**manufacturing execution system (MES)**

A manufacturing execution system (MES) is a control system for managing and monitoring work-in-process on a factory floor. An MES keeps track of all manufacturing information in real time, receiving up-to-the-minute data from robots, machine monitors and employees. Although manufacturing execution systems used to operate as self-contained systems, they are increasingly being integrated with enterprise resource planning (ERP) software suites. The goal of a manufacturing execution system is to improve productivity and reduce cycle-time, the total time to produce an order. By integrating an MES with ERP software, factory managers can be proactive about ensuring the delivery of quality products in a timely, cost-effective manner.
Integrated Control & Information

One Network, Information & Automation

ERP
MES
HMI
Control
Equipment

Seamless integration from the ERP to Control layer...
ISA95 – Typical Data Flows

Planning
Levels 4 & 5
- ERP
  - Forecasting
  - Financials
  - Production Planning
  - Formulations
  - SOPs
  - Human Resources
  - Inventory
  - Distribution
- Production Order
- Master Schedules
- Master Recipe/Product Specs
- Raw Mat'1 Inventory
- BOMs, Routings, SOPs
- Order status
- Resource status & usage
- Yields, Scrap, Waste

MES/MOM
Level 3
- Production Dispatching
- Production Execution
- WIP Tracking
- Product Genealogy
- Asset Utilization
- Performance Analysis
- Finite Scheduling
- Labor Management
- Maintenance Mgmt
- Quality Management

Execution
- Operating Instructions
- Recipes/Setpoints
- Set-up Instructions
- SOPs
- Equipment Status
- Material Status
- Labor Status
- Process Status

Control
Levels 0, 1 & 2
- Automation and Manual Ops
- Equipment Control
- Phase Logic
- Operation Steps
- SOPs
- Status / Alarming
- Safety Maintenance

Customer Focus: Business decisions
Production Focus: Plant-wide manufacturing decisions
Process Focus: Production line & process decisions
Execution - Coordinating the Resources in the Plant

1) The MES system acts like a conductor, telling plant resources what to do and when to do it, based on events that occur.

2) As plant operations take place, the resources report back confirmation and status of their activities, including timing, recorded process data, material identification, etc.

3) The result:
   - Increased quality, repeatability & efficiency
   - Information for future process improvement
   - Cost-Effective Regulatory Compliance
Loss of **Intellectual Property (capture their knowledge)**

**RETIRING WORKFORCE**

is leaving faster than new talent can be hired / trained

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**MES Solution**

Models manufacturing process & drives out variability, increasing repeatability, across the enterprise!

- Setup on machines comes automatically with the order download
- Work instructions for quick learning per operations / per station
- Quality processes integrated into operator actions

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Ready for Retirement?
Meeting existing and new Regulatory Requirements

**MES Solution**

Compliance requirements come in many forms...

- Track-and-Trace Genealogy
  - Reduce Scope of Recall
  - Financial Liability
- Counterfeit Prevention
  - Customer Loyalty
  - Brand Reputation
- Record Keeping, Process Enforcement & EBR
  - Consistent Quality
  - Better Data Collection
Continuous Improvement Initiatives

MES Solution

Plants require new ways to ensure quality

QUALITY PROCESSES become integral to production activities

Common enforceable workflows, “globally”!
COST OF QUALITY
20% Reduction in costs associated PAPER-BASED & DISPARATE SYSTEMS

TIME-TO-VOLUME
Yield Increase 40% LESS TIME
40 80

CUSTOMER SERVICE
One EMS manufacturer INCREASED REVENUE BY 8%

YIELD
One customer reported first pass yield increased to 93% REDUCING REWORK BY 50%

What will MES Provide?

MANUFACTURING COSTS
10% REDUCTION in direct labor through paperless execution

CYCLE TIME & INVENTORY
30% Reduction through elimination of WASTEFUL ACTIVITIES
FOOD & BEVERAGE
Increase efficiency & flexibility – and improve delivery of diverse mix of safe, high-quality products. 😊

TOP PRIORITIES
- Productivity
- Responsive production
- Quality
- Cost control
- Regulatory requirements
- SKU proliferation
- Food safety

Industry Challenges
- Fewer, Larger Plants
- Increasing Safety Standards
- Supply Chain Visibility
- Health-Conscious Customers
- Convenience Packaging

63% Must Optimize Production
52% Must Standardize Across One or Several Plants

SOURCE: 2016 Rockwell Automation Survey
Scalable Application Framework

- Cloud Enabled
- Thin Client Infrastructure – HTML5
- Responsive Design
- Scalable Applications
- Common Configuration UI for all Fit for Purpose Applications
- Dashboards & Reports
PRODUCTION

