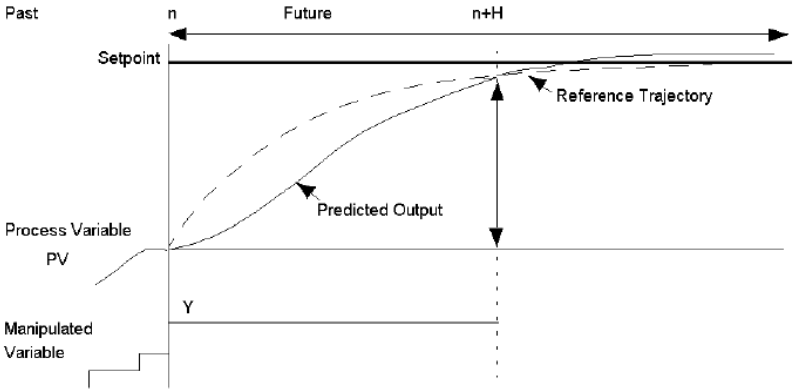
EcoStruxure Control Expert Libraries - Overview

Model Predictive Control

Value

Why use Model Predictive Control

- Some process are slow to react to a change in the manipulated value.
  - The sensor could be distant from the controller
  - It may take time for a reaction to cause the response
- Model Predictive controllers contain a model of the process which allow the system to predict the impact of the output on the process.
  - The delay in reaction is modelled within the controller
  - The actual output is tracked against the predicted output to monitor the impact of the change



Available Models

Applications for model types

1st Order Models

- Thermal Applications
  - Heat Exchanges
  - Dryers
- Tank Applications
  - Level
  - Pressure
- Fluid Applications
  - Incompressible fluid in pipe

Integrative 1st Order Model

- Chemical Applications

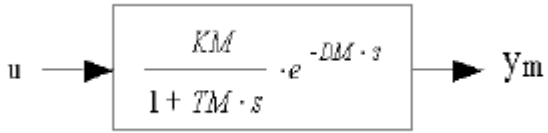
3rd Order Model

Controller Blocks

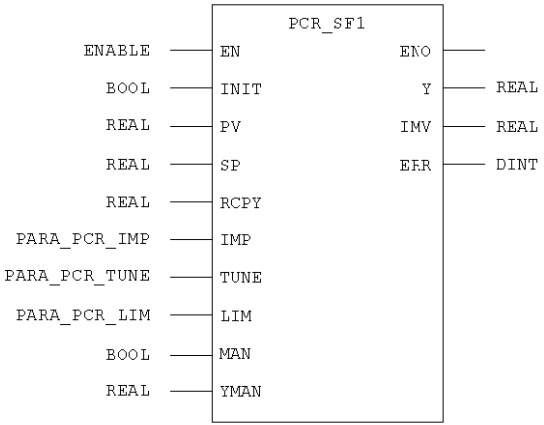
Typical Blocks

1st Order

Equation

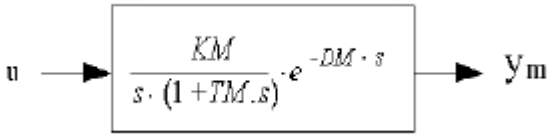


Block



Integrative 1st Order

Equation



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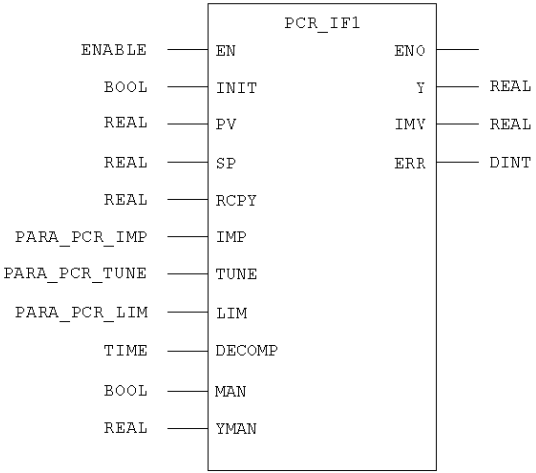
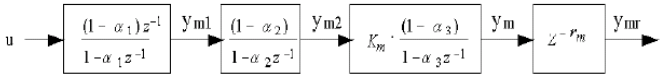


