48

MASTER BREWERS ASSOCIATION OF THE AMERICAS

Define your brewery automation...
or this guy will

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INTRODUCTION

Over the 10 years I have spent at Deschutes Brewery we, along with the rest of the craft industry, have experienced great growth. Along with this growth have come many capital projects to expand our capacity that have included automation. Many of these projects fell short and left the brewers unhappy. Simply put, many of these systems didn't make beer the way we wanted them to. As a brewer, this one of the most frustrating experiences in my opinion. We have an older brewhouse at our production facility that is still in operation. It is very manual. Brewers physically open valves, press real buttons to turn on pumps, control speeds using dials. As a brewer, you really become connected to the process in this brewhouse. It is a very satisfying feeling. So how come when you try to automate such a process it has a tendency to leave you feeling unsatisfied? Now whether you've had the same frustrations or you're just starting to implement automation at your brewery, I have good news. There are steps you can take to help ensure that your brewery automation projects will be successful. These steps are covered in this poster and we've been implementing them at Deschutes Brewery for the past two years, dramatically increasing our success rate of projects that utilize automation.

There are several perceived pros when considering automation:
- Improved Consistency & Quality
- Increased Productivity
- Reduced Operational Costs
- Reduced Waste
- Improved Safety

It is important to note that if your project isn't successful, you can get the exact opposite of each of the benefits listed above.

There are also several perceived cons when considering automation:
- Initial Investment – usually this can be justified with an attractive ROI
- Replacing Human Labor – consider shifting personnel freed up by automation to focus on other areas to improve your brewery
- Taking the "craft" out of your beer – the goal of this poster is to help to ensure that you consistently get all the "craft" in every brew
- Costs for Development, Staffing and Fixing Errors – the concepts covered in this poster help to minimize these costs
- Acceptance by Staff – the team approach covered in this poster gets your staff involved so that they are part of defining the system and develop a sense of pride around these projects

The keys to a successful automation project are:
- Your team
- A standardized and effective project workflow
- A solid project vision & scope
- Being able to effectively communicate your process requirements for implementation

THE TEAM

It is essential to include production personnel in the design of your projects. First and foremost, this is current and potential users of the systems you are creating.

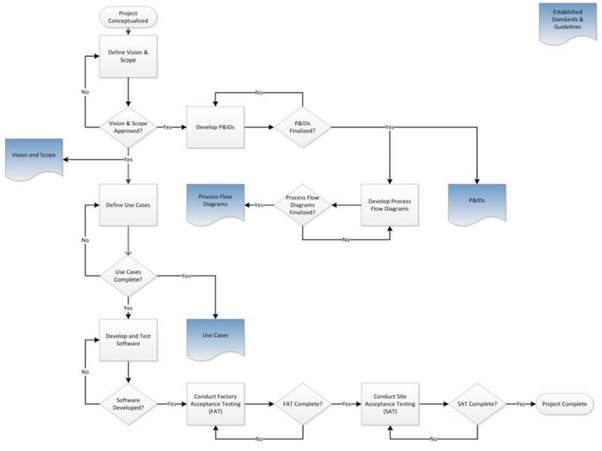
Designate an expert for the project from production. This is the go to person for any questions in regards to how the system should function from a brewer's perspective.

Also appoint an analyst from production. This person is responsible for a variety of tasks that include eliciting requirements from the various stakeholders of the project and then modeling, documenting, analyzing and prioritizing these requirements. Your analyst should have good understanding of the process, excellent communication skills and be proficient in word processing, working with spreadsheets and other office software.

Depending on how big your brewery is, your project management and engineering staff can be zero to many people. And this is where external integrators can help. A good firm can typically provide assistance with automation, process engineering and project management. The keys to look for in potential integrators are great communication skills, both written and verbal, expertise in the technology and equipment you're using, and brewery experience is a real bonus, for obvious reasons.