Manages Build Plans, tracks materials and consumptions using configurable workflows

Order
Production

End to End production management within a facility…

**BUSINESS VALUE**

- **Right 1st Time Production**
- **Retain & Transfer Knowledge**
- **Make to Demand**
- **Faster Time to Market**

**Workflow Management**

1. **Recipe Management**
   - Integrates with ERP and tracks order data and recipe parameters necessary for production

2. **Bill of Material**
   - Manages the entire bill of material and delivers to proper stakeholders

3. **Process Parameter Management**
   - Integrates with equipment to download and verify configuration data for each order

4. **Order Planning & Execution**
   - Supports accuracy of each order with detailed planning as well as work instructions, label printing and operator activity verification

5. **Process Sequence Enforcement**
   - A process step can only begin if the system confirms the proper preceding steps are complete

6. **Route Enforcement**
   - Verifies production follows the proper route based on configurable parameters

7. **Electronic Batch/Production Record**
   - Every step in production is recorded and verified for quality compliance and continuous improvement; finished goods release is automated
Error-Proofing

Guide your operators thru each production process...

SPECIFICATION CHANGES
- Manage and track in-production specification changes

GUIDES OPERATOR PROCESS
- Transforms bill of materials, production orders and procedures into enforceable work instructions and pick lists

VERIFICATION & ENFORCEMENT
- Verify the sequence of instructions and operator credentials are all verified and tracked

DATA CAPTURE
- Real-time operator display and long-term trending and analysis

ERP CONNECTIVITY
- Deliver information on real-time order status, build results, materials usage, movement and inventory records

BUSINESS VALUE

Reduce Warranty Costs

Improve Recall Response

Right 1st Time Production

Reduce Reporting Costs

Improve Throughput Up To 10%
Line Configuration - Represent Your Plant Graphically

Web based configuration...

Standard Plant Model

User configurable views

Graphically configure Material flows

The Plant Model editor provides a standard view into the manufacturing process.
See Your Production

FactoryTalk® Production
Streamline the process by providing a graphical plant layout in which you can add equipment to the system and change material flow simply by dragging connectors and editing properties.
Build Your Workflows

Drag the instruction widget into the workflow to add a work instruction task for the operator.

Open Source Forms

The work instruction is added to the workflow.

FactoryTalk® Production
To add or change a workflow, operators simply drag widgets to/around the workflow and configure properties.
Define Your Build Plans

Build plans determine which part or set of parts can be produced on a particular production line as well as the steps required to produce the part(s) on a production line.

Define what you want to build and where and how you want to build it.

Define which workflows are performed at each operator station.
Dashboards and Reports for Analytics

Genealogy

Report Info | Run Date | 9/19/2016 3:55:58 PM | Report User | admin
---|---|---|---|---
Build Plan: 0810SP11 | Serial Number: SN131 | Line: PCLine2 | Data Collection: DC1

Unit History

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<tr>
<th>Transaction</th>
<th>Reason</th>
<th>Time</th>
<th>User</th>
<th>Resource</th>
<th>Comment</th>
</tr>
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Unit Consumption

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<td>Consumed</td>
<td>BTS1</td>
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Unit Data Collection

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<th>Item Type</th>
<th>Value</th>
<th>Time</th>
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<th>Comment</th>
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<tr>
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<td></td>
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</tbody>
</table>

FactoryTalk® Production

Manage and control the order process from initiation through final shipment (Real-time WIP updates on order status, material consumptions & process deviations)
Production Management

Part of our own CE Journey
QUALITY
REDUCE COST OF COMPLIANCE

Event Driven Quality Management System
The Quality Quandary

**Quality is intrinsically linked to your brand.** Even as regulatory and market forces put new pressures on your business, quality cannot be sacrificed.

- Any failure to ensure quality can have **health implications** on consumers, resulting in **costly recalls** and bringing about greater **scrutiny** from government regulators.
- The **collection, sharing and reporting of quality information** should be **automated**, replacing time consuming and error-prone manual systems.
Automate Data Gathering and Reporting

- Automated data collection also reduces the potential for human error in documentation processes, which can lead to unacceptable product quality or even product recalls.
- Data collected from systems dispersed throughout your operations can be viewed on dashboards or reports, providing deeper insights and better decision making.
  - Compare product quality against manufacturing conditions
  - Review finished-product quality against individual suppliers’ raw materials
  - Deliver quality reports to different stakeholders, with information contextualized to each person’s role

Integration up to your ERP systems also enables greater tracking of non-conformant product and scrap, and a better understanding of rework costs.
Quality Management

Model and enforce your plant's in-process quality regimens, make data collection routine and consistent!

