

Batch Process Skid Solutions (Mixing & Blending skid)

Mixing & Blending Control System Solutions for OEMs



This paper takes a closer look at the Batch Process Skid Solution for Process OEMs

This paper provides an overview of how Mixing & Blending Templates can be applied to batch control helping OEMs save engineering time while complying with S88 standards.

LISTEN.
THINK.
SOLVE.®

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Executive Summary

As a process equipment builder, you are challenged to differentiate yourself amidst global competition and rapidly evolving technology. Process applications demand equipment that combines high production output, consistent reliability and product quality with low manpower requirements and maintenance costs. Flawless product quality is key a priority.

Whether measured from a business, commercial or technical perspective, Rockwell Automation can help improve your process equipment performance with solutions and services to lower the Total Cost to Design, Develop, and DeliverSM equipment that meets your customers' requirements.

Lower your Total Cost to Design, Develop and DeliverSM process equipment with Rockwell Automation Solutions

What may start as an "order-by-order" relationship, can eventually develop into a mutually beneficial business partnership because we strive for a holistic approach that focuses on your equipment and business performance.

The ANSI/ISA-88 (S88) design standard for batch process control has become the default standard in North America and Europe – and is rapidly gaining acceptance in Asia – within the food, beverage and life-sciences industries. Skid-based batch equipment that complies with the S88 standard provides many benefits for end users, enabling them to:

- Bring conformity to the naming procedure and help expose necessary data.
- Isolate their equipment from recipes for easier maintenance.
- Recover from abnormal events using set guidelines and a standard set of states.
- Simplify the collection and communication of customer requirements using common terminology and models.
- Validate procedures and equipment independently for faster startups.
- Reuse recipes and equipment phases to reduce costs.
- Track historical data.

End users consistently stress the importance of access to all process parameter data in order to create a blueprint of what is going on in the production process. Many skid builders provide only the product code and batch number with their skids, which is only as helpful as having a corner of a map. The manufacturing order, the campaign lot number and a lot of other product-context information is just as important to the production process. When not provided, users must add, modify or clear out codes to integrate the equipment skids.

When you follow S88 standards, your customers benefit from immediate access to valuable product context information, such as remote commands and process tracking data. In addition, helpful status parameters such as skid performance, clean-mode status, or sterilization, can also be easily addressed.

Executive Summary (Continued)

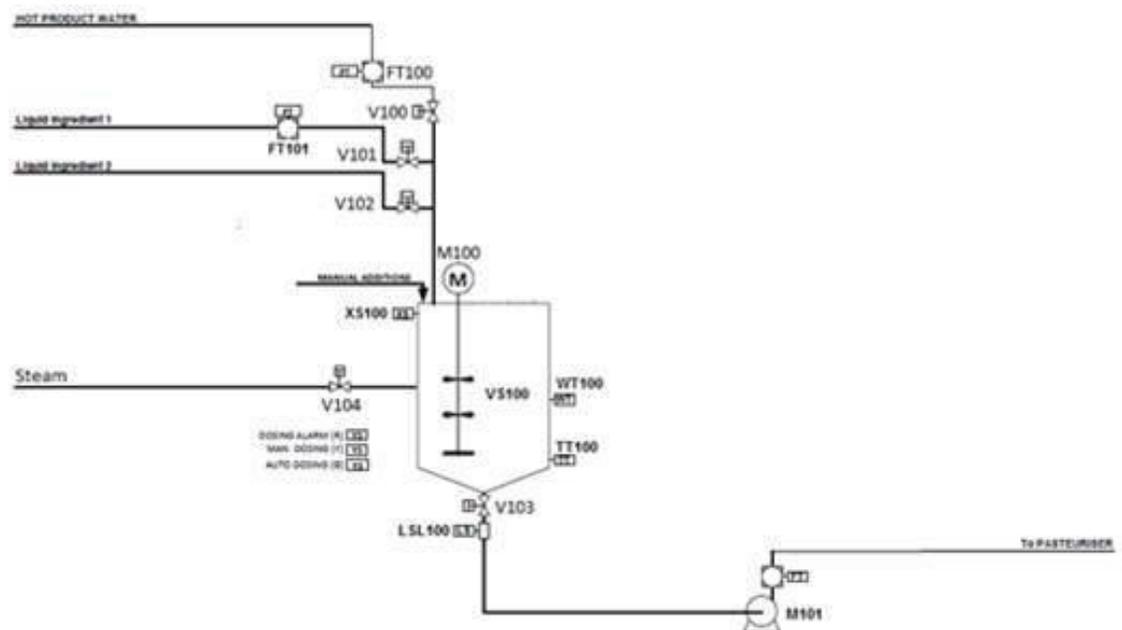
Product context information helps create a shared framework between equipment skids and the rest of the production process. This programmed relationship is extremely valuable for troubleshooting purposes, since quickly resolving or avoiding production issues can save an end user substantial amounts of money, and in some cases, such as with high-value batches, it could save several million dollars. Rockwell Automation will work with you to develop solutions that may give you a competitive advantage throughout your machine's life cycle.

