

Workflow - Implementing Operator Based Procedural Control

This white paper provides a summary of the use of workflow software systems to implement procedural control of operator executed procedures.



Table of Contents

Introduction.....	3
Manually Executed Procedure – The Gap in Process Control.....	3
Inefficiency of Paper Operations.....	4
Workflow and Process Control Provides a Complete Solution.....	5
ISA95, a Framework for Integrated Operations.....	7
Conclusion	10

Introduction

Process control and batch automation deliver capabilities for repeatable and consistent manufacturing. While these technologies are best in class, they only apply to equipment and processing steps that are controlled with instrumentation and valves. What about processes that include significant processing and information recording that are manually performed by operators? In many facilities, the production order is created as a paper document and is executed by the operator coordinating a series of manual and automated procedures, following a written procedure and documenting by hand the steps that were executed as well as critical quality data onto the paper record.

Emerson has extended its award winning PlantWeb digital architecture to include production workflow operations with its Syncade Smart Operations Management Suite. The purpose of this white paper is to describe the need, application, and value of implementing production workflow in tandem with traditional process control to provide overall procedural control for processes that include significant operator executed processing steps.

Manually Executed Procedure – The Gap in Process Control

In today's market, process manufacturers experience relentless pressure to improve operations. The challenges include globalization that is forcing facilities to become more and more efficient. Customers continue to increase expectations for quality and on-time delivery. As the workforce ages and retires, experience is lost, and government regulation from OSHA, FDA, EPA, and others bring ever increasing burdens for compliance.

Process control and batch automation have been the traditional strategies to assure manufacturing efficiency, consistency, quality, and productivity. However, the benefits of process automation are limited to that part of the manufacturing domain that is controlled with instrumentation and valves. Other operations that typically are not automated with process automation include:

- Moving materials from the warehouse to the manufacturing floor
- Material additions to the process (solids additions)
- Weighing operations
- Equipment preparation and cleaning operations
- Changes to equipment configurations
- Entry of set points into the process control system
- Initiation of process control sequencing
- Taking samples
- Manual calculations
- Recording critical process parameters into production record documentation
- Recording lot numbers of raw materials used
- Operator and supervisor signoffs on critical processing steps

These are just some examples of production activities that may be performed by operators in the production process. The impact of manually executed activities within a production process is an increase in the opportunity for error and an increase operating costs.

Inefficiency of Paper Operations

Controls for the execution of manual procedures are traditionally defined by Standard Operating Procedure (SOP) documents and verified by recording work activities on paper forms as part of the production record. Managing production, quality, material, and maintenance operations with paper procedures production records limits manufacturing efficiency for the following reasons:

