Development and Qualification of an Equipment Module standard capturing all potential Agitator functionality

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Introduction to Project

What is an Equipment Module?

- It is a container that performs different elements of procedural logic (code) to help complete a process task. For this project it will be the control of an agitator.

Agitators

Abstract

- Design an agitator equipment module that can be used for multiple functionalities. (Different vessels capacities and mixing different liquids).
- This means that the user can select the agitator type and change the parameters of the vessel to regulate the agitator speed.

Tank

Project Goal 1

- Create a formula that will allow the agitator to speed up and change its speed dependant on the level or weight of the liquid in the vessel.
- Create it in such a way that it doesn't allow the agitator to start until the vessel has reached a minimum weight/level.
- Design a User interface that will allow the operator to make these changes (i.e.. Choose the agitator type V.S.D/D.O.L, change the minimum weight/level of the vessel etc).
- V.S.D: Variable Speed Drive (changes the speed based off the Level/Weight.
- D.O.L: Direct On Line (Agitator is turned on/off at a fixed speed).

Project Goal 2

Create an Interface that can allow the user to select:

- Agitator type? V.S.D/D.O.L?
- If VSD is selected, what process parameter will be used? Level or Weight?
- What's the minimum weight/level of the vessel?
- What's the maximum weight/level of the vessel?

V.S.D

D.O.L

Apparatus and Software

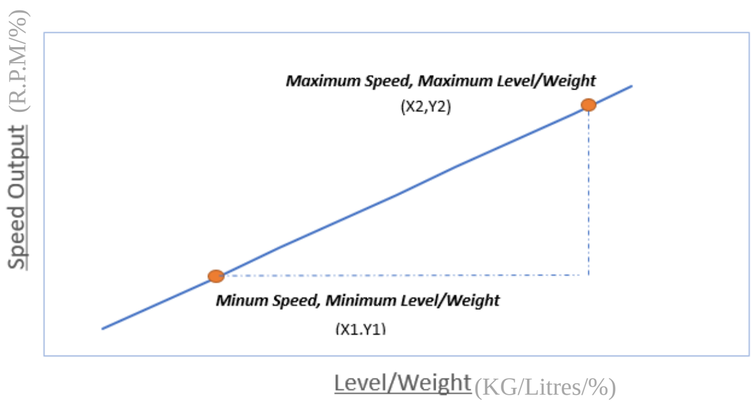
Equipment

- Allen-Bradley PLC Controller
- FactoryTalk View Studio
- Studio5000 Logix Designer

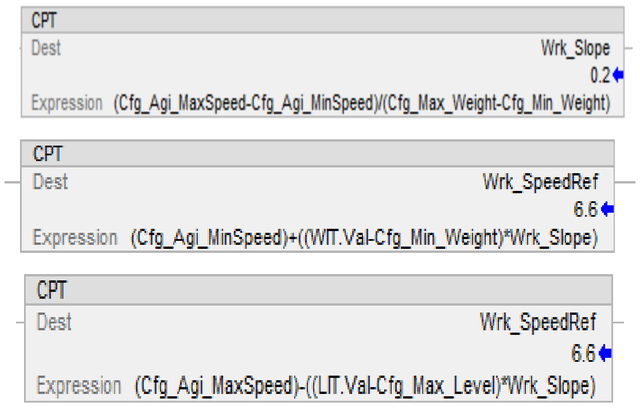
Calculations

- The calculation was based off a straight-line graph (Speed output vs Level/Weight)
- Slope Calculation: Maximum Speed – Minimum Speed / Maximum Level or Weight – Minimum Level or Weight
- Ramp-up Calculation: Line equation (Speed Output) = ((Actual Weight-Minimum weight)*slope)+(Minimum Speed)
- Ramp-down Calculation:((Actual Weight-Maximum weight)*slope)-(Maximum Speed)

Agitator EM Graph



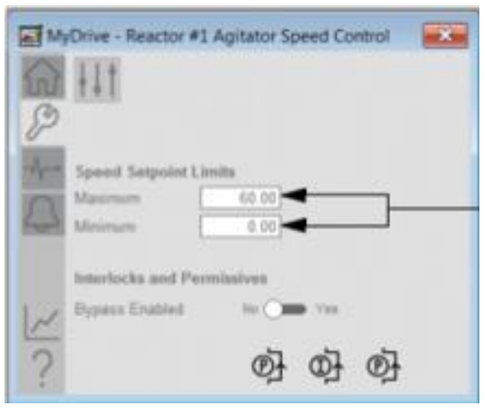
Code/Logic



- Equation implemented using the compute function
- Compute function allows the user to input formulas into a single block and produce a result

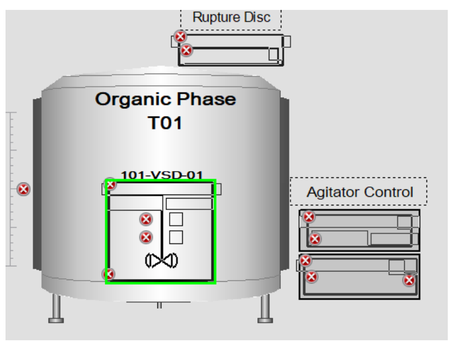
User Interface

Parameters Interface



- Example of a parameter Interface
- User can make adjustments to the agitator on an interface such as this

Tank Graphics



- Graphical interface representing a Tank and Agitator
- This interface will show the speed output of the Agitator

Final Steps

- FAT: Factory acceptance test: This a test that verifies if the equipment module meets the required design requirements
- Pre-FAT: Testing the equipment module and graphics before testing with a customer
- FAT with the customer and making required changes during the validation process
- Delivery to the customer

Size 36 Font: Heading e.g. References

Rockwell Automation Library of Process Objects: Display Elements, 4th ed. Rockwell Automation, 2022, pp. 94-313.

"Agitator Tank Mixers Agitators Chemineer Agitator PRG Ireland -", Flexachem.com, 2022. [Online]. Available: https://www.flexachem.com/mixing-technology/agitator/. [Accessed: 17- Feb- 2022]