FAQ • 01/2016

Hints for using „PID_Compact“ V2 to replace S7-200 applications

SIMATIC S7-1200

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1 Using existing PID parameters

1.1 Negative Gain

The S7-200 PID controller uses a negative gain to achieve an inverted control logic (increase of control deviation should lead to decrease of output value, e.g. for cooling applications).

„PID_Compact“ does not support negative gain values.

If you used a negative gain value for S7-200 PID controller and want to achieve the same behavior with „PID_Compact“, then invert the control logic in the configuration and use the absolute value of the previous gain value.

Figure 1-1: Configuration editor

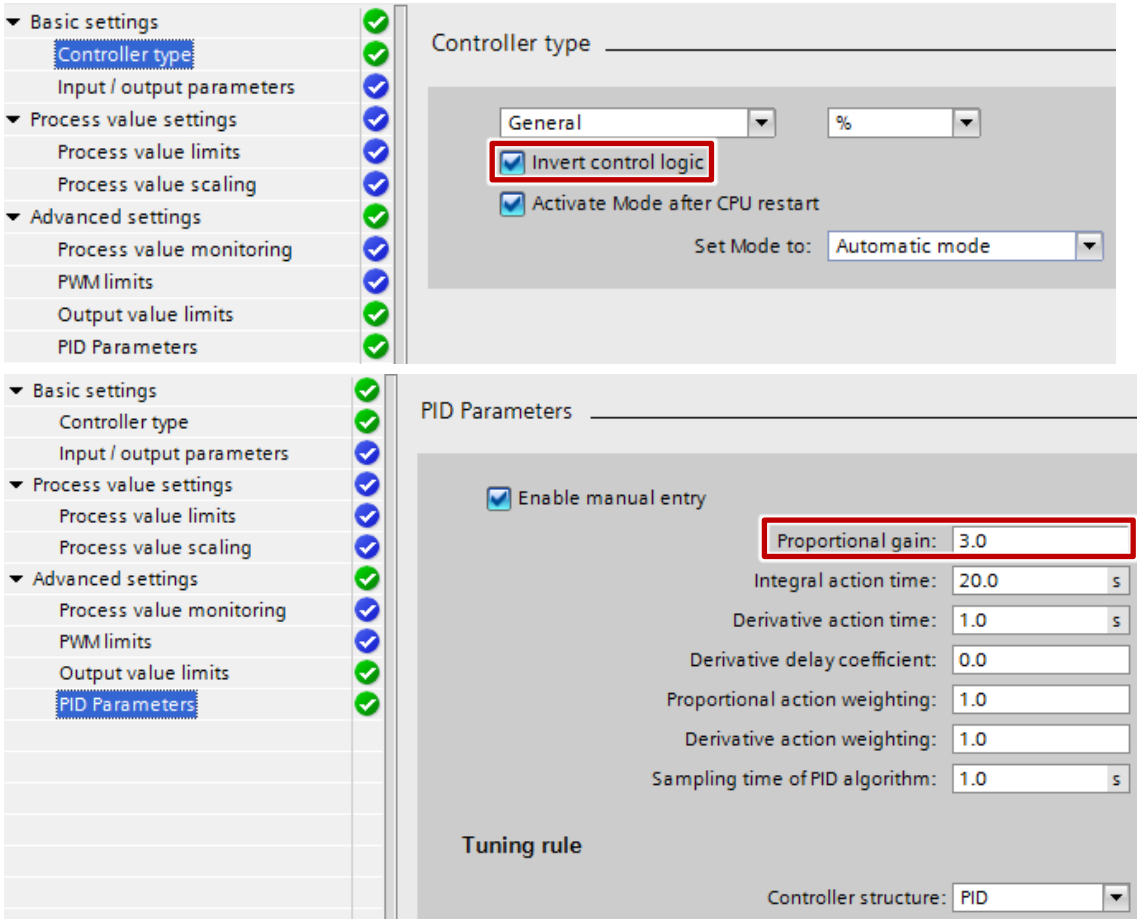


Table 1-1

DB parameters	„PID_Compact“ V2.x (S7-1200 with FW >= 4.0)
Invert control logic	Config.InvertControl
Proportional gain	Retain.CtrlParams.Gain

1.2 Additional PID parameters of „PID_Compact“

The S7-200 PID controller has no weighting for P- and D-action and its D-action is only effective for one cycle.

For „PID_Compact“ you can configure the weighting for P- and D-action and the delay of the D-action.

