RFID In Manufacturing
An Introduction to RFID Technology and How it is Utilized in the Plant

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Renee Pieti
Moderator

Wolfgang Kratzenberg
Presenter

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SME Robotics & Flexible Machinery Tech Group
Automated Mfg & Assembly Community (AMA)
http://sme.org/ama/

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Webinar Housekeeping Rules

- 1 hour webinar: 45 min + 15 min Q&A.

- Attendee phones will be muted during the webinar.

- During the presentation, you can log your questions in the Q&A window of the WebEx screen.

- The Q&A session will follow immediately after the presentation.

- The presentation will be recorded. A web link to the recording will be emailed to attendees by SME.

- If you have any difficulties, please email Natalie Lowell: nlowell@sme.org
RFID In Manufacturing
An Introduction to RFID Technology and How it is Utilized in the Plant

Wolfgang Kratzenberg
Marketing Manager for Industrial Identification
Balluff Inc.
What is RFID?

Radio Frequency Identification –
A System consisting of a tag, antenna, and processor capable of wirelessly communicating data over radio waves.
History

RFID Introduction:  Pg.6
# Variations in RFID

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Passive</th>
<th>Semi-passive</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple construction</td>
<td>Large reading range</td>
<td>Large reading range</td>
</tr>
<tr>
<td></td>
<td>Long life (20+ years)</td>
<td>Less power required from reader</td>
<td>High data transmission rates</td>
</tr>
<tr>
<td></td>
<td>Resistant to harsh environments</td>
<td>Larger data storage capacities</td>
<td>Less power required from reader</td>
</tr>
<tr>
<td></td>
<td>Relatively small size and weight</td>
<td>Integrated intelligent functions</td>
<td>Larger data storage capacities</td>
</tr>
<tr>
<td></td>
<td>Inexpensive</td>
<td></td>
<td>Integrated intelligent functions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tag-to-Tag communication</td>
</tr>
<tr>
<td>Limits</td>
<td>Short to medium read range (1 cm...10m)</td>
<td>Larger size and weight</td>
<td>Larger size and weight</td>
</tr>
<tr>
<td></td>
<td>Lower transmission rates</td>
<td>Limited battery life (2-10 yrs.)</td>
<td>Limited battery life (2-10 yrs.)</td>
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<tr>
<td></td>
<td>Correct positioning of tag is important for</td>
<td>High costs</td>
<td>High costs</td>
</tr>
<tr>
<td></td>
<td>reader.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Require higher powered readers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Store a limited amount of data</td>
<td></td>
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</table>
Passive RFID Frequencies

Shorter Read ranges  Greater Read Ranges

125 – 135 KHz
13,56 MHz

Inductive coupling

868 MHz
915 MHz
2,45 GHz
5,8 GHz

Electromagnetic coupling

standardized frequencies

Frequency [MHz]

RFID Introduction: Pg.8
Passive RFID Tag Components

"Chip" Application Specific Integrated Circuit (ASIC)

"Coil" Antenna
Passive RFID Operation

Inductive coupling
Energy + Data

Electromagnetic Backscatter Coupling

UHF and MW RFID Systems

Reader

TAG

Time

Data

Tag

Load modulation

Inductive coupling

Energy + Data

Electromagnetic Backscatter Coupling

UHF and MW RFID Systems

Reader

TAG

Time
# Commercial vs. Industrial

<table>
<thead>
<tr>
<th></th>
<th>Commercial</th>
<th>Industrial</th>
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</thead>
<tbody>
<tr>
<td><strong>Connection</strong></td>
<td>Designed for use in an office environment</td>
<td>Designed for use on the plant floor. Rugged, compact and sealed</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>TCP/IP, RS232</td>
<td>Ethernet/IP, IO-Link, PROFINET, PROFIBUS, CC-Link, EtherCat, etc.</td>
</tr>
<tr>
<td><strong>Protection</strong></td>
<td>Rated IP54 or Less = Dust Protected, but not Dust Tight. Protects against splashing water</td>
<td>IP65 or Greater = Dust Tight, Absolutely no ingress of dust. Superior protection from water</td>
</tr>
</tbody>
</table>
Common Industrial Applications

Work In Process (WIP)

- **Build Data**: What are we trying to build (for flexible MFG)?
- **Process Data**: How well did we build it (Error Proofing)?
- **Lineage Data**: Where did all the parts come from?

