i.p.a.s.-systeme

EXPERION$^{PKS™}$

ADAPCTL (Function Block)

February 2005

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

1. Functional Overview

In most cases the tuning (optimization) of PID-controllers is based on so-called “trial and error“ methods. This requires special experience and also takes a lot of time especially when trying to control sluggish processes (e.g. temperature processes). Above that the control quality does not correspond to the optimum and still leaves quite some room for improvements. The tuning procedure gets even more difficult if there are non-linear or time-variant processes to be controlled.

The adaptive controller ADAPCTL provides solutions to all these problems. It automatically adapts itself to changing process characteristics but it can also be operated as a controller with constant parameters. In this instance the adaptation is turned off after the initial optimization step and the controller then serves as a better alternative to a regular PID-controller. If necessary the adaptive mode can be turned back on any time during the operation of the controller.

Besides standard lag processes ADAPCTL is especially suited to control processes with integrating characteristics and also processes with significant deadtimes. It is common knowledge that regular controllers have problems with these types of processes.

As opposed to PID-controllers ADAPCTL provides an equally optimal control behavior in setpoint control as well as disturbance control (non-measurable signals acting on the process variable) tasks.

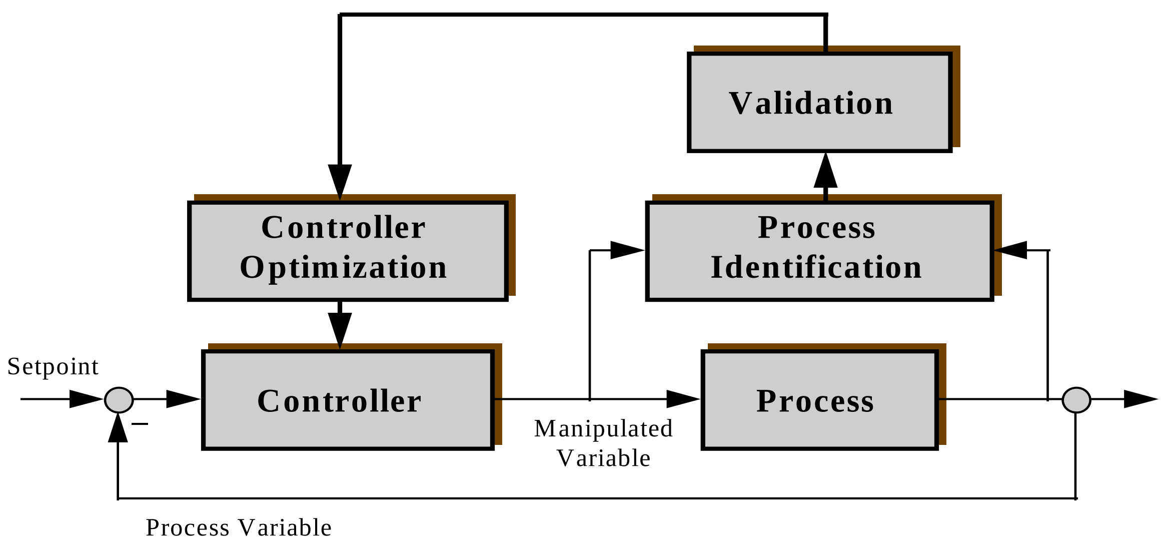

Figure 1: Block structure of the adaptive control loop

ADCO basically consists of two main parts:

* The process model estimation is based on a method which is known as DSF (Discrete Square Root Filtering) or SRIF (Square Root Information Filter). This procedure calculates a parameter model of the process to be controlled by evaluating the process signals (manipulated variable / controller output, process variable) according to the method mentioned above.

* The controller optimization is based on an estimated process model which is validated through a supervisory function. The algorithm delivers an optimal state controller. Besides the actual control error a few more states allowing a prediction about upcoming process variable values are fed into the calculation of the manipulated variable. Since the state controller evaluates more information about the process behavior than any PID-controller it provides a superior control quality even when acting on simple „linear" processes. After a setpoint change or a disturbance of the process variable all state deviations are reduced to 0. The control behavior depends on one tuning parameter (controller sensitivity) which can adapt values between -100 and 150. The default value for this parameter is 50 and does not have to be changed in many applications. Increasing the sensitivity basically means increasing the activity of the controller, i.e. the controller is acting stronger onto the process using up more energy.

Outstanding advantages compared to regular controllers:

* Essentially faster control parameter tuning
* Better control quality controlling „easy to handle" processes
* Significantly better control behavior controlling processes with integrating and/or deadtime characteristics
* Optimal tuning for setpoint <u>and</u> disturbance control
* Adaptation to changing process characteristics
* Basically no overshoot

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

2. System Requirements

Experion EXP101.0 and higher.

3. System Administration Functions

3.1 Installation and Deinstallation

Together with the ADAPCTL CCL an installation utility will be delivered.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

4. The ADAPCTL Function Block

4.1 Functional Description

4.1.1 Configuration in ControlBuilder

Like any other standard function blocks of the Experion System the adaptive state controller is also configured by filling out specific function masks. Several masks per controller can be filled out. Almost all parameter fields have given default values.

