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Контроллер CoDeSys

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GOSSEN METRAWATT

PDPI SOFTcontroller

Library programmed per IEC 61131-3 / CoDeSys

3-349-363-03
5/8.14

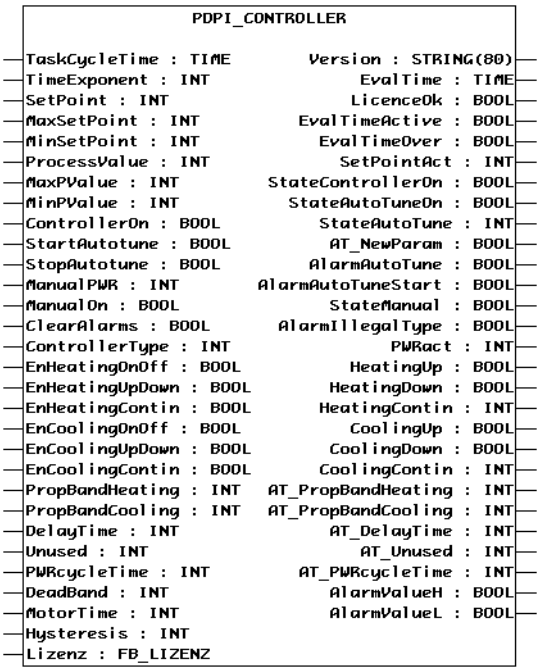
- 2 versions: basic and professional

Basic version

- Licensed library can be integrated into each compatible programming system per IEC 61131-3 / CoDeSys alliance
- Any number of control channels is configurable within a PLC, limited only by the performance capacity and its periphery
- Configurable via PLC control
- Clock cycle depending on PLC/CPU: as from approx. 2 ms
- Dead-beat PDPI control performance
- The control parameters are optimized by means of a specially developed method which can be started at any time.
- 2-step, 3-step, continuous action and step-action controller

Professional version (in addition to basic version)

- Cascade, differential, ratio and switch control
- Hot runner control with actuating circuit and booster circuit
- Synchronous heat-up
- Algorithms for water cooling
- Feedforward control
- Adaptive measured value correction
- Limit value monitoring
- Plausible manipulating factor utilized in the event of sensor failure
- Setpoint ramps (up-down)
- Heating circuit monitoring



Features

- Suitable for zones with temperature rises of approximately 10 K/clock cycle to less than 1 K/1000 clock cycles
- Monitoring for sensor failure, reversed polarity
- Numerous monitoring functions

Applications

Dead-beat PDPI control algorithms can be integrated with the PDPI SOFTcontroller in compatible programming systems per IEC 61131-3. Standard controllers cannot be used in many technical control applications. However, the PDPI SOFTcontroller makes it possible to create defined controllers for any application through the use of basic modules. In addition to simple control tasks, highly complex controllers can be configured with special filtering tasks.

Applications include multi-channel temperature controllers for rubber and plastics processing machines, semiconductor manufacturing processes, industrial and laboratory ovens, textile and packaging machines, pharmaceuticals, chemicals, process engineering, food processing industry, wood and paper industries, glass and ceramics industry.

Filter and Functions with Distorted Controlled Variable

Designation / Parameter	Function	Limitation
Peak filter	Individual erroneous measurements caused by, for example, electrostatic discharge to the sensor, are suppressed.	---
Smoothing filter	In accordance with controlled system dynamics, several measured values are combined for control purposes in order to avoid an unsteady controlled variable.	---
Adaptive measured value correction	Suppression of constant periodic, or slowly changing oscillation.	Not active if period is longer than ½ delay time
Oscillation disabling (oscillation period: 3 ... 200 clock cycles)	Suppression of oscillation with a constant period, if the period is longer than ½ Tu.	---
Feedforward control	Suppression of controlled variable swells and dips in the event of load fluctuations, e.g. caused by operation/standstill of a machine/system	Load fluctuation interval much greater than delay time
Response to sensor error, sensor error manipulating factor	If operation must be continued with a defective sensor, the controller reads out a plausible manipulated variable in order to maintain the working level.	---

