



**Critical**  
manufacturing  
an ASM PT company

## Critical Manufacturing V7 Experience Augmented MES

Critical Manufacturing V7 represents the next major leap forward in realizing Industry 4.0 by leveraging the complete capabilities of CM modern MES through Augmented Reality, creating the most advanced shop floor focused application for connecting the digital world to the physical world of Manufacturing.

# Why Critical Manufacturing Industry 4.0-Ready MES?

Realize the business gains of Industry 4.0.



Augmented Reality enables MES data to be digitally superimposed over a live image of a real product, process, line or facility area.



Provides a dynamic 3D visualization (digital twin) of the shop floor.



Scales easily with growing operational needs.



Drives visibility of production and costs across the supply chain for better decision making.



Implements rapidly on existing infrastructure.



Enables IIoT-enabled production marketplace for smart factories.



Allows users to quickly learn and do their job from any location, even with mobile devices.



Analyzes, tracks, and executes continuous improvement.



Enables efficient manufacture of personalized, mass customized and low volume products faster, more reliably, at higher quality and lower cost.



Single, integrated view of production data for improved decision-making.



Advance analytics allow predictive measures in the face of shifting business realities.



Improved utilization and throughput time.



Real-time visibility and control of production processes, even across partner or remote sites.



Support for continuous improvement analysis, tracking and execution.



Vertically integrates IoT and the shop floor with enterprise wide information flows.



Horizontal integration provides better synchronization for a smart supply chain.



Reduced equipment and IoT device automation effort with a single view of all automation workflows, with one click deployment.

## Manufacturing Systems

ANSI/ISA 95 Standard

<b>4</b> Level	Business Planning & Logistics, ERP
<b>3</b> Level	Manufacturing Operations Management MES
<b>1/2</b> Level	Automation & Equipment Controllers, Machines

## Traditional MES

Fixed model of a plant, fixed screens to view

On-premise, some intelligence for floor

Linear, fixed model of assets and processes

High-touch integration to automation and ERP

Plant-context workflow

## New MES (Industry 4.0 Ready)

IIoT event, location processing for context, augmented reality, mobile interfaces

Cloud-based; advanced data analysis inside plant context for big data

Binding to connect in real-time with context resolution

Dynamic execution of processes and status in a shop floor marketplace

Service-oriented, modular visibility across operations

# Ready to implement Industry 4.0?

Industry 4.0 initiatives need a modern MES as the foundation to bring the vision to life and realize the full benefits. Critical Manufacturing MES V7 has all the advanced functionality and capabilities to create true competitive advantage for innovative, complex industries.



## Connectivity

- Connect to IoT-enabled products and equipment
- Manage and control untethered devices
- Secure physical and digital assets



## Mobile

- Work anywhere
- Leverage location data effectively
- Use augmented reality for assets and products



## Cloud

- Leverage hosted infrastructure
- Use up-to-date versions at all times
- Focus on strategy, not IT management



## Advanced Analysis

- See real-time plant performance metrics
- Prevent problems with predictive and prescriptive analytics
- Feed contextualized data to enterprise big data



## Decentralization

- Manage complex distributed plant floor processing from a unified system
- Record events in context for complete, accurate genealogy



## Vertical Integration

- Use dynamic, rule-based workflow engine
- Integrate seamlessly with equipment, IoT and automation
- Work with enterprise systems



## Horizontal Integration

- Integrate seamlessly between plants
- Collaborate dynamically with suppliers
- Share efficiently and securely with customers