Table 1 Paper Inefficiency Vs. Business Impact

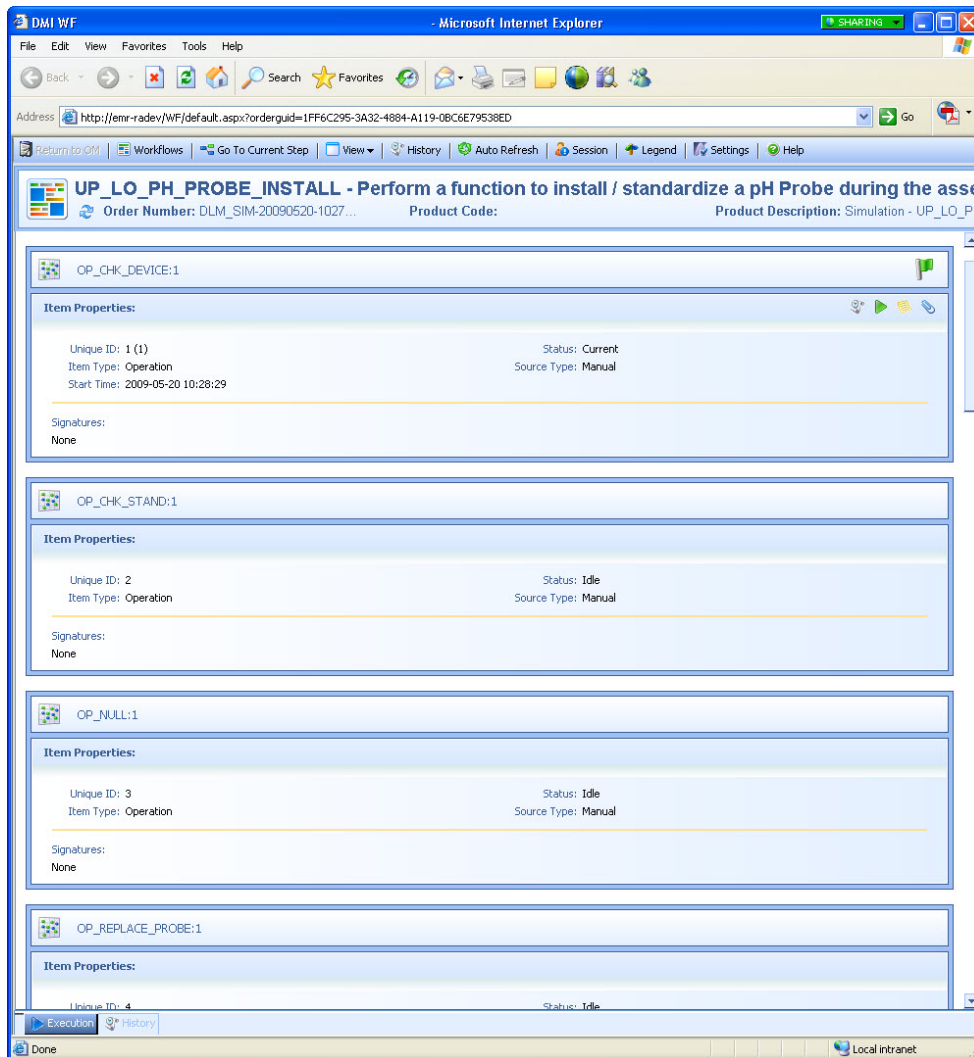
Paper Inefficiency	Business Impact
Coordination of people and information	Reduce productivity, cause delays
Execution of paper-based procedures	Operator error impacts quality, capacity utilization and productivity
Paper documentation of production data	Error prone, loss of productivity, typically needs to be transcribed between systems, results in inaccurate recording of production information
Paper-based material accounting with post production entry into ERP Inventory System	Inaccurate inventory results from latent data entry and data entry errors; can result in either excess inventory or inventory shortages
Transcribing information between computerized systems and paper documentation	Error prone, lost productivity
Paper-based tracking of production status	Limited visibility of shop floor activity creates inefficient planning and reporting activities
Paper-based production tracking can result in poor coordination of the production process	Production delays reduce capacity utilization
Paper-based maintenance management	Delays in work order execution, inability to implement predictive maintenance
Asset performance information is collected in paper log books	High maintenance costs resulting from the inability to analyze asset performance
Paper-based quality management slows production release for shipment	Excess inventory is needed to meet customer shipments
Material usage on the plant floor is documented on paper	Post-production entry of material use into ERP is error-prone and adds latency to accurate inventory management
Actual time to perform process operations is difficult to document	Use of “standard labor” hours for labor accounting results in inaccurate understanding of labor costs.

Workflow and Process Control Provides a Complete Solution

Process control used in combination with electronic workflow, provides a complete solution for process manufacturing to maximize “right first time” performance and manufacturing efficiency. Process control systems (PCS) provides computerized control for those aspects of the process controlled with instrumentation and valves, and the workflow addresses control for those parts of the process that need to be executed by the operator.

A “workflow” is a computerized procedure that is presented to the operator and enforces a sequence of steps that the operator must perform.

Figure 1 Example of an Electronic Workflow



A workflow is an electronically executed manual work process. Paper procedure documents may be replaced by a web browser that dispatches step-by-step procedures to an operator. Workflows provide the following benefits over paper procedure documents.

