**PID controller**

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A [block diagram](http://en.wikipedia.org/wiki/Block_diagram) of a PID controller

A **proportional–integral–derivative controller** (**PID controller**) is a generic [control loop](http://en.wikipedia.org/wiki/Control_loop) [feedback mechanism](http://en.wikipedia.org/wiki/Feedback_mechanism) ([controller](http://en.wikipedia.org/wiki/Controller_%28control_theory%29)) widely used in industrial [control systems](http://en.wikipedia.org/wiki/Control_system) – a PID is the most commonly used feedback controller. A PID controller calculates an "error" value as the difference between a measured [process variable](http://en.wikipedia.org/wiki/Process_variable) and a desired [setpoint](http://en.wikipedia.org/wiki/Setpoint_%28control_system%29). The controller attempts to minimize the error by adjusting the process control inputs.

The PID controller calculation ([algorithm](http://en.wikipedia.org/wiki/Algorithm)) involves three separate constant parameters, and is accordingly sometimes called **three-term control**: the [proportional](http://en.wikipedia.org/wiki/Proportionality_%28mathematics%29), the [integral](http://en.wikipedia.org/wiki/Integral) and [derivative](http://en.wikipedia.org/wiki/Derivative) values, denoted *P,* *I,* and *D.* [Heuristically](http://en.wikipedia.org/wiki/Heuristic), these values can be interpreted in terms of time: ***P* depends on the *present* error, *I* on the accumulation of *past* errors, and *D* is a prediction of *future* errors, based on current rate of change.**[**[1]**](http://en.wikipedia.org/wiki/PID_controller#cite_note-0) The weighted sum of these three actions is used to adjust the process via a control element such as the position of a [control valve](http://en.wikipedia.org/wiki/Control_valve), or the power supplied to a heating element.

In the absence of knowledge of the underlying process, a PID controller is the best controller.[[2]](http://en.wikipedia.org/wiki/PID_controller#cite_note-ben93p48-1) By tuning the three parameters in the PID controller algorithm, the controller can provide control action designed for specific process requirements. The response of the controller can be described in terms of the responsiveness of the controller to an error, the degree to which the controller [overshoots](http://en.wikipedia.org/wiki/Overshoot_%28signal%29) the setpoint and the degree of system oscillation. Note that the use of the PID algorithm for control does not guarantee [optimal control](http://en.wikipedia.org/wiki/Optimal_control) of the system or system stability.

Some applications may require using only one or two actions to provide the appropriate system control. This is achieved by setting the other parameters to zero. A PID controller will be called a PI, PD, P or I controller in the absence of the respective control actions. PI controllers are fairly common, since derivative action is sensitive to measurement noise, whereas the absence of an integral term may prevent the system from reaching its target value due to the control action.