<i>Design</i>	<i>Develop</i>	<i>Deliver</i>
<ul style="list-style-type: none">• <i>Design Productivity</i>• <i>Extensible Engineering</i>• <i>Scalability</i>• <i>Global Standards</i>• <i>Risk Assessment</i>• <i>Design for Sustainability</i>	<ul style="list-style-type: none">• <i>Time to Market</i>• <i>Supply Chain Efficiency</i>• <i>Safe, Flexible Equipment Models</i>• <i>Simplified Integration</i>• <i>Design Optimization</i>	<ul style="list-style-type: none">• <i>Commissioning</i>• <i>Global Service & Support</i>• <i>Safety, Reliability & Quality</i>• <i>Equipment Performance</i>

Introduction

Mixing and Blending vessels are commonly used in the Food, Beverage, Pharmaceutical ingredient manufacturing process, often as one of the first few production steps to mix the raw materials which could be liquid or solid, then transfer out to the subsequent production process.

Mixing and Blending vessels usually consist of one or more raw material inlets, controlled by weight or flow, one or more final material outlets, agitation system, heating/cooling system, CIP/SIP system, and auxiliary devices such as level transmitter, weight scale.



For this process we determined 1 unit and the following 7 equipment phases:

1. Add milk
2. Add water
3. Stir
4. Heat
5. Add liquid sugar
6. Add cocoa
7. Discharge

Mixing and Blending systems usually consist of one or more raw material inlets, controlled by weight or flow, one or more final material outlets, agitation system, heating/cooling system, CIP/SIP system, and auxiliary devices such as level transmitter, weight scale. Single or multiple products may be processed by the mixing and blending system.

Challenges/Trends

Traditionally the design of a control system depended on the end user's requirements. Therefore, all the possible control logic in the PLC depended on the various end users' requirements. Re-engineering, testing and commissioning were required for equipment delivered to different end users resulting in excess costs in time and resources.

By relying on the various end-user requirements, the design and configuration of single device control is also a challenge. It takes time and effort to design a motor/valve/transmitter control block in PLC which is modular, duplicable, contains powerful function, consumes reasonable amount of resource, and more importantly, a respective user friendly HMI faceplate which links to the control block. Additionally, it is more difficult to design a standardized code between device control and sequencing control.

In summary, the traditional way of designing a control system by simply implementing codes according to the user requirement can cause OEMs

- Re-engineering/testing for every piece of equipment delivered, dependency on control engineer resource is high, equipment lead time is long
- Difficultly controlling the quality of code, increasing the chance of errors
- Difficulties transferring knowledge, increasing the challenges servicing/trouble shooting the equipment

