SIEMENS TIA PORTAL

DO & GROW

FEBRUARY 2023

VARIABLE SPEED PUMPING STATION

WITH LIAM BEE

TIA V17
V16

CONTROL OVERVIEW

A 2 stream pumping station requires a single PLC to manage 5 variable speed pump sets. The pumps are not explicitly defined at this moment in time. You are free to use any Profinet enabled variable speed drive.

The pumps are protected from cross pumping and gravity return by isolating valves on the outlet (as well as a non-automated non-return valve). The valves are opened before the pump is run and closed after the pump is stopped. Both systems have their own flowmeters, which are used as part of the control of the pumps.
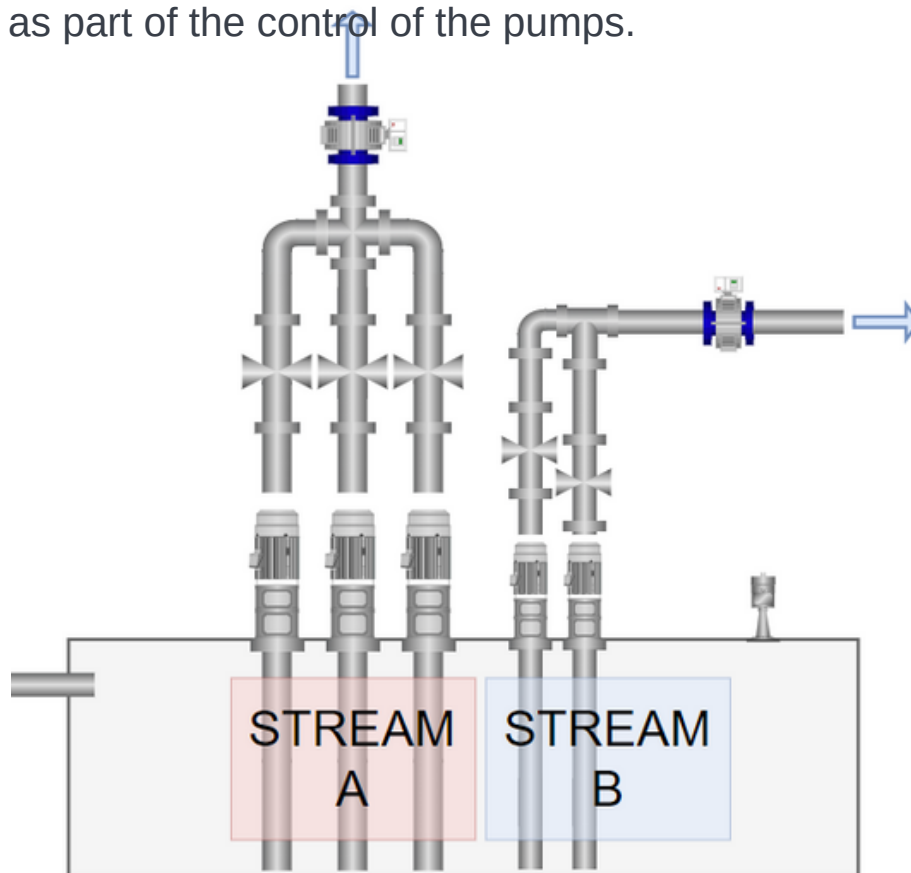
The two streams are pictured above as a reference.

STREAM A CONTROL

Stream A is tasked with maintaining a variable Flow Setpoint.
The flowmeter, common to all 3 pumps, is used against a Flow Setpoint set by an upstream process.
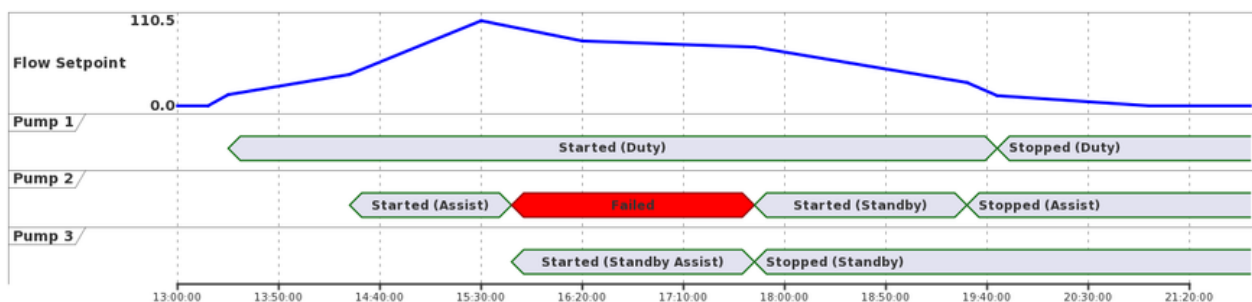
Using PID Control, the pumps are to maintain the Flow Setpoint, using the flow from the common flowmeter.