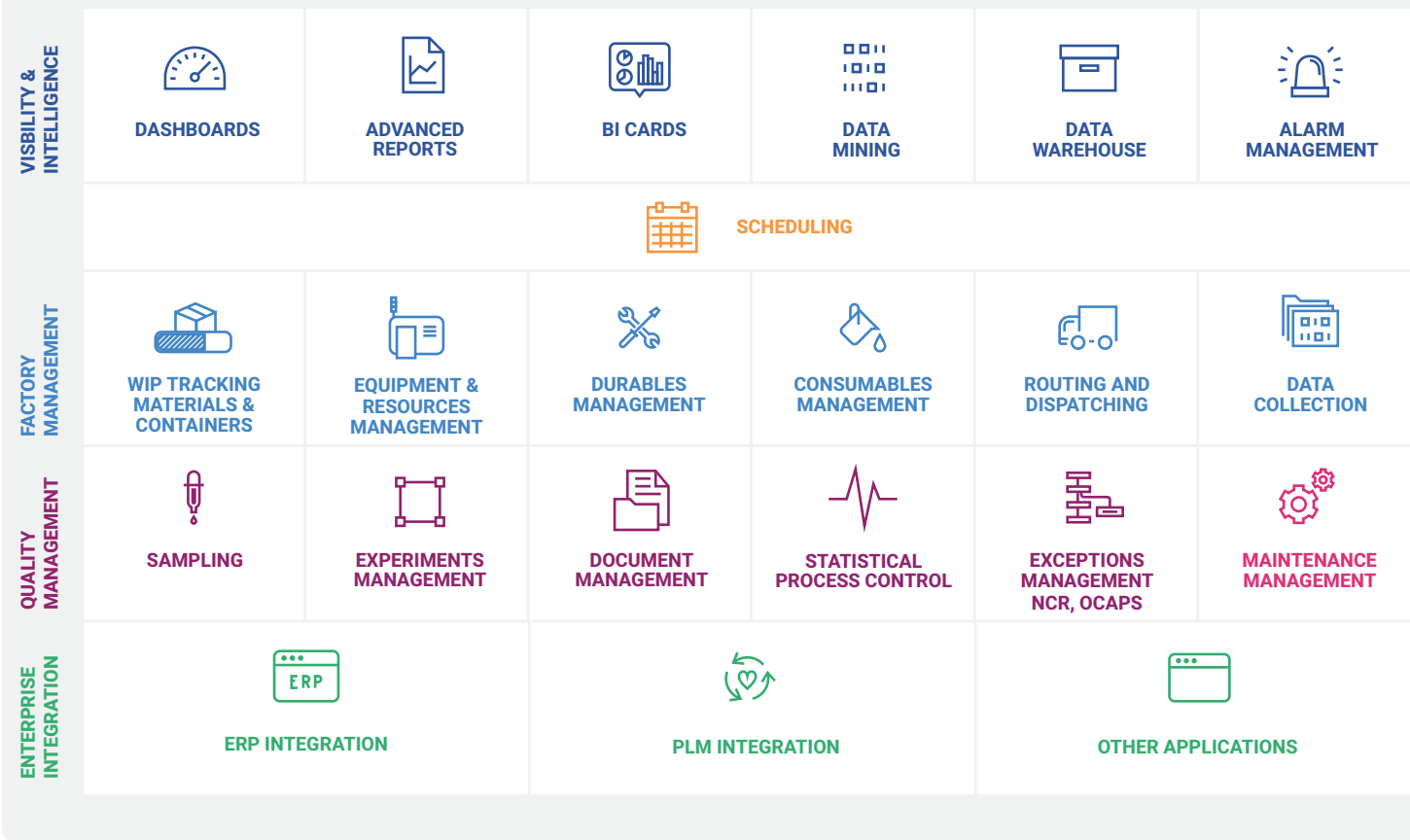
Critical  
Manufacturing  
MES

V7

Experience Augmented MES

# Critical Manufacturing MES™ V7

## CHANGE MANAGEMENT/MASTER DATA



## The most complete, modular MES for industry 4.0

### Dashboards

Visualize business performance through graphical charts derived from user defined queries into real-time process data.

### Advanced Reports

Take concrete business action based on standard or customized reports published from the online database, operational data store, or external database.

### BI Cards

Quickly and easily create BI Cards and dashboards and share them with all applicable production users. Monitor production in a single common view with real-time information.

### Data Mining

Derive business insight through advanced data mining. Leverage a variety of powerful algorithms including time series, decision trees and neural networks.

### Data Warehouse

Store business critical data in a multi-dimensional data warehouse. Gain business insight using roll up, drill down, slice, dice, pivot, and cross-tab OLAP operations.

### Alarm Management

Respond to and manage events that require user attention. Define who to notify and who can clear events. Track each event life cycle as it occurs.

### Digital Twin

Gain real-time 3D visual insight into your shop-floor. View historical overview of production, or zoom in to process details within your factory in real-time. Create a digital twin of factory assets and production with deep analytical capabilities and reports.

### Augmented Reality

Expands the physical world of the plant, superimposing layers of digital information from the complete MES onto a live camera image of the real product, process, line or facility area.

### Mobile & Advanced Operator Interfaces

Visualize real-time factory layout and dashboards remotely or "on the go" with mobile devices. Interact with user defined and configured graphical interfaces (GUIs) as you move through the plant.