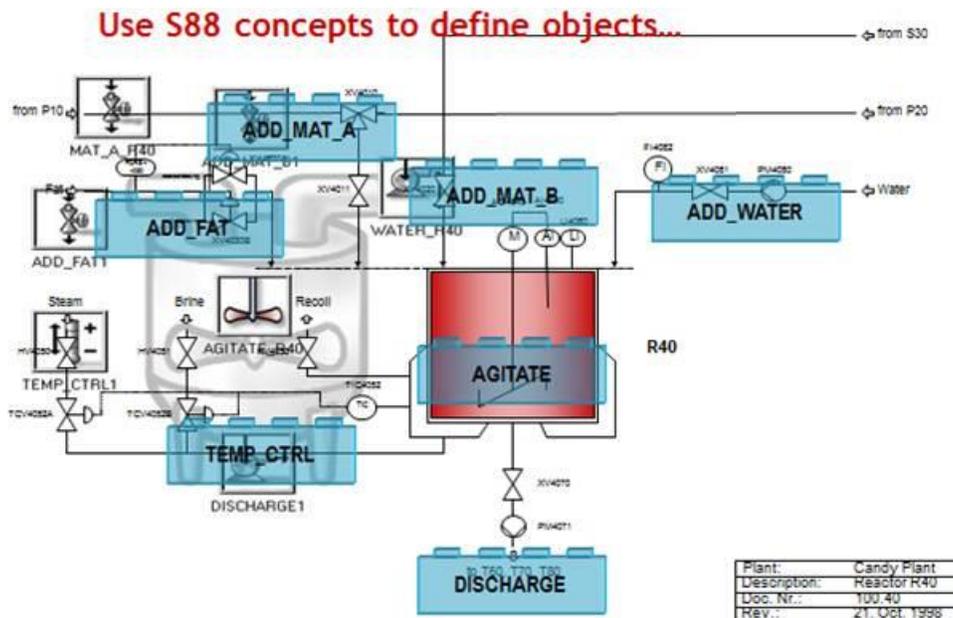
It can also lead to these challenges to the equipment users (manufacturers)

- Integrating the equipment into their production system
- Reducing production quality due to hidden error in the code, especially after logic change
- Difficulties in maintaining and servicing the equipment due to the lack of standardized code
- Decreasing production flexibility, where each and every process change could require re-engineering, re-testing



Proposed Solutions

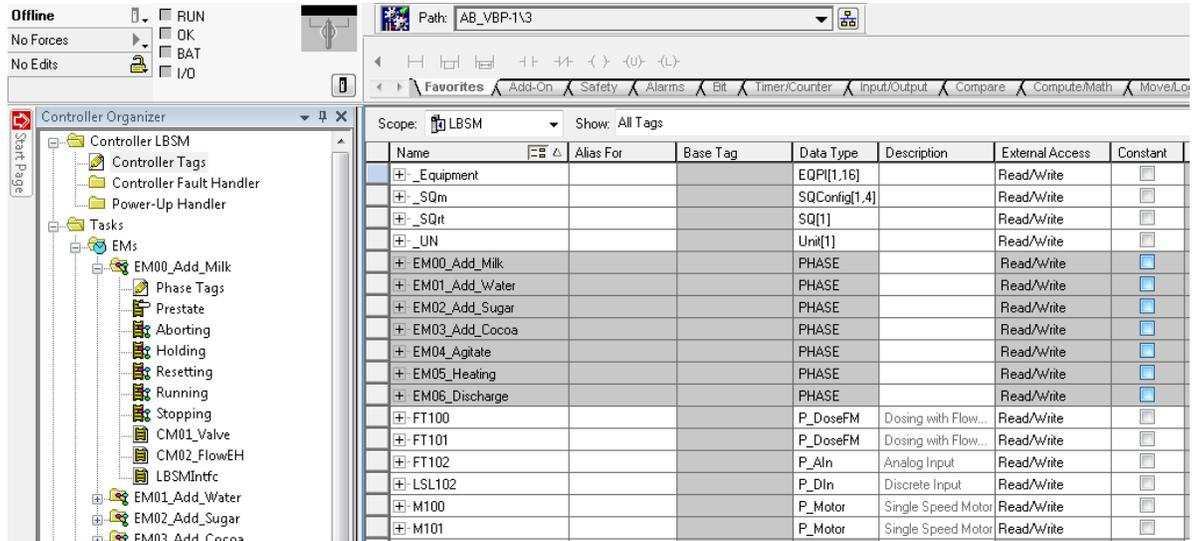
With introducing the S88 Batch concept, devices are configured as control modules, and grouped as equipment modules based on function groups. The logic of each equipment model is configured in Phase, and phase logic doesn't change much except changeable parameters via HMI.



