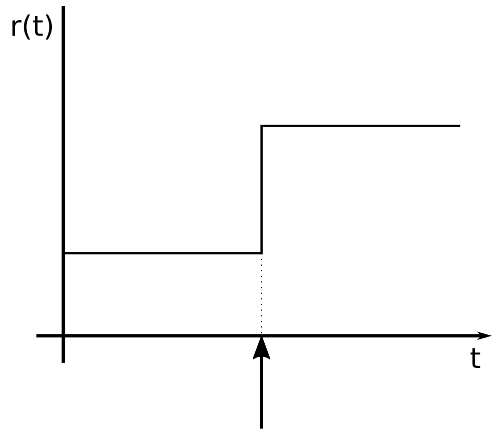
Alternative Derivative Action (Continuous-time)

Imagine a step change in reference signal $r(t)$. This results in a theoretically infinite, practically very large response of the derivative term.



$\Rightarrow$ Add a low-pass filter to the derivative term:

$$\frac{U_d(s)}{E(s)} = \frac{K_d s}{1 + s\tau}$$

With $s = j\omega$, breakpoint at $\omega = 1/\tau$. This prevents amplification of high frequencies.

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$$\frac{U_d(s)}{E(s)} = \frac{K_d s}{1 + s\tau}$$

Further $e(t)$ is replaced by $c \cdot r(t) - y(t)$ with c the setpoint weighting, which is often set to zero to further reduce immediate influence of a sudden set-point jump.

In the time-domain:

$$u_d(t) = -\tau \frac{du_d}{dt} + K_d \frac{d}{dt}(c \cdot r(t) - y(t))$$

Outline

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1. Introduction
2. Analog and Digital formulations
3. Implementations
   - Analog Implementation
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4. PID Tuning
   - Manual Tuning
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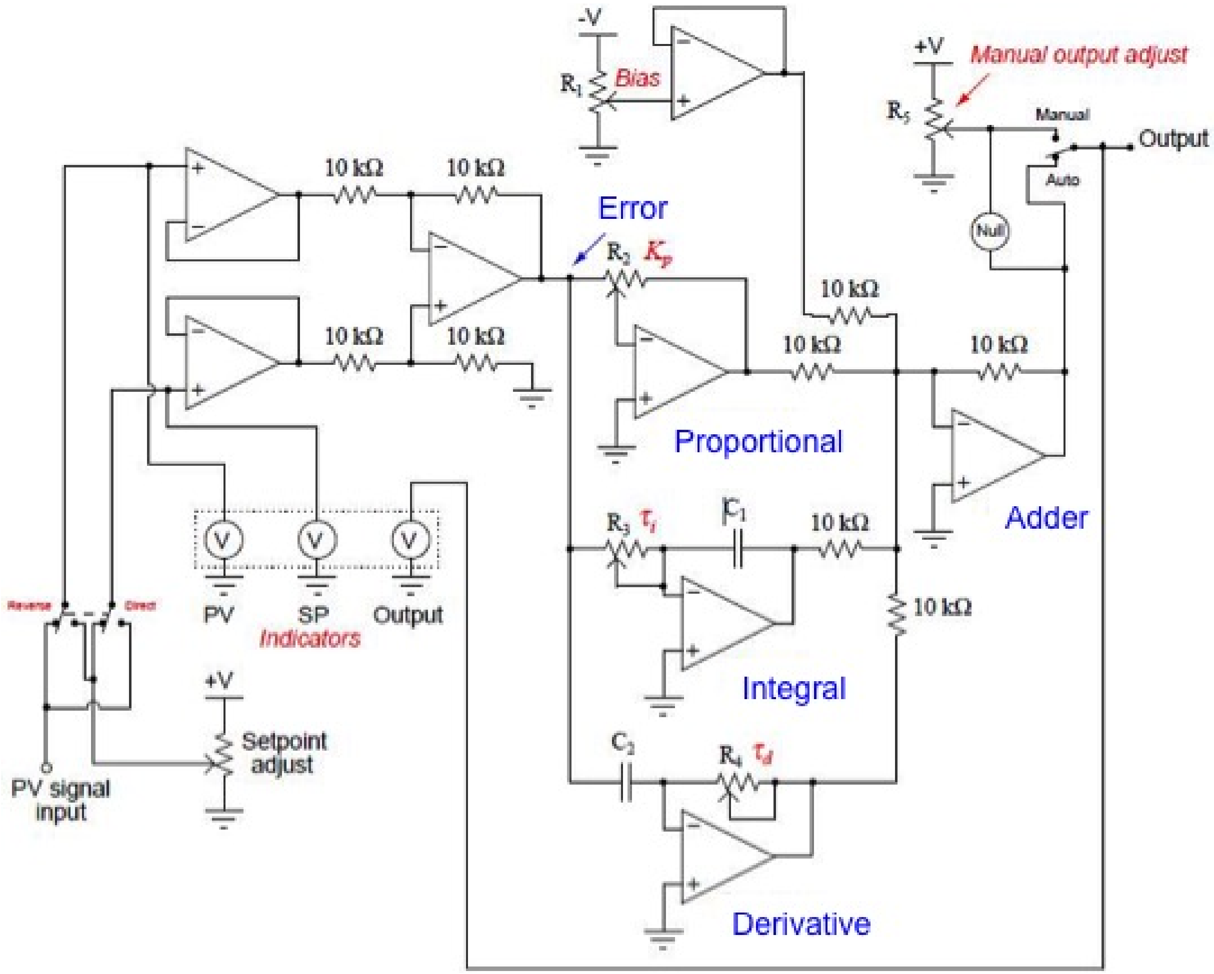
Analog Implementation

The key building block is the operational amplifier (op-amp).



- PV - Process Variable $y(t)$
- SP - Setpoint $r(t)$
- Output - Control action $u(t)$

Analog Implementation

Analog PID controller: FOXBORO 62H-4E-OH M/62H