Table 2 Capabilities of Electronic Workflow

Capability	Benefit
Procedure Execution	Workflows replacing paper Workflows provide step-by-step guidance / enforcement of procedures to assure they are performed correctly, reducing or eliminating errors in the performance of manual procedures.
Data Entry and Validation	Required data entry can be enforced, and data values can automatically be compared to their allowed tolerance ranges, and therefore out-of-range process values may be flagged in real time
Writing Data Parameters	Data values may be written to other systems such as the process control system. For example, if a manufacturing procedure requires a series of set point changes, these can be written from the workflow to the PCS. Paper-based procedures require the operator to read the value from the paper procedure and type them into the PCS, creating the opportunity for error.
Reading Data Parameters	Data values may be read from other systems such as the process control system. For example, if a procedure requires critical process values to be recorded, these can automatically be read from the PCS into the workflow document, eliminating the need for the operator to manually record the value. This increases productivity and reduces the opportunity for error.
Production Coordination	Workflows coordinate manual work procedures with other systems. The overall manufacturing procedure typically must be coordinated with material, quality and production activities. A workflow can be used to coordinate all activities related to a releasable lot of production.
Operator Calculations	Manual operator calculations can be eliminated increasing productivity and reducing error
Material verifications	Using bar code scanners for material verification increases productivity and eliminates error
Equipment Verifications	Using bar code scanners for equipment verification increases productivity and eliminates error

