Streamlining a Batch Control System Implementation - Drawing Board to Production in 11 Weeks

Background

Food manufacturer consolidates several kitchens and numerous kettles in effort to reduce operating costs and increase capacity.

Goals:

- Maintain existing production.
- Install new equipment where the existing equipment resides.
- Install controls similar to some of the existing controls.
- Create flexibility such that any kettle can be routed to any kettle...multiple connection paths between units

Specifications

Software:

- *FactoryTalk Batch™*
- *FactoryTalk View SE™*
- *RSLogix™ 5000*
- *SoftLogix™ 5000*
- *RSNetWorx™*
- *RSLinx™*
- *SQL Server™*
- *MS Sharepoint Services™*

Networks:

- *Ethernet*
- *ControlNet™*
- *DeviceNet™*
- *Remote I/O*
- *Modbus Plus*
- *Hart*
- *Fiber and copper media*

Hardware:

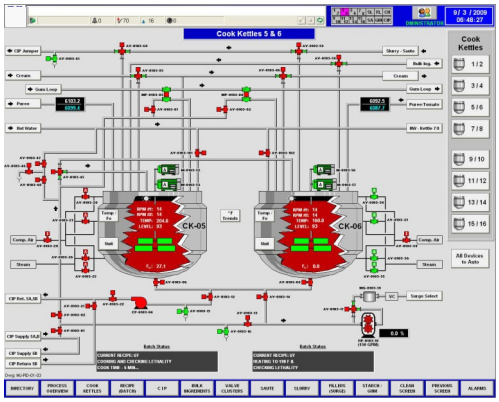
- *(7) ControlLogix PLC's*
- *(1000) Networked Air Valves*
- *(300) Mixproof Valves*
- *(120) Networked Powerflex VFD's*
- *(4) Dell Client Computers*
- *(5) Dell Servers*

Instrumentation:

- *Mass Flow Meters*
- *Mag Flow Meters*
- *Weigh Scales*
- *Level Transmitters*
- *Load Cells*
- *Temperature Transmitters*
- *Conductivity Transmitters*
- *Transition Sensor*

S88 Model:

- *(47) Units (not including CIP)*
- *(377) Phases*
- *(950) Equipment Modules*
- *(1200) Control Modules*
- *Over 150 unique recipes*



Challenges:

The new equipment was installed and commissioned in a phased approach in order to maintain the existing production. The new equipment had to be installed in the same general plant areas as the existing equipment, however production could not be lost.

The new controls had to be integrated with the existing (in production) controls and repeatedly modified as new equipment was brought online. The existing controls were an assortment of different of controllers (Allen Bradley SLC, ControlLogix and Modicon 984, 584, Quantum), different networks, and different equipment.

The project schedule was extremely aggressive. The controls contract was awarded eleven weeks prior to the first production trials to be produced on the initial kettles. The following tasks had to be achieved concurrently during that time.

- Develop functional description
- Develop network architecture
- Hardware design
- Fabricate PLC and Drive panels
- Program and test
- Factory Acceptance Test
- Controls installation *
- Commissioning *

* On initial units for production trials

Solution:

In order to meet the aggressive schedule and deliver the flexibility, ECS decided to implement Rockwell Automation's FactoryTalk Batch, a proven product that followed the ISA S88 Batch Standard conventions. The S88 standard would not only allow for the flexibility needed for the operators to run the equipment how they wanted to, but would also streamline the development process and allow for the anticipated changes in the process that would inevitably occur during commissioning.

The installation and commissioning phases of the project would require a tremendous amount of organization and effort to be successful. The development of the network architecture, the hardware designs, and the programming had to occur concurrently in order to meet the required deadlines. Teams of individuals were assigned to each task and dual project managers working closely together split responsibilities of software and hardware.

ECS worked closely with several vendors; Rockwell's Drive Center in Cincinnati to produce the drive panels, Endress & Hauser to provide the instrumentation, Numatics to provide the pilot valves. The coordination with the vendors was critical to ensure the correct materials would be onsite to install at the appropriate time.

Operation:

The new equipment would be driven by three operators, each with a dedicated HMI, working independently from each other in one central loca-

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tion. Each operator would select recipes to run concurrently. Different recipes frequently shared some of the same equipment. Support personnel were in designated areas to get materials loaded into the system upon request.

