

# Operational Business Intelligence in Manufacturing



SIMPLIFYING RFID ADOPTION



# SmartWIP - Intelligent Manufacturing with RFID

Manufacturers are under competitive pressure to fulfill the market demand of delivering quality products in shorter time frames while ensuring compliance with various regulatory bodies. This impacts every aspect of the company, especially manufacturing. In order to maintain the necessary margins and continuously growing quality benchmarks, their supply chain needs to be agile and flexible - one that can quickly respond to changing business requirements.

Hence the collaboration between their ERP (Enterprise Resource Planning system) and MES (Manufacturing Execution System) is key, as they own the manufacturing workflows and production plans where decisions directly affect profitability. By integrating plant level operations with various enterprise processes and adopting a lean manufacturing model, companies will be able to reduce lead times, work-in-process inventory and overall costs of manufacturing.

But as manufacturing processes become complex due to multiple product variations, multi-step process flows and varying production conditions, current MES systems are only useful in coordinating and synchronizing production activities at the batch level. To manage the growing complexity, factories must become "Intelligent". They need to collect information at the item level at each step of the process so that shop floor personnel can leverage it for improving efficiency. They need to perform process level validations in real time at the point of failure to reduce scrap and work-in-process inventory.

The traditional MES system does not have the ability to collect product genealogy information at the item level, perform validations, track defects at the point of failure or automatically route products for rework. They essentially are not geared to provide operational business intelligence in real time.

KeyTone's SmartWIP solution has taken a unique approach to addressing the limitations of existing MES systems through a Work-In-Process solution leveraging the fundamental value of RFID technology.

KeyTone's SmartWIP solution transforms current batch manufacturing to "intelligent" manufacturing by providing:

- **Granular Traceability**  
SmartWIP records the changes made in every component of the product during the manufacturing process to be able to manage potential recalls and regulatory compliance
- **Improved Quality**  
SmartWIP identifies defects at the point of deviance and provides the ability to rework the product to increase first pass yield
- **Lean Inventory**  
SmartWIP maintains WIP inventory at levels that prevent process starvation and achieve JIT manufacturing
- **Improved Equipment Utilization**  
SmartWIP provides visibility into the entire manufacturing operation to determine the current output and identifying areas of improvement to increase overall yield

KeyTone's manufacturing analytics solution allows companies to improve overall profitability and effectiveness in manufacturing operations by combining RFID information with planning and execution systems to provide operational business intelligence. Companies will be able to achieve overall operational efficiency in manufacturing by empowering its users with real time production information to take decisions on the factory floor.

# KeyTone Product Genealogy Solution



Business Challenges	KeyTone Benefits
<ul style="list-style-type: none"> <li>• Recalling only defective products</li> <li>• Maintaining pedigree information for compliance</li> <li>• Eliminating recalls through increased quality</li> </ul>	<ul style="list-style-type: none"> <li>• Provides detailed historical information related to production, inspection, genealogy, and usage</li> <li>• Provides historical information on the product both upstream tracking parts that make the product and downstream detailing location of products containing a certain part</li> <li>• Provides real-time reports and dashboards on the machines, components, stations, shifts and operators involved in the defective product and processes <i>before</i> the product is shipped</li> </ul>

Overview

Documenting the 'Genealogy' of the product has become extremely important in complex manufacturing environments with many product variations requiring coordination across equipments, tools and process steps. This traceability information enables discrete manufacturers to reduce scrap, improve quality and minimize product recalls.

Solution Benefits

KeyTone's RFID based product genealogy solution offers complete lot, batch and even item level traceability by automatically capturing detailed manufacturing process information as raw materials move through different stations on the production floor. It ensures that each process criteria are met in the required manufacturing conditions as raw materials are routed through the production process.

KeyTone's solution easily compliments existing manufacturing execution systems by providing tracking both upstream - providing historic data on the parts that were used in the production process and downstream - providing the location and status of every product in the making from its raw materials.

