# Three FSM-based Pump Controller Models

This collection of models demonstrate s alternative designs for a water pump controller system. TheDiscrete Event model incorporates Finite State Machine (FSM) and Synchronous Data Flow (SDF) components. It also features a dynamic control unit and operational animation. The model demonstrates the integration of FSM and SDF modules into a DE design and the use of dynamic control and animation components. There are three alternative designs for the controller system, each with its own set of FSM modules.

The complete system consists of a water tank equipped with a drain to remove water from the tank, two pumps to refill the tank, and a controller that monitors the level in the tank and controls the operation of the two pumps.

The top level model (Figure 1) consists of of a clock, a water drain, the controller, two identical pump modules, the visualization components, and a block to update the tank water level reduction, one of two shared memories in the system.

Water Pump Demo with single controller FSM.
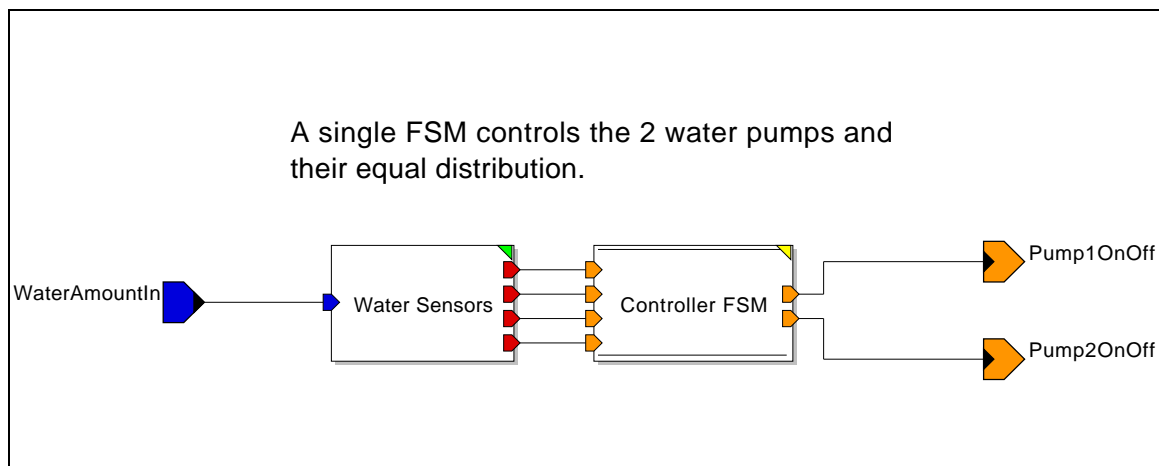See the Controller module for details.
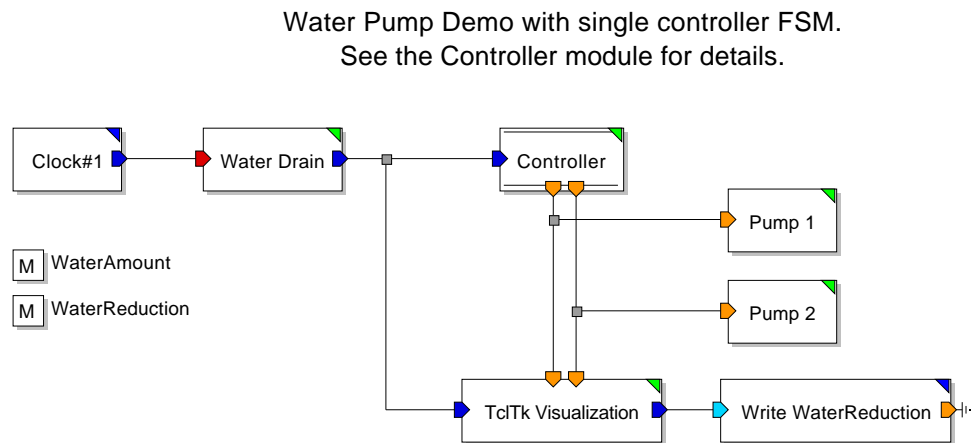
Figure 1: Top-level system model

