CRITICAL MANUFACTURING

CRITICAL MANUFACTURING V6

UPGRADE TO INDUSTRY 4.0

Critical Manufacturing MES for PCB™

The New MES for the Future of Manufacturing Things

WHY CRITICAL MANUFACTURING INDUSTRY 4.0 READY MES?

New Industry 4.0 uses mean PCB manufacturers must focus operational excellence efforts on the challenges of high-mix and complete traceability.

KEEPING UP WITH CONSTANT CHANGE AND COMPLEXITY

New applications in IoT, communication, automotive, medical and aerospace bring higher product complexity, high-mix, as well as cost, and agility to deliver. At the same time, pressures mount from material availability and cost, regulatory requirements and handling constant change and traceability requirements.

With an array of complex products moving through a demanding manufacturing environment. PCB manufacturers need more than manufacturing visibility. With mistakes now more costly, companies need a flexible manufacturing system capable of connecting to the latest IoT and automation as well as office-based systems.

FLEXIBILITY, TRACEABILITY AND PERFECT QUALITY

Critical Manufacturing MES for the PCB™ industry addresses the unique challenges of all segments of the PCB industry: high-density interconnect (HDI), IC substrates, and commodity PCBs. At a time when copper foil and substrate glass materials can be expensive, Critical Manufacturing MES supports facilities in delivering perfect quality to the most demanding specifications and full reporting on all processes, whether traditional or additive manufacturing. Become Industry 4.0 ready, where Smart equipment and IoT enabled products can help guide the production process. Critical 's MES is designed to work with all of the new IoT protocols for integration and automation and to share intelligence across enterprise-wide systems.

- Achieve full traceability and a 3D digital twin for real-time views of equipment status;
- Leverage Industrial IoT with a distributed architecture designed for Industry 4.0;
- Boost flexibility to easily model lines for high-mix, low volume, frequent changeovers;
- Speed new product introduction by improving quality and yield in a way that's visible to engineering, production and R&D;
- Make fast, confident decisions leveraging all information for continuous improvement.

GAIN THE BENEFITS OF INDUSTRY 4.0

Critical Manufacturing MES for the PCB™ helps manufacturers accelerate their digital transformation to become Industry 4.0 ready and overcome the challenges associated constant change and complexity.

Critical's manufacturing execution and intelligence capabilities improve decision-making and manufacturing flexibility with a complete set of easily configurable and smoothly integrated modules. fulfilling the most challenging Agility, Visibility and Reliability requirements,

Agility: Improve yield, production flexibility and equipment utilization with an integrated process, materials management and advanced manufacturing intelligence system,

Visibility: See the current state of production in a 3D live digital twin, improve real-time decision-making in complex and variable production environments,

Reliability: Improve NPI confidence with automation, control, closed-loop quality management and traceability exceeding the highest customer standards and specifications.

BECOME INDUSTRY 4.0-READY

Manufacturers must improve speed and the lower cost to innovate. Mass customization and personalization are becoming the norm. There will be fewer high volume products and more low volume products, resulting in a need for quick changeovers.

Quality must improve to approach zero defects. Customer requirements, and therefore products, are often complex. At the same time, there is intense price and margin pressure driven by advances in technology. How does Industry 4.0 enable companies to outperform competitors? By delivering vastly more data and intelligence to make better decisions.

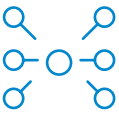
The New MES is the foundation for realizing the speed, flexibility, efficiency and cost reduction outlined in Industry 4.0. Critical Manufacturing's latest Industry 4.0-ready MES has all the advanced functionality and capabilities to create true competitive advantage for the PCB, HDI and IC substrate manufacturers.

