Strategies for Improving Batch Consistency and Quality
Monday, April 27th, 2020

Hosts:
Steve Novak - Sales Director

Mandeep Ahuja - IIOT Solutions
• One of the largest manufacturers of industrial sensors and controls
• Family-owned technology company founded in 1969
• 70 subsidiaries located in major countries
• 7,200 dedicated employees
• Annual global sales exceed €1.1 billion sales (2019)

ifm global headquarters is located in Essen, Germany

Owners
Martin Buck and Michael Marhofer
ifm efector is a subsidiary of ifm electronic

- ifm USA was founded in 1985 and is currently servicing 26,000 customers resulting in $180 Million in Sales
  Corporate Headquarters is located in Malvern, PA
- Our Distribution Center is located nearby in Downingtown, PA
- ifm prover, the USA production center is also located in Malvern, PA
- A network of sales and technical engineers are located throughout the US to serve our customers
- ifm USA employs approximately 250 dedicated employees
20+ years experience working with OEM and food/beverage manufacturers

Product development focused on specific market requirements

Proven solutions for all areas of the brewing process
- Brewhouse
- Filling
- Packaging
Why are we focusing on the brewing process?
• The biggest trend is the popularity of variety in craft brews. New flavors, styles, varieties are a must. Producers have ramped up offerings.

• Production runs are now shorter. There is a focus on quick and efficient changeovers with precise batch monitoring.

• With tight product margins, every production batch has to convert into sellable product.

Source: 2019 PMMI Craft Breweries and Distilleries Machinery and Automation Trends
ifm employees love beer just like you!
How does ifm help improve the consistency and quality of your production no matter how you make it?
WHAT DO YOU MONITOR?
IFM DESIGN PRINCIPLES

How does ifm develop products that help you make great beer?

TCC Temperature Sensor

- One-piece housing eliminates ingress
- IP69K rating, protection against high pressure cleaning
- Thermal shock tested (-15 °C to 140°C)
- High shock/vibration ratings
- At-a-glance indication of sensor health
- No calibration or programming required
RECOMMENDED SOLUTIONS FOR MANUAL BREWSYSTEMS

Temperature

Flow
TD TEMPERATURE TRANSMITTER
TD TEMPERATURE TRANSMITTER – ACCURATE WITH FAST RESPONSE
Current Situation:
Mechanical flow switches used to measure hot water to mash tun or wort to fermentation tank have parts that wear and break. Flow monitoring is critical for consistent batches.

Solid state sensors are too expensive to purchase and too difficult to maintain.

Proposed Alternative:
SM Magmeter provides accurate monitoring up to 2” pipes, 160 gpm.

No moving parts that stick or break.

Power supply options available for portable measuring of process.
• Improve the quality of your process control with a 100% digital signal that is more reliable and accurate compared to analog.

• Recipe changes can be easier, because of bi-directional communication with process instruments.

• Predictive information from sensors will help to improve calibration process and product quality.

• Reduce cost by eliminating analog input cards and reducing size of control cabinets.

Learn More:  https://tinyurl.com/ifmbeer
Wirelessly monitor and Data logging functionality

System components
1. IO-Link master
2. E30446 Bluetooth adapter
3. IO-Link sensor
4. Mobile device
IO KEY – ACCESS TO YOUR OPERATION ANYWHERE/ANYTIME
IFM ECOSYSTEM FOR AUTOMATED BREWHOUSES

PLC/HMI controller

IO-Link masters (Digital communication)

Temperature  Flow  Conductivity  Pressure  Level  Valve Feedback  Vibration
TCC – REAL TIME MEASUREMENT VERIFICATION

Applying TCC technology

Engineering and Design

- Solves
  - Moisture ingress
  - Mechanical vibration
  - Mechanical shock
  - Thermal shock
- Increase of Reliability

Measurement verification

- Minimize measurement uncertainties
- Elimination of uncertainties between calibration intervals
- Cost reductions through real time information
- Increase of quality by reducing manual checks and records

IO-Link Features

- Fast response time
- Precision
- Digital signal and information
- Machine throughput and integrity

Quality
Visual status indication

• Instant status feedback for process operators and maintenance.
• Large bright LED is easy to see from extended distances
• Three color alerts for operational status

TCC – REAL TIME NOTIFICATION OF MEASUREMENT DRIFT
Conductivity in Brewing

- Ensure efficient cleaning by monitoring chemical concentration of cleaning fluids (CIP)
- Prevent residual cleaning fluids from contaminating your beer by monitoring final equipment rinse
- Accurately detect phase shift transition in water pushes maximize efficiency of beer transfer
- Monitor the quality of your base water (main ingredient) to ensure product consistency
- Measure conductivity of final product as a metric to maintain consistent product quality
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Continuous and Point Level in Brewing

Accurate level monitoring prevents overflow in tanks resulting in less product per batch. LMT point level sensor can serve as high alarm sensor or detect empty pipe condition before starting a pump.

Continuous

- Direct hydrostatic level measurement with ceramic sensing cell eliminates the need for metal diaphragms.
- Accurate and reliable tank level measurement with no influence from foam or turbulence.

Point

- Sensing principle is not impacted by build-up, providing reliable level detection.
- Sensor can differentiate between media and foam for precise process control.
- With no moving parts, sensing technology is more reliable than fork sensors.
• Cleanliness to maintain high quality product
  • Protect against mixing cleaning agents and product
  • Maintain recipe quality during changeovers
• Ability to automate valve positions for increased production

How Valves Work

• Seals are a wearable item in the application and can fail
• Build-up can block the valve
IO-LINK – SIMPLE INSTALLATION PREVENTS PRODUCTION ERRORS

Why IO-Link Sensors?

