

PID_Controller Overview:

The PID_Controller is an advanced function block used for process control. It implements a Proportional-Integral-Derivative (PID) control algorithm with features like anti-windup protection, output limiting, and safe initialization. These features help maintain stable and reliable system behavior.

Inputs:

ENABLE (BOOL): Turns the controller on or off. When FALSE, the output resets to zero.

SP (REAL): The desired target value (Setpoint).

PV (REAL): The current measured value (Process Variable).

Kp (REAL): Proportional gain.

Ki (REAL): Integral gain.

Kd (REAL): Derivative gain.

OUT_MIN (REAL): Minimum allowed controller output.

OUT_MAX (REAL): Maximum allowed controller output.

RESET (BOOL): Resets the integral accumulator when set to TRUE.

FirstScan (BOOL): Should be set to TRUE during the first scan to properly initialize the derivative calculation.

Outputs:

OUT (REAL): The final controller output, limited by min and max settings.

ERROR (REAL): The difference between SP and PV.

INTEGRAL (REAL): The current value of the integral term.

DERIVATIVE (REAL): The current value of the derivative term based on the rate of error change.

Internal Variables:

IntegralSum (REAL): Accumulates error for the integral term, updated only when conditions allow (to prevent windup).

PrevError (REAL): Stores the last error value to calculate the derivative.

IsWithinLimits (BOOL): TRUE if the output is within the min/max range.

IsWindupBelow (BOOL): TRUE if the error is positive and the output is clamped at the minimum.

IsWindupAbove (BOOL): TRUE if the error is negative and the output is clamped at the maximum.