Process controller

1 Description

The function enables a process control independent of the DCS. Apart from the specified setpoint, an actual value is also fed to the actuator.

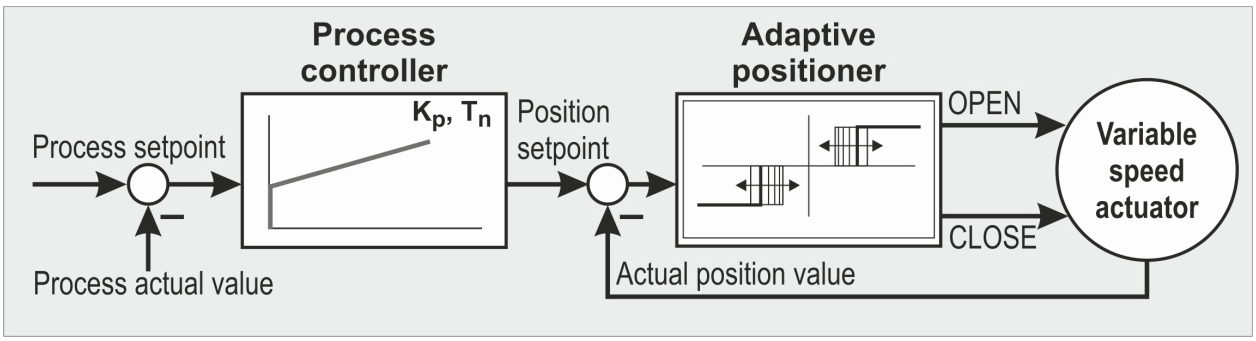
Depending on the version, the setpoint feed for the process controller differs (process setpoint) and is parameterized via the "control mode“ parameter:

- Conventional, via analog input (0/4 – 20 mA), "Process controller AI1" or "Process controller AI2".
- Via fieldbus, "Process controller“.
- Internal (fixed setpoint 0 – 100 %), "Process controller fixed setpoint“.

The binary STOP signal enables change-over to a second control mode (only if "Pulse contact" is not parameterized), see also parameter “Alternative control mode”.

The actual process value (e.g. current signal of a sensor/lever meter) is supplied to the actuator via the second analog input.

The analog outputs of the actuator can signal the current “Position actual value” or the current “Process actual value”. Which one is determined via the parameters “Analog output AO1” resp. “Analog output AO2”.



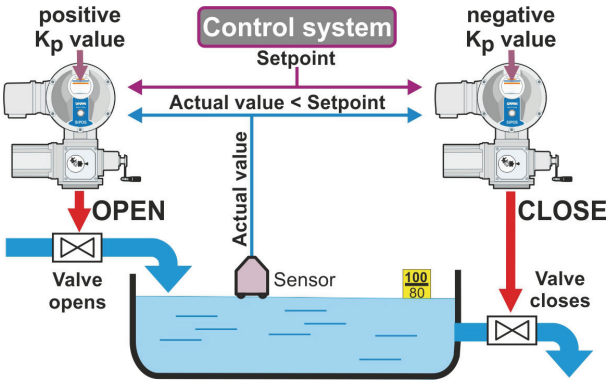
The process controller is implemented as a classic PI controller. Gain K_p and reset time T_n can be parameterized.
The **controller output** is used as **setpoint for the internal positioner**.

2 Parameterization

Main menu ➔ Parameters ➔ Control system		
Parameter *Default value*	**Parameter value**	**Explanation**
Control mode *Permanent contact*	Possible modes:	
Analog	Process controller AI1	Process controller with setpoint via analog input AI1. The process controller within this actuator is activated. Setpoint is recorded via analog input AI1 (0/4 –20 mA). The actual process value is recorded via AI2 (0/4 – 20 mA).
	Process controller AI2	Process controller with setpoint via analog input AI2. As for process controller AI1. Setpoint via analog input AI2, actual process value via analog input AI1.
Fieldbus	Process controller	Process controller with setpoint via fieldbus.
Internal	Process controller fixed setpoint	Process controller with fixed setpoint. The adjustable fixed setpoint is controlled by the process controller.
Alternative control mode *Not active*	The "Alternative control mode“ parameter enables the change-over to a second control mode, to change, e.g. in case of an error, from analog to binary control. As a prerequisite, "Pulse contact“ must not be selected for the "Control mode“ parameter. The change-over is performed for an active binary STOP signal. Possible second control mode:	
	Not active	Change-over to a second control mode is not possible. The control mode chosen via parameter “Control mode” is active - independent of the STOP signal.
Binary	Permanent contact	For detailed information refer to operation instructions.
	Proportional move	
Analog	Positioner AI1	
	Process controller AI1	
	Positioner AI2	
	Process controller AI2	
Fieldbus	Permanent contact	
	Positioner	
	Process controller	
	Proportional move	
Internal	Process controller fixed setpoint	
Analog input AI1 *Rising, 4 – 20 mA*	Setpoint from the DCS for the process controller via analog input AI1, if “control mode” is set to “Process controller AI1“. Process actual value from sensor for the process controller via analog input AI1, if “control mode” is set to “Process controller AI2“.	
Slope	Rising	20 mA corresponds to 100 % OPEN.
	Falling	20 mA corresponds to 0 % OPEN.
Range	4 – 20 mA	Detection of open-circuit is possible (live zero).
	0 – 20 mA	Detection of open-circuit is not possible (dead zero).
Analog input AI2 *Rising, 4 – 20 mA*	Process actual value from sensor for the process controller via analog input AI2, if “control mode” is set to “Process controller AI1“. Setpoint from the DCS for the process controller via analog input AI2, if “control mode” is set to “Process controller AI2“.	
Slope	Rising	20 mA corresponds to 100 % OPEN.
	Falling	20 mA corresponds to 0 % OPEN.
Range	4 – 20 mA	Detection of open-circuit is possible (live zero).
	0 – 20 mA	Detection of open-circuit is not possible (dead zero).