The solution offers enterprises the ability to:

- Recall only the products that were manufactured using a specific part or raw material using detailed history of every receipt, production, movement, inspection, rejection/sorting, and shipment. Know the who, what, when & where of the assembly of a specific part
- Track product genealogy back to the raw materials including batch / lot / supplier that were used in the manufacture of this product to identify all lots that contain the raw materials identified
- Identify potential problem areas within labor that might lead to contamination or defects through tracking which operators worked on creating this product

Product Genealogy Reports

Process reports around genealogy include:

- Lot History Detail by process
- Lot History Detail by station
- WIP Data by process
- WIP Data by station
- Lot Recipe Detail by station

# KeyTone Production Inventory Solution



Business Challenges	KeyTone Benefits
<ul style="list-style-type: none"> <li>• Minimizing WIP inventory</li> <li>• Increasing visibility into manufacturing by process</li> <li>• Optimizing process scheduling and reducing bottlenecks</li> </ul>	<ul style="list-style-type: none"> <li>• Provides real time inventory by process and station with details on how long a part stays within a manufacturing process</li> <li>• Enables lean production by helping to maintain equipment, schedule resources and route material in real time</li> <li>• Provides historical information on the product both upstream tracking parts that make the product and downstream detailing location of products containing a certain part</li> </ul>

Overview

To minimize production downtime, companies carry high buffer inventory and store them at points of assembly not only locking working capital but also valuable factory floor space. Since the current barcode infrastructure provides limited visibility and is not suited for various manufacturing environments, companies are looking at ways to reduce the work-in-process inventory they carry on their manufacturing floor.

Solution Benefits

KeyTone's production inventory solution provides accurate item level WIP inventory information in real time enabling enterprises to reduce overall inventory, prevent process starvation and move work away from bottleneck resources.

KeyTone's solution easily compliments the existing manufacturing execution system and factory information systems by significantly increasing the reliability, accuracy and robustness of real-time inventory information. The solution provides operational business intelligence by determining production velocity including inventory available to the process and to the next process in the route that help enterprises improve their costs, quality, flexibility and speed of execution.

KeyTone's solution offers the enterprise the ability to:

- Reduce work-in-process inventory to achieve lean manufacturing and reduced costs
- Accurately determine process bottlenecks resulting in increased yield and OEE - For example, an additional machine can be added in parallel to increase the throughput capacity.
- Identify non-value adding activities that will decrease cost - Non-value adding activities may include rework, waiting, testing and inspecting, and support activities.
- Optimize the manufacturing process enabling the improvement of one or all process performance measures.

Inventory Management Reports

Process reports around production inventory include:

- Inventory by product
- WIP Inventory Transaction History by process
- Non Lot Inventory History by product
- Shipping Inventory by product
- Non Lot Scrap by product
- Lot Report By station
- Lot History by process

# KeyTone Defect Tracking Solution



Business Challenges	KeyTone Benefits
<ul style="list-style-type: none"> <li>• Catching defects through process monitoring in real time</li> <li>• Operator error proofing</li> <li>• Reducing the overall scrap generated during manufacturing</li> <li>• Predictive defect reduction</li> <li>• Real time validation of product routing within the manufacturing process</li> <li>• Defect root cause analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Provides the ability to automatically ensure only the right products are being processed for the defined manufacturing process</li> <li>• Provides the ability to increase yield and reduce scrap by enabling products to be reworked at the point of failure</li> <li>• Provides the ability to track defects by process and material providing the ability to identify problem areas in manufacturing</li> <li>• Eliminates assembly errors by assuring correct setup and that production routes are enforced</li> <li>• Provides details on the type of defect and the point of failure driving to identifying areas where defects occur.</li> </ul>

Overview

Discrete manufacturers are faced with the difficulty of tracking defects and change requests within a complex product. Defects are often logged against the whole product though they apply to a particular sub component that requires rework. Tracking defects and resolving these issues without a capable system leaves room for process failure, lower yield and higher scrap. Traditional factory automation systems can only track productions by the lot which might contain thousands of identical items which cannot be identified individually – leading to defects being tracked by lot and not by individual items.

Solution Benefits

KeyTone's defect tracking solution captures defect data of every product, by station, by time of process deviation. The availability of this information in real time empowers line supervisors and factory managers to rework defects at the point of occurrence considerably increasing first pass yield and quality. For discrete manufacturers the KeyTone solution not only supports best practices in production but also in test, repair and non-conformance handling. KeyTone's solution offers the enterprise the ability to:

- Identify where the most common defects occur to enable process change that will reduce defects
- Identify the source of defects to be able to determine the root cause of the defects - be it part of the manufacturing process, human resource or environment
- Quarantine defective parts at the point of failure to prevent defective parts from continuing through the production line
- Automatically notify process owners when a defect is detected to enable real time decision making at the process level