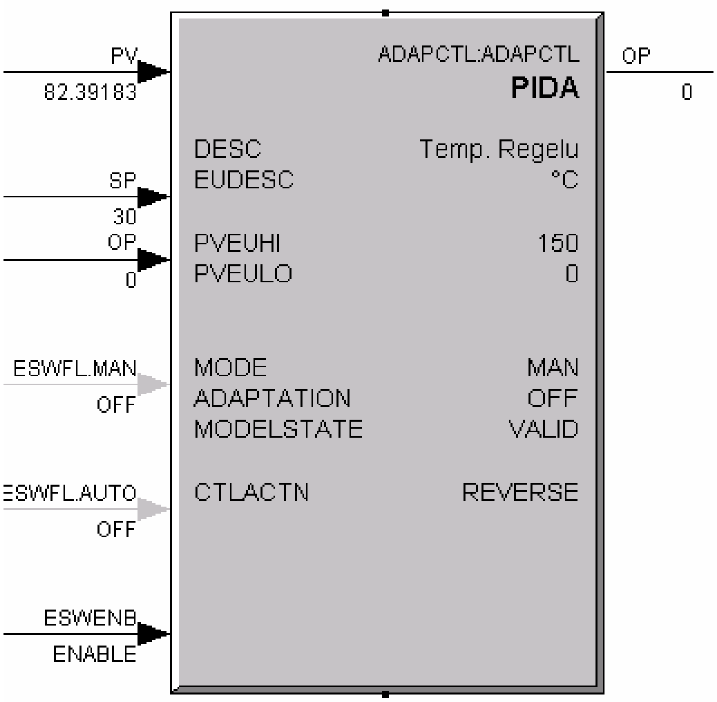

Figure 2: ADAPCTL function block

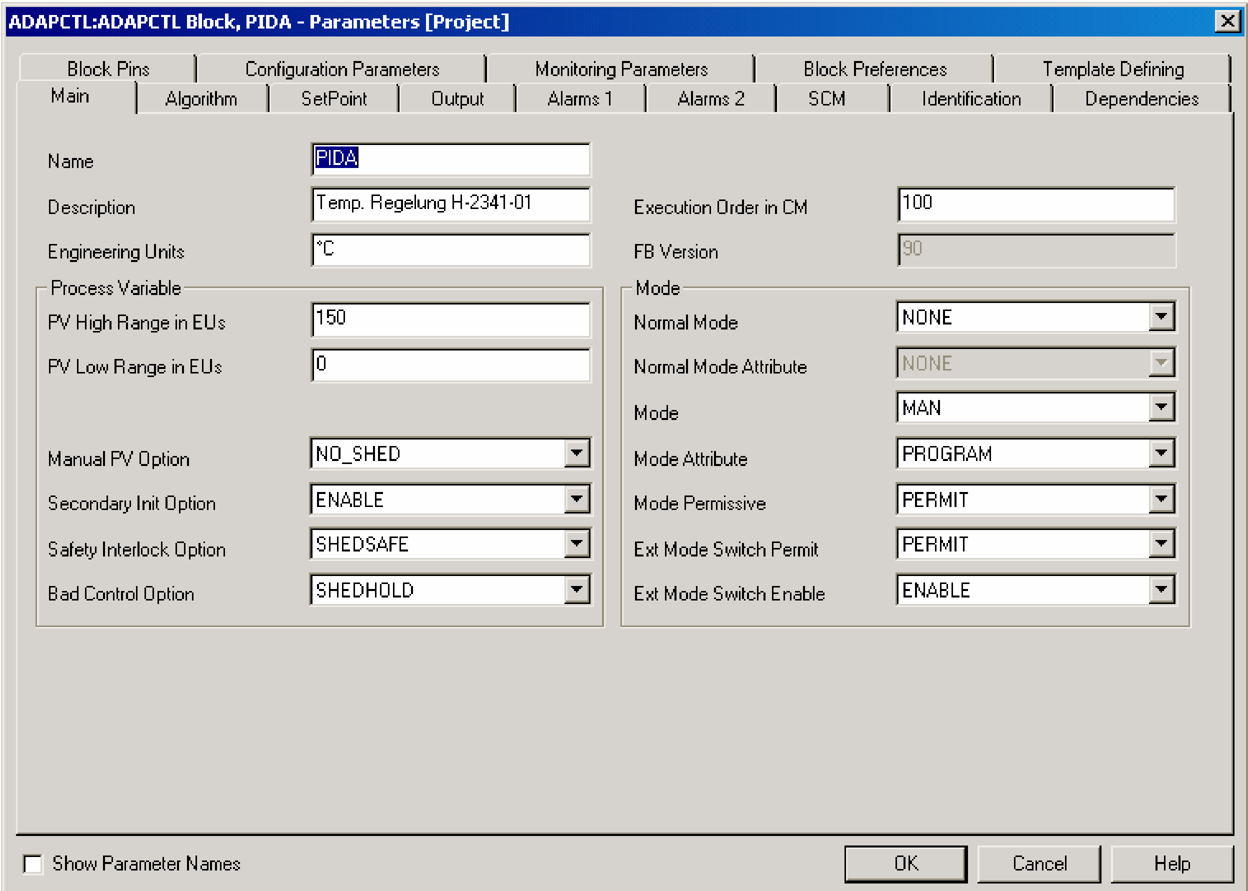

Figure 3: Control Builder / ADAPCTL Main

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

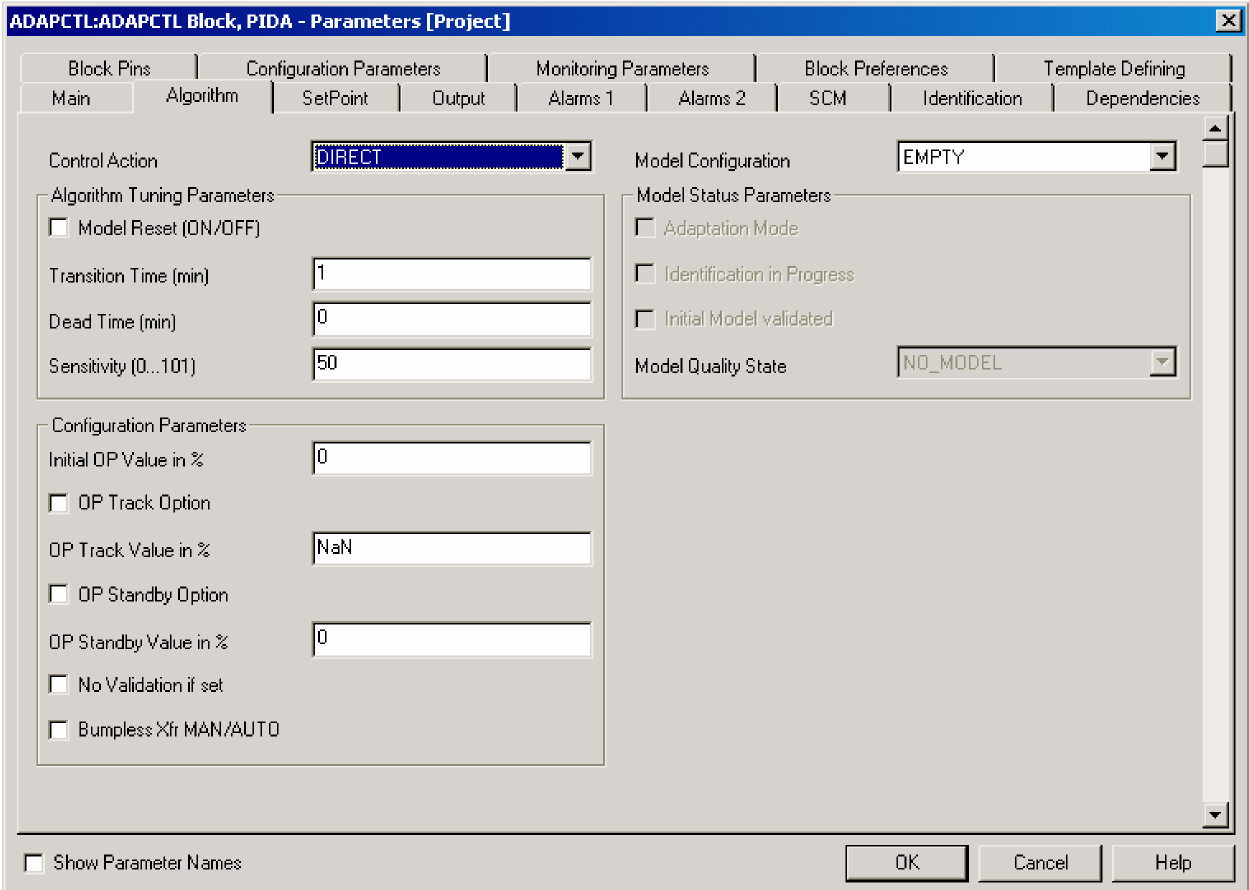

Figure 4: Control Builder / ADAPCTL Algorithm

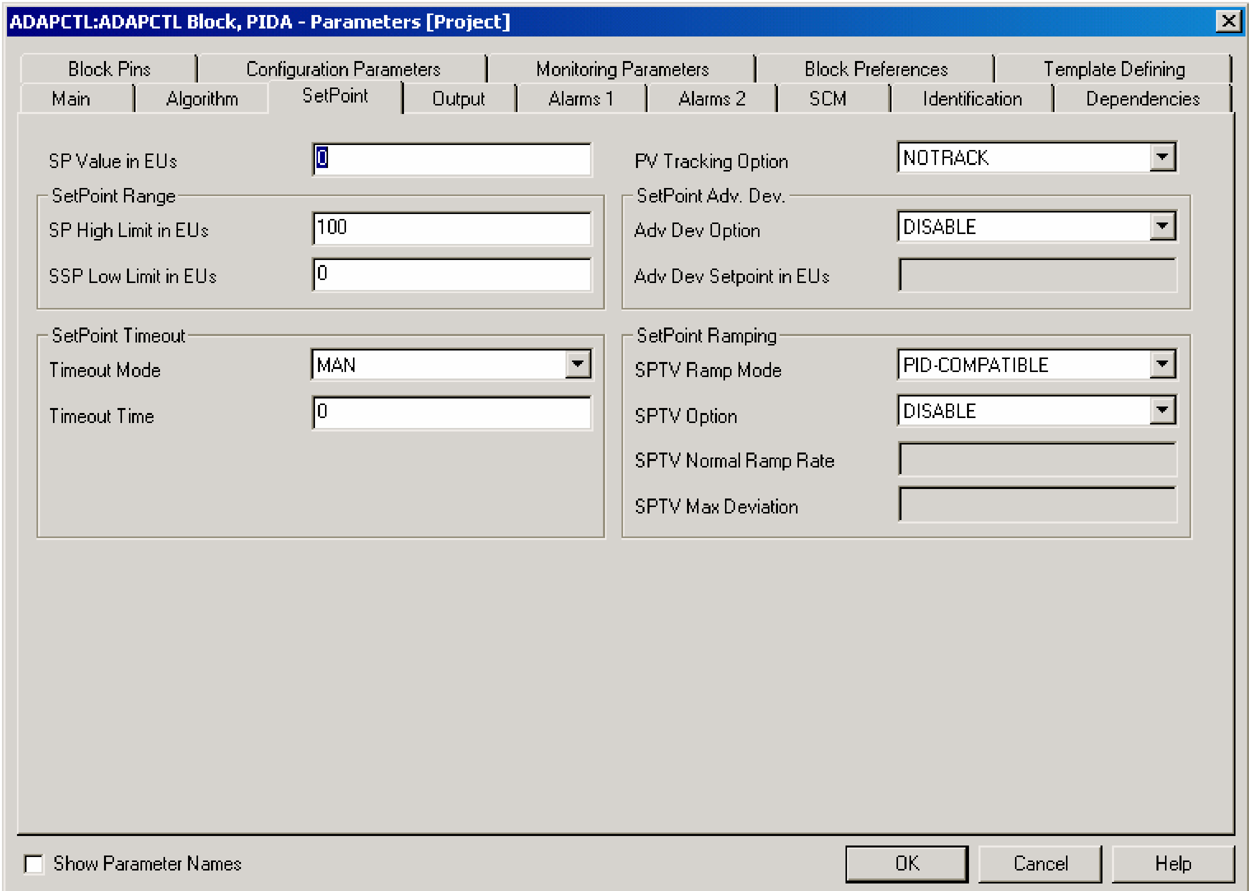

Figure 5: Control Builder / ADAPCTL Setpoint

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

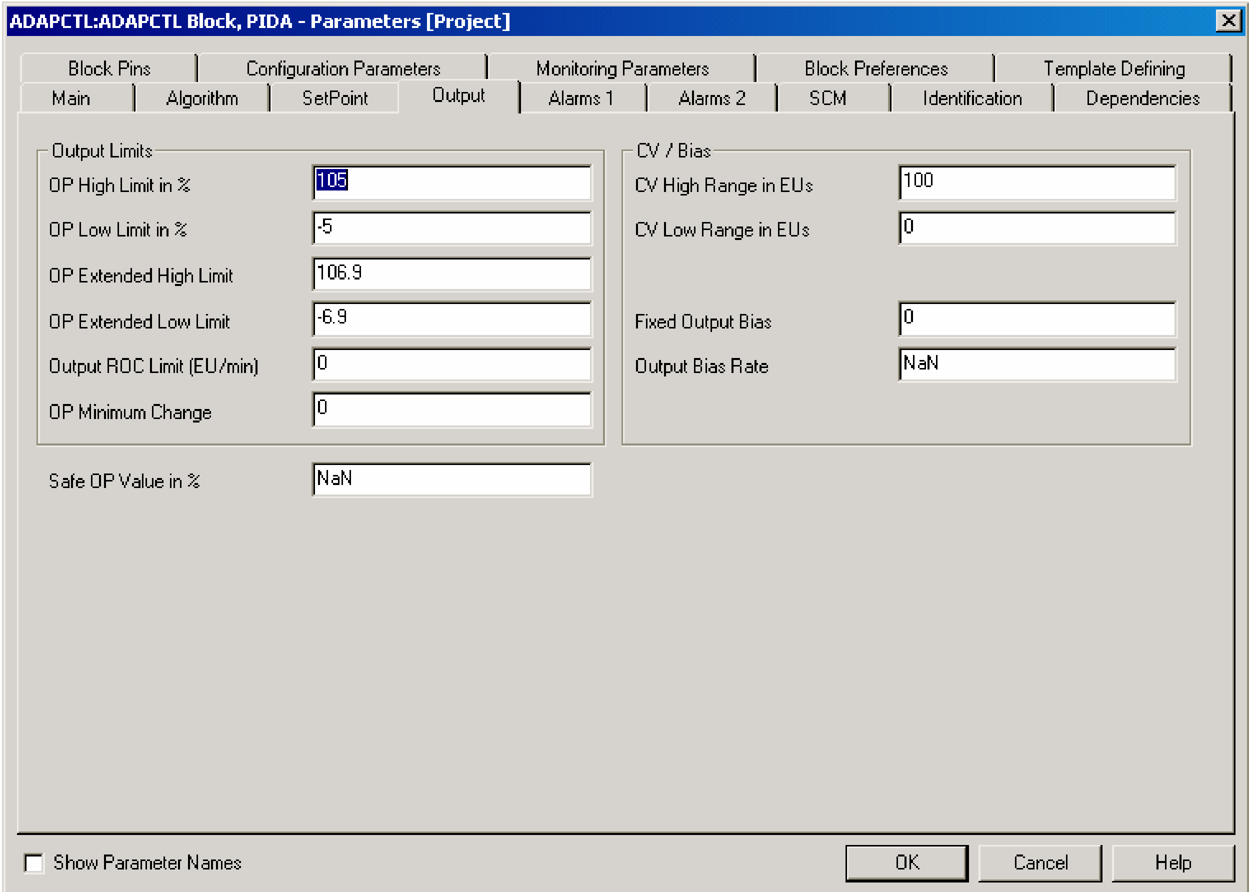

Figure 6: Control Builder / ADAPCTL Output

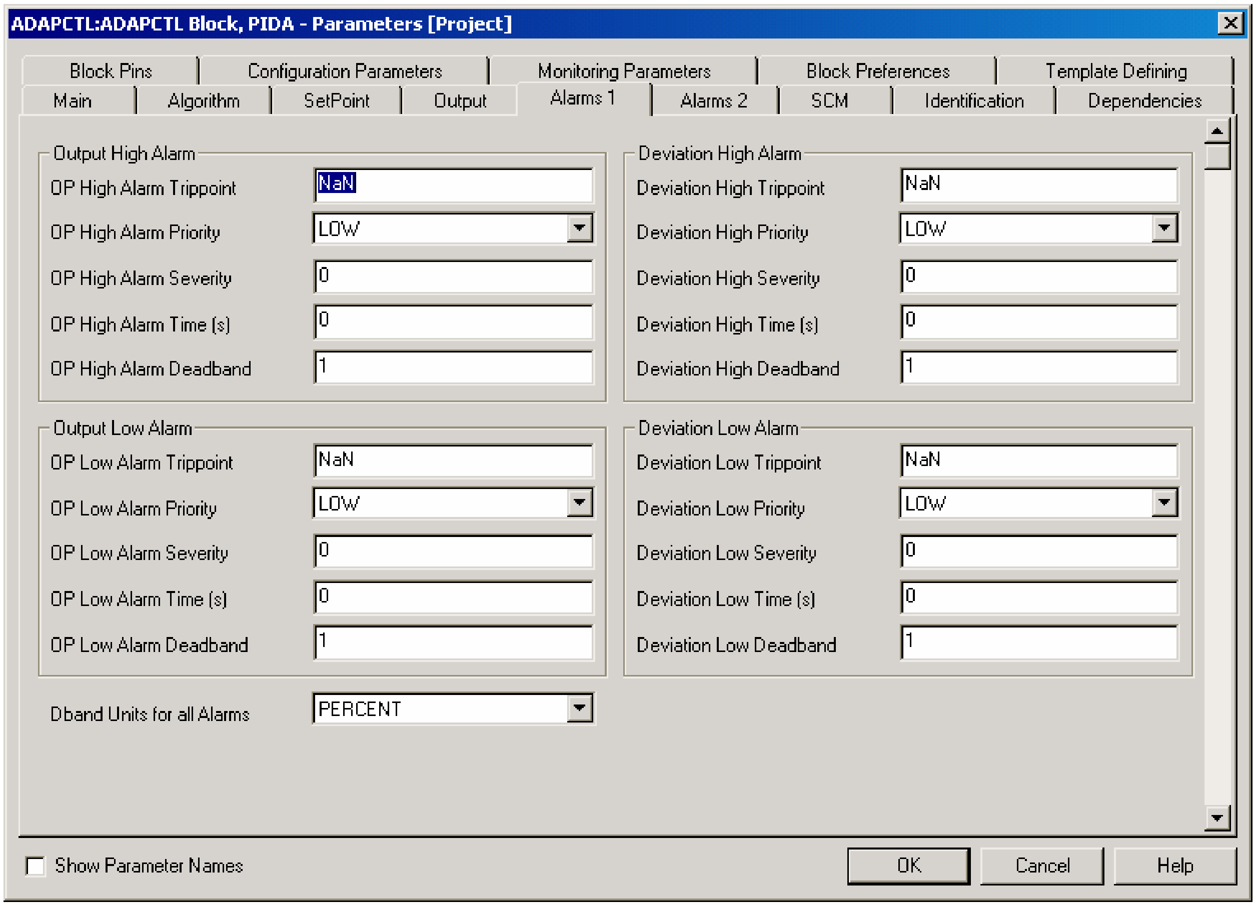

Figure 7: Control Builder / ADAPCTL Alarms 1

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

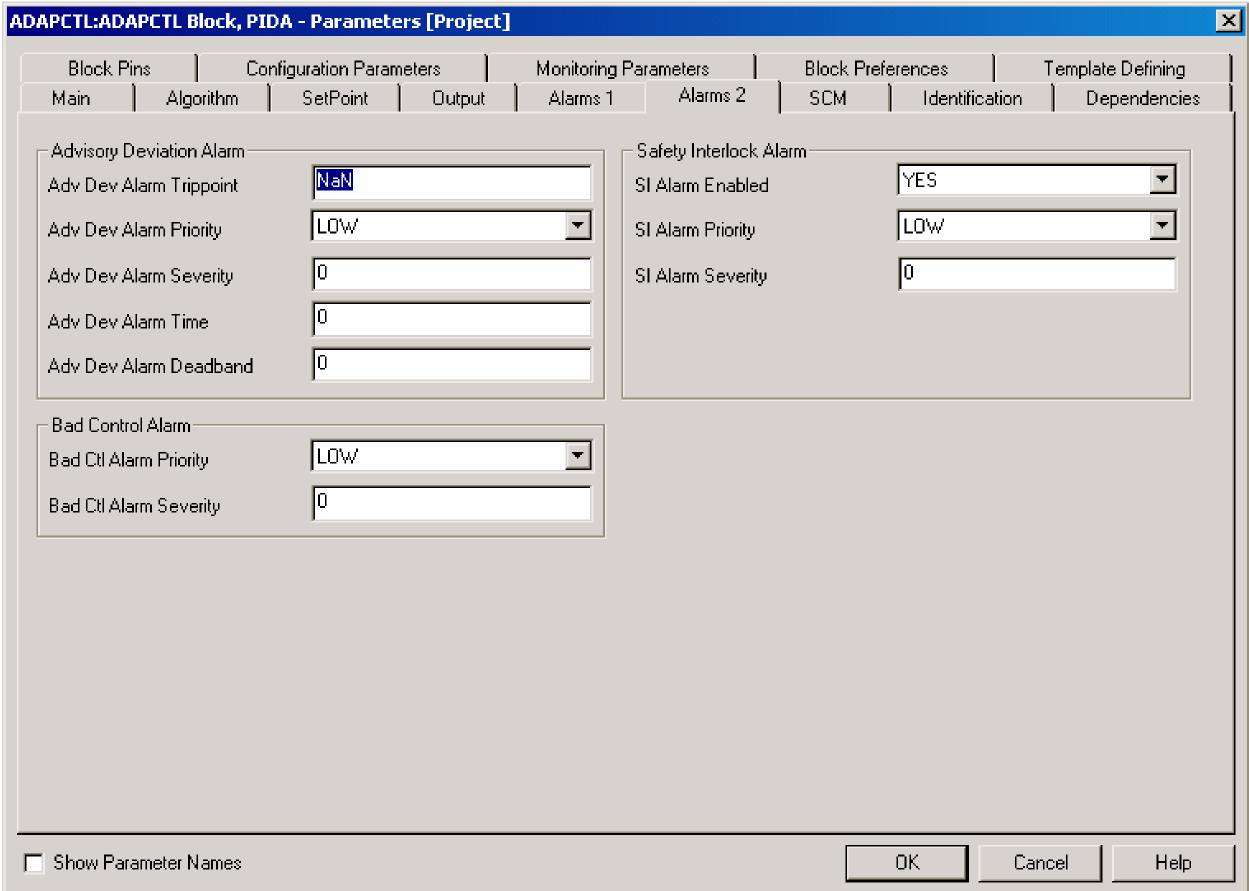

Figure 8: Control Builder / ADAPCTL Alarms 2

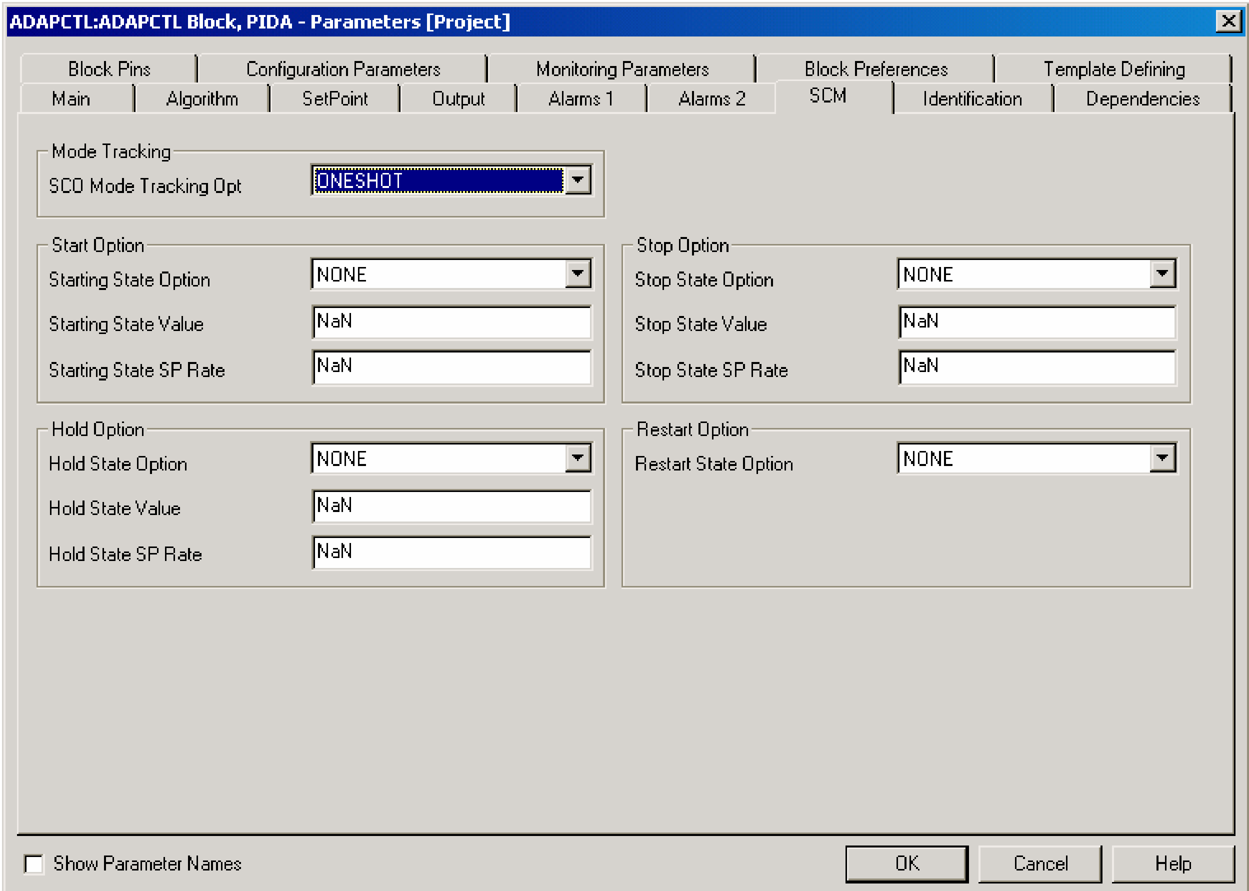