3rd Order

Equation



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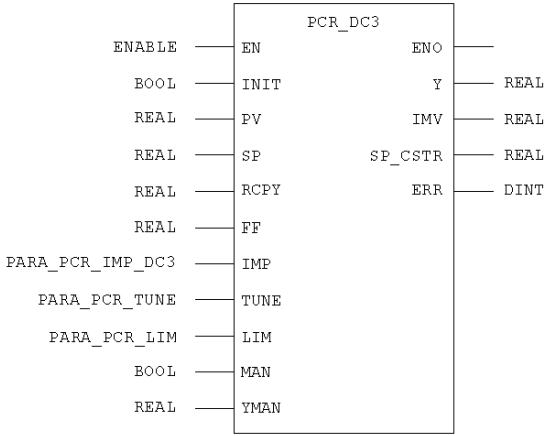


Parameters

What can be controlled

Model Parameters

KM: Gain

TM: Time Constant

DM: Pure Time Delay

Tune Parameters

TS: Sampling Time

H: Coincidence Point

TRBF: Closed Loop Response

Output Parameters

YMAX: Maximum Value

YMIN: Minimum Value

YRATE: Maximum Rate

3rd Order Only

TM2: Time Constant 2

TM3: Time Constant 3

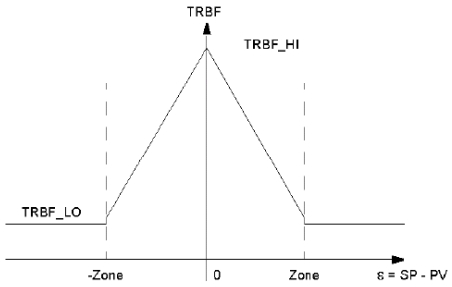
Options

Additional Functionality

PV Zone Control

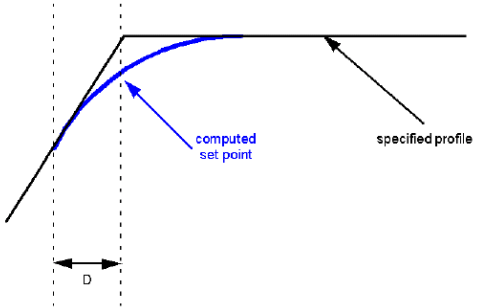
For Non-linear process

- TRBF (95% closed loop response time) can be changed dynamically
- Within zone TRBF is changed linearly



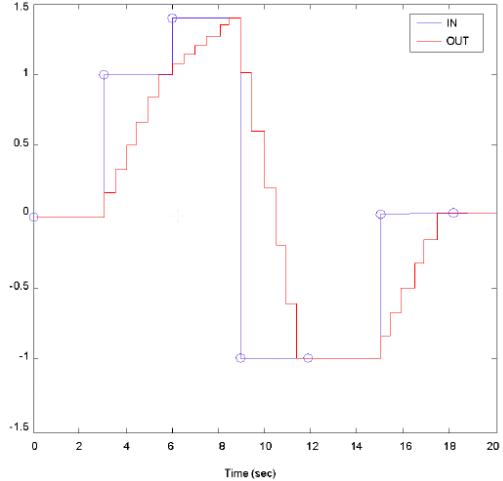
SP Ramp & Docking

- Controls the change of set point
- Supports a table of recipes for Time, Value and Docking horizon



Rate Limiter

- Limits the first derivative of a signal passing through it.
- Used to sync between master and slave controller rates