BUSINESS VALUE

- **Brand Protection**
- **Positive Release**
- **Eliminate Plant Floor Quality Paper Work**
- **Reduced Cost of Compliance**
Creating Quality and Recipe Plans

FactoryTalk® Quality

Use the Quality Layout editor to create custom-designed forms for operators to fill out.
Goods Receipt Quality Check

FactoryTalk® Quality
Use the Quality Layout editor to create custom-designed forms for operators to fill out.
# Product Acceptance

**Data Range:** 3/05/2017 – 4/15/2017 7:23:14 PM  
**Resource:** WorkCenter  
**Resource:** MOCAD101_P01_Recept1n

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<th>State</th>
<th>Resource</th>
<th>Product Info</th>
<th>Collection Time</th>
<th>Expiration Time</th>
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<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Value</th>
<th>View Instructions</th>
</tr>
</thead>
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<tr>
<td>1.1 - Order Number</td>
<td>PO-1001</td>
<td>NONE</td>
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<td>1.2 - Material Type</td>
<td>1000001</td>
<td>NONE</td>
<td>No</td>
</tr>
<tr>
<td>1.3 - Batch Number</td>
<td>B-123123412</td>
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<td>1.4 - Sublot Number</td>
<td>SL-1213</td>
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<td>1.5 - Received Quantity</td>
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<td>No</td>
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<td>1.6 - Visual Inspection</td>
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<td>No</td>
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<tr>
<td>1.7 - Comments</td>
<td>NONE</td>
<td>NONE</td>
<td>No</td>
</tr>
<tr>
<td>21 - Water Content (%)</td>
<td>10.467</td>
<td>PASS</td>
<td>No</td>
</tr>
<tr>
<td>22 - Protein Content (%)</td>
<td>10.8</td>
<td>PASS</td>
<td>No</td>
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<tr>
<td>23 - Fat Content (%)</td>
<td>3.16</td>
<td>PASS</td>
<td>No</td>
</tr>
<tr>
<td>24 - Ash Content (%)</td>
<td>3.018</td>
<td>PASS</td>
<td>No</td>
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**Plan:** 3/05/2017 8:30:04 PM (Regular Plan)  
**State:** Executed  
**Resource:** MOCAD101_P01_Recept1n  
**Product Info:** Batch B-123123412 Material: 1000001 Order: P0-1001 Sublot: SL-1213  
**Collection Time:** 1/23/2018 5:03:27 PM

---

**FactoryTalk® Quality**  
View data collected from systems dispersed throughout your operations on reports for deeper insights and better decision-making.
Provides visibility to OEE and machine performance to support Lean and Continuous Improvement initiatives
Performance Management

OEE = Availability x Performance x Quality and State Tracking

START

DATA COLLECTION CONFIGURATION

MACHINE EVENT TRACKING

DOWN TIME DATA COLLECTION

OVERALL EQUIPMENT EFFECTIVENESS

MEAN TIME BETWEEN FAILURE

MEAN TIME TO REPAIR

OPERATOR CONSOLE

DRIVES OPERATIONS EXCELLENCE

Tag browsing requires no changes to automation

Equipment state is recorded at all times for analysis and trouble shooting

A complete picture into what was happening when equipment goes offline

Understand how effectively manufacturing assets are utilized by tracking availability, performance and quality

Detail on MTBF makes preventive maintenance possible

Make better use of staff and reduce downtime by understanding maintainability of equipment systems

OEE analytics and event editing & reporting in one simple user interface

Enable lean and continuous improvement efforts

BUSINESS VALUE

Lean & Continuous Improvement

Preventive Maintenance

Improved Asset Utilization

Operational Excellence
The Plant Model editor provides a standard view into the manufacturing process.
Data Collection Configuration

FactoryTalk® Performance

Connect to automation through standard tag browser. States can be generated in automation or edited in FactoryTalk Performance.

Online or Offline Browsing

Browse to Controllers

Simply add tags
WAREHOUSE

Warehouse Management increases profitability by helping to improve material, equipment and operator traceability as well as material visibility of WIP and finished products.
Warehouse

Streamlines all aspects of inventory to reduce costs and safety stocks compared to paper-based systems!