Figure 9: Control Builder / ADAPCTL SCM

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

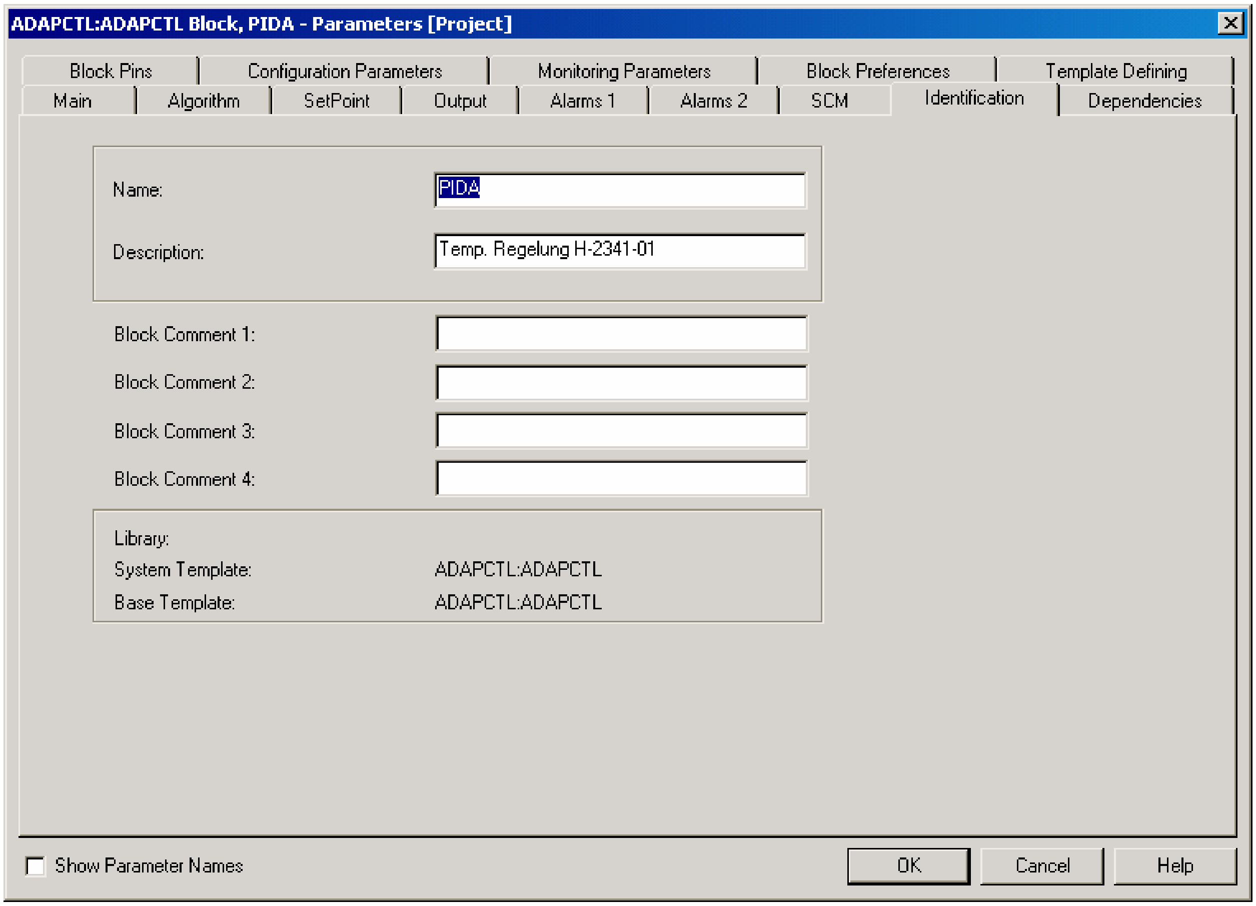

Figure 10: Control Builder / ADAPCTL Identification

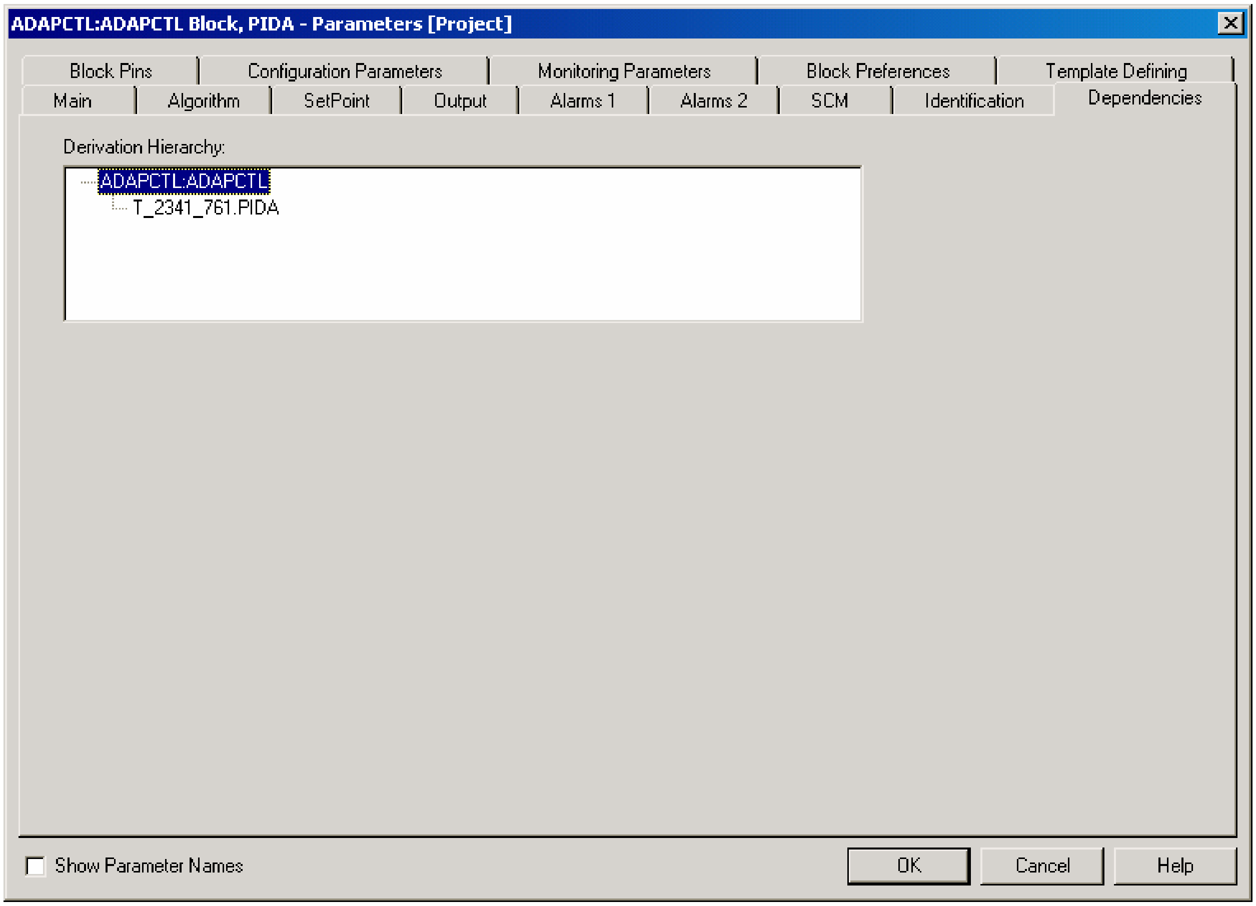

Figure 11: Control Builder / ADAPCTL Dependencies

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

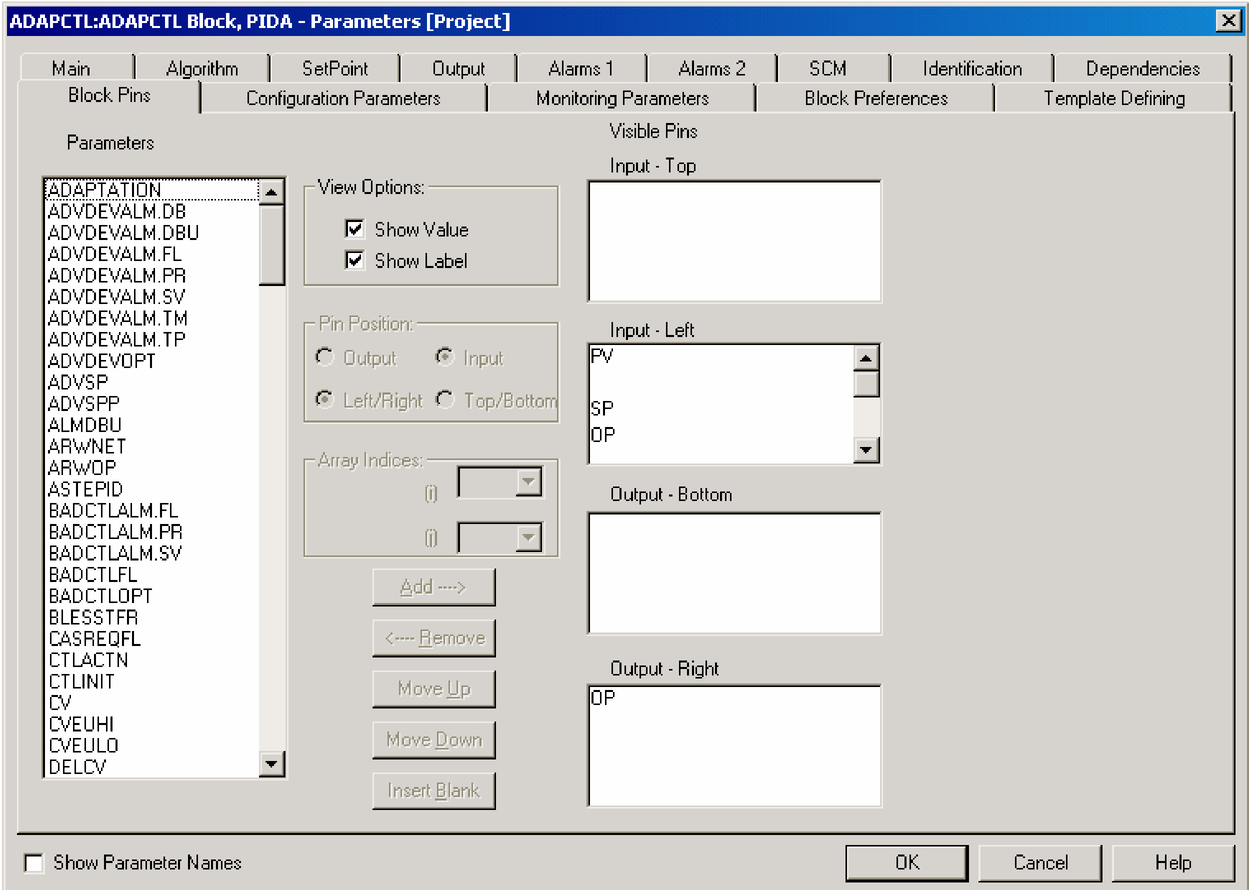

Figure 12: Control Builder / ADAPCTL Block Pins

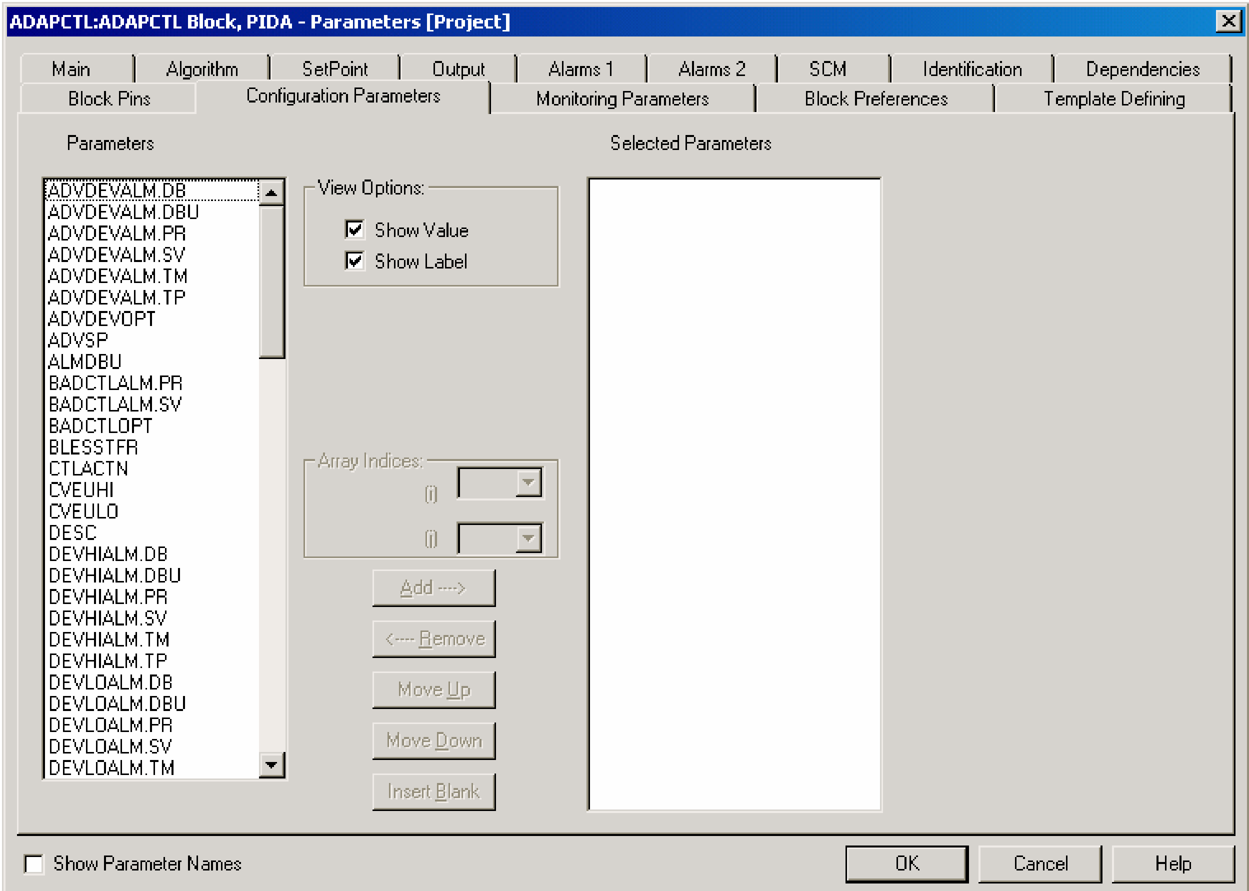

Figure 13: Control Builder / ADAPCTL Configuration Parameters

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

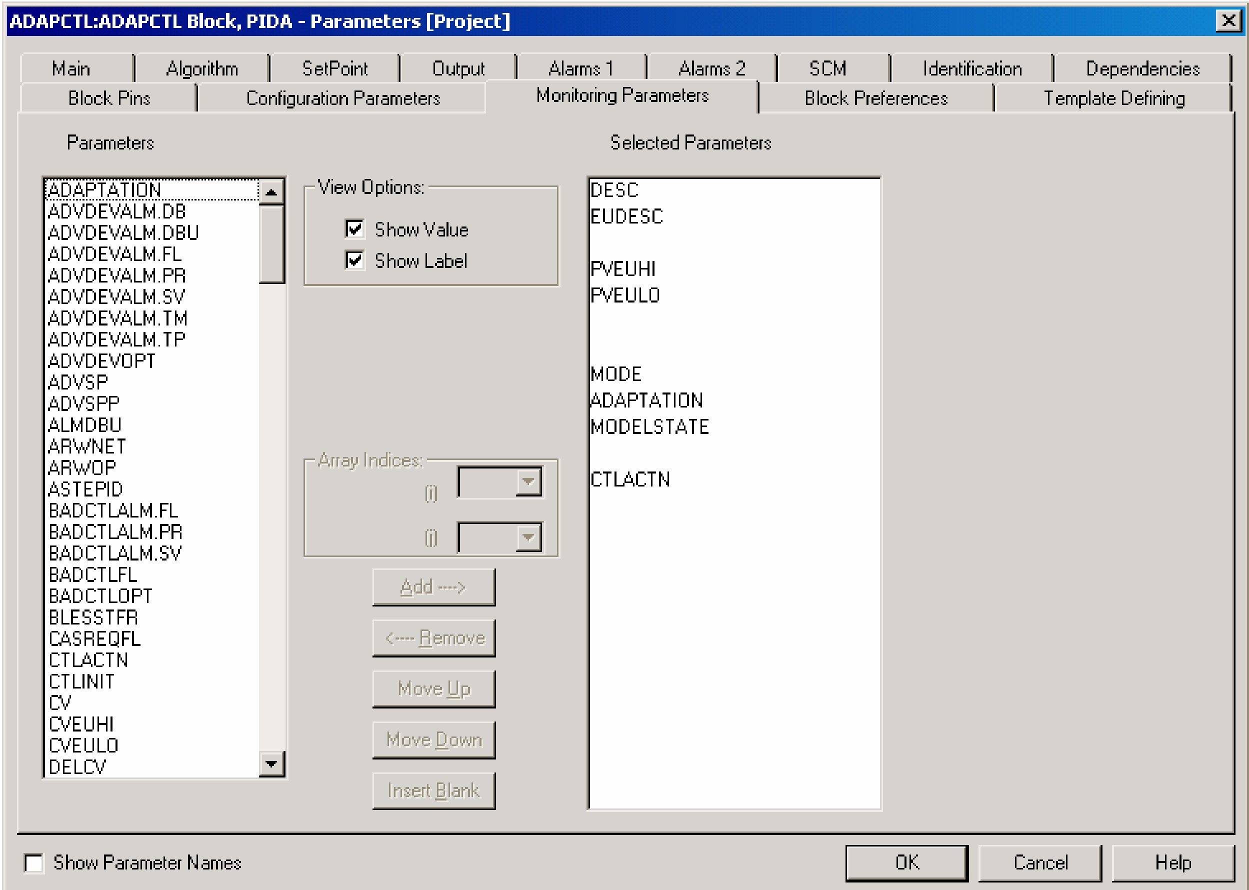

Figure 14: Control Builder / ADAPCTL Monitoring Parameters

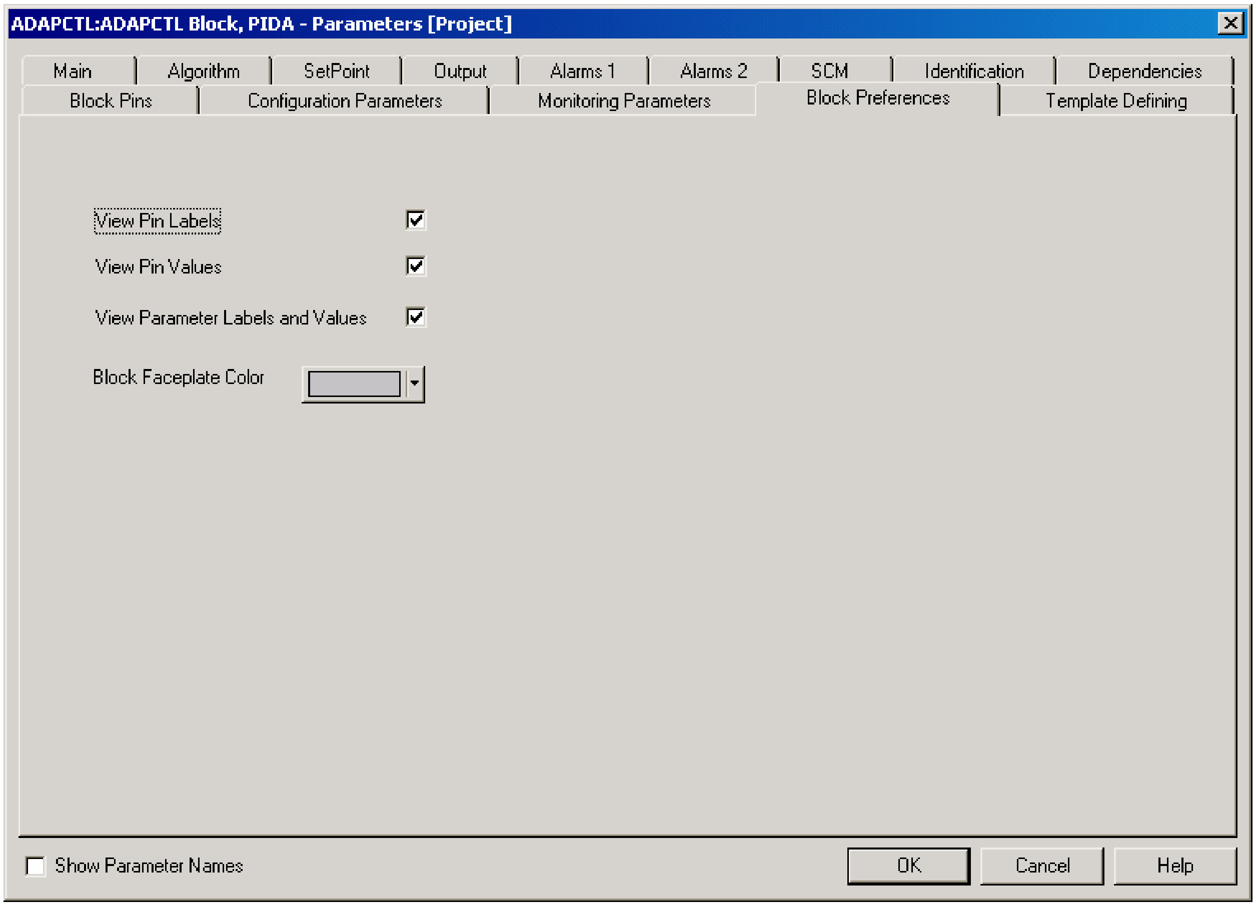

Figure 15: Control Builder / ADAPCTL Block Preferences