### Scheduling

Schedule people and resources using multiple weighted criteria. Simultaneously enforce correct process sequences while optimizing production throughput.

### WIP Tracking, Materials & Containers

Keep detailed tracking of raw materials and work in process. Model hierarchical bills of material. Model positional carriers in which materials are stored and moved through the plant.

### Equipment And Resource Management

Manage and track resources and equipment required to perform process steps. Link to processing with Recipe Management, Maintenance, Exceptions and Data Collection modules.

### Durables Management

Manage and track resources and the durables required to perform process steps. Link step processing with Recipe Management, Maintenance, Exception and Data Collection modules.

### Consumables Management

Accurately track all of your consumables to limit waste and reduce cost. Maintain optimum consumable levels in production. Integration with Recipe Management, Maintenance, Exceptions and Data Collection modules.

### Routing And Dispatching

Dispatch and route materials to available resources according to configurable process plans. Develop and deploy plans that define both first pass and rework operations.

### Data Collection

Collect engineering and process data according to manual or automated data collection plans. Route the data to Statistical Process Control (SPC) and Exceptions Management modules.

### Bill Of Materials

Access the most accurate, authorized BOM, ensuring that the right material, configuration, processes and documents are used in manufacturing.

### Electronic Work Instructions

Operators can access and view all types of documents from interactive work instructions, diagrams, pictures and media at workstations or through mobile devices and Augmented Reality. Ensure that all steps are performed in sequence.

### Traceability And Genealogy

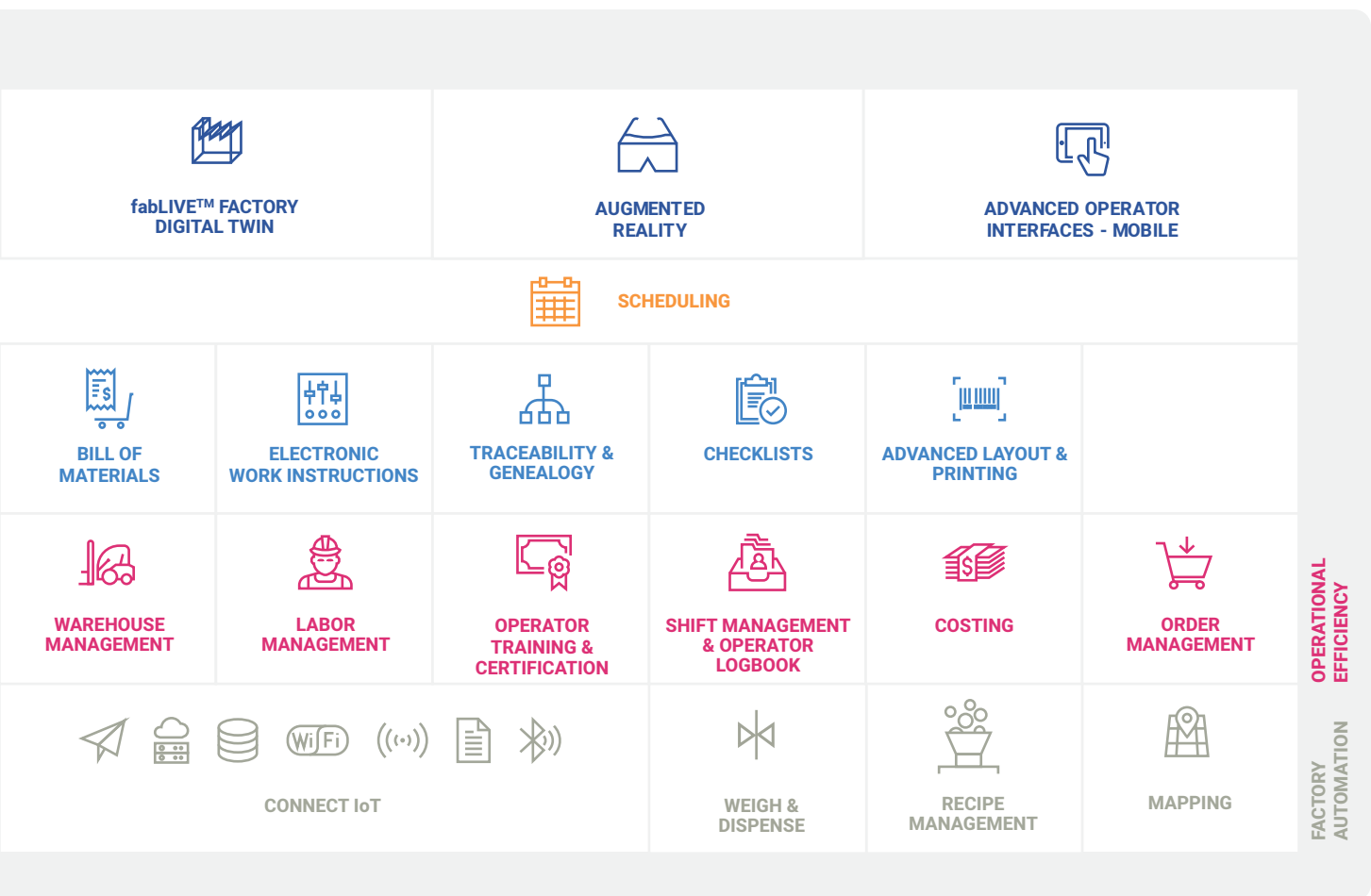
Capture complete product genealogy with forward/backward traceability for all products, components, materials and sub-materials across hierarchical flows.