Use the following configuration to achieve the same behavior like S7-200 PID controller with „PID_Compact“:

Figure 1-2: Configuration editor

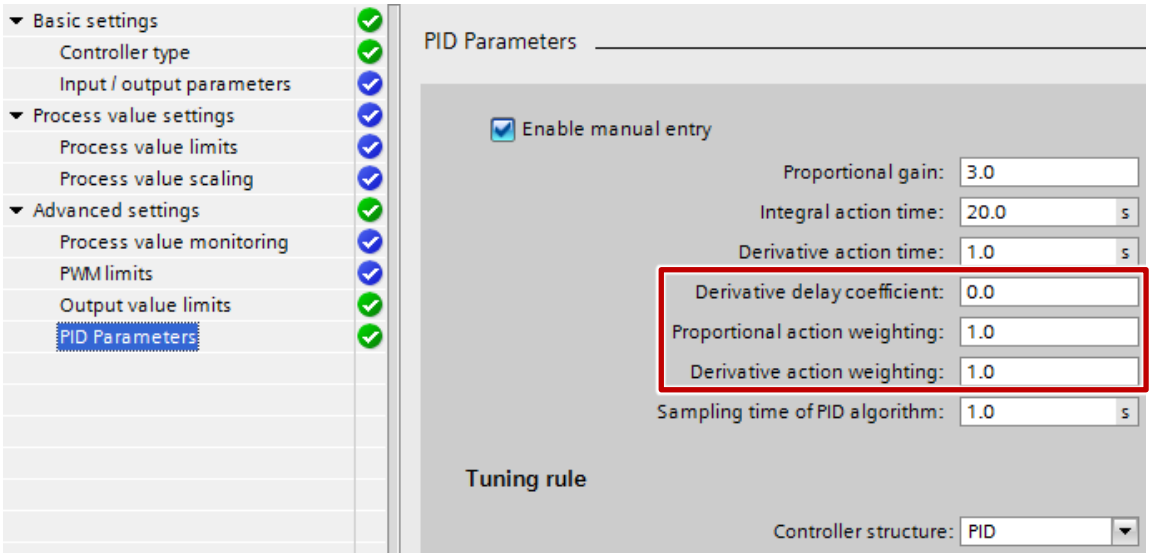


Table 1-2

DB parameters	„PID_Compact“ V2.x (S7-1200 with FW >= 4.0)
Derivative delay coefficient	Retain.CtrlParams.TdFiltRatio = 0.0
Proportional action weighting	Retain.CtrlParams.PWeighting = 1.0
Derivative action weighting	Retain.CtrlParams.DWeighting = 1.0

1.3 Unit for integral and derivative time

All time parameters of „PID_Compact“ are configured with seconds as unit, while the S7-200 PID controller uses minutes for integral time (TI) and derivative time (TD).

Be aware of that when you copy PID parameters from S7-200 PID controller to „PID_Compact“.

NOTE The sample time is configured in seconds for both controllers, so you can take this value out of your STEP 7 Micro/WIN project without converting in STEP 7 (TIA Portal).

Figure 1-3: Configuration editor

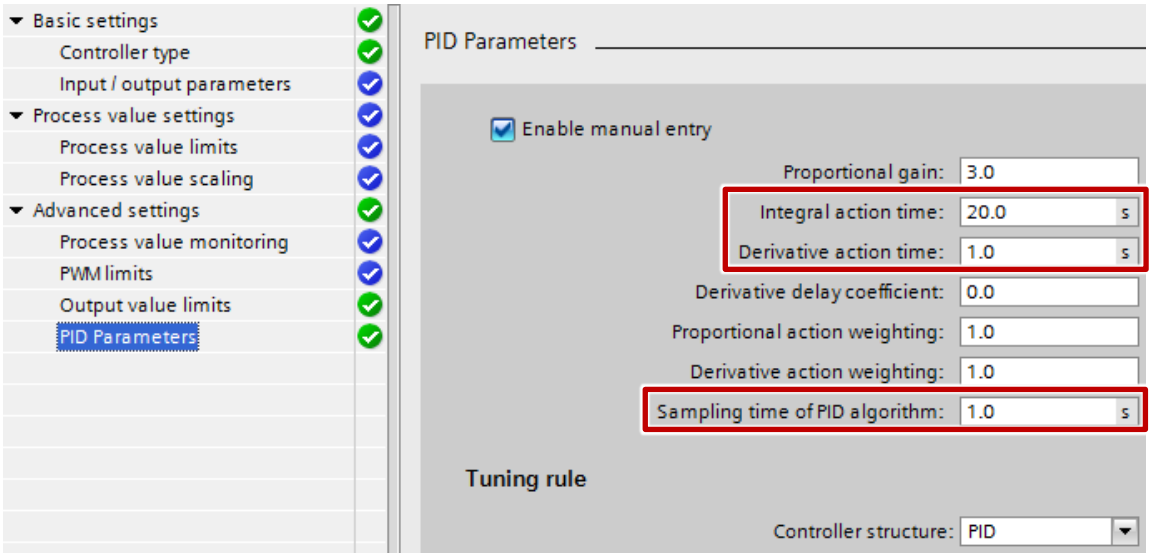


Table 1-3

DB parameters	„PID_Compact“ V2.x (S7-1200 with FW >= 4.0)
Integral action time	Retain.CtrlParams.Ti
Derivative action time	Retain.CtrlParams.Td
Sampling time of PID algorithm	Retain.CtrlParams.Cycle

1.4 Influence of scaling on effective control loop gain

The input and output scaling of a closed loop control always impacts on the effective control loop gain. This has to be considered when you want to achieve the same behavior after changing the closed loop control system (e.g. S7-200 -> S7-1200).