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

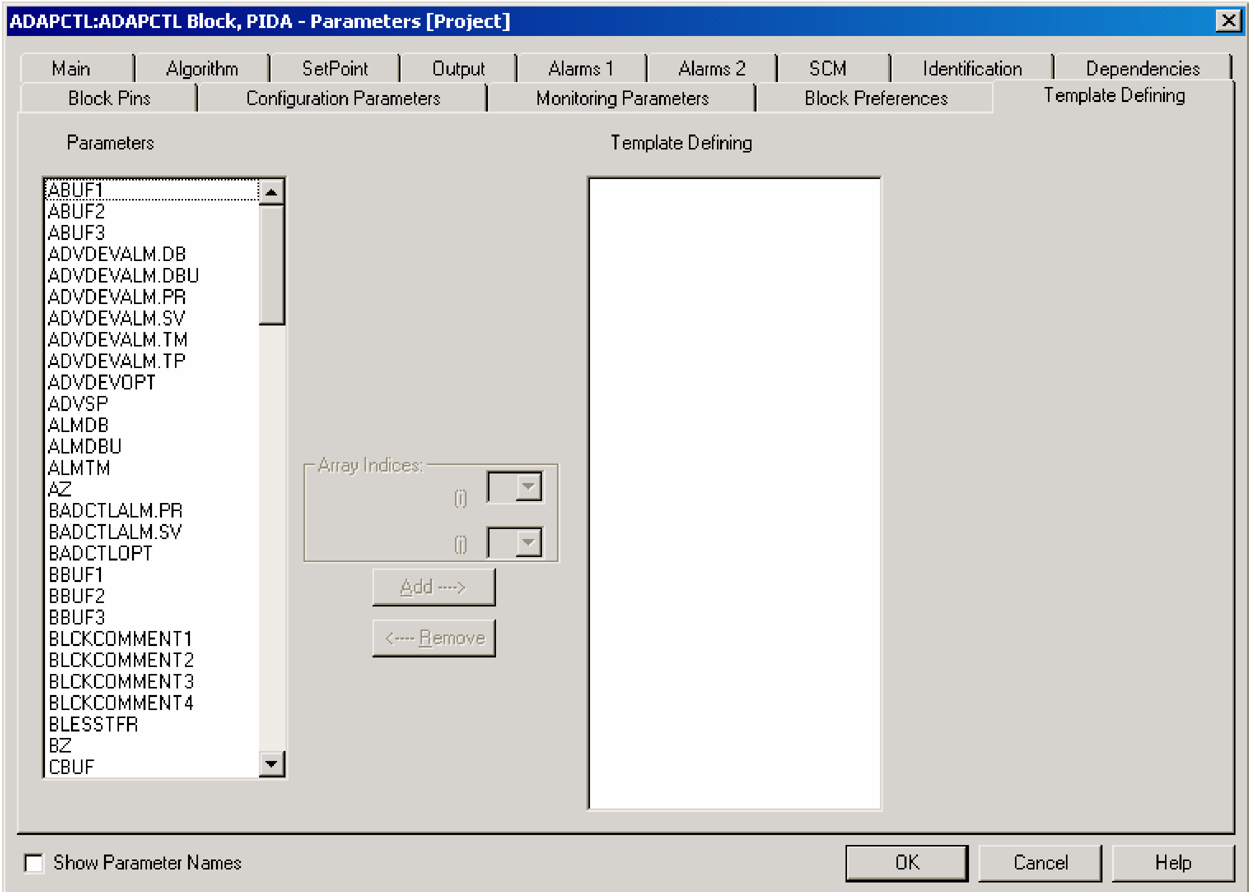

Figure 16: Control Builder / ADAPCTL Template Defining

4.1.2 Representation in the STATION software

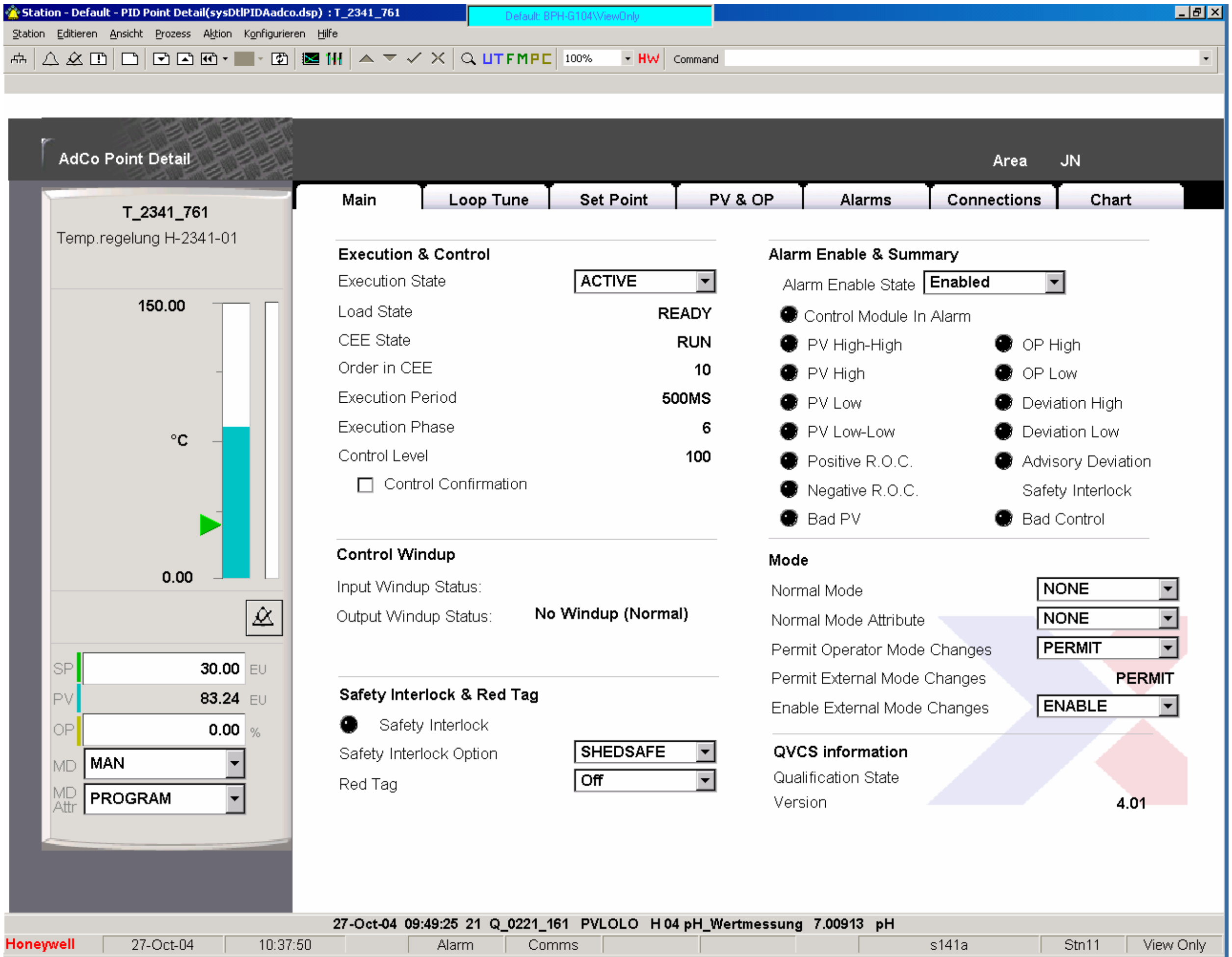

Figure 17: ADAPCTL Point Detail Main

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

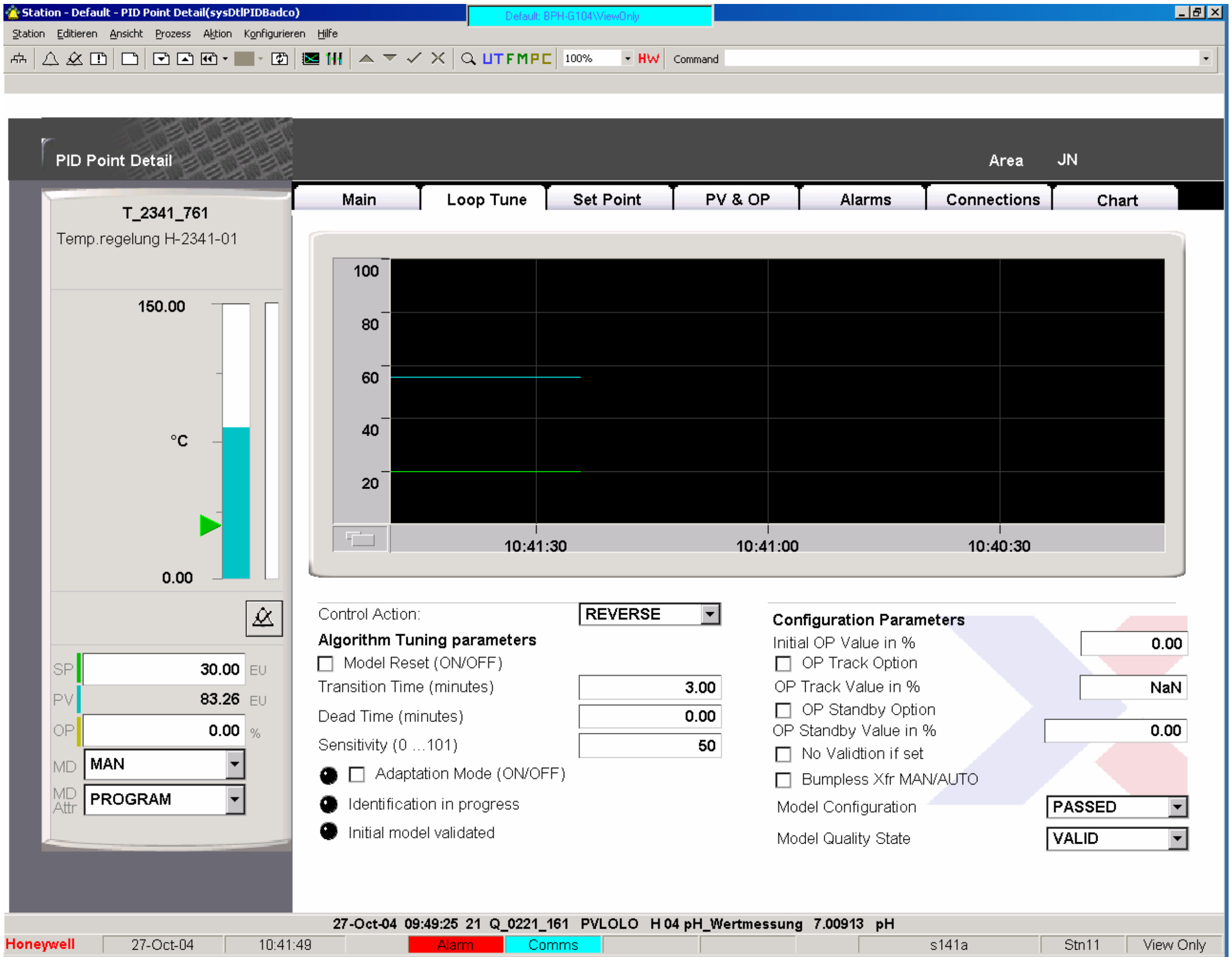

Figure 18: ADAPCTL Point Detail Loop Tune

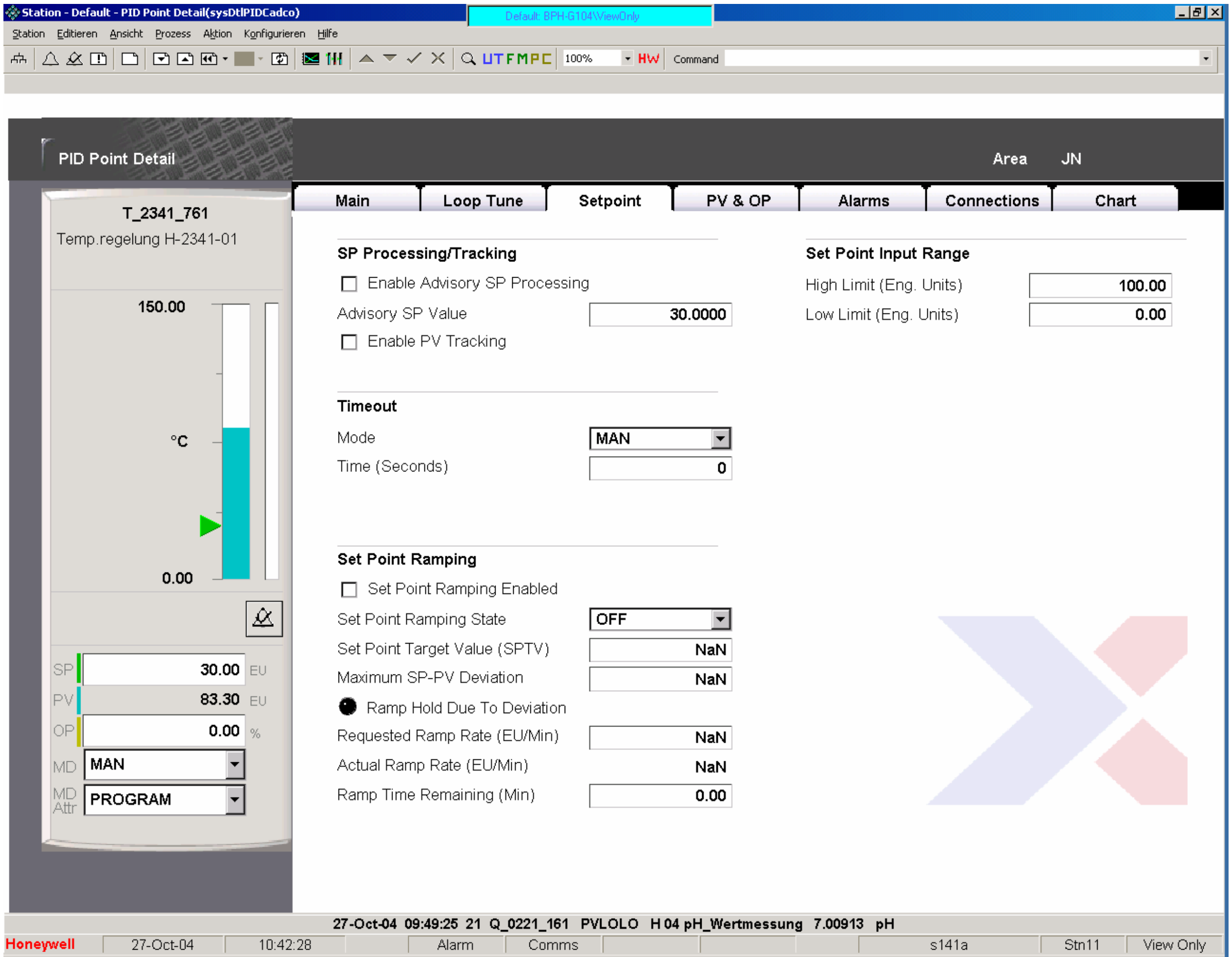

Figure 19: ADAPCTL Point Detail Setpoint

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

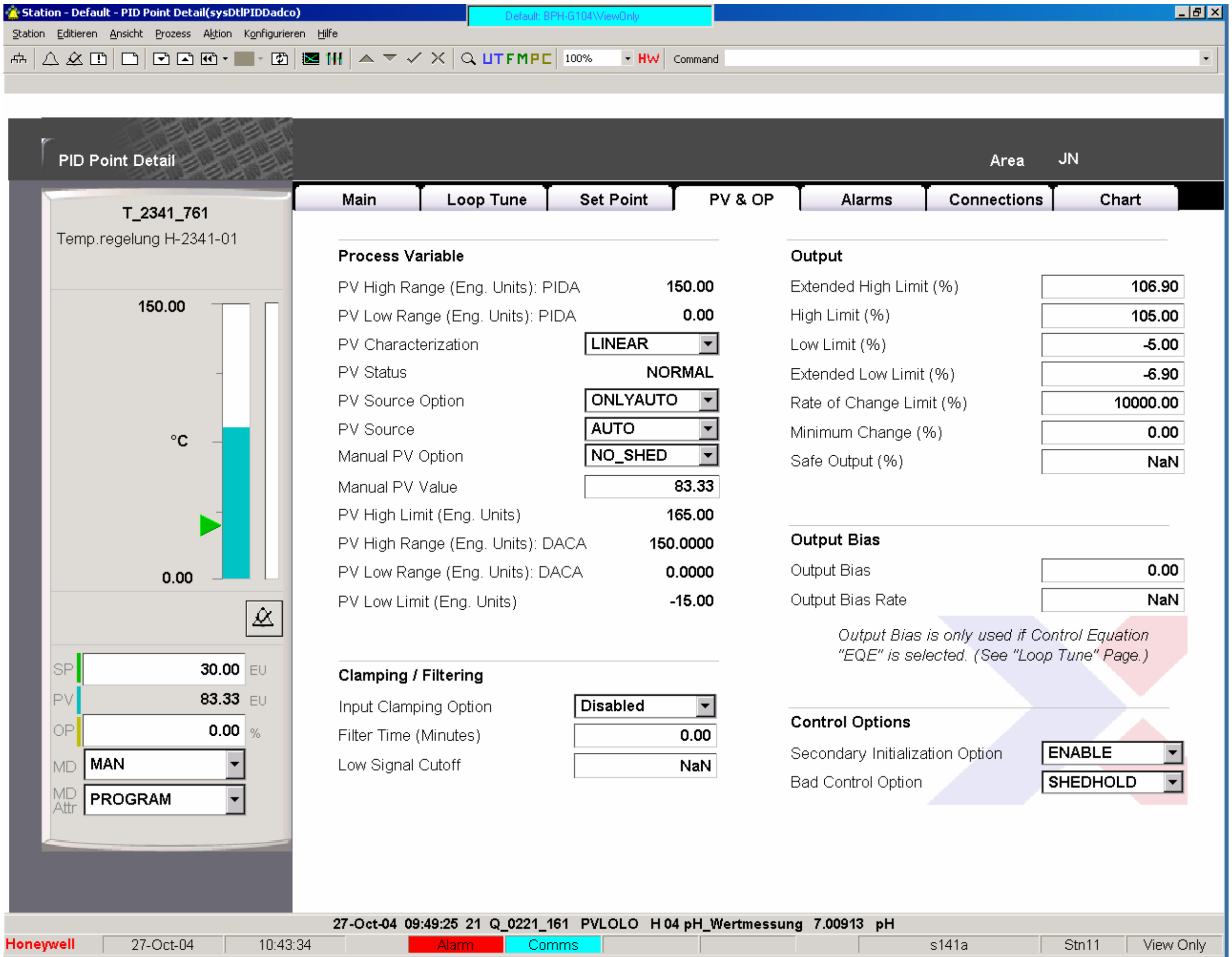

Figure 20: ADAPCTL Point Detail PV & OP

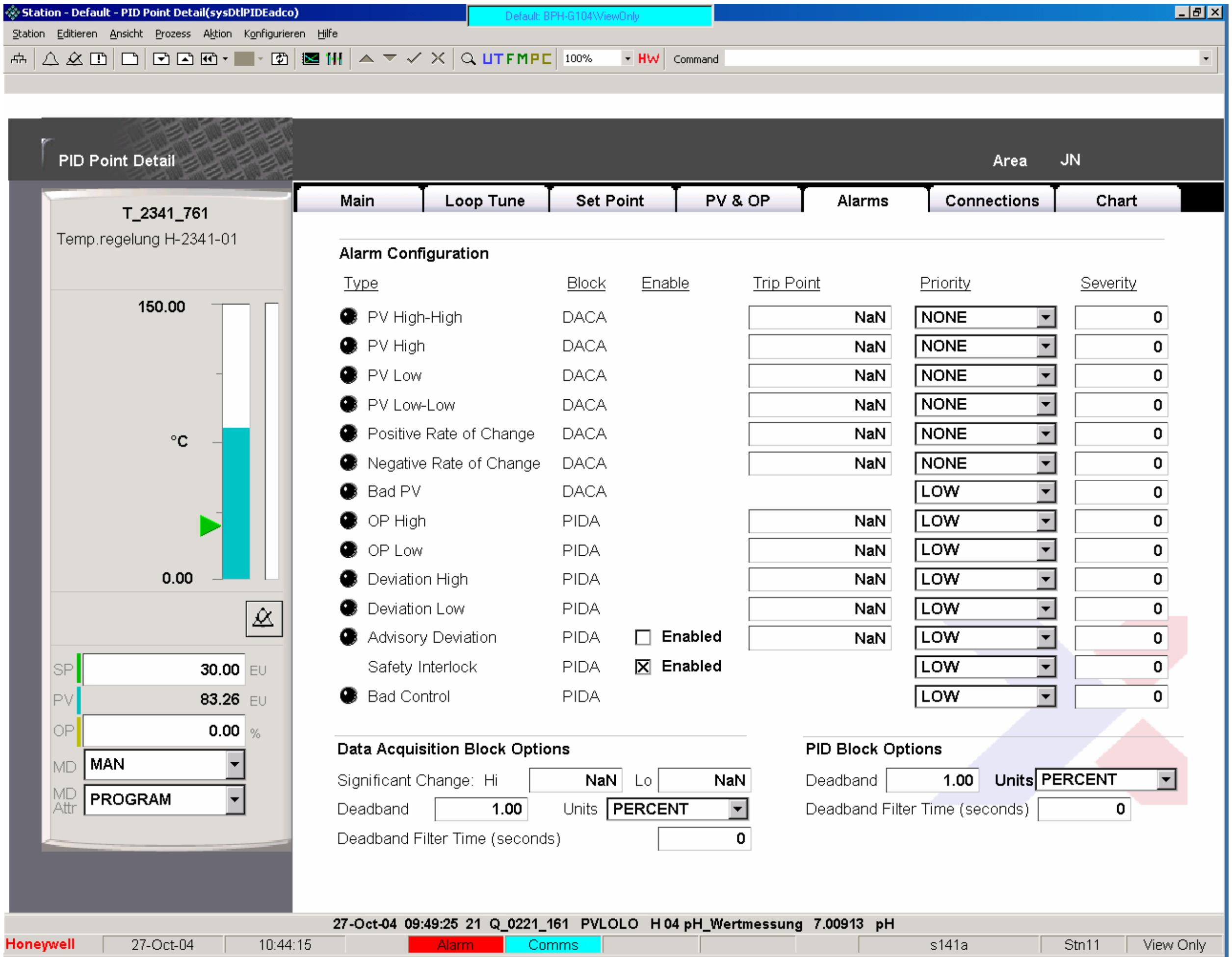

Figure 21: ADAPCTL Point Detail Alarms

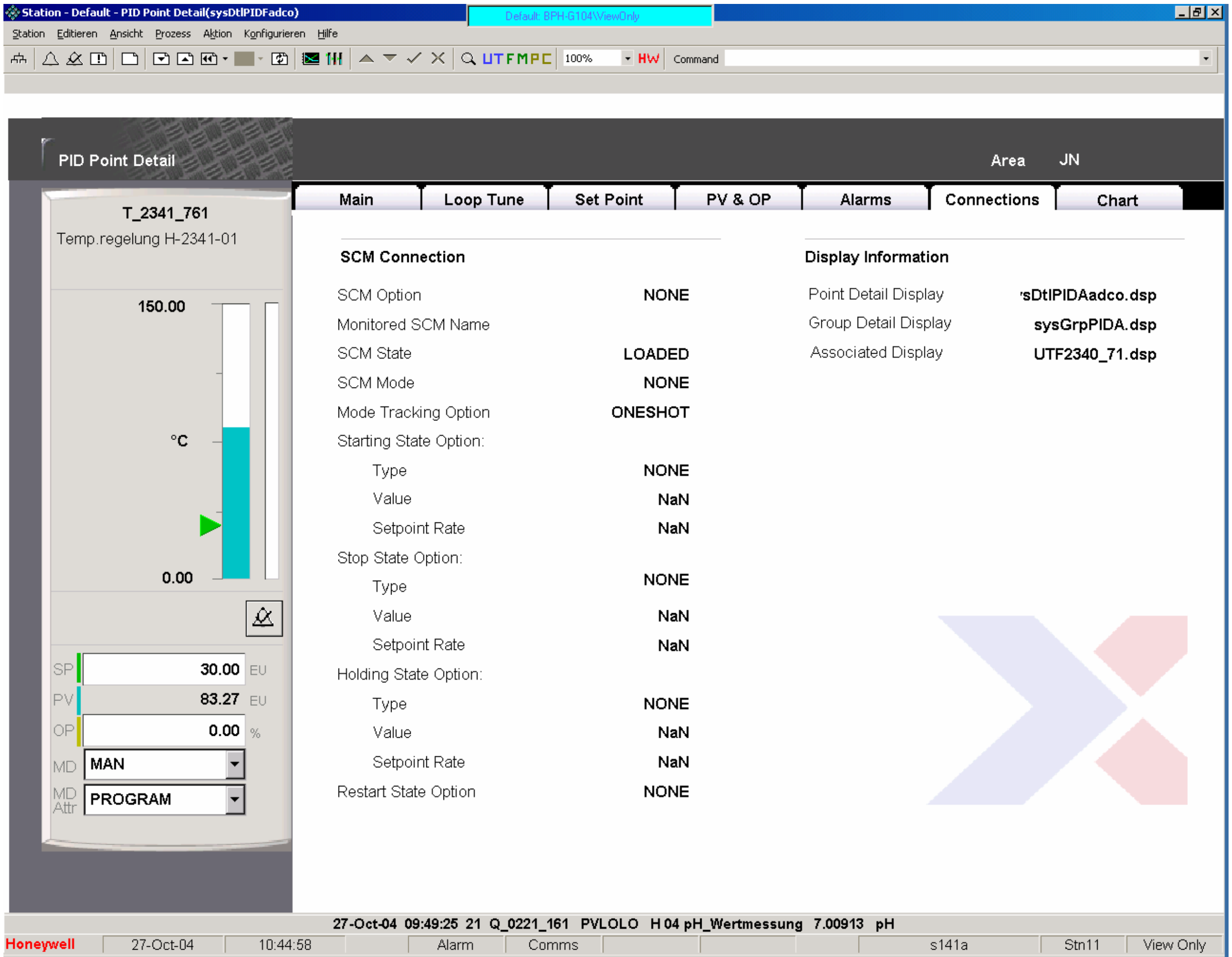