### Checklists

Deploy flexible logic blocks constructed from mandatory or optional steps. Connect steps sequentially or use floating multi-step checklists. Define logic blocks with parameters and incorporate custom business rules for precise control of your operations.

### Advanced Layout & Printing

Design, preview and print labels and lot travelers defined by context driven information such as text, image or barcode.



#### Experiments Management

Design and execute experiments in a seamless, integrated manner. Fully define, carry out and explore a variety of experiments in order to achieve optimum process performance.

#### Sampling

Define and execute time and counter based sampling based on flexible contexts. Flexible rules for in-step sampling (to select which sub-materials to measure).

#### Document Management

Visualize, control and approve shop-floor documents in line with the execution of a process step.

#### Statistical Process Control

Stabilize and continually assess your manufacturing process using Western Electric and user defined rules. Plot collected data using variable and attribute charts. Integrate out of control conditions with Exception, Resource, and Material tracking modules.

#### Exceptions Management

Define manual or automatic exception protocols. Trigger protocols with out of limit EDC conditions or SPC rule violations. Link protocols to process checklists.

#### Nonconformance Management (NCR)

Identify and document events that affect product quality from any production source across the enterprise. Isolate non-conformant materials, investigate root causes, and route according to disposition decisions.

#### CAPA/ OCAPS

Funnel all real-time quality related incidents into a single system. Eliminate risk by systematically analyzing incidents using a collaborative, flexible process. Adapt to industry needs and enforce product or process changes.

#### Maintenance Management

Activate equipment maintenance procedures with ad-hoc, time or usage based triggers generated by Material and Resource Tracking, Data Collection and SPC modules. Link replacement parts and checklists to maintenance procedures.

#### Warehouse Management

Manage request and return of materials between the shop-floor and the warehouse.

#### Labor Management

Qualify and certify operators capability to perform operations. Assign employees and teams to shift schedules.

#### Operator Training And Certification

Ensure that operators are certified to perform a specific task or operate equipment to avoid risk of non-compliance. Define and easily configure the required training for a wide range of roles, including scope and expiration.

#### Shift Management & Operator Logbook

Log and transfer critical "pass down" information from one shift to the next.

#### Costing

Record absorbed labor, equipment and material cost as it occurs in real-time.

#### Order Management

Track and manage production order fulfillment as it occurs on the shop-floor.

#### PLM Integration

Flexible PLM integration for tight alignment between virtual design and physical production. Collaborative feedback loops between design engineering and production to reduce ramp-up time, accelerate new product introduction and increase quality.

#### ERP Integration

Transfer updates to and receive updates from your ERP system, keeping production orders, inventory status, master data and maintenance information in sync. Assure production can continue in the event of ERP downtime.

#### Connect IoT

Visualize all automation workflows in one place. Easily drag and drop equipment and IoT devices into a model of your shop floor, creating a network of entities. Define equipment and device connections using SECS/GEM with semiconductor equipment or OPC/OPC UA with PLCs. Map services and messages to speak via MQTT or AMQP over Bluetooth, wireless network, or Ethernet with intelligent devices. Use shared files or databases to speak with LIMS or other applications. Deploy to production with a single click.

#### Weigh & Dispense

Ensures that formulation and dispensing operations are followed precisely and provides complete and strict adherence with safety regulations and recipes.