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Performance and Memory Occupancy

Memory occupancy	approx. 100 kB, basic version approx. 170 kB, professional version
Performance	< 1 ms for one control channel
CoDeSys	runs under version 2.3

Control Performance

Setpoints

Setpoint limiting	Adjustable upper and lower setting limits
Setpoint increase (boost)	Value and maximum duration can be configured
Ramp function (separate for rise and fall)	Specification of change gradient, activated by: – Restarting the controller – Changing the current setpoint value – Activating the proxy setpoint – Switching from manual to automatic operation

Configurable Control Modes

Limit transducer	Two-step / three-step controller without time response	
PDPI controller / PI controller	Heating	Cooling
	can be combined as desired	
	Switching	Switching
	Hot-runner	Water cooling
	Continuous	Continuous
	Step	Step
	No heating	No cooling

Control Channel Combinations

Differential controller	The temperature difference is corrected.
Cascade controller	The setpoint from one or several control channels is manipulated dynamically.
Switch controller	Depending upon operating state, a control loop with only one actuator can be controlled at two different (temperature) measuring points.
Ratio controller	Controlling to a defined ratio

Alarms

All errors and alarms can be separately programmed:

- broken sensor, reversed polarity
- loop break alarm
- adaptation error

Heating Circuit Monitoring, Configurable

Error messages for 100% heat without rising temperature, i.e. for short-circuited thermocouple, interrupted heating, no sensor in heating circuit

Self-Tuning

Can be started at any time from any operating state.
Intervention and change of control parameters is possible.

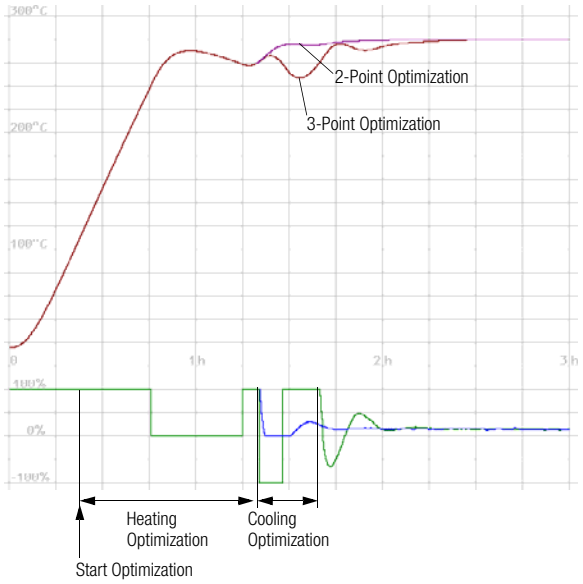

Figure 1 Control Performance during Self-Optimization

Hot-Runner Control Functions

Actuating Circuit

Actuation with a reduced manipulating factor and dwelling at a specific actuation setpoint serves to dry out hygroscopic heating elements.

Synchronous Heating

Synchronous heat-up prevents thermal stress by minimizing actual value differences.

If self-optimization has been started, it takes actual value management into consideration, as well as the actuating circuit.

Boosting – Temporarily Increased Setpoint

Temporarily increasing the setpoint frees clogged mould nozzles of “frozen” material remnants.

PDPI SOFTcontroller

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Description of Inputs (Basic Version)

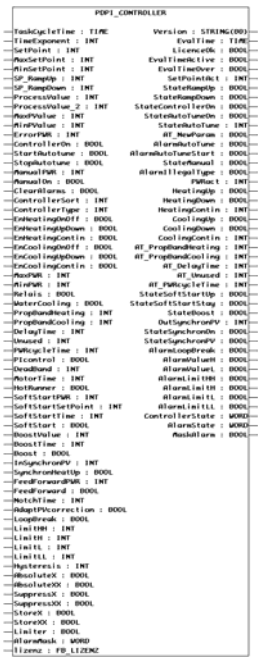
The description of the professional version, as well as further details, are included in the operating instructions available at our website (www.gossenmetrawatt.com > Products > Controllers; Control Systems > SOFTcontroller > Professional-CoDeSys).