- Used to control automation processes and track work through entire process
- Key for flexible manufacturing
Build Data

Key component in a Flexible Manufacturing Environment

<table>
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<th>XYZ Corp</th>
<th>Detroit, MI</th>
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<tr>
<td>Customer: ABC</td>
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<tr>
<td>Part #: 8308636</td>
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</tr>
<tr>
<td>Sequence #: 000082761</td>
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<tr>
<th>Airbag</th>
<th>POS</th>
<th>Rec</th>
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<tbody>
<tr>
<td>YES</td>
<td>DR 14</td>
<td>MANU</td>
</tr>
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</table>

<table>
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<tr>
<th>Color</th>
<th>Trim</th>
<th>Lum</th>
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<tr>
<td>LT TAN</td>
<td>LEATH</td>
<td>MANU</td>
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<th>Adj</th>
<th>Lum</th>
<th>Heat</th>
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</thead>
<tbody>
<tr>
<td>PWR</td>
<td>MANU</td>
<td>NO</td>
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<tr>
<td>8TK37</td>
<td>05</td>
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</tbody>
</table>
Process Data

Drives rework and Statistical Process Control (SPC)
Lineage Data

- Tracing all components to their source
- Critical for:
  - Recall information
  - Liability claims
  - Regulatory compliance
Lineage Concept

Data from multiple locations into one location
Tracking Options

RFID Tag on **Pallet**
Ideal for palletized assembly

RFID Tag on **Part**
Ideal when there is no pallet or part leaves the pallet

RFID Introduction:  Pg.17
Common Industrial Applications

Asset Tracking

- Goal is to reduce non-productive time and asset losses while increasing overall productivity and utilization by accurately tracking assets.
- RFID technology tracks changes to an asset's location, condition, conformity status, and availability.
Asset Tracking

Commonly Tracked Assets:

• **Machine Tools**: Offset Measurements(from presetter), Usage, Tool Pocket Matching
• **Molds and Dies**: Set-Up Parameters, Usage, Maintenance and Part Matching
• **Totes and Containers**: Contents, Location, Usage and Parts Matching
• **Hand Tools**: Calibration Data, Location, Use Level, Part Matching
• **Storage Tanks and Vessels**: Confirm Contents, Usage and Maintenance
• **Automated Guided Vehicles (AGV's)**: Location, Flow Control, Usage and Maintenance
Commonly Tracked Assets
Common Industrial Applications

E-Kanban: Automated Replenishment

- Reduce levels of in-process inventory
- Maintain tight control of in-process inventory levels
- Implement Just-in-Time inventory flow with outside vendors
E-Kanban Material Flow

How it looks in the manufacturing plant
Common Industrial Applications

Logistics (Intra-) or (Inter-)

- Maintain tight flow control with multiple sub suppliers
- Reduce time and potential errors when receiving components
- Maintain high level of visibility and traceability from sub suppliers to finished products
- Maintain regulatory compliance
RFID, From Idea to Implementation

- Identify the Problem "Pain"
- Quantify the Problem- i.e. Cost of Downtime, Cost of compromised quality, Cost of Non-Compliance, Cost of Recall, etc.
- Pre-Pilot/Proof of Concept – Feasibility study, Can RFID be used to address the Pain
- Site Survey – Should be conducted in the environment in which the equipment will be operating.
- Pilot – Start with a small area or a closed/contained application
- Evaluation – Where was it successful and what can be done to improve performance. Did it meet expectations of all concerned parties?
- Make adjustments – consider mounting options, tag location, environment, etc.
- Replicate the success in a similar way throughout the plant
Questions?

Renee Pieti
Moderator

Wolfgang Kratzenberg
Presenter
Q: What frequency do the chips that are used in toolholders operate at? What range do they have?

A: These machine tool systems are either HF or LF. These two frequencies perform well in this environment. Depending on the antenna and tag combination used, the range can be a few mm to a couple cm.

Q: Could active tags be continuously reused in a situation where you are consuming the tagged item?

A: Yes. Active tags can be used many times and their life is limited to the life of the battery in the tag. Passive tags can be used many times without having to replace batteries.