The water drain block models the operation of the tank drain and associated tank levels. Shared memories track the water level and the water level reduction.
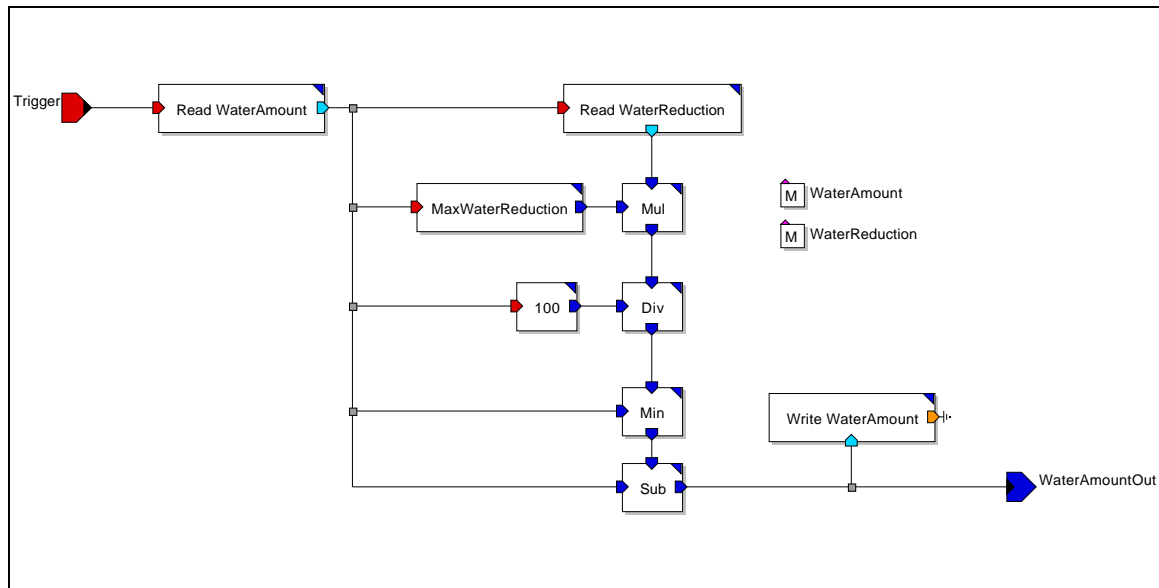
Figure 2: Drain module

The controller block contains a SDF water sensor module and the FSMs. For version one there is one FSM.