The pumps are capable of the following maximum flows:
- 1x Pump: 60l/s
- 2x Pump: 112l/s

The pumps should be controlled so that both follow the same speed reference.

An example of an ~8 hour timeline is given below. This demonstrates the normal function against the flow setpoint, and also the assist requirements. Should the Duty or Assist pump fail, the standby is to take over that responsibility, as shown.

Remember that Stream A's objective is to control the Flow to a set value, not to control the level in the Tank.

STREAM B CONTROL

Stream B is tasked with maintaining a level in the Tank. The control is not designed to be "Tight" and the tank is allowed to rise and fall within reason.

Using PID Control, the pumps are to maintain a Level setpoint, using the level from the suction Tank.

The pumps are capable of the following maximum flows:
- 1x Pump: 50l/s
- 2x Pump: 85l/s

The pumps should be controlled so that both follow the same speed reference.

An example of an ~8 hour timeline is given below. This demonstrates the normal function against the flow setpoint, and also the assist requirements. Should the Duty or Assist pump fail, the standby is to take over that responsibility, as shown.
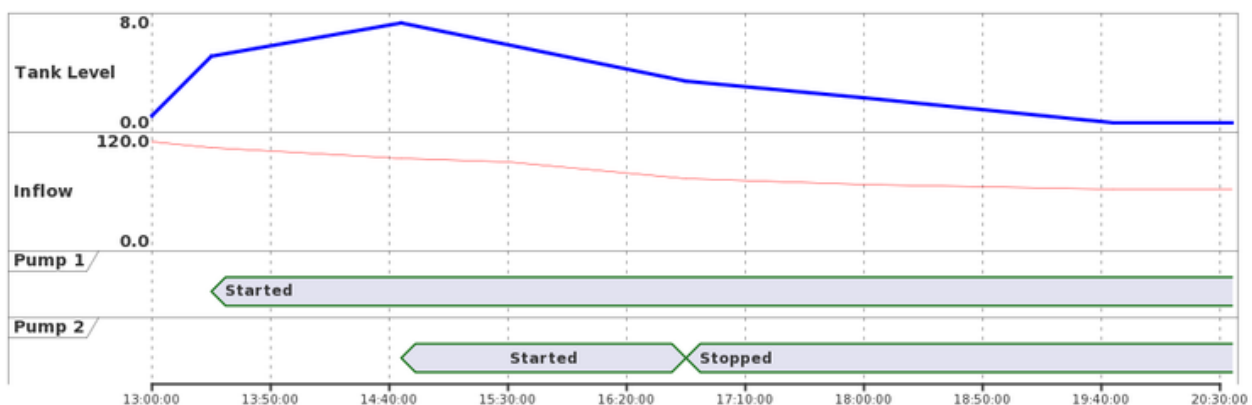
Remember that Stream B's objective is to control the Level to a set value, not to control the Flow leaving the Tank.

Note: The "Inflow" in the diagram above is unknown in practice

COMMON CONTROL

Both streams must adhere to the following control rules:

- All pumps communicate with the PLC via Profinet
- If the level fails, both streams must stop pumping immediately
- If a flowmeter fails, the respective stream must stop pumping immediately
- Once a week, the duty of the pumps must rotate
    - For Stream A, the Duty, Assist and Standby must rotate
    - For Stream B, the Duty and Standby must rotate.
    - This occurs even if the pumps have not been running or a pump is failed.
- Duty pumps are always called to run first
- Assist pumps are always called to run secondly
- Standby pumps can take the responsibility of either the Duty or Assist pumps
- In the event that both the Duty & Assist pump is failed, the Standby will run alone
- The HMI must raise basic alarms for the following:
    - Failed Instruments
    - Failed Valves
    - Failed Pumps
    - Low Flow
    - Low Tank Level
    - High Tank Level
- The HMI should highlight assets in a different colour if failed, running and stopped.
- The HMI should show the scaled values of all instrumentation next to the respective instrument

CONTROL SCENARIO ASSUMPTIONS

It is safe to assume, and therefore not include, the following in this control scenario:

- Hand / Off / Auto controls are handled locally on the panel

You can include the above if you want to, but they may not appear in the end solution