BULK MATERIAL RECEIVING
- Accurate and consistent detail on material/ingredient receipt

BULK MATERIAL INVENTORY
- Removes inventory guesswork with immediate and accurate information on inventory levels and properties

WIP & RM INVENTORY MANAGEMENT
- Track work-in-progress and raw material lots/lots to keep lines moving and track particular units as necessary

MATERIAL PATH MODELING
- Never start an order before validation-required materials are available

WET & DRY INVENTORY CONSUMPTION RULE CONFIGURATION
- Piece of mind that the correct material lot is consumed and recorded for auditing purposes

CARRIER MANAGEMENT
- Manage and validate the appropriate carrier is used and in production ready state

INVENTORY TRANSACTIONS
- Keeps enterprise and plant systems aware of what's been consumed, what materials need to be ordered and more

BUSINESS VALUE

Supply Chain Efficiency

Make to Demand

Inventory Stock Reduction

Lean Manufacturing
Warehouse Management
Enterprise Manufacturing Intelligence
Visualization Overview – Dashboarding and Analytics platform

CONNECT
- Premier Integration with Rockwell Data Sources
- 3rd Party Historians, 3rd Party Systems via OPC / OPC DA
- Database Connectivity (Oracle and SQL)

ORGANIZE
- Organize the data in a way that makes the most sense for your users
- Combine multiple data sources into one logical unit
- Reuse model content for increased productivity

(Press, Trimmer, Hundegger CNC, Randek Cut Saw)

VISUALIZE
- Mobile: Mobile First Design Model Browser and Display Creation
- Ad Hoc / Self Service Tools: Excel, Trend, XY Plotter
- Enterprise Reporting Tools: SQL Server Reporting Services and Sharepoint Web Parts
The Unified Production Model
Key to standard and reusable reporting solutions!
Expansive Mobile Widget Library
Ad Hoc Reporting Made Easy. Simply Drag and Drop!

- Indicator Widget
- Value Box
- Gauges
- Linear Gauge
- Bar Chart
- Trend
- Query Table
- Time Series Table
A few key customers at a glance

<table>
<thead>
<tr>
<th>CPG/Process</th>
<th>Automotive</th>
<th>Medical Device</th>
<th>Discrete MFG</th>
<th>Pharmaceutical</th>
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<tbody>
<tr>
<td>Fonterra</td>
<td>Ford</td>
<td>invisalign</td>
<td>Andersen</td>
<td>Pfizer</td>
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<td>Mondelez</td>
<td>Tata Motors</td>
<td>GE Healthcare</td>
<td>Johnson Controls</td>
<td>Roche</td>
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<td>Mars</td>
<td>Mahindra</td>
<td>St. Jude Medical</td>
<td>SonoSite</td>
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<td>Chivas</td>
<td>Becton Dickinson</td>
<td>Ologic</td>
<td>HEXCEL</td>
<td>Dr. Ruddy's</td>
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<td>Ferring</td>
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<td>Aptargroup</td>
<td>Ethicon</td>
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<tr>
<td>George Weston Foods Limited</td>
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</table>
# The Connected Enterprise

## Rockwell Automation Transformation

<table>
<thead>
<tr>
<th>LOWER TOTAL COST OF OWNERSHIP</th>
<th>FASTER TIME TO MARKET</th>
<th>ENTERPRISE RISK MANAGEMENT</th>
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<tbody>
<tr>
<td><strong>Inventory</strong></td>
<td><strong>Delivery</strong></td>
<td><strong>Time to Want</strong></td>
</tr>
<tr>
<td>120 days to 82 days</td>
<td>Mid-80s to 96%</td>
<td>82% to 98%</td>
</tr>
<tr>
<td><strong>CapEx</strong></td>
<td><strong>Lead Times</strong></td>
<td><strong>Quality</strong></td>
</tr>
<tr>
<td>30% per year in capital avoidance</td>
<td>Reduced 50%</td>
<td>5.0% reduction in PPM</td>
</tr>
</tbody>
</table>

**Productivity** ➤ 4% to 5% per year
The Connected Enterprise at Rockwell Automation

Our Journey: Discovery to Implementation

387,000 SKUs

20 PLANTS
200 PARTS
20 YEARS
AVG ORDER
AVG PRODUCT LIFE

PRODUCT TYPES
- Stock + Configure to Order
- Engineered to Order
ERP Integration

- Premium Integration with Rockwell Scalable MES
- Industry Templates (Value packs) for Process, Discrete, Automotive and Pharma
- Templates contain industry specific channels (comparable to EIG)