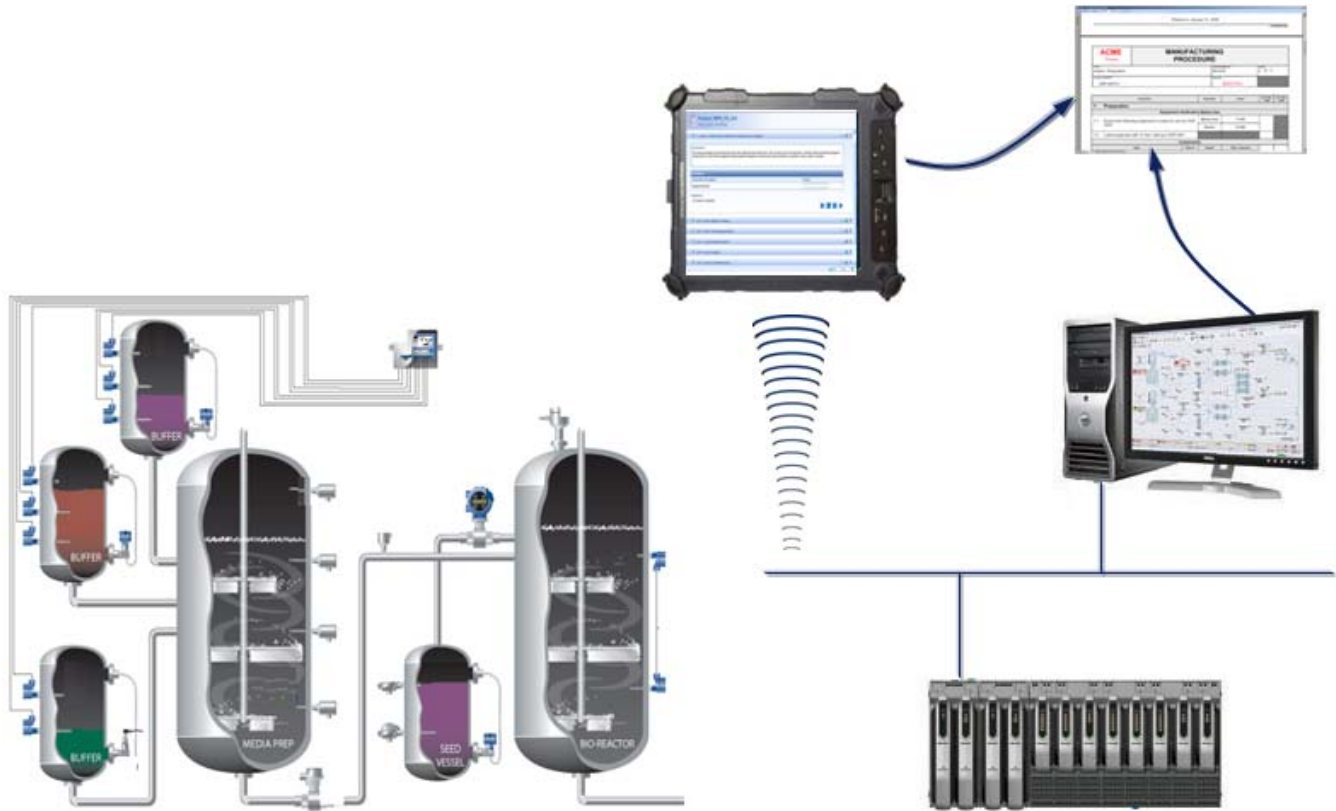
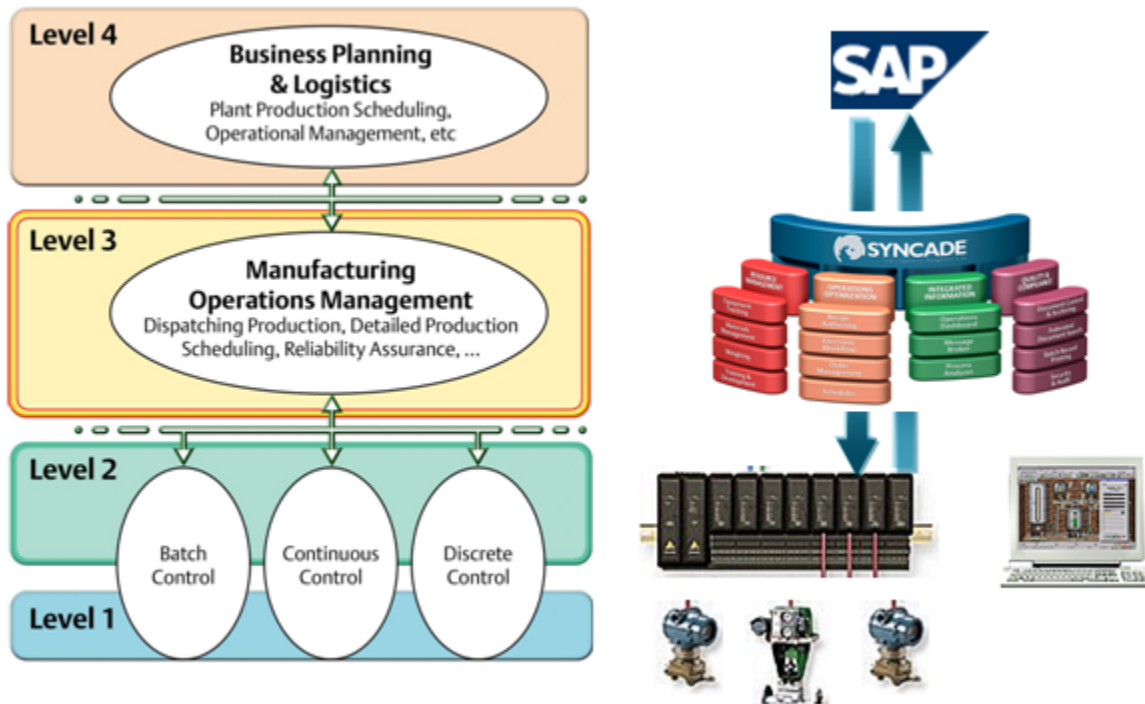


Figure 2 Workflow and Process Control Coordinate Production Management

ISA95, a Framework for Integrated Operations

World class process manufacturing companies are transforming from inefficient paper-based operations management to highly efficient, coordinated, integrated, computer-based production, materials, and quality management. This transformation is enabled by investing in Operations Management systems and integrating these systems with the other strategic manufacturing systems. ISA95 (www.isa-5.com/subpages/technology/isa-95.php) defines a systems architecture standard to provide guidance for the implementation of a digital manufacturing by implementing integrated software systems to eliminate paper-based processes. Figure 3 provides a brief summary of the ISA95 manufacturing systems model and typical systems available for each level. Level 0 references the process, level 1 references instrumentation, level 2 references control and supervision, and level 4 references the business planning and logistics. Level 3 is defined for Manufacturing Operations Management and represents the least automated area of the ISA95 model and is managed by paper in many process facilities.