Input Parameter		
Name	**Type**	**Description**
TaskCycleTime	TIME	Cycle time required for the task
TimeExponent	INT	Scaling for magnitudes of time
SetPoint	INT	Setpoint / reference variable
MaxSetPoint	INT	Upper limit of the utilized setpoint
MinSetPoint	INT	Lower limit of the utilized setpoint
ProcessValue	INT	Controlled variable
MaxPValue	INT	Upper range limit, largest possible controlled variable
MinPValue	INT	Lower range limit, smallest possible controlled variable
ControllerOn	BOOL	Switch the controller on
StartAutotune	BOOL	Start self-tuning
StopAutotune	BOOL	Stop self-tuning
ManualPWR	INT	Manual manipulated variable
ManualOn	BOOL	Manual operation
ClearAlarms	BOOL	Delete stored alarms
ControllerType	INT	Type of controller 2 Actuator Manual manipulated variable is read out. 3 Limit transducer Heating outputs active where controlled variable < setpoint Cooling outputs active where controlled variable > (setpoint + dead band) Switch-on and switch-off delay is equal to actuation cycle time. 4, 5 PDPI controller, PDPI step-action controller The PDPI control algorithm assures quick settling without overshooting. 5 = pure PDPI step-action controller, 4 = all other actuator combinations. Other Controller is off, “IllegalType” error is indicated.
EnHeatingOnOff	BOOL	Configuration for discontinuous heating
EnHeatingUpDown	BOOL	Configuration for motorized heating actuator
EnHeatingContin	BOOL	Configuration for proportional heating actuator
EnCoolingOnOff	BOOL	Configuration for discontinuous cooling
EnCoolingUpDown	BOOL	Configuration for motorized cooling actuator
EnCoolingContin	BOOL	Configuration for proportional cooling actuator
PropBandHeating	INT	Proportional band I (Xp I) for heating
PropBandCooling	INT	Proportional band II (Xp II) for cooling
DelayTime	INT	Controlled system delay time (Tu) The PDPI control algorithm can also be set using rules according to Chien, Hrones and Reswick. Fixed relationships between derivative action time (Tv), integral action time (Tn) and delay time apply, and are hard programmed: Tn = 2 * Tu and Tv = 0.5 * Tu
PWRcycleTime	INT	Actuation cycle time
DeadBand	INT	Dead band The dead band prevents quick alternation between heating and cooling or frequent advancing and retracting of a motorized actuator in the event of an unsettled controlled variable. The dead band is dynamic and does not result in any permanent system deviation.
MotorTime	INT	Motor running time Running time of the actuating motor between min. and max. limit stops.
Hysteresis	INT	Hysteresis for limit value monitoring and limit transducers
License	FB_ LIZENZ	Enabling of the control function

Description of Outputs

Output Parameter		
Name	**Type**	**Description**
Version	STRING	e.g. 'V01_00'
EvalTime	TIME	Remaining evaluation time without valid license
LicenseOk	BOOL	License is valid
EvalTimeActive	BOOL	Evaluation time is running
EvalTimeOver	BOOL	Evaluation time has elapsed
SetPointAct	INT	Momentary setpoint
StateControllerOn	BOOL	Automatic mode
StateAutoTuneOn	BOOL	Self-tuning is running
StateAutoTune	INT	Self-tuning phases
AT_NewParam	BOOL	Self-tuning has determined control parameters
AlarmAutoTune	BOOL	Self-tuning abort alarm The controller remains inactive until the error cleared.
AlarmAutoTuneStart	BOOL	Self-tuning start-up alarm The controller remains active, the error must be cleared.
AlarmIllegalType	BOOL	Incorrect controller type
StateManual	BOOL	Manual operation
PWRact	INT	Momentary manipulated variable
HeatingUp	BOOL	Manipulated variable “Up” for binary heating or motor
HeatingDown	BOOL	Manipulated variable “Down” for binary heating / motor
HeatingContin	INT	Continuous heat manipulated variable
CoolingUp	BOOL	Manipulated variable “Up” for binary cooling or motor
CoolingDown	BOOL	Manipulated variable “Down” for binary cooling / motor
CoolingContin	INT	Continuous cooling manipulated variable
AT_PropBandHeating	INT	Value ascertained by self-tuning for proportional band I for heating
AT_PropBandCooling	INT	Value ascertained by self-tuning for proportional band II for cooling
AT_DelayTime	INT	Value ascertained by self-tuning for controlled system delay time
AT_PWRcycleTime	INT	Value specified by self-tuning for actuation cycle time
AlarmValueH	BOOL	Range alarm, controlled variable too high
AlarmValueL	BOOL	Range alarm, controlled variable too low