Figure 3: Version 1 controller module

All three versions use the same SDF water sensor module. The sensors are positions at different level on the tank. You can see the sensor locations on the water tank in Figure 7. The version 1 model uses a single FSM to control the pumps.
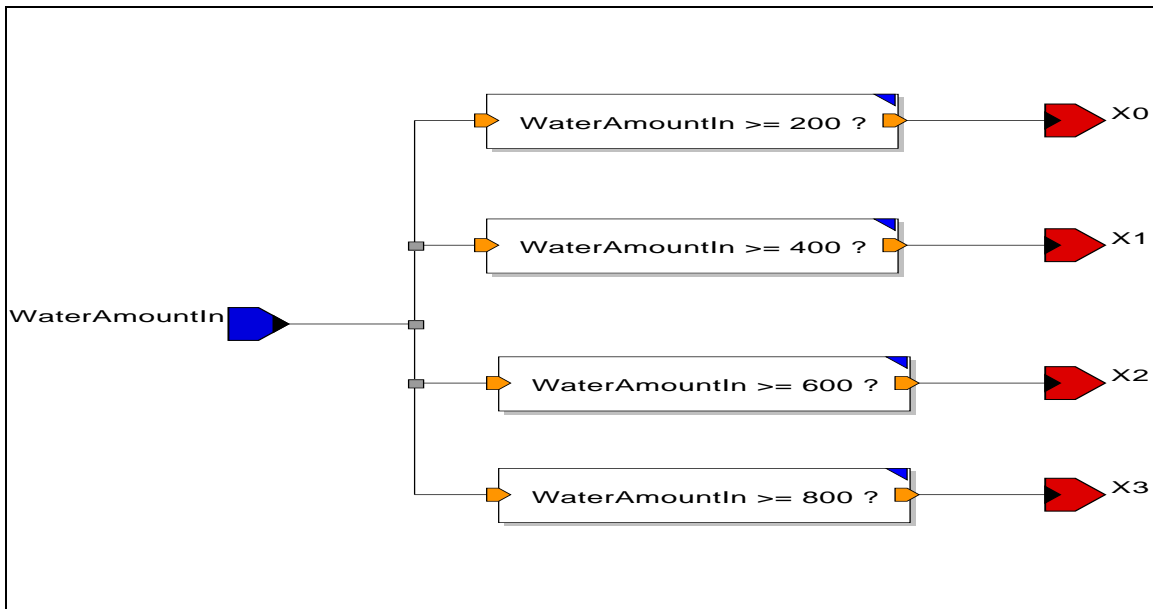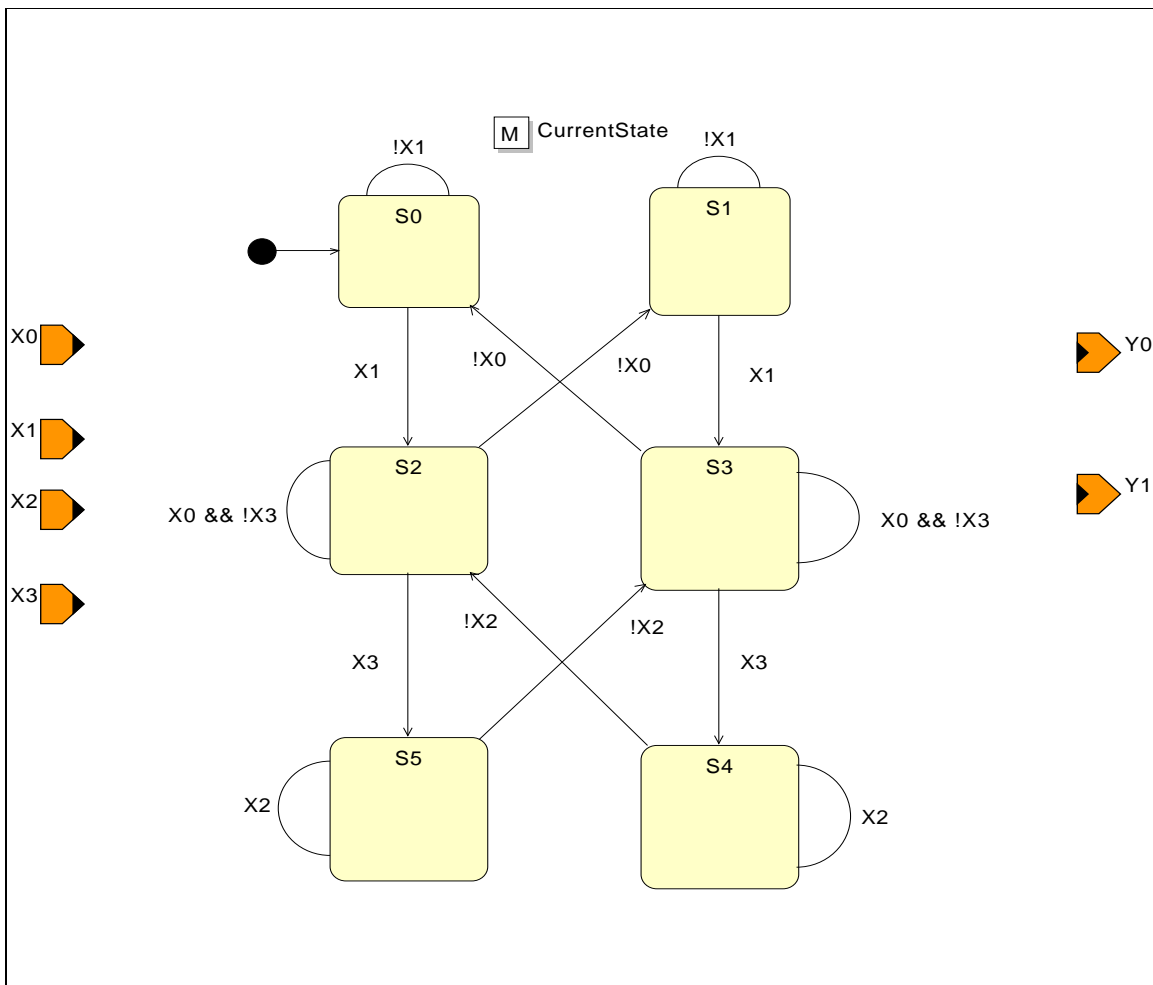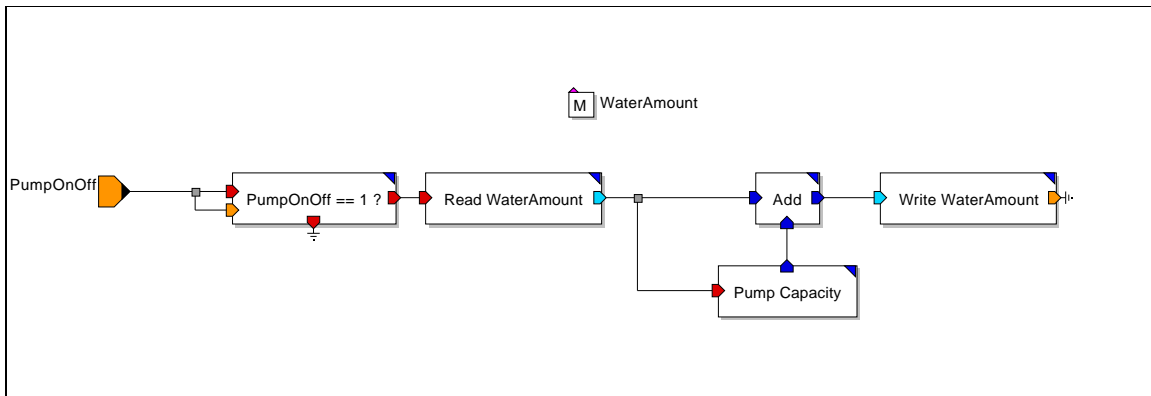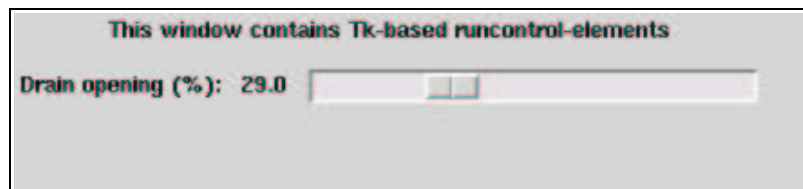
Figure 4: Water level sensor