This issue is not a specific S7-200 -> S7-1200 problem, but must be considered every time when input or output scaling is changed in a control loop e.g. because a different module is used.

The both following figures shows exemplary possibilities of a temperature control in a range from -250 to 750°C realized with S7-200 and S7-1200.

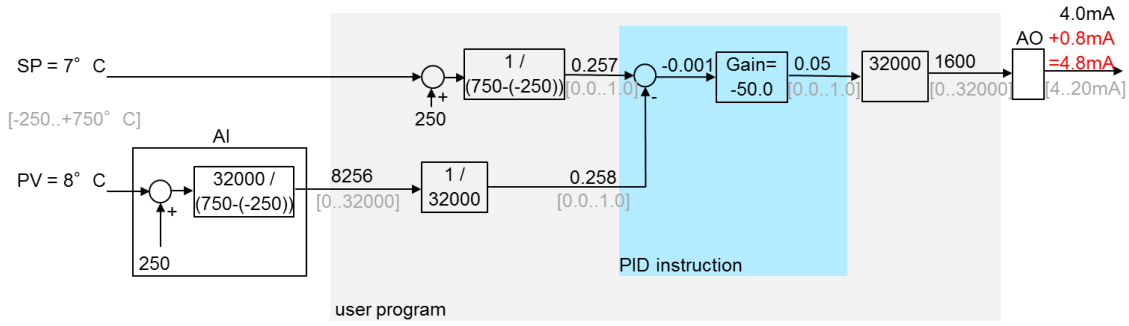
S7-200 PID controller loop: Temperature control with current output

For S7-200 the process value is captured as analog input in a range from 0 to 32000.

The S7-200 PID controller normalizes the process value and the setpoint in ranges from 0 to 1.0 and calculates the control deviation and the normalized PID output with the given PID parameters.

The PID output is scaled in the user program to an analog output in a range from 0 to 32000 which means a current from 4 to 20mA.

Figure 1-4



[x..y] = value range from x to y

S7-1200 PID_Compact: Temperature control with current output

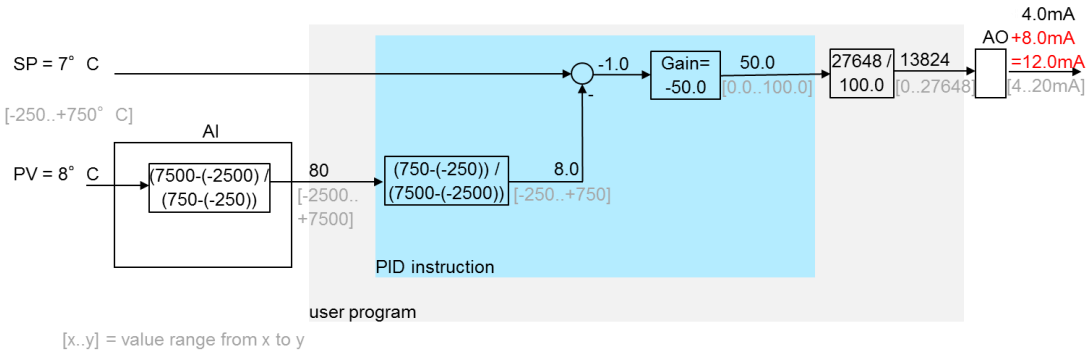
For S7-1200 the process value is captured via RTD input. The value displays the temperature multiplied with 10.

The S7-1200 PID controller uses the integrated scaling to get the real temperature value.

With control deviation and the given PID parameters the S7-1200 PID controller calculates the PID output in a range from 0 to 100.

The PID output is scaled in the user program to an analog output in a range from 0 to 27648 which means a current from 4 to 20mA.

