays a key role in ensuring that companies comply with regulatory demands.

▸ **www.mt.com/1-click-weighing**

Reliable Sugar Production
Meeting Customer Expectations

Every autumn 10,000 tons of sugar beets are delivered to a Swiss sugar plant daily from which 125,000 tons of sugar are produced annually. Such a high throughput along with a harsh production environment presents real challenges for much of the equipment used. The METTLER TOLEDO precision balances and laboratory instruments used in the quality control laboratory have successfully overcome these challenges.

Checking the sugar content

The sugar beet is tested in an incoming control laboratory upon delivery from the fields. As farmers are paid according to the quality of sugar beet delivered, the beet sugar content must be determined. This initial testing process mimics the actual production process, although on a much smaller scale. In Frauenfeld, Switzerland, the whole process is fully automated. A METTLER TOLEDO GB1302 Precision Balance (of 1310 g capacity and 0.01 g readability) is integrated into the system to provide a highly accurate sample weight reading for exact final sugar content determination. Further precision balances are used to weigh the reagents and during the preparation of standards.

Sweet quality control

Following production, the sugar is tested in the QC laboratory working to GLP quality standards. Seven technicians in the QC laboratory use in-house SOPs to test the sugar for color determination. As well as using METTLER TOLEDO balances and pH meters, the Frauenfeld sugar plant also uses an HB43-S Moisture Analyzer. The moisture content of the final sugar should not exceed 0.04 %.

Quality is written in capitals

The head of quality control at the Frauenfeld sugar plant, Dr. Gabriele Schober, praised the performance of the METTLER TOLEDO balances under difficult operating environments including: humidity, high temperature and the strong vibrations caused by the conveyor belt transportation of sugar beet for large scale production. Apart from their robustness, METTLER TOLEDO instruments are also outstanding for their accuracy, efficiency and reliability.

By employing a comprehensive array of analytical methods and sophisticated laboratory equipment, the Frauenfeld plant ensures that their sugar fulfils customers' high expectations.

For more information:

- **www.mt.com/sugarMA**
- **www.mt.com/excellence-precision**

A METTLER TOLEDO precision balance is integrated into an automatic sugar content determination process.

HB43-S Moisture Analyzer is used to determine the moisture content of final sugar.

Intelligent Sensor Management (ISM®) for the Sugar Industry

Ensuring your production can cope with today's competitive challenges includes the use of highly dependable process analytical instruments. With ISM, METTLER TOLEDO's digital sensor technology, maintenance becomes predictable, sensor handling is easy, and production becomes more efficient.

The benefits of ISM translate into substantial gains for sugar refineries in relation to process reliability, sensor lifecycle management, and cost of ownership.

Unlike analog probes, ISM sensors output a robust digital signal and retain their own calibration as well as process data. Thanks to diagnostics tailored to sugar production applications, ISM sensors even predict when they will need maintained or replaced. And the new mobile app provides a quick sensor check on the go.

In pH, conductivity, and turbidity systems ISM gives you much more than just a measurement.

Greater process reliability

Increased operational uptime
ISM provides real-time information on sensor condition, helping you run production at peak efficiency.

Read the white paper on achieving greater process integrity:
▶ **www.mt.com/ISM-chem-wp**

Easy sensor handling

Convenient lifecycle management
With iSense software you can pre-calibrate sensors for error-free exchange at the process.

Discover the new iSense software for ISM sensors:
▶ **www.mt.com/iSense**

Reduced maintenance

Low cost of ownership
ISM reduces sensor lifecycle costs and enables higher sensor use.

Find out how much time and money you can save by switching to ISM:
▶ **www.mt.com/ISM-cost-calculator**

Systems for your processes …
From extraction to carbonation to effluent monitoring, your entire refinery benefits from the unsurpassed reliability, simplified sensor handling, and low maintenance requirement of ISM solutions.

ISM®

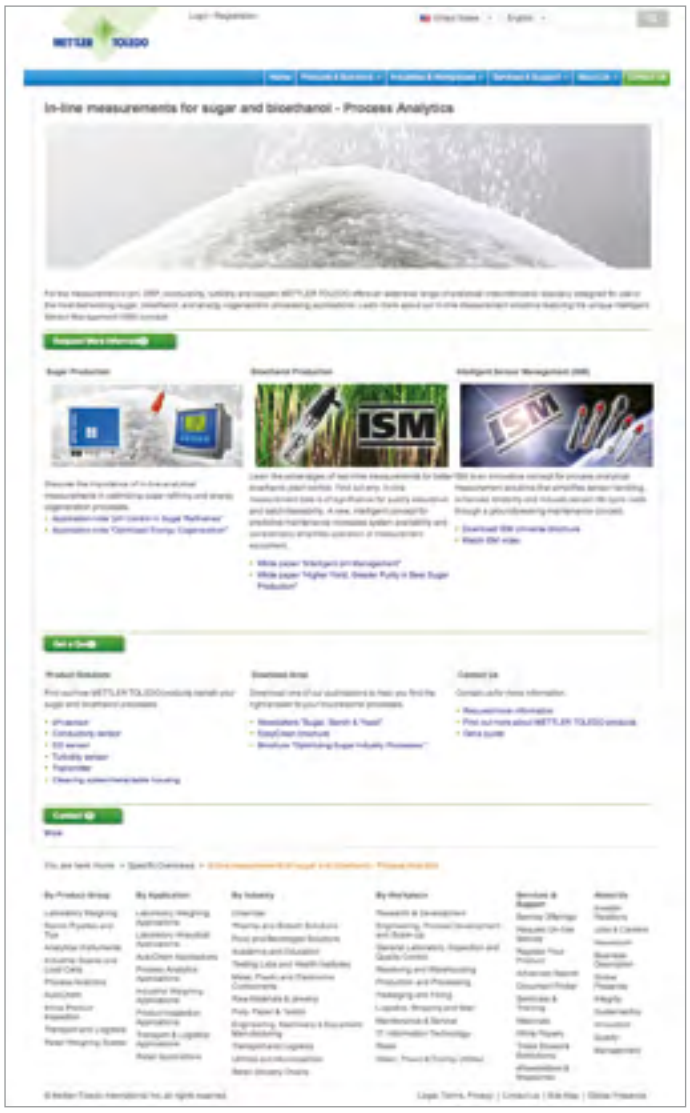
… adaptable to your requirements
Our ISM transmitter portfolio covers single-parameter, single-channel units for maximum process safety, to multi-parameter, multi-channel devices for greater convenience and flexibility.

Incorporating ISM solutions into your asset management or plant control system via transmitters or converters allows seamless integration of sensor diagnostics information for remote monitoring.

Discover how ISM can help you at:
► **www.mt.com/ISM-sugar-starch**

M800 transmitter showing iMonitor sensor diagnostics utility.

Get in-line with METTLER TOLEDO



Help Is at Hand – In-line Measurements
for Sugar and Bioethanol

Visit us online and find out more about our extensive range of analytical instrumentation specially designed for use in the most demanding sugar, bioethanol, and energy cogeneration processing applications.

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► **www.mt.com/pro-sugar**

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