Standard software structure which can be easily replicated and expanded can reduce engineering, commissioning and testing (validation) effort. When programming in a PAC (Programmable Automation Controller) code, only the control module and equipment module level need to be programmed. Depending on the complexity of the manufacturing process, the end user is free to design the process with the combination of phases on recipe level during commissioning and anytime later. Industry trends show there is a growing increase of OEMs and end users requesting S88 compliant software structure because of these benefits. ¶

For a mixing & blending system, Rockwell Automation has developed a sample program (application template) which utilizes several technologies to demonstrate how we can help address these increasing challenges.

Rockwell Automation RS Logix™ 5000 software code structure is S88 batch complaint. The control modules and equipment modules of a mixing & blending system are structured in a clear way. The structure is easy to understand and duplicable to adapt to logic changes.



The control modules use the Rockwell Automation Process Library. The Process Library consists of logic blocks in PLC and faceplates in HMI.

The Rockwell Automation Process Library is designed to maximize design and application development efficiencies while offering enhanced information to the operator. It allows the user to configure a control application using pre-defined objects rather than having to rely on repetitive programming. Each object in the Library consists of a number of elements:

Add-On Instructions for Logix

Graphic Symbols and Faceplate displays for FactoryTalk® View (SE or ME)

- For a variety of valves, motors, pumps, drives inputs, outputs and other devices.
- Supporting instructions for modes, alarms, permissive, interlocks, and statistics.
- Reference Manuals.
- Technical Support.

Process Library Benefits

- Eliminates the need for OEMs or system integrators to perform similar labor intensive work to develop basic individual equipment control elements.
- Tested blocks/faceplates,
- Comprehensive functions fulfill automation requirements of most industry applications.
- Standardized programming.

The phase logic for equipment modules and links to control modules are the only items that need to be programmed in the PAC. The remainder of the code can be managed by recipes. The recipes decide the sequence of all phases which has to be combined and executed according to the production requirement. This enables the OEM to deliver the standard mixing & blending system with a recipe manager in the human machine interface (HMI). The configuration and design of recipes can be done at later stage during commissioning to reduce the time to market for equipment. This process also enables the end user to change the recipe without involving the control engineer – making flexible production a possibility.

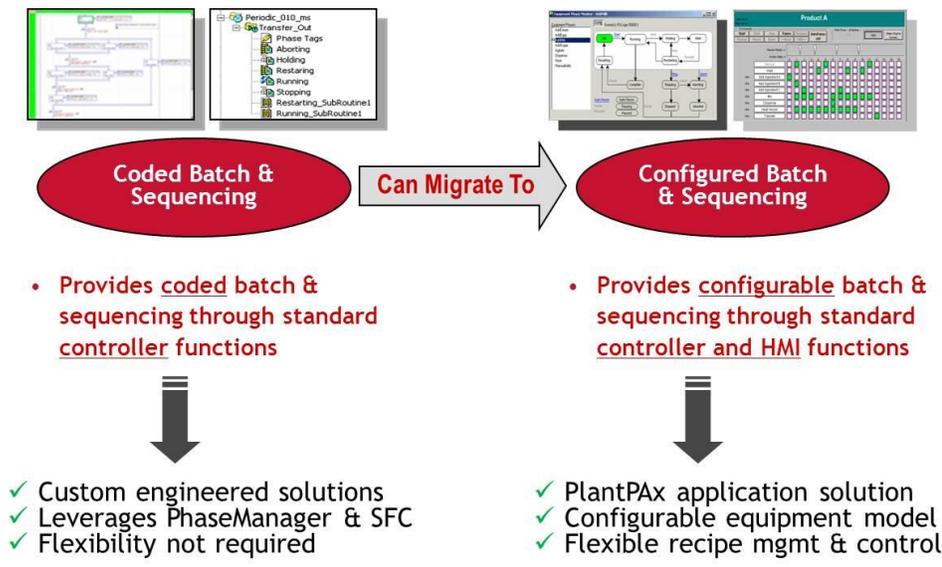
As “one size does not fit all” when it comes to batch and sequencing, Rockwell Automation offers a scalable solution through its Logix Batch & Sequence Manager. This flexible, controller/Human Machine Interface (HMI) based batch & sequencing solution is independent of application servers and software.