#### Recipe Management

Manage recipe parameters in the context of process steps being performed at process equipment.

#### Mapping

Collect, edit and visualize large two-dimensional material maps (such as wafer or panel maps). Synchronize quantities with material tracking.

#### Master Data Management

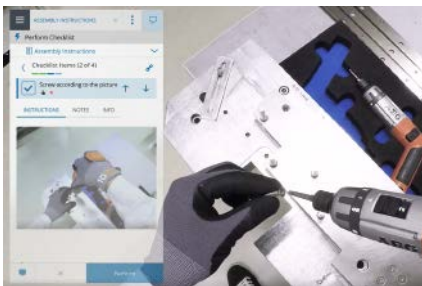
Manage the entire life cycle of critical objects, including creation or bulk loading, approval and versioning.

#### Change Management

Collaborate, review, implement and distribute changes to master data across dispersed manufacturing facilities. Maintain high quality data management controls across the enterprise without losing the flexibility to accommodate local variations.

# Experience Augmented MES

The new Augmented Reality module joins the groundbreaking Manufacturing Digital Twin and Connect IoT to make Critical Manufacturing MES the most advanced Industry 4.0- ready solution available. Now manufacturers can view and act on complete manufacturing data through a new and exciting immersive experience. This Augmented Reality is truly encompassing because it draws on all of the data from across the MES.



## Operator Information:

AR allows operators to access and view complex assembly instructions, schematics, materials and product and process steps to simplify operations, avoid errors and speed production.

## Product Information:

Point your AR device at any product on the shop-floor to instantly view complete traceability records such as; lot, batch or device history records, product specifications, order details, customer details, quality metrics etc.

## Equipment Information:

Point the AR device at any shop floor equipment to view important KPI's, including in-process lots, OEE performance, MTTR and MTBF, Yield, Cycle time, maintenance schedules and much more.

# Distributed Architecture for availability and Scalability

Extensible at every tier



## Presentation Services

Create your own pages and wizards without coding. Add or modify GUI's and visual components. Create your own themes and styles.

## Business Services

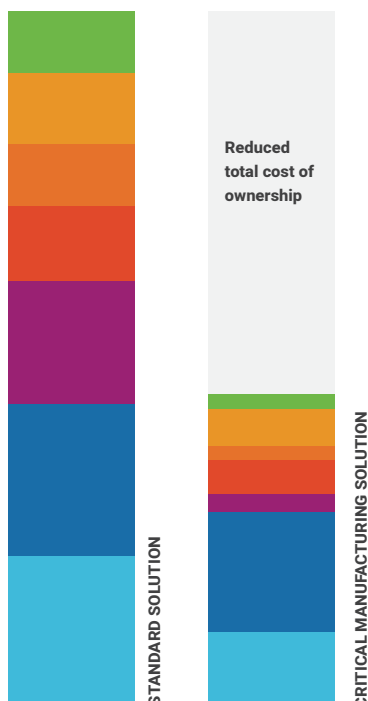
Create your own business objects or extend existing ones. Create your own services without coding, using any objects. Add or modify pre and post transaction logic during runtime.

## Persistency & Intelligence

Create or modify any report. Integrate data to and from any data source. Analyze and visualize data using OLAP, data mining, or interactive dashboards.

# Low total cost of ownership (TCO)

Through reduction of all cost factors



### Administration

- Single IT stack, with powerful admin tools
- Application admin through a unified GUI

### Modeling

- Rich, pre-customized object model
- Modeling through the same GUI
- Empowered end-users

### Usability

- User training time lower than ever
- Process enforcement even on mobile
- Unique screens that upgrade

### Installation

- Server side full installer ready in minutes
- No client installation

### 3rd Party Licenses

- 100% Microsoft Technology
- No hidden costs

### Software

- Scalable pricing model, based on size
- Modular functionality

### Hardware

- Scalable HW based on needs
- From single server to full fault-tolerant, high availability configuration

# About Critical Manufacturing

Critical Manufacturing provides the most modern, flexible and configurable MOM solution available to help manufacturers stay ahead of stringent product traceability and compliance measures; reduce risk with inherent closed-loop quality; integrate seamlessly with enterprise systems and factory automation; and provide deep intelligence and visibility of global production operations. As a result, our customers are Industry 4.0 ready, enabling them to easily adapt to changes in demand, anywhere, at any time.

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