Figure 5: Version 1 FSM

Both pumps blocks are identical and are the same in all thee versions.
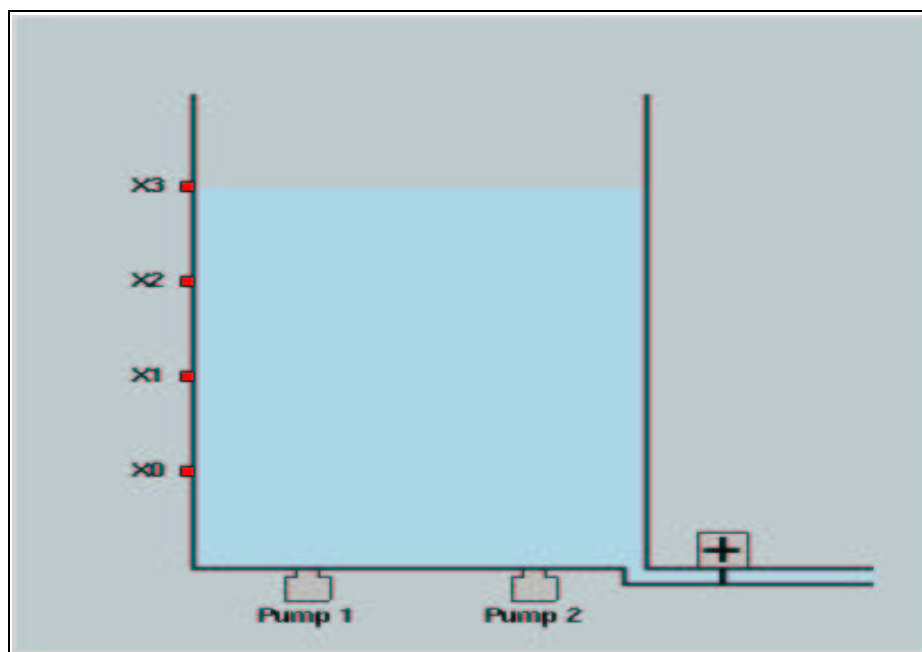