PROJECT WORKFLOW

The flowchart listed to below depicts the workflow we use at Deschutes Brewery for projects. Accented in blue are physical documents that are generated from various stages of the project workflow. Established standards & guidelines for your projects may already exist. These include HMI standards, automation logic structural guidelines, naming conventions, etc. Several stages in the workflow can run concurrently. For example, we typically develop P&IDs, mark up process flow diagrams (PFDs) and develop use cases in parallel. You can also transition back to stages in the workflow as needed. For instance, if an error in design is discovered during factory acceptance testing (FAT), this could result in updating P&IDs, PFDs, use cases prior to redeveloping and retesting software.



VISION & SCOPE

Say you have a great project conceptualized at your brewery. Now what? A better question might be, have you ever had a project that was implemented and it didn't satisfy the needs you expected? We've had a lot of these at Deschutes Brewery; however they are becoming a thing of the past. We're making this happen by working diligently on defining project vision & scope. This simple document will help align everyone affected by the project on the vision, what is to be completed and when. Your appointed team analyst from production will be leading this effort. The first thing we want to do is flush out the project stakeholders. This is anyone who will be affected by the project. Reference your company organizational chart for potential stakeholders. Once you have identified your stakeholders, this is the audience you will be interviewing and writing for. This document will be organized into 4 sections.

The first section, Business Requirements, should give a background of how this project became conceptualized. We want to discuss the opportunity this project presents, the needs that it will fulfill and identify potential risks so we can make efforts to mitigate them. We also want to define objectives and success criteria that we can measure, so we can communicate to external integrators what success for the project looks like to us and so that we can grade our team performance after the project is complete.

In section 2, Vision of the Solution, we start with a vision statement. This should be short, but inspire your team members. We want to identify the major features of the system so that we can work on engineering them. We also want to identify any assumptions and dependencies so that we can plan for them.

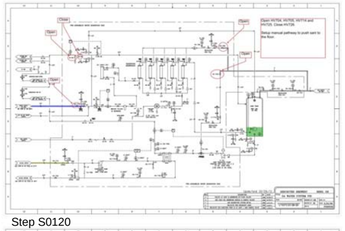
Section 3, Scope and Limitations' purpose is to define what work will be done and if it will be completed in multiple phases. It also states any project limitations and/or exclusions.

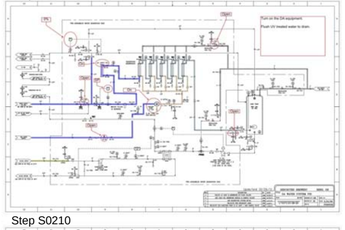
Lastly, section 4, Business Context, notes the perceived values, attitudes, interest and perceived constraints of the various interviewed stakeholders. Capturing this information is helpful in meeting the expectations of your project stakeholders and minimizing their concerns.

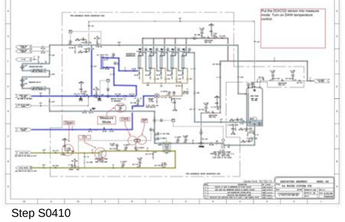
An electronic vision & scope document sample is available by contacting the author via email.

COMMUNICATING PROCESS REQUIREMENTS FOR IMPLEMENTATION

At the end of the day, for your project automation to be successful, it all comes down to how well you communicated your process requirements for implementation. We've found the combination of P&IDs marked up as process flow diagrams (PFDs) and supplemented with use cases to be most effective in communicating our process requirements for successful implementation by automation engineers. An example of this follows below. A digital copy of the entire PFD sequence and the use case is available by contacting the author via email.