Figure 1-5



Conclusion

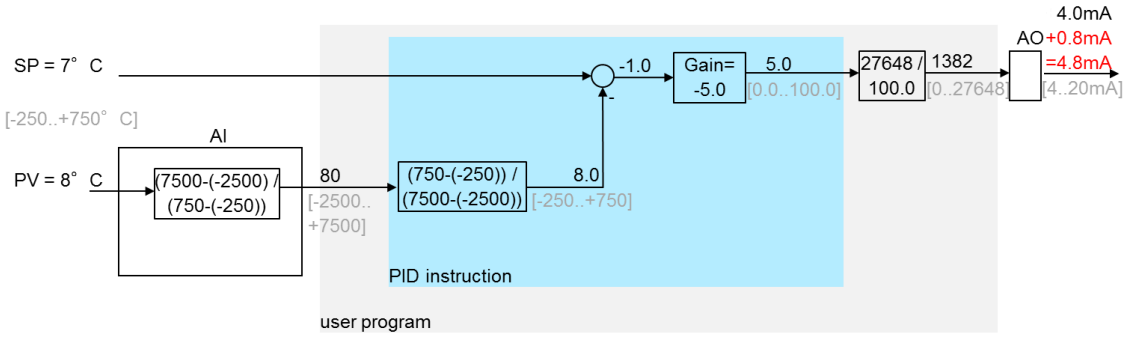
Both controllers use full range of input and output module and same gain value, but the same control deviation (setpoint – process value) leads to different output values for the output module.

This is caused by different scaling that leads to different effective gains.

There are two options to solve this problem with S7-1200 PID_Compact:

Option 1: Change the Gain to get same output values (for this example from -50.0 to -5.0)

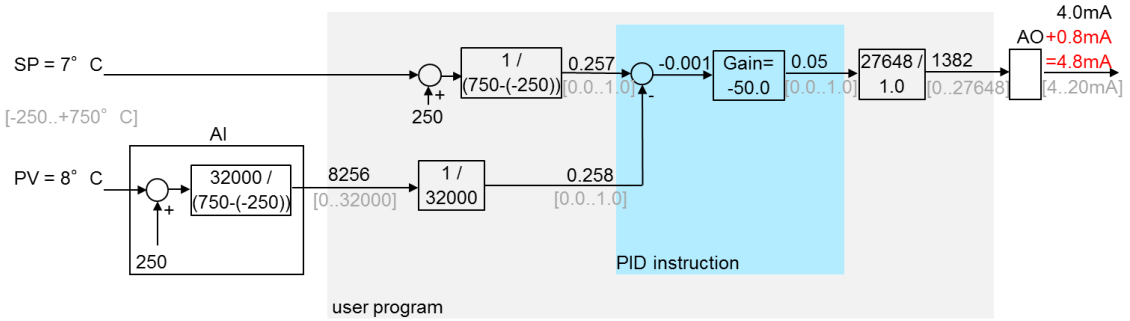
Figure 1-6



The factor for the gain change (0.1 in this example) results from the scaling factors that are different to S7-200 program.

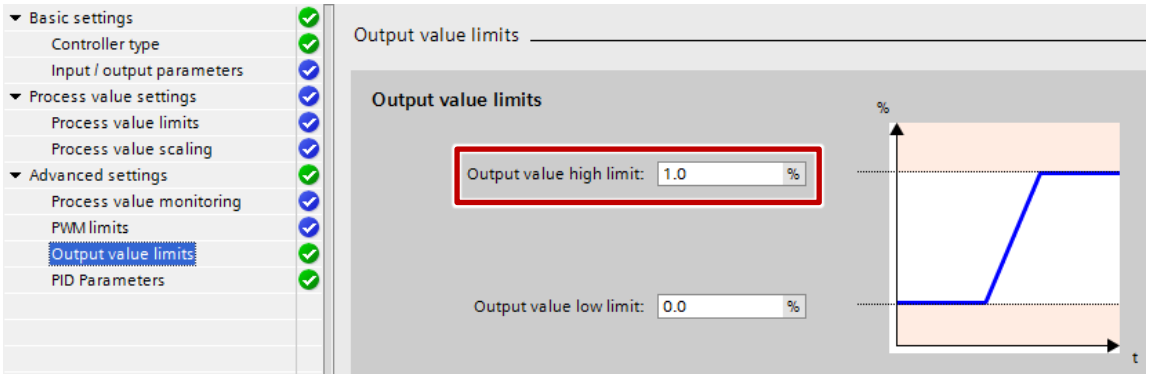
Option 2: Use same scaling (input and output!) as S7-200

Figure 1-7



The output value limits must be changed from 0.0..100.0 (default) to 0.0..1.0 in this case, to get the same behavior as S7-200!

Figure 1-8: Configuration editor



2 Initialization of integral part

The S7-200 PID controller starts with integral part 0.0.

For „PID_Compact“ V2.x (S7-1200 with FW >= 4.0) you can configure the behavior of integral part when state is changed from inactive to automatic mode via the tag “IntegralResetMode”.
With the default setting of “IntegralResetMode” the behavior is identical to the S7-200 PID controller.

NOTE You will get further information about the tag "IntegralResetMode" in the description of the „Static tags of PID_Compact V2“ in the manual „STEP 7 Basic V13.1“.