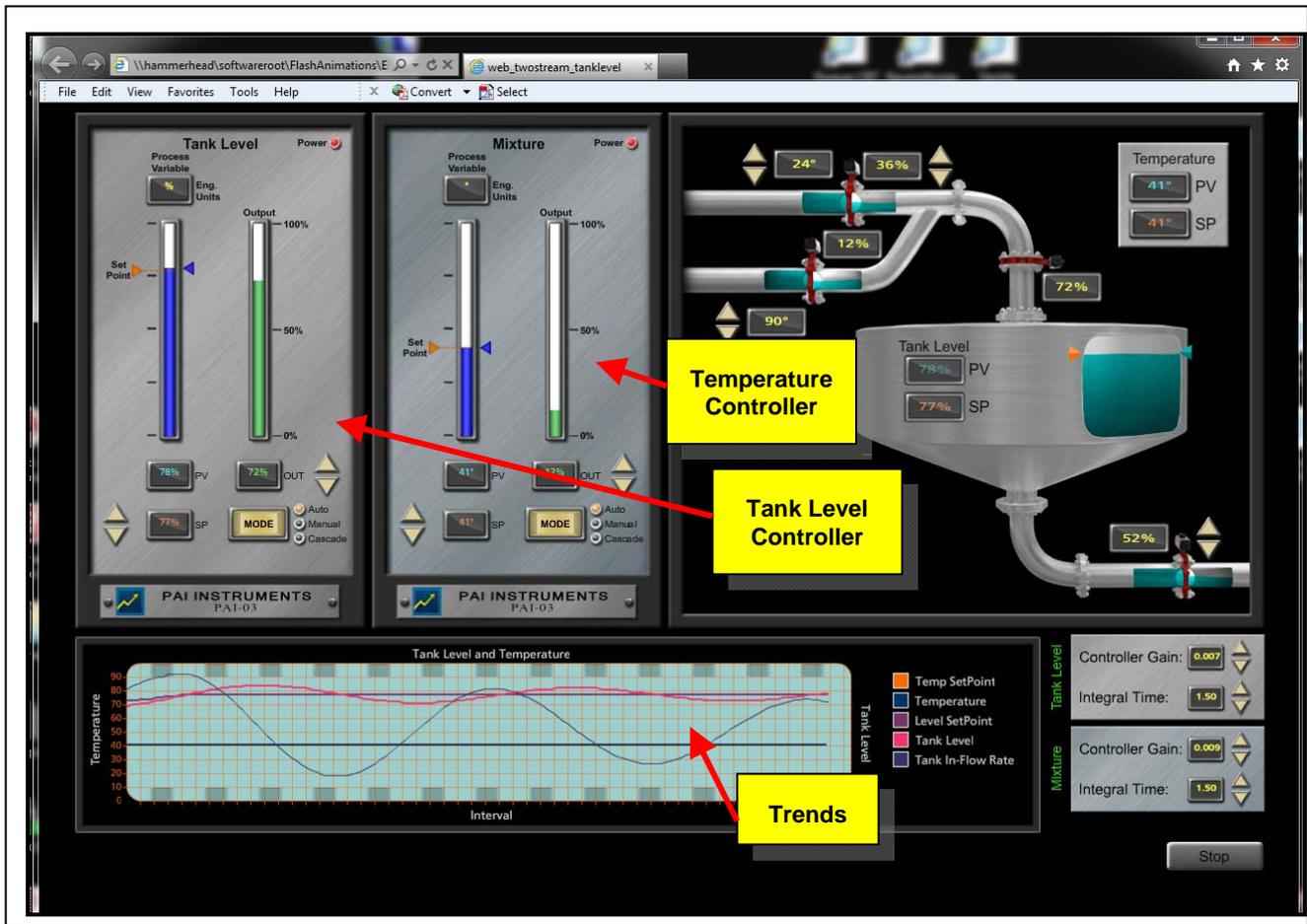# PID Control Loop Simulation

The control loop simulation provides two PID controllers—one controlling tank level and the other controlling temperature at the tank water inlet.

1. The temperature at the water inlet to the tank is controlled by mixing a stream of high-temperature water with the main low-temperature stream of water. The high-temperature stream defaults to 90°C and the-low temperature stream defaults to 24°C; however, the user can vary these values using the up and down arrows provided. The control scheme varies the high-temperature flow rate to achieve the set point temperature at the inlet to the tank.