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

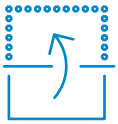
MOBILE
- Work anywhere
- Leverage location data effectively
- Use augmented reality for assets and products

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

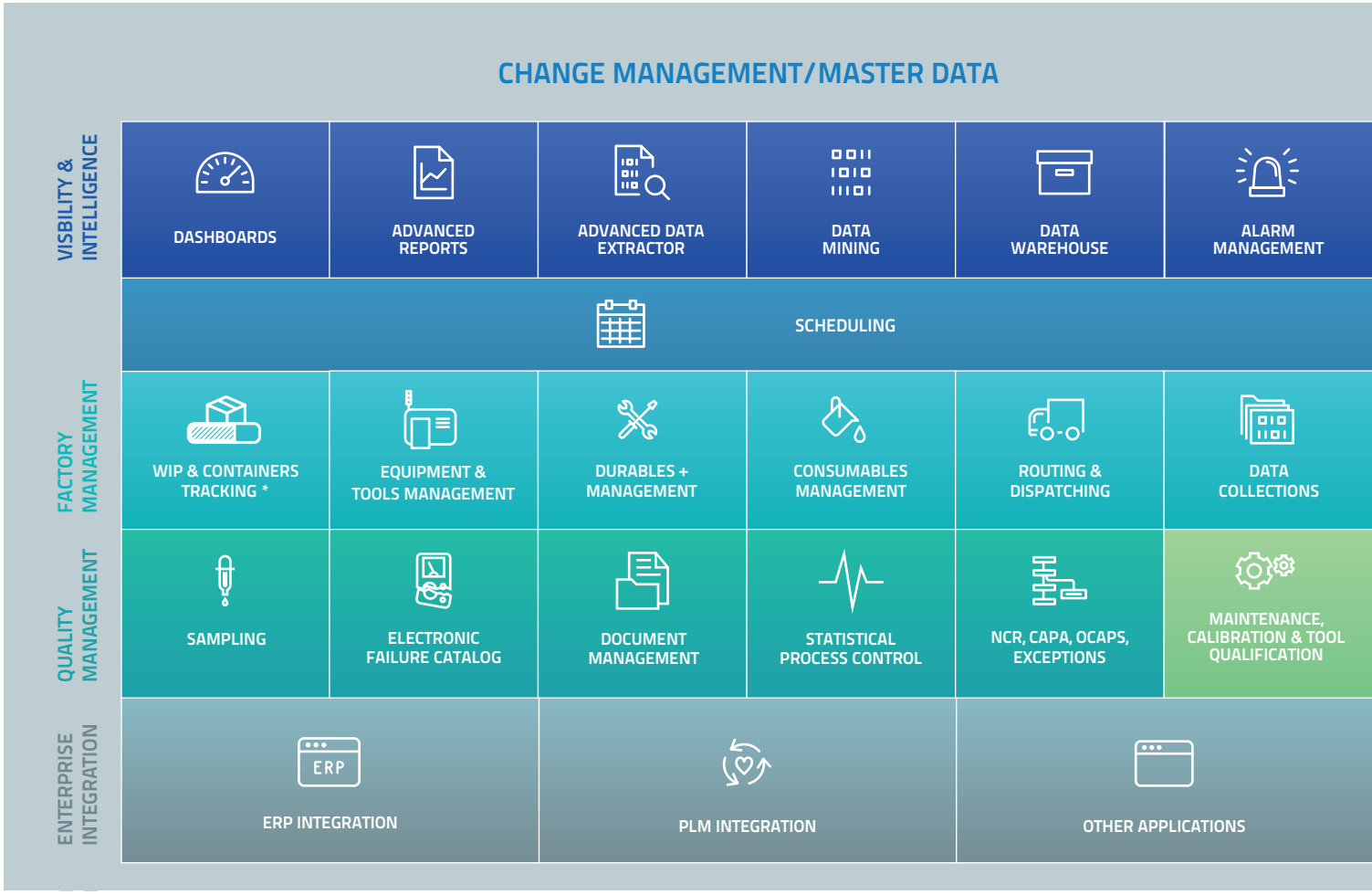


DECENTRALIZATION
- Manage complex distributed plant floor processing from a unified system
- Record events in context for complete, accurate genealogy



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



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

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

ADVANCED DATA EXTRACTOR
Automate extraction and intelligent analysis of data from multiple sources.

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.

FACTORY 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.

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 (GUI's) 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 & CONTAINERS TRACKING
Keep detailed track 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.

RESOURCE AND DURABLES TRACKING
Manage and track resources (such as equipment) 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 consumables level 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 and are used in manufacturing.