Presentation as Function Block (Professional Version)



PDPI SOFTcontroller

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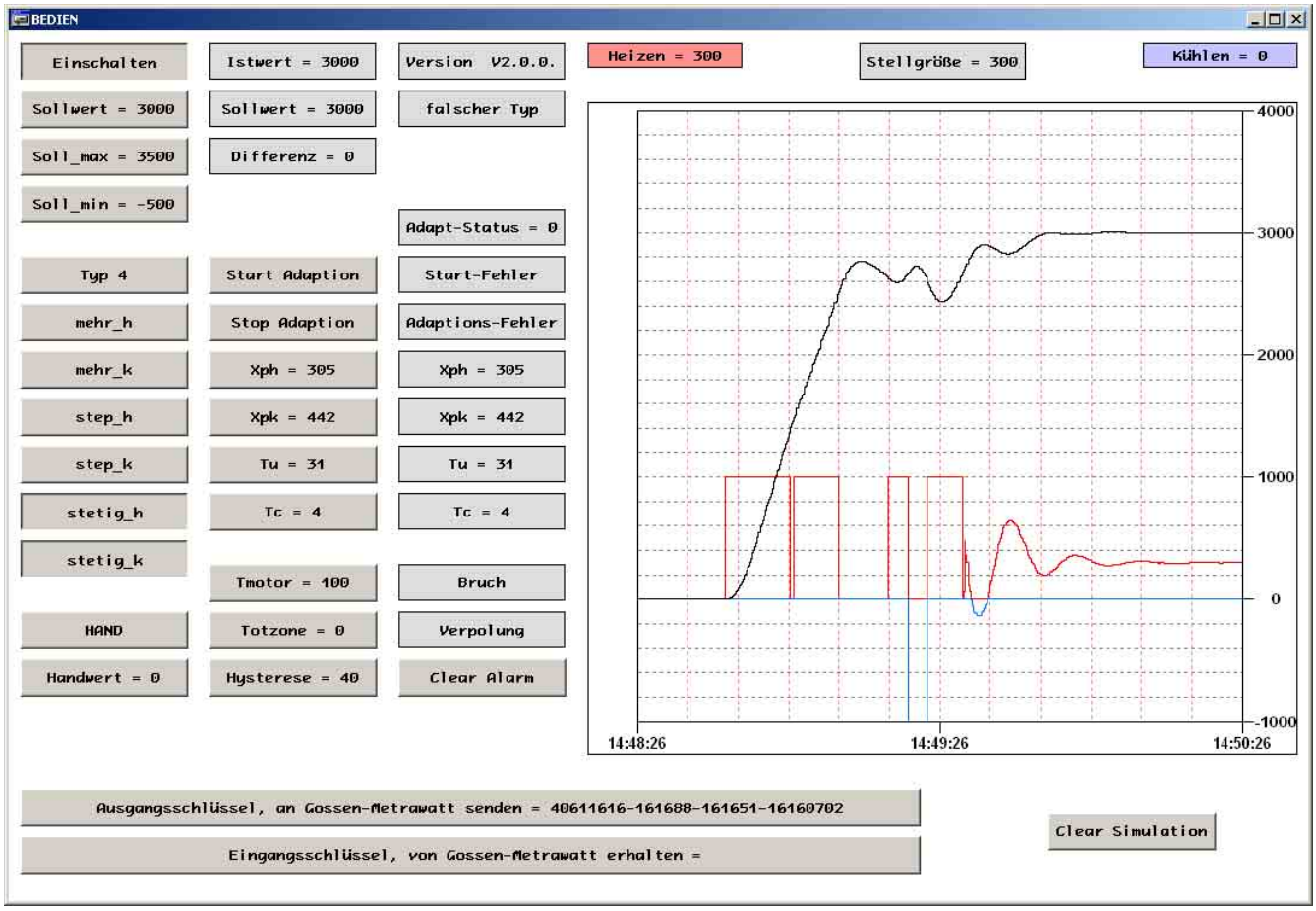
Visualization Example

