Industry 4.0 the Next Industrial Revolution
The Smart Factory
MB Allen, Product Manager
KIC
Agenda

- Industry 4.0 +++
- Smart Factory
  - What
  - How
  - Why
- Q&A
Industry 4.0 is commonly referred as the **fourth industrial revolution**.
Industry 4.0, IIoT, IoT, Made In China 2025, Smart Factory

Industry 4.0 is a name for the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things, cloud computing[1][2][3][4] and cognitive computing.

Industry 4.0 creates what has been called a "smart factory". Within the modular structured smart factories, cyber-physical systems monitor physical processes, create a virtual copy of the physical world and make decentralized decisions. Over the Internet of Things, cyber-physical systems communicate and cooperate with each other and with humans in real time, and via the Internet of Services, both internal and cross-organizational services are offered and used by participants of the value chain.[1]

- From Wikipedia
Smart Factory – Outcomes/Benefits

What value is this technology supposed to drive?

- Production planning
- Corrective action
- Lower production costs
- More competitive operations
- Consistent high quality
- Higher profits
- Happy customers
1. Using data to run the factory more effectively AND efficiently
   - Actionable data, useful data

Effectiveness versus Efficiency?
   - Being effective is about doing the right things
   - Being efficient is about doing things right
Effective And Efficient

<table>
<thead>
<tr>
<th>Pursuit of Appropriate Goals / Doing Right Things</th>
<th>Pursuing right goals, but inefficient (costs are high)</th>
<th>Pursuing right goals and efficient (high-ROI, cost-efficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pursuing wrong goals and inefficient (not producing enough and are expensive)</td>
<td>Pursuing wrong goals but is efficient (not producing enough but low-cost)</td>
<td></td>
</tr>
</tbody>
</table>

Use of Resources / Doing Things Right
Smart Factory – How?

1. Using data to run the factory more effectively

2. Data analytics and optimization - SOFTWARE

   □ AI – Artificial Intelligence
     - Artificial intelligence, sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and other animals.

   □ Machine learning
     - Machine learning is a field of computer science that uses statistical techniques to give computer systems the ability to "learn" (e.g., progressively improve performance on a specific task) with data, without being explicitly programmed.
Data

- Live
- Actionable, Useful
- Diagnostics
- Corrective
- Planning
- Traceable
Optimization

- Faster setup
- Faster changeover
- Reduce electricity costs
- Reduced downtime
Smart Factory – How?

1. Using data to run the factory more effectively
2. Data analytics and optimization
3. Sensor based technologies to acquire data

Future of Manufacturing - Manufacturing's intelligent makeover

“Software, sensors, data analytics and network technologies are the new "hammers" of American manufacturing. The entire production lifecycle can be transformed with intelligent tools, and early adopters are forging their way to competitive advantage.”

From Siemens.com
Smart Factory – How?

1. Using data to run the factory more effectively
2. Data analytics and optimization
3. Sensor based technologies to acquire data
4. Connectivity
Connect

- Immediate notification/reaction to process change
- Data sharing
- Mobility
- Factory Integration
ASM Smart

Smart #1 SMT Factory
We are on the smart move

ASM Smart

#1 in Process Integration
Integrate and optimize complex production processes

The Connected Factory in Action

Automation
High value information
Manufacturing technologies
Customer intimacy

Digitization

SMART Industry
Smart Factory – How?

1. Using data to run the factory more effectively
2. Data analytics and optimization
3. Sensor based technologies to acquire data
4. Connectivity
5. Process visibility and traceability
Traceability

- Levels
- Barcode
- Documentation
- Historic information
Smart Factory – How?

1. Using data to run the factory more effectively
2. Data analytics and optimization
3. Sensor based technologies to acquire data
4. Connectivity
5. Process visibility and traceability
6. Sustainable production
Automate

- Eliminate manual tasks and wasted time looking for things
- Human errors
- Documentation
- Immediate notification and action

Retrofitable
Smart Factory Integration
Smart Factory Integration – What Is It?

- Factory-wide connection to all equipment, Auto & Manual
- Event Data/Connected Devices
- Database/Storage
- Search → Filter → Analyze
- Web + Mobile
- Enterprise Integration
- Networking
- Management
- Analytics
Smart Factory Integration – What is it?

- Refined decisions
- Flexibility
- Production planning
- Machine to machine learning
- Corrective action
- Efficiency
- Scheduled maintenance
- Product tracking and traceability
- Acquisition and Processing of machine parameters
Factory Integration
### Factory Integration

**Production Run Search**

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>OVEN ID</th>
<th>START TIME</th>
<th>LOT ID</th>
<th>PROCESS WINDOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product C</td>
<td>Oven Line 4</td>
<td>09/02/2017 08:32 PM</td>
<td>1201</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/03/2017 02:27 PM</td>
<td>1404</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/04/2017 02:26 PM</td>
<td>1401</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/03/2017 01:49 PM</td>
<td>1403</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/01/2017 01:18 PM</td>
<td>1208</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/03/2017 02:46 PM</td>
<td>1402</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/03/2017 01:29 PM</td>
<td>1407</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/03/2017 04:27 PM</td>
<td>1206</td>
<td>B</td>
</tr>
<tr>
<td>Product D</td>
<td>Oven Line 4</td>
<td>08/03/2017 08:06 PM</td>
<td>1205</td>
<td>B</td>
</tr>
<tr>
<td>Product C</td>
<td>Oven Line 4</td>
<td>08/03/2017 01:54 PM</td>
<td>1201</td>
<td>B</td>
</tr>
</tbody>
</table>

**SUMMARY**

- **Product**: Product C
- **Lot ID**: 1201
- **Board Count**: 300
- **Oven Name**: Oven Line 4
- **Process Window**: B
- **Max PPM**: 60%
- **Min PPM**: 60%
- **Start Date**: 09/02/2017 01:32 PM
- **End Date**: 09/03/2017 03:36 PM
Factory Integration

- Real-Time Automatic Data Output to MES or Factory Management System – Machine Learning
- Software
Recap
Smart Factory – Outcomes/Benefits Achieved

What value is this technology supposed to drive?

- Production planning
- Immediate corrective action
- Lower production costs
- More competitive operations
- Consistent high quality
- Higher profits
- Happy customers
How To Get Started

- Overcome: Fear, Risk, Denial
- Biggest bang for the buck
- Current process/factory status
- Big or small?
- Lowest risk
- Lowest cost to entry
- Learning tool
- Resolves future questions, issues
- The future is a smoother path
Q & A
THANK YOU !!

MB Allen, Product Manager
KIC
mballen@kicmail.com
+1.858-673-6050
www.kicthermal.com