Main menu ➔ Parameters ➔ Control system		
Parameter ***Default value***	**Parameter value**	**Explanation**
Analog output AO1 *Rising, 4 – 20 mA*	The analog output AO1 provides analog signals on: - the position actual value (position of the actuator), or - the process actual value (transfers the sensor signal).	
	Process actual value	Process actual value is issued via the analog output AO1.
	Position actual value	Position actual value is issued via the analog output AO1
Slope	Rising	20 mA corresponds to 100 % OPEN.
	Falling	20 mA corresponds to 0 % OPEN.
Range	4 – 20 mA	Detection of wire break is possible (live zero).
	0 – 20 mA	Detection of wire break is not possible (dead zero).
Analog output AO2 *Not active*	The analog output AO2 provides analog signals on: - the position actual value (position of the actuator), or - the process actual value (transfers the sensor signal).	
	Not active	No value is issued.
	Position actual value	Position actual value is issued via the analog output AO2.
	Process actual value	Process actual value is issued via the analog output AO2.
Slope	Rising	20 mA corresponds to 100 % OPEN.
	Falling	20 mA corresponds to 0 % OPEN.
Range	4 – 20 mA	Detection of wire break is possible (live zero).
	0 – 20 mA	Detection of wire break is not possible (dead zero).

Main menu ➔ Parameters ➔ Safety		
Parameter ***Default value***	**Parameter value**	**Explanation**
Fault control source *Keep position*	The response to a detected open circuit can be parameterized. All inputs of the current remote control source (analog, binary or fieldbus) are monitored. The possible settings are:	
	Move to EMERGENCY pos.	Move to parameterized EMERGENCY position. The display indicates: “No signal – EMERGENCY pos.“
	Keep position	Stay in current position. The display indicates:“No signal – Pos. held“
	Keep actual process value	The current actual process value is retained The display indicates:“Keep actual process value“
	Move to fixed setpoint	The fixed process setpoint is approached and retained The display indicates:“Move to fixed setpoint“

Main menu ➔ Parameters ➔ Software functions		
Parameter ***Default value***	**Parameter value**	**Explanation**
Process controller	"Process controller" software function is enabled.	
Gain (Kp) *0.00*	-1.00 – +1.00 (in 0.01 steps)	Gain K_p can be set within the range of -1.00 to +1.00. For a positive control deviation (setpoint > actual value) - a positive K_p causes an operation in OPEN direction; - a negative K_p causes an operation in CLOSE direction.  Fig.: Inverse operation process controller – behavior of the actuator depending on the set K_p parameter
Reset time (Tn) *100.0 s*	0.1 – 3000.0 s (in 0.1 steps)	Reset time T_n can be set within the range of 0.1 to 3000.0 s.
Fixed setpoint *0.0%*	0.0 % – 100.0% (in 0.5 % steps)	Fixed percentage specification of the process setpoint for the process controller. Only effective, if "control mode" is set to "Internal - Process controller fixed setpoint".

The parameters can be read or written via fieldbus and COM-SIPOS for all actuator types.
For details on the fieldbus telegram refer to the respective operation instructions.

3 Comments

- The setting of the process controller parameters depends strongly on the application environment where the controller is used.
- As a basis for the setting, the gain K_p should be set very low, while the reset time T_n should be set very high (e.g. 100.0 s).
- If a small control deviation requires a large position change, the gain K_p has to be increased.
- When reaching the controller output limit, the I-portion is automatically adjusted so that the controller can exit the limit at any time ("anti-reset-windup-structure").
- When changing over to local operation or in case of an error, the control output is adjusted so that the system deviation of the adaptive positioner is zero (impact-free connection).
- This function cannot be combined with any other optional software function. Exception: If no process controller is active as "Control mode", the actuator can be operated via the "Stroke-time curve" (travel dependent freely adjustable positioning times) software function.