Controls were installed and programmed so the operator did not have to understand the piping to control the system. Over 1000 routes containing an assortment of different valves, pumps, and instrumentation were programmed into the system. The operator need only select the raw material, quantity and designation in order to deliver product to a certain kettle manually. Alternatively, the operator can select a particular recipe to automatically control the delivery of the appropriate raw materials to the correct designations, cook temperatures and times, and send the finished product to the packaging equipment.

System Equipment:

Seven key areas in the overall process were identified and designated to have dedicated PLC processors. Three HMI's were installed in one central location. The HMI's were interchangeable, allowing each to control any part of the overall process. Large valve banks were installed to allow any of the kettles to deliver to any other kettles, providing the ultimate flexibility.

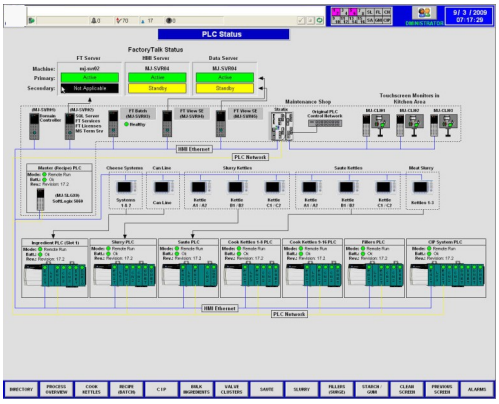
Additional scaled down HMI's were strategically placed in different areas allowing support personnel to interface with the system as they added the requested raw materials.

Multiple Ethernet networks were installed to effectively manage traffic.

Operator and Maintenance Tools:

ECS developed many tools into the system in order to assist in the operation and maintenance of the system. The tools are presented to the operator via popups on the HMI. These tools include-

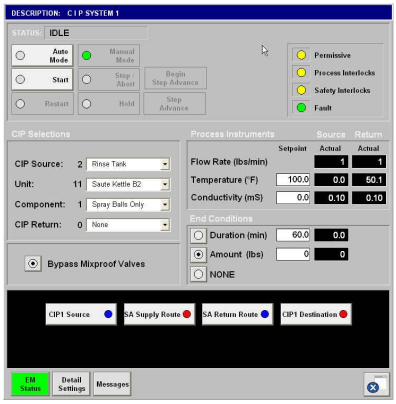
- Plant Location and Panel ID denoted on each HMI device popup



- Instrument calibration tools for level, temperature, etc.
- VFD diagnostics
- PID loop tuning parameters and auto-tune capabilities
- Advanced fault identification via drill downs at appropriate kettle, tank
- Alarms (system guides operator to the area of the alarm to address the issue promptly)
- Navigation between popups similar to relational database functionality
- Operator instructions, prompts, and acknowledgments generated from the recipe instructions and displayed on the HMI graphic for the appropriate kettle
- Animated graphics to show when devices are acquired or interlocked, on or off

CIP Made Easy:

One of the amazing features of the system is the functionality of the CIP, which integrates the CIP and process controls. The new system was designed with multiple CIP skids. The system was configured to allow the operator via a popup display, like the popup used for process control, to manually select any of the CIP skids



to run a CIP sequence (automatically monitoring time, temperature, and conductivity) through any route of pipes without selecting any individual valves. Alternatively, the operator can select a CIP recipe to clean an entire area using the parameters entered into the recipe.

Batch Equipment Module Engine:

Innovative engineering tools were developed and programmed into the HMI and PLC that reduced the development and commissioning time and provided the ability to quickly adapt the system to changes in the process. ECS developed a configurable equipment module engine that allows the addition or modification of routes, and the addition of valves and pumps, without PLC or HMI programming.

Features:

- Fully Automatic – controlled via recipes developed with sequential function chart's (SFC) to allow recipes to be easy to generate and easy to maintain
- Semi-automatic mode – to enhance flexibility for operators and reduce downtime, can fully produce product and recipes without the use of the batch server
- Manual – for maintenance and flexibility, a popup for each individual device provides manual operation
- Configurable System to customerize to match plant's equipment
- CIP – fully automatic, integrated with process, CIP procedures developed and maintained via SFC recipes
- Flexibility – Any kettle to transfer to any kettle
- Scalable to any size system