

**TABLE 1** Effects of independent P, I, and D tuning on closed-loop response.

For example, while  $K_I$  and  $K_D$  are fixed, increasing  $K_P$  alone can decrease rise time, increase overshoot, slightly increase settling time, decrease the steady-state error, and decrease stability margins.

	Rise Time	Overshoot	Settling Time	Steady-State Error	Stability
Increasing $K_P$	Decrease	Increase	Small Increase	Decrease	Degrade
Increasing $K_I$	Small Decrease	Increase	Increase	Large Decrease	Degrade
Increasing $K_D$	Small Decrease	Decrease	Decrease	Minor Change	Improve