Figure 22: ADAPCTL Point Detail Connections

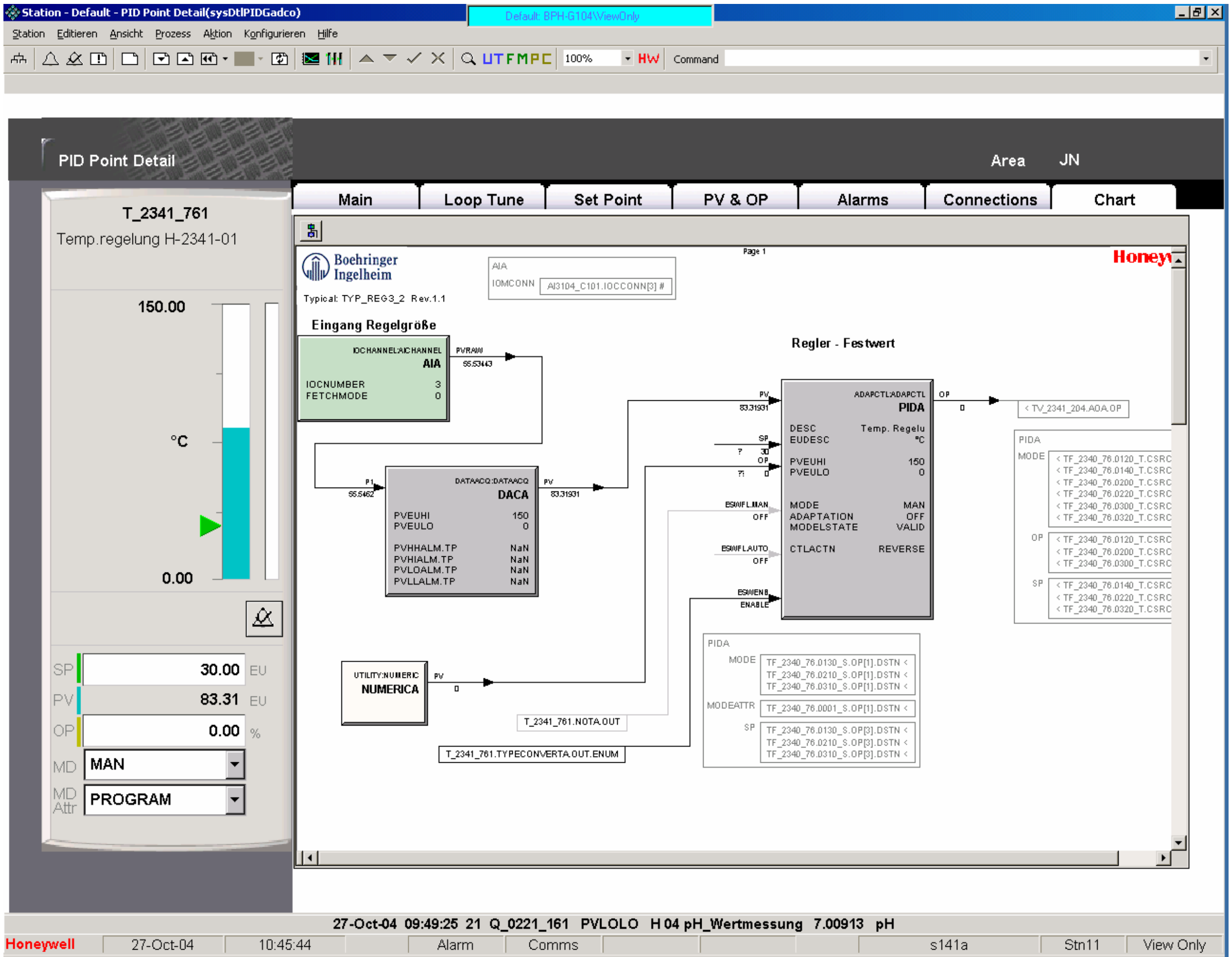

Figure 23: ADAPCTL Point Detail Chart

4.1.3 Controller Tuning

If a new controller has been configured or an existing one has been reset the control algorithm does not have any information about process characteristics. Therefore the controller optimization which is based on an estimated and validated process model can not be performed. In this situation the algorithm prevents the controller from being switched to automatic. Through manual stimulation (changing the manipulated variable) knowledge about the process behavior has to be relayed to the identification routine.

First of all the adaptive control algorithm needs some basic information about the process dynamics (transition time) and possibly about