Sequences and formulas can now be configured directly in the controller through a standard HMI interface without requiring code changes to the system. It is ideal for applications that require sequence management capabilities, but are not complex enough for a server-based batch software package. It uses the same configuration, networking and visualization environment as Rockwell Automation’s larger-scale systems, enabling local single unit supervision and control, while supporting multiple, independent units in a single controller.

OEMS, system integrators and end users now have cost-effective options when integrating into a plant-wide control system.

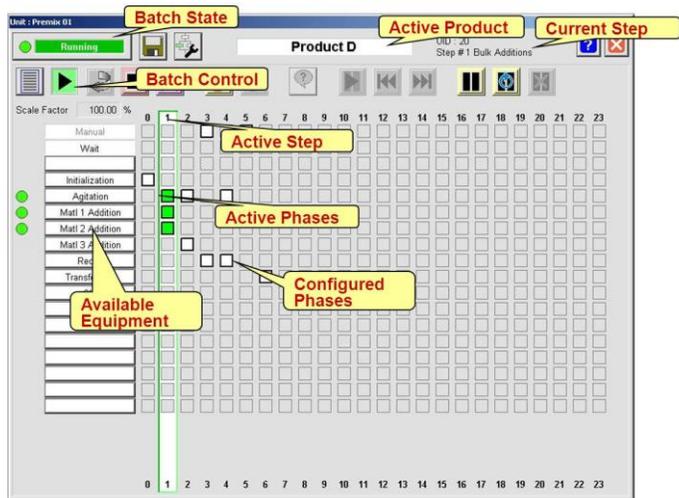
- Configurable equipment model in the controller (ie. equipment name, inputs, outputs)
 - Flexible recipe management (i.e. formula, procedure, equipment)
 - Enables single unit supervision & control, yet supports multiple units in a single controller
 - Procedural control following ISA-88 state model (running, holding, stopping, etc.)
 - If desired, Leverage Logix Phase Manager technology above and below the engine
 - Use FactoryTalk Batch to coordinate controller operations and unit procedures
 - Use Logix Batch & Sequence Manager to sequence and control phase
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Logix Batch & Sequence Manager



Basic capabilities allow you to start small and expand if needed

LBSM Intuitive Runtime Operation



LBSM Benefits

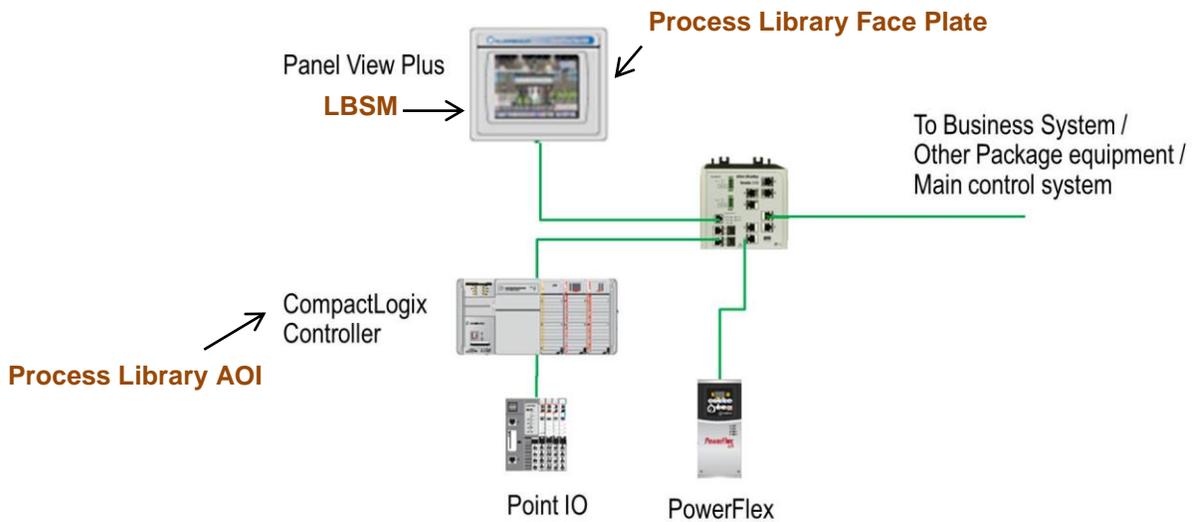
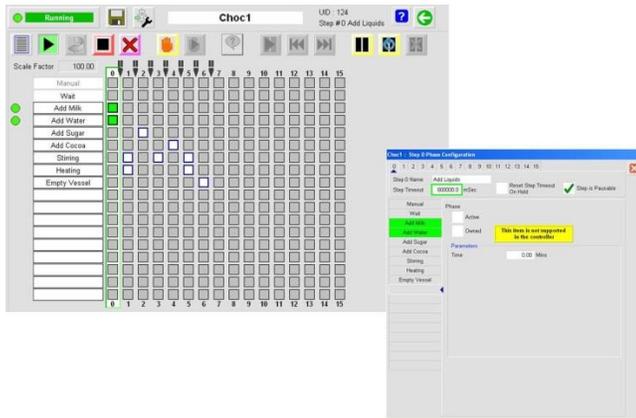
Competitive PAC based batch solution, no cost for PC, batch server license and other DCS architecture

