# Control Loop Library

The "Control Loop Library" includes controls and filters for process control and signal processing.

## Product description

The control library includes function blocks for process control. It consists of different elements that are assembled flexibly into a control structure. These include various differentiators and integrators, for which various anti-windup strategies are available. In this way, the structure of the created control can be derived from the selected components. This library also provides an example for the use of nested object-oriented function blocks.

The library also contains several digital filters that can be used for signal processing. One must determine the weighting parameters oneself.

## More information

The following function blocks are included in the library:

### Controls

- `Controller_Base`: Abstract basic function block for creating individual controls
- `Controller_P`: Function block for implementing a P control
- `Controller_PD`: Function block for implementing a PD control
- `Controller_PI`: Function block for implementing a PI control
- `Controller_PID`: Function block for implementing a PID control

### Integrator approximation

- `Integrator_Base`: Basic function block for creating individual integral approximations
- `Integrator_ParabolicApproximation`: Function block for approximating the integral by means of a parabola using the last values
- `Integrator_RectangleApproximation`: Function block for approximating the integral by means of a rectangle
- `Integrator_TrapezoidApproximation`: Function block for approximating the integral by means of a trapezoid

### Anti-windup strategies

These functions blocks provide different strategies to avoid an overflow of the integrator in case of a prolonged control variance.

- `AntiWindUp_Base`: Abstract basis function block for creating individual anti-windup strategy
- `AntiWindUp_Clamping`: Function block for using an anti-windup strategy that fixes the integrator value to the set maximum
- `AntiWindUp_BackCalculation`: Function block for using an anti-windup strategy that decreases the integrator value over time

### Differentiator approximation

- `Differentiator_Base`: Abstract basis function block for creating individual differentiator approximations
- `Differentiator_BackwardDifference`: Function block for linear approximation of the differential using the last value
- `Differentiator_LinearAverageApproximation`: Function block for linear approximation of the differential using the last values
- `Differentiator_LinearFourPointApproximation`: Function block for linear approximation of the differential using the last values
- `Differentiator_ParabolicApproximation`: Function block for approximating the differential by means of a parabola using the last values

**BangBang controls**

- `BangBangController`: Function block for implementing a BangBang control
- `BangBangControllerWithTimeHysteresis`: Function block for implementing a BangBang control with time-based hysteresis
- `BangBangControllerWithValueHysteresis`: Function block for implementing a BangBang control with value-based hysteresis

**Three-point controls**

- `ThreePointController`: Function block for implementing a three-point control
- `ThreePointControllerWithValueHysteresis`: Function block for implementing a three-point control with value-based modulation

**Filters**

- `Filter_Base`: Abstract basis function block for creating individual filters
- `Filter_FIR`: Function block for implementing a finite impulse response filter
- `Filter_IIR`: Function block for implementing an infinite impulse response filter
- `Filter_SOS`: Function block for implementing a second-order section filter

**PWM Creator**

- `PWM_CreatorBase`: Abstract basis function block for creating individual PWM signals
- `PWM_Creator`: Function block creating a PWM signal
- `PWM_Creator_FixedCycle`: Function block creating a PWM signal with a fixed cycle time differing from the task cycle time calling this

## General information

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|---|---|
| **Manufacturer:** | 3S-Smart Software Solutions GmbH |
| | Memminger Strasse 151 |
| | 87439 Kempten |
| | Germany |
| **Support:** | https://support.codesys.com |
| **Item:** | Control Loop Library |
| **Item number:** | 000113 |
| **Sales:** | CODESYS Store |
| | https://store.codesys.com |
| **Included in delivery:** | |
| | CODESYS Package |

## System requirements and restrictions

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| **Development system** | CODESYS Development System V3.5.14.0 or later |
| **Runtime** | CODESYS Control V3.5.14.0 or later |
| **Supported platforms and devices** | Note: Use the "Device Reader" project for locating the functions supported by the PLC. The "Device Reader" project is available in the CODESYS Store free of charge. |
| **Additional requirements** | - |
| **Restrictions** | - |
| **Licensing** | - |
| **Required accessories** | - |

*Note: Not all CODESYS features are available in all territories. For more information on geographic restrictions, please contact sales@codesys.com.*

*Note: Technical specifications are subject to change. Errors and omissions excepted. The content of the current online version of this document applies.*