Defect Tracking Reports

Process reports around defect tracking include:

- Inventory by product
- WIP Inventory Transaction History by process
- Non Lot Inventory History by product
- Shipping Inventory by product
- Non Lot Scrap by product

# KeyTone OEE Tracking Solution



Business Challenges	KeyTone Benefits
<ul style="list-style-type: none"> <li>• Determine machine utilization</li> <li>• Determine process tool throughput</li> <li>• Increase yield without increasing capacity</li> </ul>	<ul style="list-style-type: none"> <li>• Provides details on the operating conditions of tools to determine the overall operating time of tools and the throughput associated with the tool</li> <li>• Provides the ability to determine the actual output of a process tool over time to determine the expected throughput under normal operating conditions</li> <li>• Provides details on the difference between reality and the ideal to help identify the sum of the losses and, consequently, provide focused areas where there is 'room for improvement'.</li> </ul>

Overview

If all machines were perfectly balanced in terms of production rates and capacities, calculation of line OEE would be simple. But perfectly balanced production lines are rare and do not represent the real picture in most plants. Most manufacturing plants do not contain a straight line process with a part traveling from one machine to the next in perfect harmony with all other machines. Processes are usually complicated, with machines in series and parallel, and they usually include side processes.

Solution Benefits

The KeyTone solution collects WIP data at all stations both at the beginning of a work process and at the completion of the work process. In addition to the WIP data collected at every station, the solution also captures the equipment state. This real time WIP data capture combined with the equipment state provides the ability to accurately monitor equipment utilization and productivity

- Identify the overall equipment effectiveness of all processes and tools within the factory to improve yield
- Identify individual tool MTBF and MTBA specifications to determine optimization that will increase process tool throughput while reducing program management
- Identify lean periods within the manufacturing cycle to better optimize production scheduling to increase OEE

Defect Tracking Reports

KeyTone provides operational business intelligence through web based dashboard and more than 30 pre-defined reports.

- Real-time Equipment Status
- Equipment Utilization
- Equipment Reliability
- Equipment Availability
- Equipment THROUGHPUT
- Equipment MTBF
- Equipment MTBA

# Manufacturing Business Analytics



## Overview

Intelligent manufacturing is achieved through identifying the overall effectiveness of the manufacturing operations – from the shop floor through to the top floor. Tying machine level data to inventory and batch level production mandates will provide a holistic view of the entire manufacturing operation.

Transforming the real-time, historical and business data collected during production activities through the KeyTone SmartWIP platform will provide the synergy between intelligence and execution – the ability to take decisions based on intelligent manufacturing data.

The responsiveness and agility that organizations can realize through analytics on the data collected through SmartWIP during manufacturing will prove to be invaluable in increasing yield and achieving six sigma objectives.

## Production Management Analytics

Production management analytics tracks all aspects of the manufacturing production. Developed for management it will provide historically accurate records as well as real-time information of the production process including details of defect tracking and complete product genealogy. In doing so it will enable the communication of real-time manufacturing data from the shop floor to the decision makers when they need it.

- **Business risk management** - allowing backward and forward traceability of any given serial number or materials purchased from a vendor, permitting manufacturers to monitor the entire history of materials used to produce a product
- **Inventory management** – allowing the tracking of all inventory both in WIP and in pre-production
- **Scrap management** – enabling personnel to track the efficiency of production and estimating the cost of quality through the production process
- **Quality Assurance** - enabling personnel to track a consistent output of sensible quality to help ensure that products are built with the right materials in the right processes

### Example Metrics

- Lot History, Production Inventory by product, WIP Inventory by process, Non Lot Inventory by product, Shipping Inventory, Non Lot Scrap by product

# Manufacturing Business Analytics



## Production Performance Analytics

Production Performance analytics addresses the need for accurate real time asset performance analysis on the plant floor, thereby speeding up the decision making and planning processes. The information made available assists in the achievement of world-class manufacturing practices by clearly identifying downtime duration and reasons, generation of production performance against plan reports, calculation of quality performance and monitoring overall equipment effectiveness.

The fundamental data elements of performance management analytics are derivatives of manufacturing Key Performance Indices (KPI). These elements of information define the important operational factors of the machine, production line or manufacturing process.