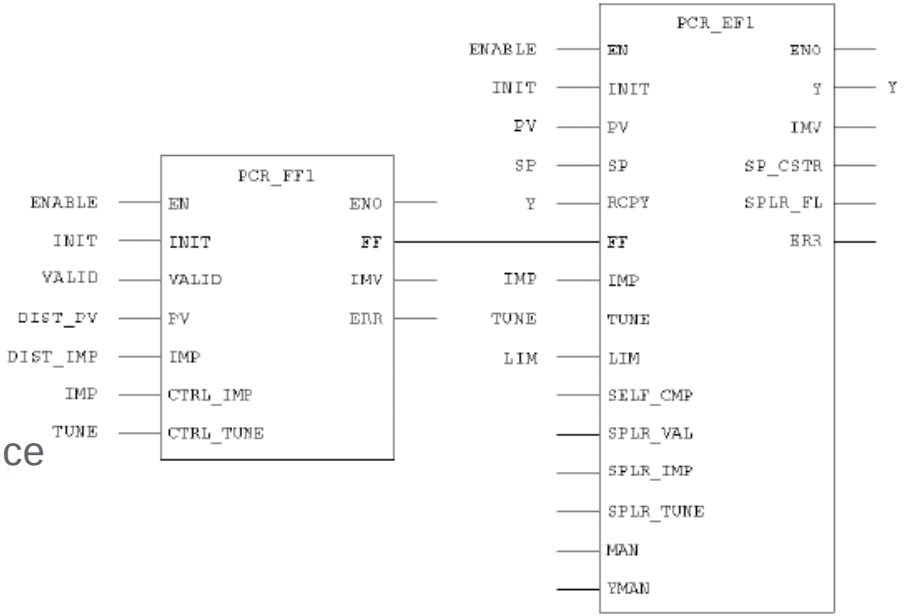


Feed Forward Compensation (Enhance Controllers Only)

Managing Process Disturbance

- Applications
  - Any where a known process (steam flow in a boiler) will have a measurable impact of the operation of the process.

- The Feed Forward block computes a compensation value to be applied to the controller in order to correct for the disturbance

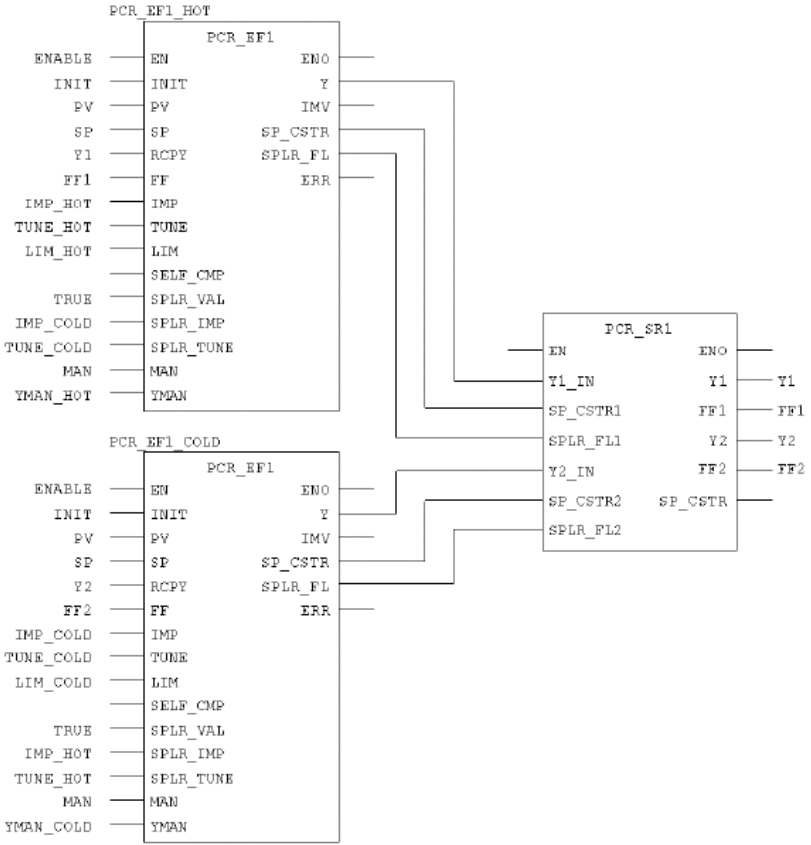


Split Range Compensation (Enhance Controllers Only)

Managing Dual Outputs

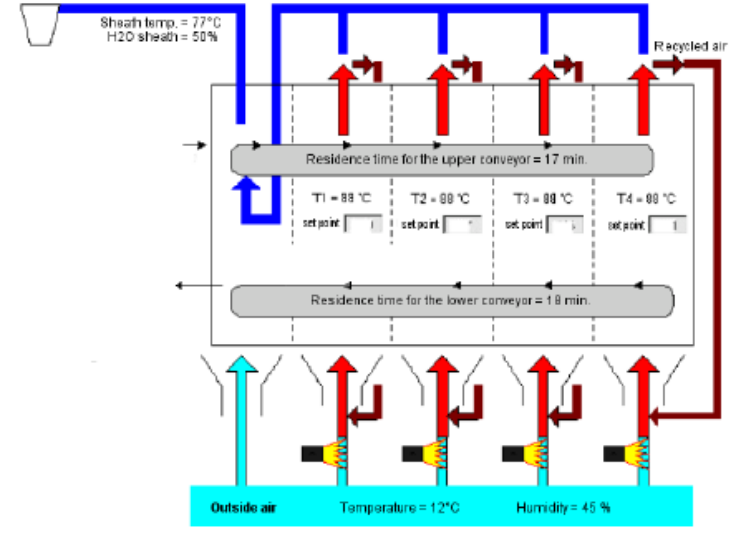
- Applications
  - Heating / Cooling valves to a heat exchanger
  - (Another application would be good)