- Multiple digital signals
  Ex: Flow rate and Temperature

- Low-level diagnostics per device
  (connection/device OK, etc)

- Same part number, no added cost, can still be used as D.I.

- Automatic Device Replacement

- True digital signal. Shield cables not needed

- Many more in the market
## Comparison of resolution of IO-Link and analog signals

<table>
<thead>
<tr>
<th>Measuring range (μS/cm)</th>
<th>PLC analog input card (12 bit)</th>
<th>IO-Link *</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...500</td>
<td>1 μS/cm</td>
<td></td>
</tr>
<tr>
<td>0...5,000</td>
<td>2 μS/cm</td>
<td></td>
</tr>
<tr>
<td>0...15,000</td>
<td>4 μS/cm</td>
<td></td>
</tr>
<tr>
<td>0...100,000</td>
<td>25 μS/cm</td>
<td></td>
</tr>
<tr>
<td>0...500,000</td>
<td>122 μS/cm</td>
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</tr>
<tr>
<td>0...1,000,000</td>
<td>244 μS/cm</td>
<td>1 μS/cm</td>
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</tbody>
</table>

* LDL100 measuring range is limited to 15,000 μS/cm
## CONTROLS AND AUTOMATION – THE OLD WAY

<table>
<thead>
<tr>
<th>Part</th>
<th>Cost (Approx.)</th>
</tr>
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<tbody>
<tr>
<td>CPU</td>
<td>$500 - $3000</td>
</tr>
<tr>
<td>HMI Touchscreen</td>
<td>$750 - $1500</td>
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<tr>
<td>Software Licenses (multiple)</td>
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<tr>
<td>I/O Cards</td>
<td>$300 ea.</td>
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<tr>
<td>Build &amp; Wiring</td>
<td>$150/hr.</td>
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<tr>
<td>Certified Cabinet</td>
<td>$500</td>
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<tr>
<td>Misc. (Fabrication etc.)</td>
<td>$500</td>
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<tr>
<td>IoT Gateway/Data Logging</td>
<td>$800</td>
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<tr>
<td>Support &amp; Warranty</td>
<td>$3000/yr.</td>
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<tr>
<td><strong>Total</strong></td>
<td>~$10,000</td>
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</table>
IFM ECOMATIC DISPLAYS

- PLC – HMI all in one
  - Quad Core CPU
  - Data Logging
  - Alarm Logging
  - IoT Connectivity

- Robust
  - IP67 - IP65
  - Vibration/Shock
  - Temperature

- Mounting options
  - In cabinet
  - Stand-alone
  - Rotatable display

859x467
75x21
<table>
<thead>
<tr>
<th>Part</th>
<th>Cost (Approx.)</th>
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<tbody>
<tr>
<td>CPU</td>
<td>$450 - $2200</td>
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<tr>
<td>HMI Touchscreen</td>
<td>Included</td>
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<td>Software Licenses</td>
<td>Included</td>
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<tr>
<td>I/O Cards</td>
<td>IO-Link $250ea.</td>
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<td>Build &amp; Wiring</td>
<td>M12 Quick Disconnect</td>
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<tr>
<td>Certified Cabinet</td>
<td>Not Required</td>
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<tr>
<td>Misc. (Fabrication etc.)</td>
<td>Not Required</td>
</tr>
<tr>
<td>IoT Gateway/Data Logging</td>
<td>Included</td>
</tr>
<tr>
<td>Support &amp; Warranty</td>
<td>5 yrs. all components</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>~$1500</strong></td>
</tr>
</tbody>
</table>
IFM ECOSYSTEM

DO
On/Off

AL1123 (IP69K)

192.168.82.252

2 X 4..20ma

Heater

2 X 0..10V

VFD

Temperatur
e

Boil Kettle

Continuous Level

Flow

Access Control

Daisy-Chain more IO-Link Blocks

FUNCTIONS

• PLC Controls
• HMI/Display
• Edge Gateway
• IoT Connectivity

Hardware Part Number | Price ($)
---|---
CR1077 (7" Touch Display/HMI Controller) | $2,000
AL1123 (IO-Link Master EIP) | $350
TA2812 (Temp Sensor) | $150
PM1708 (Continuous Level) | $400
SM8001 (Flow, Volume, Temp) | $650
DP1213 (2 X 4..20ma) | $145
DP1223 (2 X 0..10V) | $145
EVF331 (Y-Splitter with M12 Cable) – 2pcs | $150
EVF551 (M12 – RJ45 Ethernet cable) | $34
EVF481 (M12 5m Power cable) - 1pcs | $27
EVF044 (M12 5m Patch cord) – 4pcs | $160
Total | $3,211

AWS IoT Core
Azure IoT Hub
HTTPS
MQTT
OPC UA
AUTOMATION UPGRADE – CONSISTENT RECIPE CHANGES

RECIPE MANAGEMENT

Recipe Management

Rec. Definition: Beer

Import
Start
Snapshot
Remove

Recipe Names

| 0 | HEFEWEIZEN |
| 1 | IPA         |
| 2 | KOLSCH      |
| 3 | PALE ALE    |
| 4 | PILSNER     |
| 5 | PORTER      |
| 6 | STOUT       |

New Recipe Name: PALE ALE

Last Error: 0x0

CODESYS
Sensor

Data Acquisition

Controls
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Thank you.