- Reduces engineering costs and delivery time by providing a single process control solution independent of end user preference for stand-alone or integrated control
- Eliminates the need for costly, engineering-intensive custom coded sequence management solutions
- Reduces startup and process validation time by enabling integration into higher level batch and sequence management software systems.

With utilization of RSLogix™ 5000 software, LBSM as recipe manager, and Process Library for control modules, the fresh design of Mixing & Blending systems can address the challenges of OEMs and End Users.

- Utilization of Process Library objects, saves engineering and testing time, achieves standardization
 - S88 compliant code structure with clear demonstration of control modules and equipment modules fulfills the compliance requirement, eases replicable programming and , increases production quality
 - PLC managed phases enables recipes to be managed in by process engineers in the recipe manager (LBSM and reduces engineering/testing/validation time.
 - Recipe changes without involving PLC code changes speeds time to market and enables flexible production
 - Overall system performance increases
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The Mixing & Blending application template illustrates a unique solution for process equipment in Batch applications from Rockwell Automation. This technology can be applied to a mixing system, blending vessel, fermentation skid, CIP skid, fluid bed drying equipment, liquid preparation system, and other batch applications.

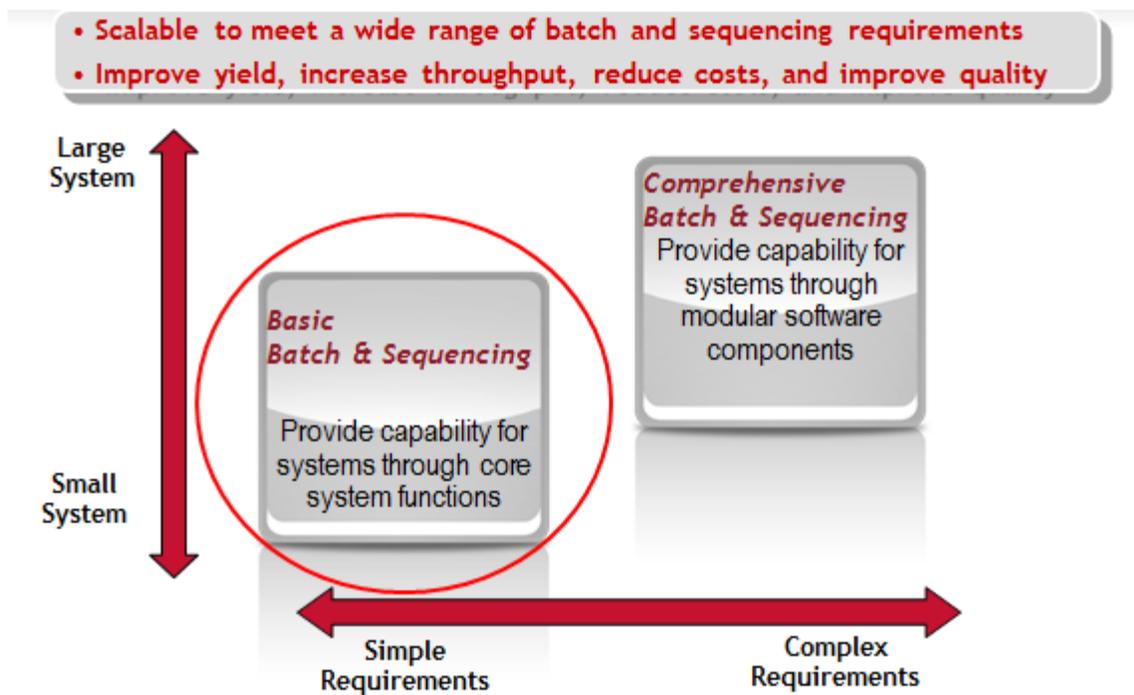


Logix allows configuring both the controller and device simultaneously using one software package, RSLogix™ 5000, to help eliminate configuration mismatch errors. Configure devices in a single project file that you can download to your controller for easy replacement or restoration.

The networks in our Integrated Architecture system — EtherNet/IP, DeviceNet, ControlNet — all share a common protocol, the Common Industrial Protocol. This enables open access to real-time

information with no additional programming or routing. Integrated Architecture networks support real-time control, device configuration, data collection and bridge power.

Furthermore, when a turnkey solution is required for entire plant control and recipe management is required, Rockwell Automation can offer a flexible batch solution. Basic batch & sequencing can be handled by LBSM while comprehensive batch & sequencing can be handled by FactoryTalk Batch Manager. The Phase logic in the PAC can be reused to make a truly scalable batch solution.



Global Solutions – Locally Delivered

Whether you're around the corner or around the world, our Services & Support network can provide the skills and resources you need to optimize performance and utilization of your automation equipment, helping you meet your business objectives.

- Global emergency support 24/7
- Offices and agents in more than 80 countries
- 35,000 distributors and agents
- 1000 service engineers, consultants and project managers worldwide

Summary

