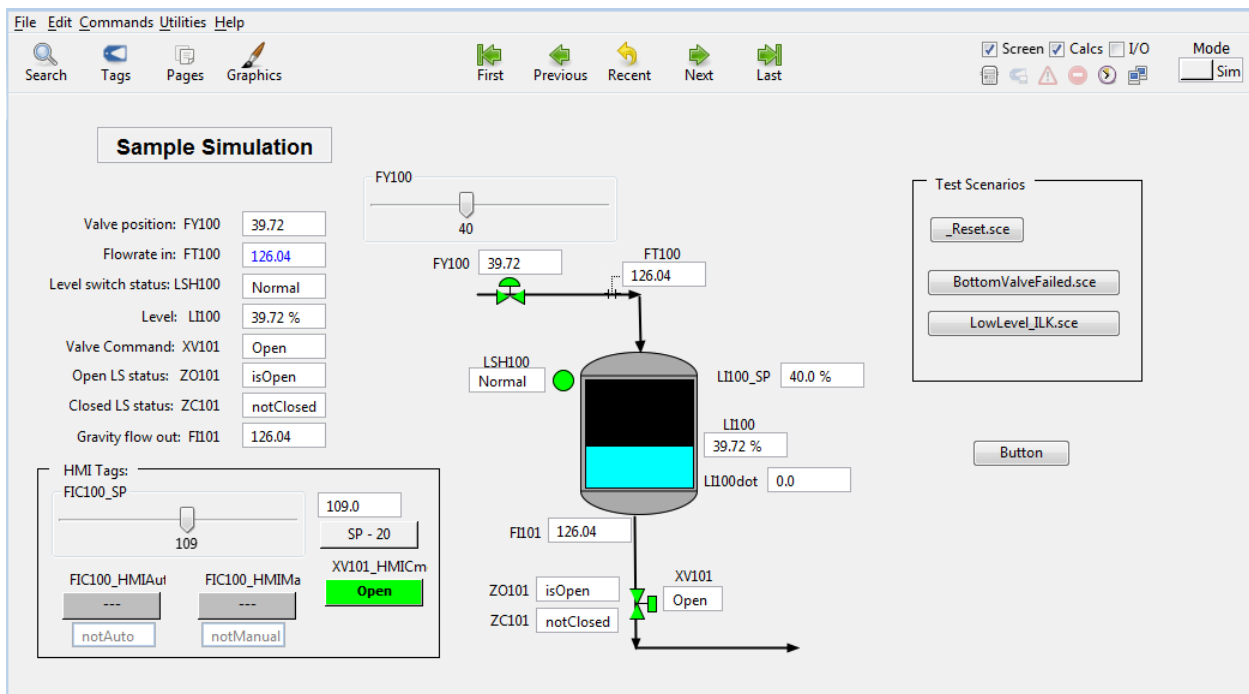# SIMPLE TANK SIMULATION

Using VP Link with a very simple model

Abstract

The simple tank model exposes the basic VP Link concepts. This is a guide to how the model works..

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A simple level simulation has been built with VP Link. Below is a description of the elements of that simulation.