- Optimize throughput even in high-mix conditions by using the real time validations of the products by station
- Cope effectively with change by automatically viewing the impact of a process change within the production process
- Tighten your grip on shop floor execution by using the real time alerts and process monitoring through the intelligence dashboards

### Example Metrics

- Production Rate Performance, Asset Yield, Asset Utilization and Overall Equipment Effectiveness. Equipment Utilization, Equipment Reliability, Equipment Throughput, Equipment MTBF, Equipment MTBA, Total defects by tool, Total rework by process, Total rework by tool, Defects by lot and Defects by product

## Manufacturing Operations Analytics

Manufacturing process analytics enables the improvement of overall profitability and effectiveness in manufacturing operations by providing information on several critical, interrelated areas of production. These areas include the ability to better utilize plant assets (such as people, equipment and materials) through a single or multi-site view of overall equipment efficiency.

- Enable route validations to ensure there are no deviations from the determined process routes within the production environment
- Perform real time data validations on all products. Lots and products that pass preset tolerance thresholds can automatically move to the next process step
- Analyze production information and get to the root cause of issues to rework products in real-time to increasing first pass yield and your cost margin

### Example Metrics

- Equipment status, Equipment availability, Lot Report By station, Defects by tool, Lot Inspection History and Process validations

# KeyTone SmartWIP Platform Overview



The SmartWIP platform has been developed on Microsoft technologies as a service oriented architecture. The SmartWIP platform integrates seamlessly with existing legacy applications and with factory floor automation software such as an MES.

**Rapid implementation** - SmartWIP is easy to deploy and its configuration tools make it very easy to customize specific features to support a given manufacturing process. Its operator interfaces are intuitive and with the powerful SmartWIP's Simulator, companies can now reduce the time to pilot by RFID enabling any process quickly.

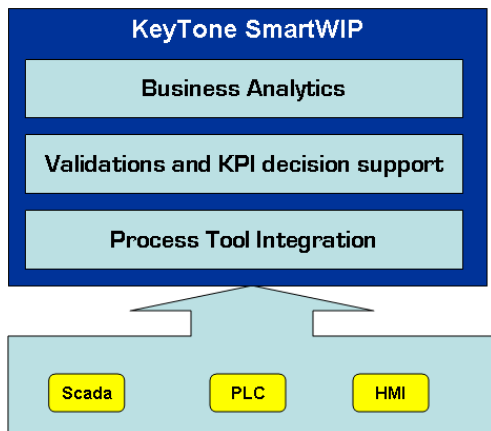
**Standards support** – SmartWIP support industry standards for data and process integration. Including Semi E-10 standards for tool state management and Web Services for data integration to enterprise systems.

**Architecture** – SmartWIP supports integrated web reports and robust analytical capabilities for real time control of production operations. The Web Services Framework and APIs support real-time communications with enterprise systems regardless of data format or platform.

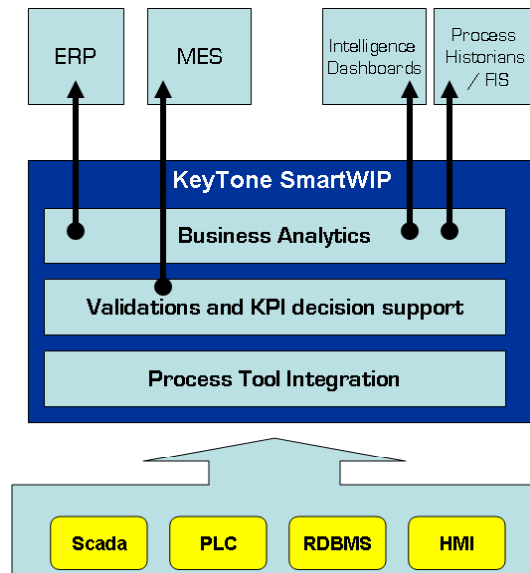
**Scalability** - SmartWIP supports the ability to deploy the solution across a single process line and scale the implementation to support multiple manufacturing lines. The distributed architecture of SmartWIP enables tool level WIP tracking across the factory floor, relieving data validation bottlenecks while performing load balancing. Advanced data caching capabilities enable seamless transfer of validations, lots and lot history between distributed clients and centralized data stores.

SmartWIP – Overview

## SmartWIP – Stand Alone Configuration



## SmartWIP – Integrated Configuration





To learn more about how the KeyTone's Intelligent manufacturing solutions can help increase your manufacturing efficiency and visibility, contact us at 888.816.0727



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