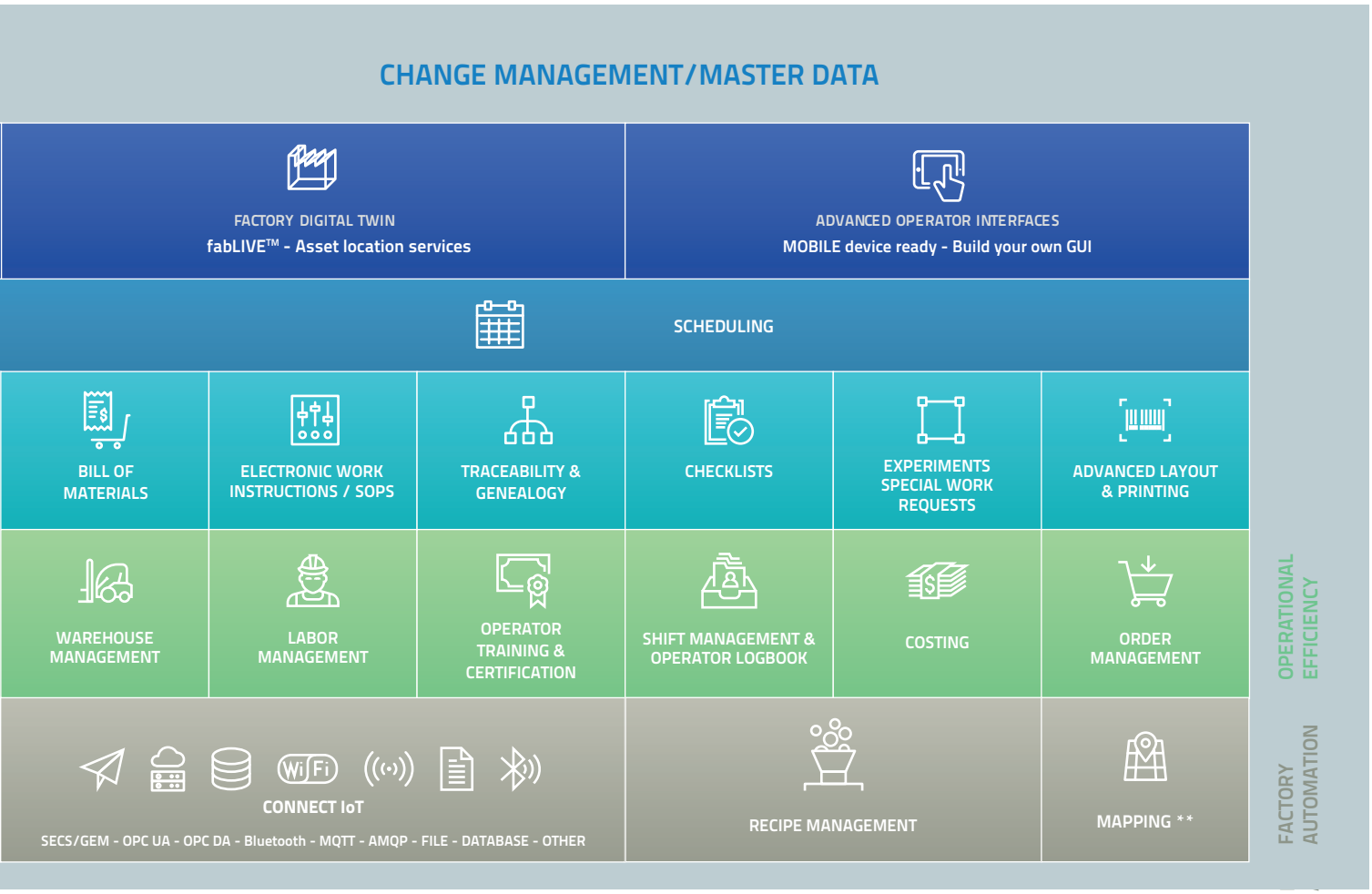
ELECTRONIC WORK INSTRUCTIONS / SOPS
Operators can access and view all types of documents from interactive work instructions, diagrams, pictures and media at assembly workstations or mobile device. Ensure that all steps are performed in sequence and the required data is recorded. Reduce shop floor errors and rework.