Figure 6: Pump model

When the model starts, the tank animation and drain control appear and the tank fills. The drain is closed.


Figure 7: Drain open


Figure 8: Full tank

When the drain is opened, the water flows out, triggering the sensors. The controller detects the change in level and starts the pumps. When the tank reaches a set level, the controller shuts off the pumps.

The model cycles continuously while the drain is open. Water flows out, the tank level drops, sensor detect the lowered level, the controller gets the information from the sensors and switches on the pumps to raise the level to a preset level. The pumps stop, the water level drops and the cycle stops again.
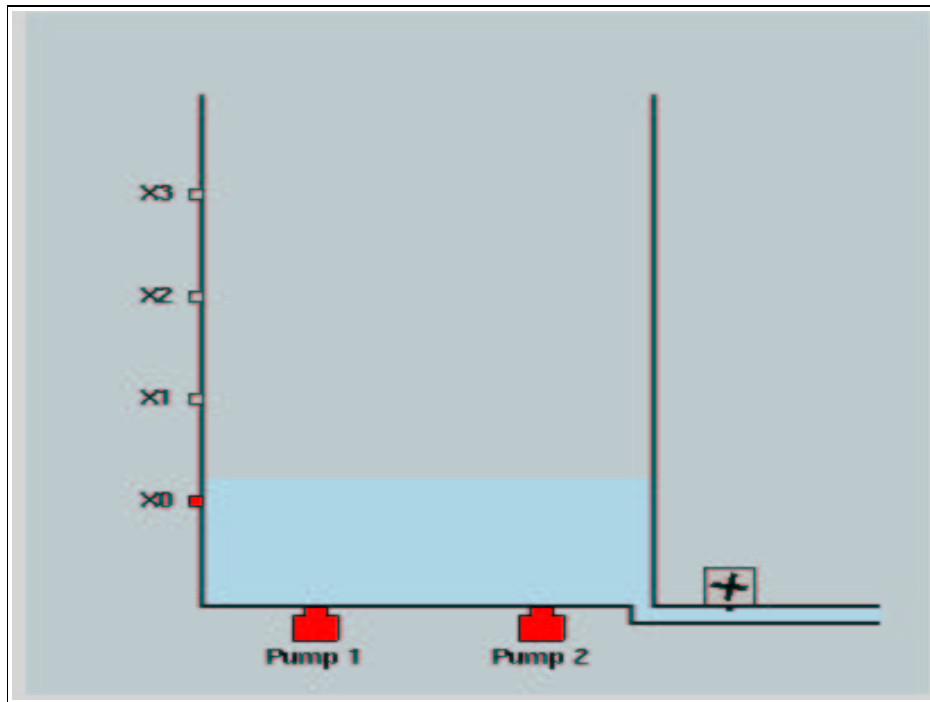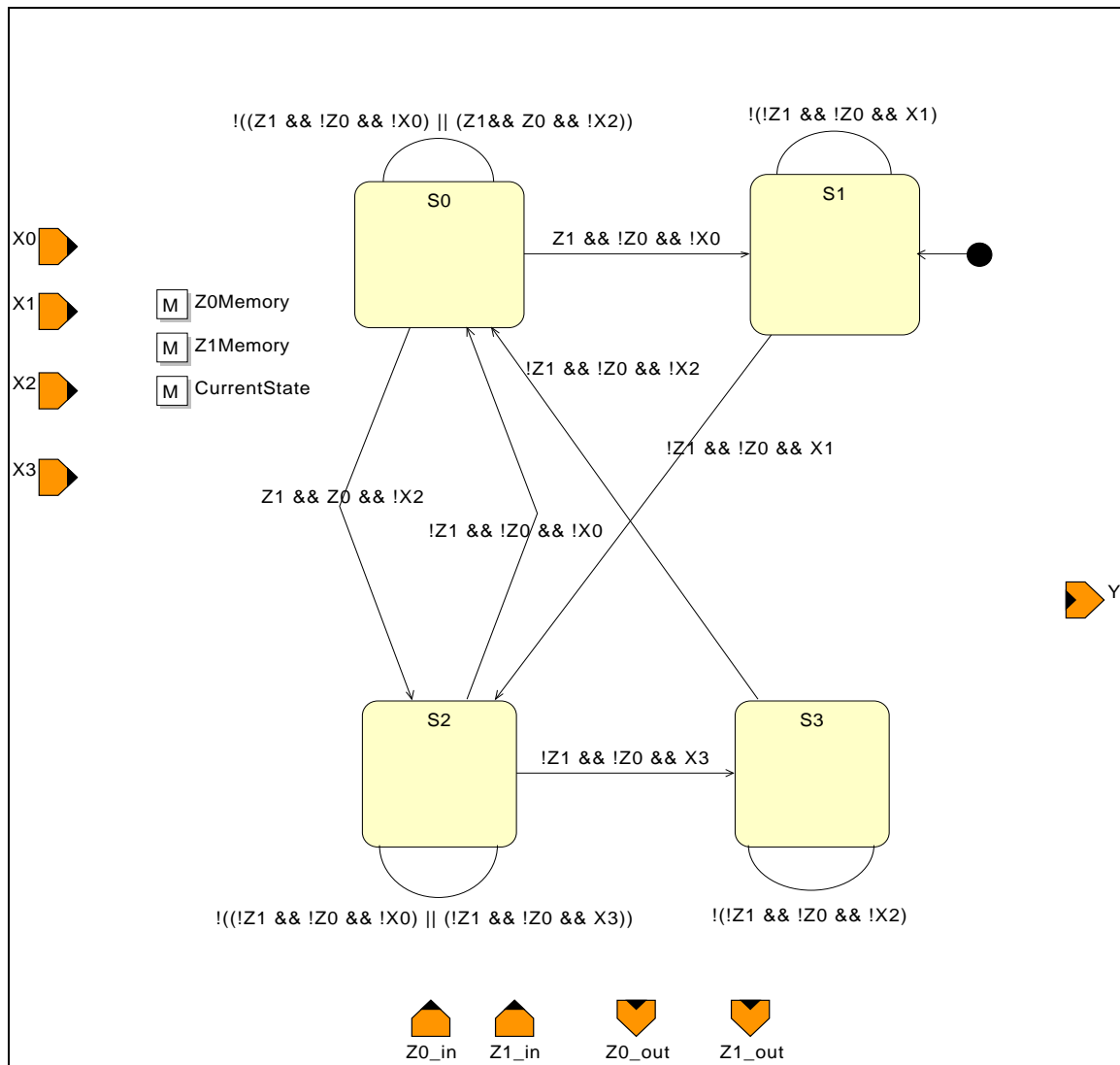