Step S0120


Step S0210


Step S0410

Phase Step	Actor Action	System Response	Big Picture
S0100	1	1 Sets the DAW system status = Production Start Up.	
S0110	2	2 Puts all equipment in a known off / closed state.	All equipment is a known closed / off state.
S0120	3	3 Prompts the operator to open HV704, HV705 and HV714 and close HV726.	
	4 Opens HV704, HV705 and HV714 and closes HV726 and then acknowledges the prompt.	4	
S0130	5	5 Opens the DAW tank outlet.	
	6	6 Prompts the operator to confirm sanitizer is blown out.	
	7 Confirms sanitizer is blown out and then acknowledges the prompt.	7	
S0140	8	8 Closes the DAW tank outlet.	
	9	9 Prompts the operator to open HV726.	
	10 Opens HV726 and then acknowledges the prompt.	10	
S0150	11	11 Opens the pathway to the DAW tank spray ball.	
	12	12 Prompts the operator to confirm sanitizer is blown out.	
	13 Confirms sanitizer is blown out and then acknowledges the prompt.	13	
S0200	14	14 Opens the inlet to the DAW tank.	
	15	15 Prompts the operator to confirm sanitizer is blown out.	
	16 Confirms sanitizer is blown out and then acknowledges the prompt.	16	Sanitizer is blown out for the DAW tank outlet, spray ball pathway and inlet.
S0210	17	17 Flushes the DAW membranes w/UV treated water to drain.	
S0250	18	18 Prompts the operator to confirm sanitizer is pushed out at V712.	
	19 Confirms sanitizer is pushed out at V712 and then acknowledges the prompt.	19	
S0300	20	20 Starts filling the DAW tank.	
	21	21 Waits for DAW tank level >= 97%.	
S0320	22	22 Turns on the pump to push the outlet to drain.	
	23	23 Waits for DAW tank level < 7%.	
S0340	24	24 Turns off the pump.	
	25	25 Prompts the operator to confirm sanitizer is pushed out at HV725 and then close HV725.	
	26 Confirms sanitizer is pushed out at HV725, closed HV725 and then acknowledges the prompt.	26	Sanitizer is rinsed from the DA membranes to the DAW tank to drain.
S0350	27	27 Starts filling the DAW tank.	
	28	28 Waits for DAW tank level >= 50%.	
S0401	29	29 Attempts to stabilize flow in the DAW loop.	
S0402	30	30 While this step is active If DAW tank level >= 97% Stops filling and starts recirculating the DAW tank. If DAW tank level < 97% Stops recirculating and starts filling the DAW tank.	
	31	31 Waits for loop flow rate to be > 60 GPM for 60 continuous seconds.	
S0403	32	32 While this step is active If DAW tank level >= 97% Stops filling and starts recirculating the DAW tank. If DAW tank level < 97% Stops recirculating and starts filling the DAW tank.	
	33	33 Turns on the carbonator.	
	34	34 Waits for loop flow rate to be within ± 5 GPM for 120 continuous seconds.	
S0410	35	35 While this step is active If DAW tank level >= 97% Stops filling and starts recirculating the DAW tank. If DAW tank level < 97% Stops recirculating and starts filling the DAW tank.	
	36	36 Turns on the CO_2/DO meter and temperature control.	
S0430	37	37 Enables the seat lift sequence.	
	38	38 While the number of seat lift sequences completed < 3 If DAW tank level >= 97% Stops filling and starts recirculating the DAW tank. If DAW tank level < 50% Stops recirculating and starts filling the DAW tank.	
S0470	39	39 Sets the DAW system status = Production.	
	40	40 Disables the seat lift sequence.	DAW system has stable pressure and flow, is being temperature controlled, has adequate volume and is ready for production.
S9900 S9900A S9900B S9900C S9900D S9900E	41	41 Constantly monitors for the following conditions If cancel wait = true Goes to system response system response 42. Else If DO alarm exists Stops filling and starts recirculating the tank to lower DO (S9900A). Else if the DAW system has no users and the DAW tank level >= 97% Stops filling and starts recirculating the DAW tank (S9900B). Else if the DAW system has no users and the DAW tank level < 97% Starts filling the DAW tank (S9900C). Else if the DAW system has users and the DAW tank level >= 97% Stops filling the tank and starts recirculating the DAW tank (S9900D). Else if the DAW system has users and the DAW tank level < 97% Starts filling the DAW tank (S9900E).	Constantly monitor and react to various conditions.
S9940	42	42 Shuts down the DAW system.	The DAW system is shutdown.

CONCLUSION

Using the philosophy outlined in this poster we are reaping all the benefits that automation can provide, while minimizing costs. We are getting our staff engaged in designing systems for brewers, by brewers. Most importantly, we are getting our systems to consistently make our beer, exactly the way we want it.

Remember – if you don't define your brewery automation, someone will. Most likely, it will not be the person that should.

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