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.

EXPERIMENTS & SPECIAL WORK REQUESTS
Accelerate NPI, test process changes and configure experimental processes for special work requests. Modify process steps and instructions, enforce specific splits and merges, pre-define workflow steps, execute different sequences, change processing parameters and data collection for detailed engineering analysis.

ADVANCED LAYOUT & PRINTING
Design, preview and print labels and lot travelers with context driven information for text, images or barcodes.



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).

ELECTRONIC FAILURE CATALOG
Browse through applicable failure high-resolution images to classify and select loss codes.

DOCUMENT MANAGEMENT
Visualize, control and approve shop-floor related documents within MES context and at the right operation.

STATISTICAL PROCESS CONTROL (SPC)
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)
Enables the identification and documentation of quality events from any production source across the enterprise. Contain out of specification materials, conduct investigation, route appropriately and enforce disposition decisions.

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, CALIBRATION & TOOL QUALIFICATION
Activate equipment maintenance, calibration and tool qualification 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 the required training and certifications, including scope and expiration. Easily configure training and certification for a wide range of operational roles.

SHIFT MANAGEMENT & OPERATOR LOGBOOK
Qualify and certify operators capability to perform operations. Assign employees and teams to shift schedules.

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.

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.

PLM INTEGRATION
Achieve 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.

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.

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

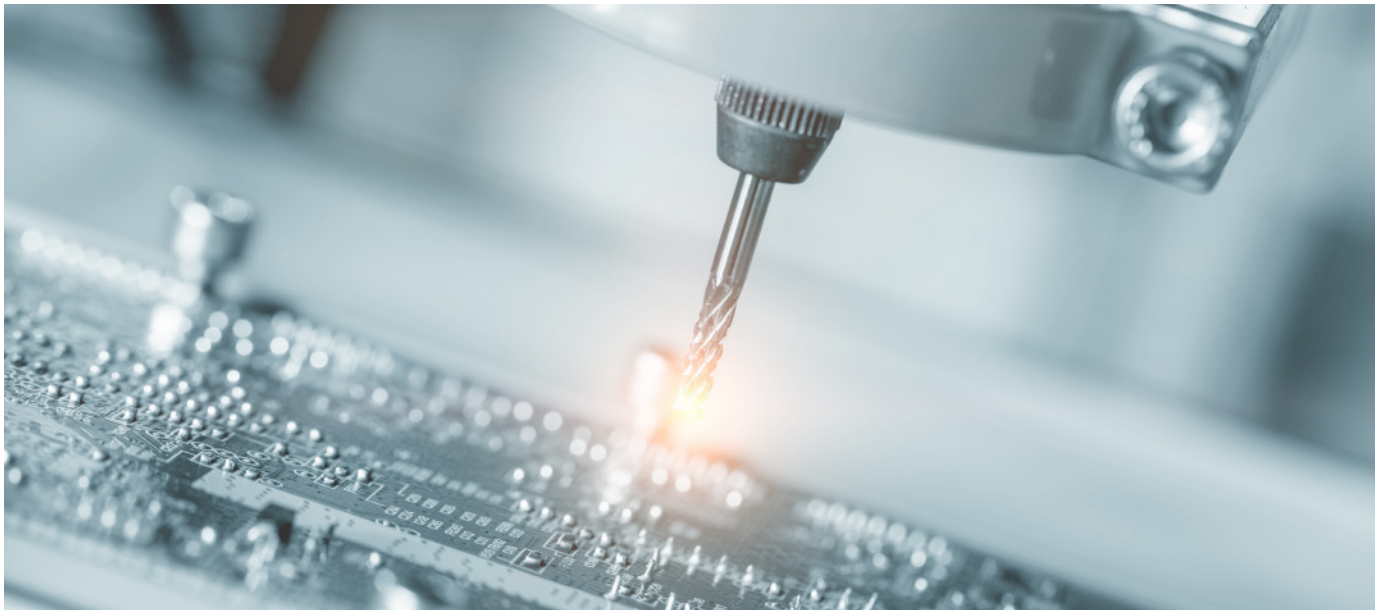
MAPPING
Collect, edit and visualize large two-dimensional material maps (such as wafer maps and burn-in boards etc.) and synchronize quantities with material tracking.