Figure 3 ISA95 Model and Systems Reference



Process manufacturers have for the most part invested in electronic systems for process measurement, control, supervision, and the enterprise resource planning functions. Investing in electronic systems for level 3, manufacturing operations management, has lagged largely because the systems available for meeting the Operations Management functions have required a high degree of customization and have been costly to implement and own. This has now changed with the availability of cost effective, configurable, web-based, standard product solutions for Operations Management. Emerson’s product for operations management is Syncade Smart Operations Management Suite. (www.emersonprocess.com/syncade)

The process industries are now transforming from paper-based to electronically executed manufacturing operations in order to increase production efficiency and quality. Configurable solutions are now available to manage process plant production, quality and maintenance activities. Syncade Smart Operations Management Suite provides software to manage process manufacturing operations and functions complimentary to the process control layers (ISA95 levels 1&2), providing solutions for material tracking, order management, manufacturing procedure workflow, systems integration and data visualization, and document management.

Figure 4 Syncade Smart Operations Management Suite Applications



In addition to changes in the economics of operations management software, the advent of wireless plant network solutions has also made implementation more practical. Many operations are performed by plant workers at the process unit. The mobile nature of this work has made the use of a paper on a clip board the traditional medium for controlling the execution and documentation of plant floor operations. Emerson now offers Wireless Plant Networks (see www.emersonprocess.com/smartwireless) that enable workers who are mobile within the process plant to perform and document work procedures interactively with a wireless terminal.

Figure 5 Emerson Wireless Mobile Worker Device



The wireless mobile worker terminal is well suited for industrial environments and is available with a class 1 Div II electrical classification and can include bar code scanners for use with the operations management software.

Conclusion

Electronic workflow can be used to replace paper production orders and tickets to manage production activities on the plant floor. Electronic workflow provides procedural control over activities and greatly aids in “right first time” performance, production efficiency, and quality.

Better quality can be expected from reducing errors and the cost of quality can be reduced with fewer deviation investigations and exception reports. Because quality is improved and fewer errors are made, faster quality assurance review and approval can be expected.

Better “right first time” rates increase productivity and reduce waste and rework. Higher capacity utilization is realized through increased visibility to the plant floor and improved cycle times.

The following summarizes the benefits of electronic manufacturing operations management:

- Reduced operator errors
- Better production coordination
- Better inventory management
- Faster cycle times
- Increased productivity
- Higher capacity utilization
- Reduced working capital
- Improved right first time rates
- Less waste and rework
- Better quality, lower cost of quality
- Improved compliance

Evaluating investment in software systems for operations management should begin with establishing business objectives and then developing a business case for investment. Emerson consultants can help with overall investment assessments and business case development.

Contact Emerson at Syncade@emerson.com for more information on how Emerson can help you develop a strategy to streamline process manufacturing.

To locate a sales office near you, visit our website at:

www.EmersonProcess.com/syncade

Or call us at:

Asia Pacific: 65.777.8211

Europe, Middle East: 41.41.768.6111

North America, Latin America: +1 800.833.8314 or
+1 512.832.3774

For large power, water, and wastewater applications

contact Power and Water Solutions at:

www.EmersonProcess-powerwater.com

Or call us at:

Asia Pacific: 65.777.8211

Europe, Middle East, Africa: 48.22.630.2443

North America, Latin America: +1 412.963.4000

© Emerson Process Management 2009. All rights reserved. For Emerson Process Management trademarks and service marks, go to:
<http://www.emersonprocess.com/home/news/resources/marks.pdf>.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein or their use or applicability. All sales are governed by our terms and conditions, which are available on request. We reserve the right to modify or improve the design or specification of such products at any time without notice.



www.emersonprocess.com/syncade