The process is shown below. There is a tank with level measurement, an inlet control valve (FY100) and a block valve with two limit switches at the bottom of the tank. The net flow in or out of the tank determines its level in each successive simulation time step.
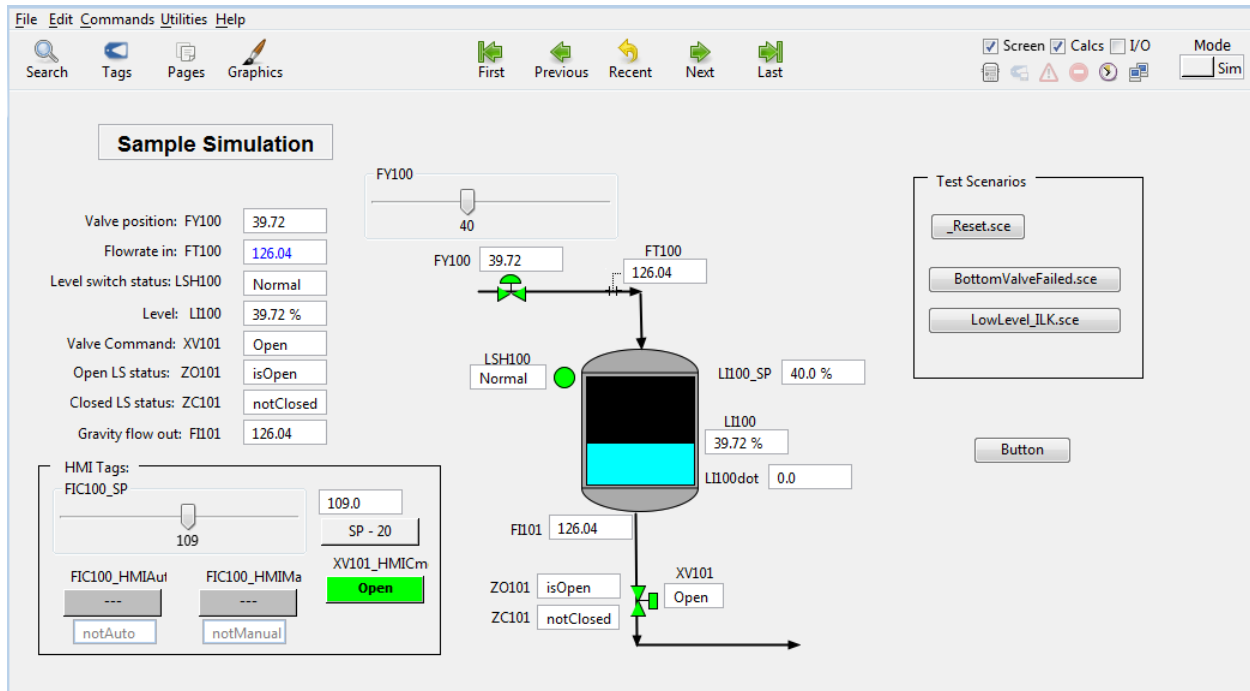

Figure 1 -- Process overview of the Simple Tank problem

The tank level is measured in percent, so its range is 0 – 100%. The two calculated flows, FT100 and FI101, have units of gallons/minute (gpm). The size of the tank is such that a net flow of +1 gpm will make the level rise at 0.25 %/min. There is an additional tag in the simulation, LI100dot, which calculates the rate of change of the level in the tank in %/minute. This is calculated from the current level and the level in the tank at the previous time step—similar to the way a control system might calculate the derivative.

The flow through the FY100 valve is non-linear. It has a characteristic of many control valves such that as the valve starts to open, the change in flow vs. the change in position is high. And once the valve gets most of the way open, the incremental change in flow vs. valve position is low. This is approximated with a square root function, such that the flow rate (as a fraction of its maximum) is proportional to the square root of the valve position (as a fraction of its maximum). The maximum flow through the valve is 200 gpm. Naturally that occurs when the valve is fully open.

In this particular example, the process engineer has done a remarkable job of sizing the discharge piping so that when the tank is completely full, the discharge rate out the bottom of the tank is also 200 gpm. At other levels, the discharge flow rate follows typical hydraulic laws such the pressure drop through the piping (which is supplied by the liquid head in the tank) is proportional to the square of the flow rate. Naturally flow only leaves the bottom of the tank when the block valve, XV101, is open.

A liquid level setpoint is supplied by the operator in tag LI100_SP. The units of that tag are percent—to match the level measurement in LI100.

The level switch, LSH100, will transition to "High" when the level is greater than 80%.

There are other tags that are shown in the "HMI Tags" box. These are used as a simple HMI when the demonstration is connected to a physical or emulated controller. For the purposes of using the simulation with Bonsai, these tags can be ignored. However, if you are a VP Link user with a license for the VP Link CLX driver and have access to the Rockwell Logix Emulator, you can use this simulation to investigate how the AutoTuner works (and compare it with Bonsai).