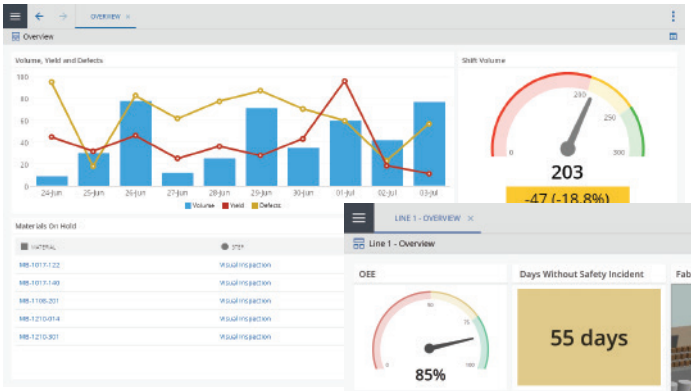
MASTER DATA MANAGEMENT
Manage the entire life cycle of critical objects, including creation or bulk loading, approval and versioning.

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.

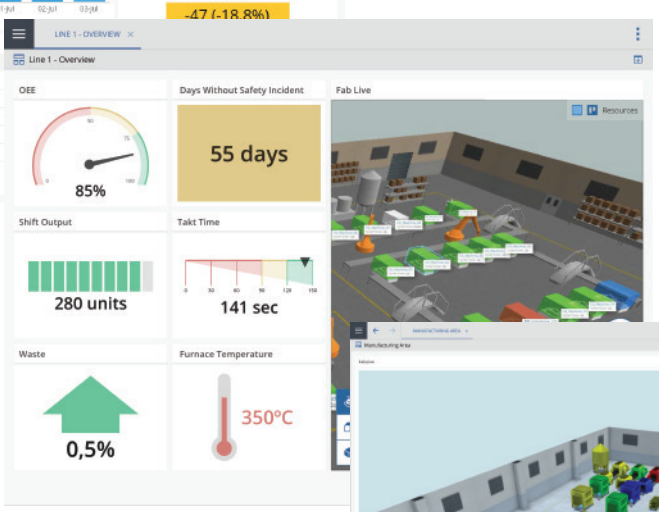
NEXT GENERATION USER EXPERIENCE

Critical Manufacturing is simpler, faster and more flexible than any other MES on the market. Users can create sophisticated graphical user interfaces (GUI):



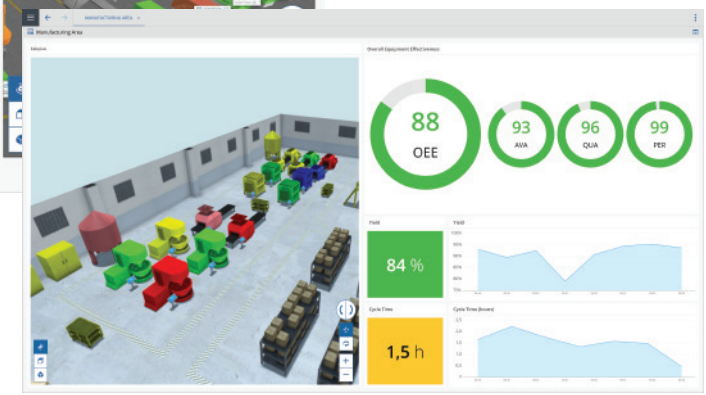


Straightforward drag and drop technology.



Web based interface able to run on multi-platform and multi-form size devices.

Quickly generate personalized process views based on users' individual needs.



No complicated coding. Total flexibility.

DISTRIBUTED ARCHITECTURE FOR AVAILABILITY AND SCALABILITY

Presentation Services

Business Services

Persistency & Intelligence

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.

REALIZE THE BUSINESS GAINS OF INDUSTRY 4.0 WITH CRITICAL MANUFACTURING V6

- **Manufacture personalized, mass customized or 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 shop floor with Enterprise wide information flows.**
- **Horizontal integration provides better synchronization for a smart supply chain**
- **Reduced automation effort with a single view of all automation workflows in one place, with one click deployment.**

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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.

www.criticalmanufacturing.com