- Split Range Compensation
  - Balances the output from the individual controllers (Hot & Cold) to balance the output
  - Real output is returned to the controllers via the RCPY parameter



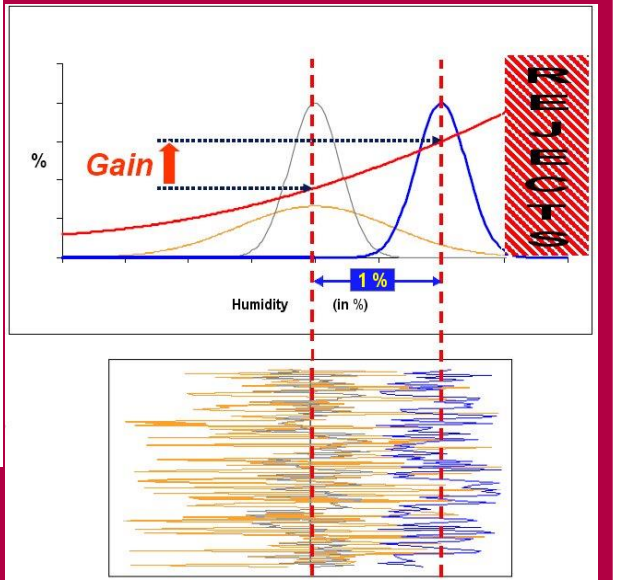
Case Study: Dryer

Food & Beverage



Better Control of the product humidity for higher savings

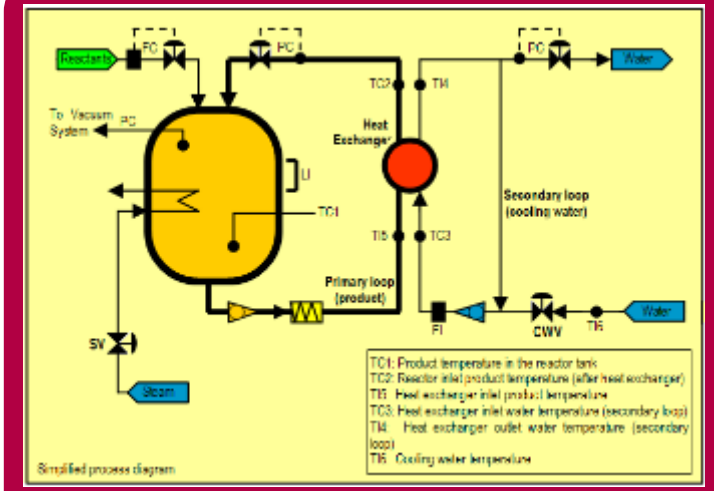
1 % improvement



Huge Savings / year

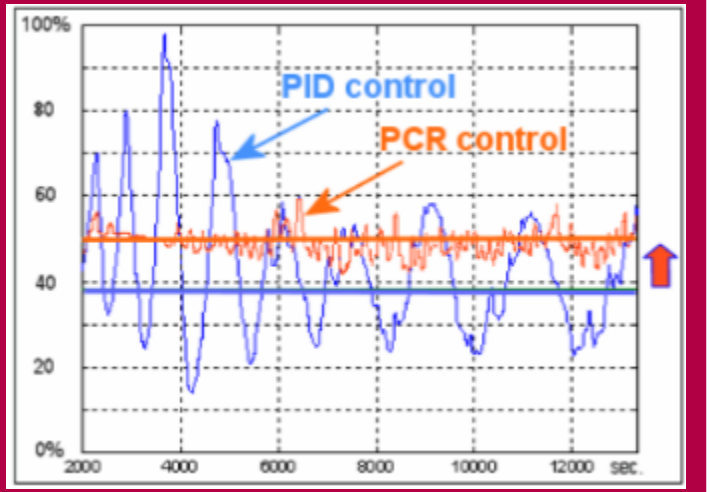
Case Study: Temperature Management

Repsol, Spain: Chemical



- **Better Dynamic Control of the temperature of an exothermic reactor**
- **Productivity Improvement → +17%**

- **Shorter batch via increased reactant injection**
- **Less stress on equipment**



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