PID controllers are the most used controllers in automatic process control applications in industry. Without them, the regulation tasks have to be done manually. Like this unfortunate human depicted here that has to watch the temperature gauge to adjust the gas valve to keep the water temperature at a required value. If the temperature is too high, he has to close the valve a bit and if it becomes too cold, he has to open the gas valve.

Here, this person actually does the feedback control because he changes the firing rate based on the feedback that he gets from the temperature gauge. This manual control system is not efficient in the long run and the need for automatic control lead to the introduction of controllers such as PID. In fact, think of the PID controller as the operator that gets feedback from the process value and manipulates the valve accordingly to keep the process value closed to the desired value.

So, to automate the process and free the person from the tedious work, we use PID controller and we will also need more components to make it happen. We will need a sensor to measure the temperature or the process value and then it should be compared to the set point which was previously set by the operator as the desired temperature. The error should be fed to the PID controller and the controller will issue a control output that will manipulate the automatic valve to reduce the error and make the process variable closer to the set point. To automate the valve, we will need to add an actuator to it.

PID stands for proportional, integral, and derivative controllers. Each of its control modes reacts differently to the error. So, instead of abstractly studying these in terms of some math equations, let’s see them with an example.