All input parameters of the basic version shown in this diagram are accessible, the control characteristics are displayed in the graphic diagram and the initial status of each curve is visible.

(Application example under CoDeSys: www.gossenmetrawatt.com > Products > Controllers; Control Systems > SOFTcontroller > Basic/Professional-CoDeSys)



Order Information

SOFTcontroller CoDeSys

Designation	Article number / Feature
CoDeSys Basic	M510A
CoDeSys Basic License	M510B
CoDeSys Professional	M511A
CoDeSys Professional License	M511B

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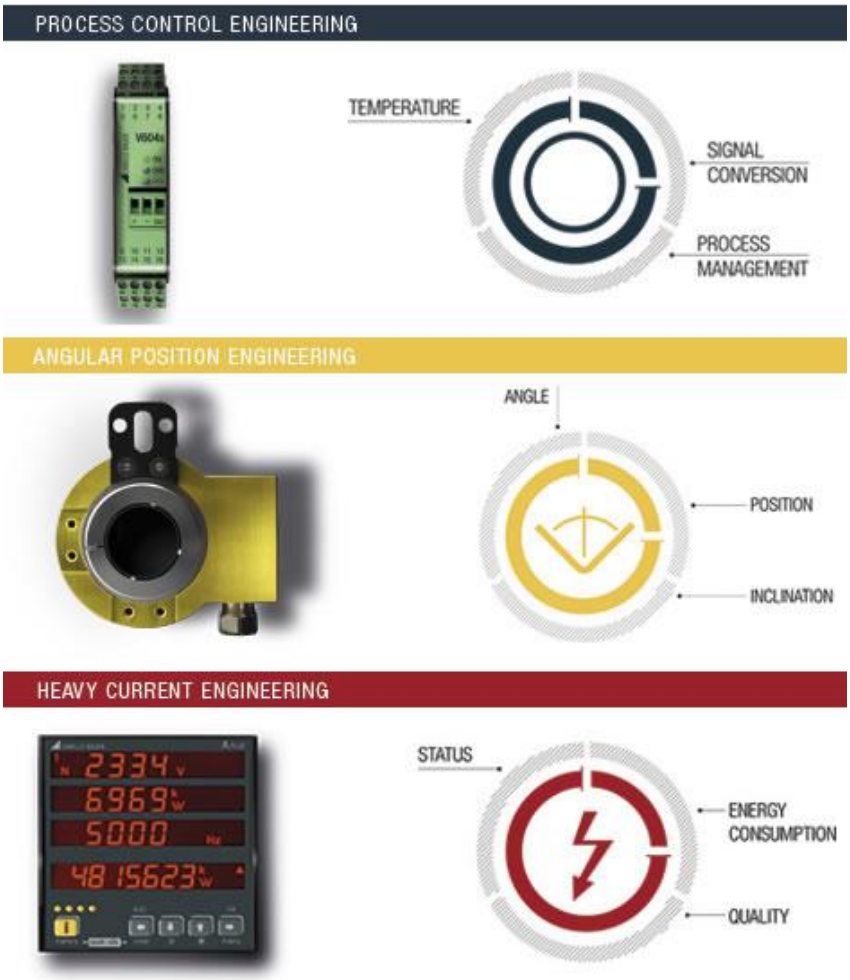

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