2. The tank level is controlled by varying the flow rate into the tank using the control valve just above the tank inlet. Note that the user can vary the process load on the tank by modulating the valve on the tank outlet using the up and down arrows.

The trend line (strip chart) shows values for temperature and temperature set point, as well as level and level set point. A relative trend is shown for water inflow rate.

Each controller can be switched between *Auto* and *Manual*. In *Auto*, the set point can be changed with the up and down arrows on the left side. In *Manual*, the output can be directly changed using the up and down arrows on the right side.

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The *Controller Proportional Gain* and the *Integral Time* for each controller can be independently varied using the controls at the lower right of the screen. The derivative time is a constant, is not shown, and cannot be changed.

Each controller face plate contains a bar graph for the process variable and another for controller output as a percentage. The set point is shown by the orange arrow.
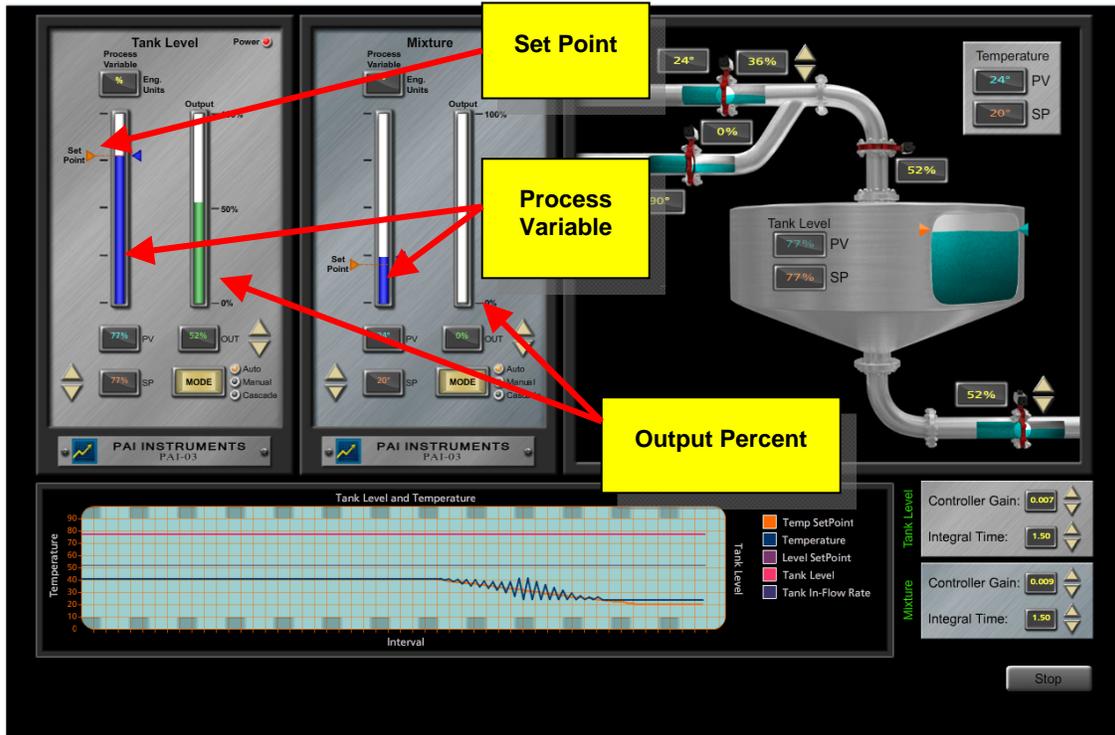
Note that in the screen above, the user has reduced the set point of the mixture temperature to 20°C. However, the main stream temperature is 24°C; therefore, the hot water stream controller has closed the hot water valve completely. (Note the zero output on the controller face plate.) Although the user has adjusted the set point to 20°C, the best that can be achieved is the 24°C of the main cool water stream. Note the offset in the trend line between the 20°C set point and the 24°C mixture which is as close as the controller can get to the set point.

In the screen below, the user has now increased the tank level set point to 80 percent. Note the increase in the set point and process variable values. Also note the modulation of the inflow rate. Note that as the level goes above the set point, the inflow rate trends down. As the level goes below the set point, the inflow rate trends up.

The user can switch to *Manual* mode by clicking on the **Mode** button. Each click toggles the mode from *Auto* to *Manual* and back to *Auto*.

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