Figure 9: Low tank

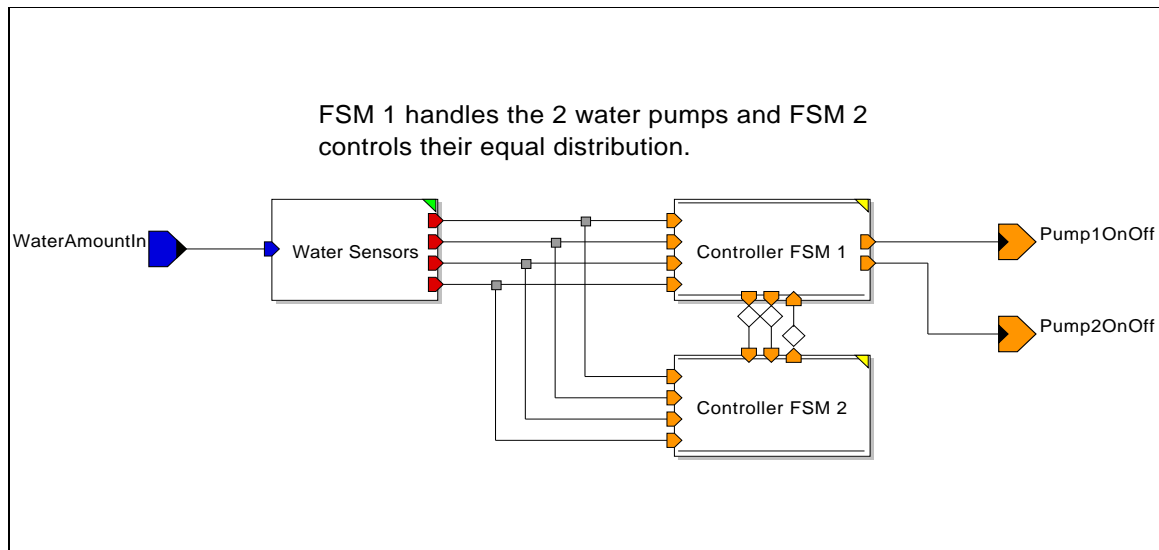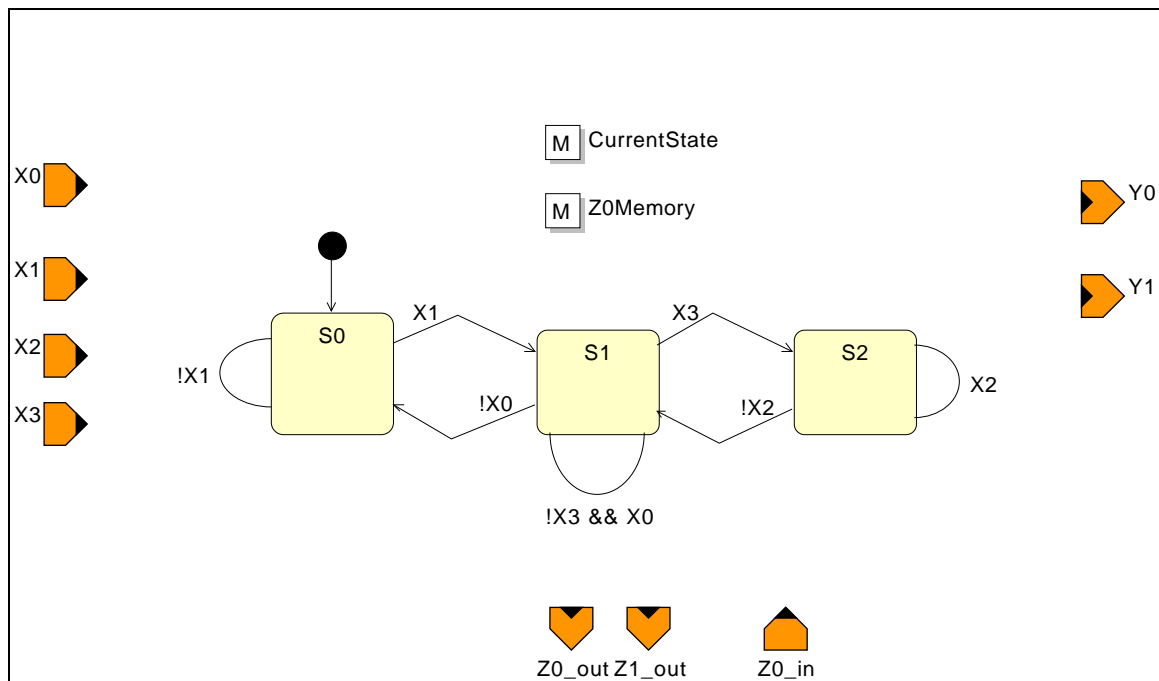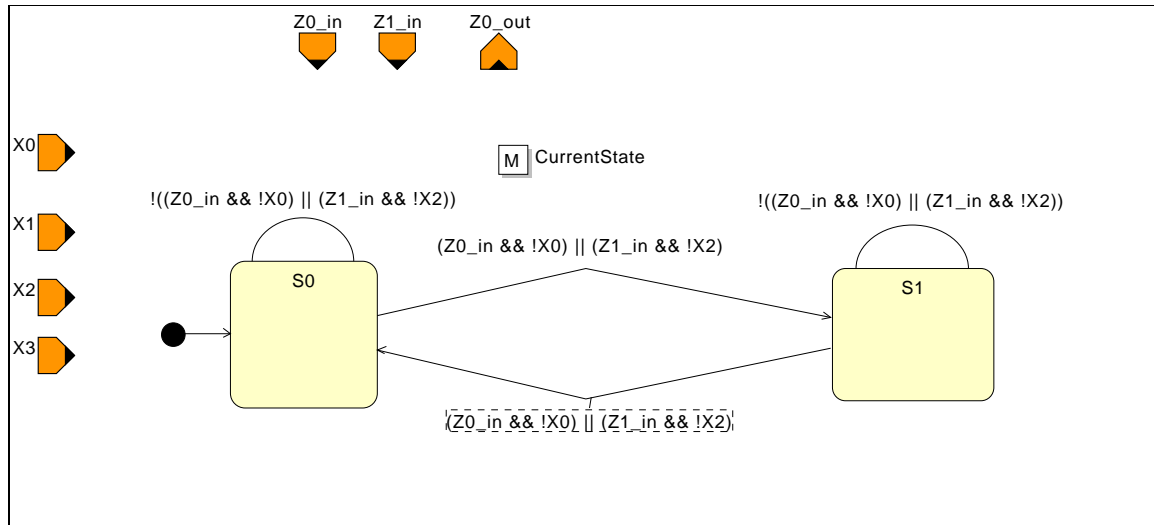Version 2 uses a different controller design with two parallel controllers.
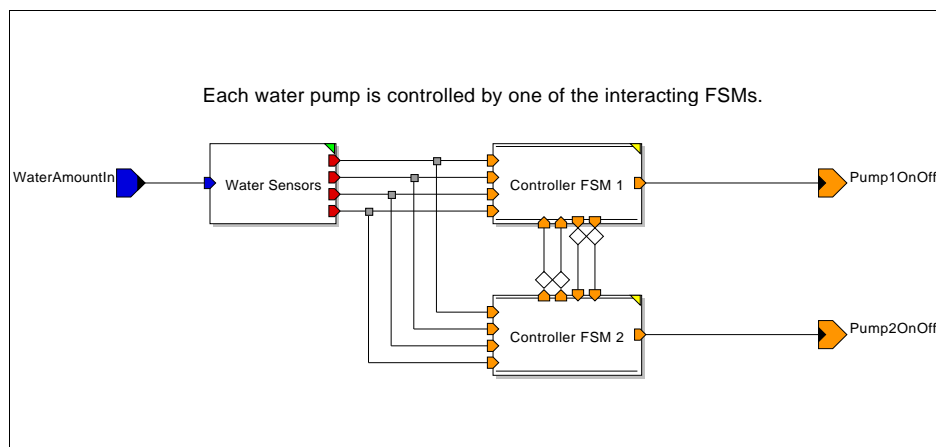
Figure 10: Version 2 controller

Figure 11: Version 2 FSM

The version 3 controller has two different FSMs and has more precise pump control.

FSM 1 handles the 2 water pumps and FSM 2 controls their equal distribution.

Figure 12: Version 3 controller

Figure 13: Version 3 FSM 1

Figure 14: Version 3 FSM2