Skid integration for process control systems can consume up to 50 to 70 percent of a project budget, making it a prime target for system improvements. However, streamlining the integration process can be quite challenging, as skid builders typically expose commands, data and alarms in languages unique to their company. Differences like this can be challenging when integrating skids and bringing a factory together. To reduce skid-integration costs, skid builders must define how to communicate and tie skid commands, data and alarms together. This will help reduce the time it takes to configure equipment for a process plant and significantly reduce integration costs for the end user. Mixing & Blending application template is a clear illustration of how LBSM and Process Library from Rockwell Automation can address issues from OEMs and end users. This solution provides benefits such as reduce engineering and commissioning time, standardized S88 compliant code which is easily replicable, easy to trouble shoot, and flexible production. Data, alarm and parameter integration can be extended much easier with S88 compliant programming.

Customer Case Study

Jurag Separation A/S takes advantage of scalable batch with from Rockwell Automation

Jurag Separation A/S is specialised in developing, designing and delivering electro-membrane processes for the pharmaceutical-, biotech-, food and feed ingredient industries etc.

The company wanted an automation supplier that could offer a modular system and programming environment that would satisfy & customize to the current and future needs of its customers.

Jurag opted for an Allen-Bradley® Logix based platform, Logix Batch and Sequence Manager (LBSM) which uses library components from the company's industry-leading PlantPAX® process automation and control suite that consisted of cGMP and S88 capabilities.

This subsequently led to the development of Jurag's patented 'Reverse Electro-Enhanced Dialysis' (REED) technology. The technology used unique electro-membrane separation technology, which is able to solve complicated separation steps – resulting in significantly increased production yield.

Results of Implementing a Rockwell Automation Solution

Open Platform for Easy Modifications, Flexibility to Adapt To Future Needs

Based on a recommendation by Rockwell Automation, Jurag worked with a local Danish programmer

As many of their process developments involve new technology, this offers Jurage the flexibility to make changes to the new system than it was with the older and more closed solutions. Rockwell Automation software was also found to be more user friendly for a 'non-programmer'.

We got so much support, and Rockwell Automation demonstrated a very different approach to that from other suppliers.

Rockwell Automation showed a long-term investment; its competitors had a very short-term, quick-sale view

Jung Separation A/S

Scalable and Pharmaceutical industry-compliant programming

With Rockwell Automation solutions, Jurage can provide the cGMP documentation needed for the industry. It is also scalable to address wide ranging requirements as it often develops pilot-scale devices that then need to be transitioned into full production machines.



Separation Technology Company opts for single, scalable, open platform running industry – proven batch solution

Resources

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www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846