process deadtimes. The transition time (see figure 5.5) is defined for lag as well as for integrating processes. Concerning lag processes the transition time is the time necessary for the process to reach a new steady state after a step change of the manipulated variable (controller output). Dealing with integrating processes the transition time is the time the process needs - starting out at a steady state - to change its process variable by n/2 % as a response to a step change of the controller output of n% (e.g. 20% step change of the manipulated variable -> 10% change of the process variable). It is sufficient to enter the transition time as an approximate value in [min]. The control algorithm is so robust that the entered value can be five times higher or five times lower than the real transition time without impairing the resulting control quality. The deadtime [min] should have a higher degree of accuracy.

If these times are unknown they have to be determined by applying a step change to the manipulated variable (with the adaptation turned off). The necessary numbers can be classified by taking a look at the resulting process variable graph. During the following learning phase (adaptation turned on!!) a classical transfer function (answer to a step change of the manipulated variable) can be recorded. Furthermore it is also possible to adjust the controller output several times during the learning phase. So it is conceivable that the process variable is manually controlled and led to its setpoint. As soon as the algorithm detects its first valid process model the controller can be switched to automatic, i.e. the internal lock to force the controller to manual mode is no longer effective. With the vast majority of processes it is not necesary to operate the controller in a continously adaptive mode. The control algorithm can then work with a constant control parameter set (after turning off the adaptation).

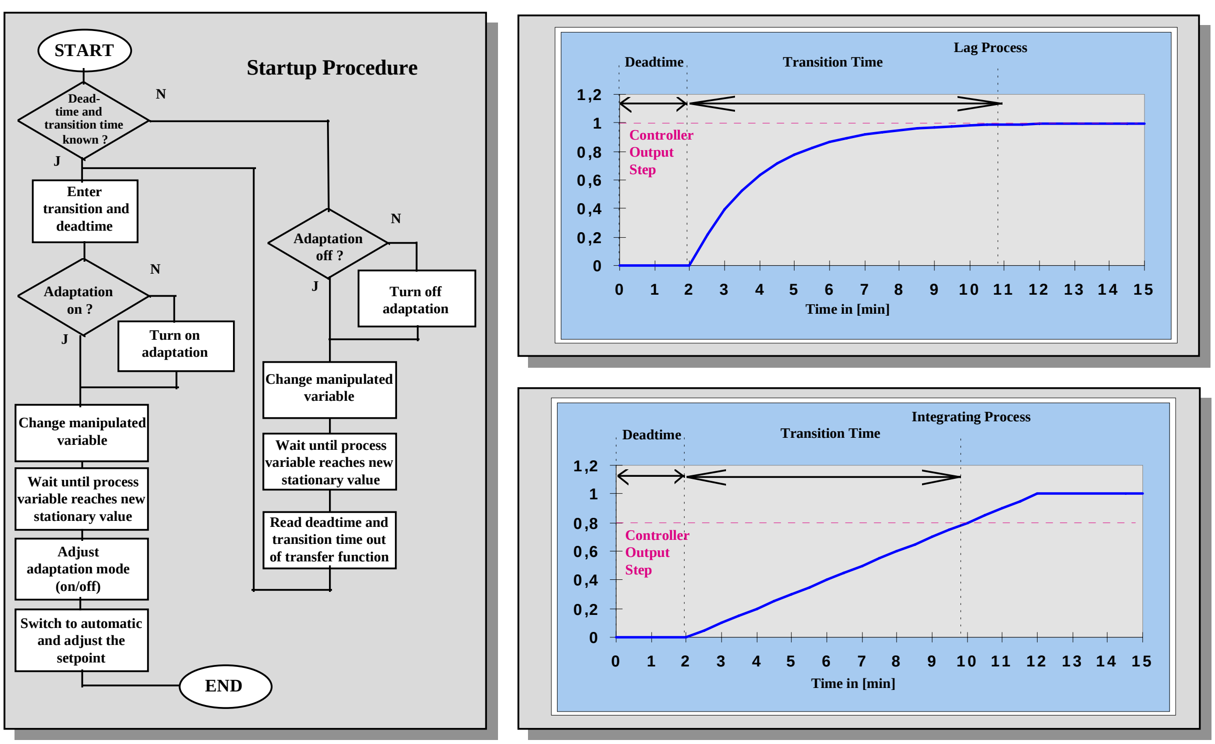

Figure 24: Startup procedure for the adaptive controller

4.1.4 Tips and Tricks

- Basically the learning phase to set up a process model and to optimize a state controller based on this model can be started any time. During the first learning phase (i.e. after a new controller has been activated in an Experion system or after an existing controller has been initialized) the process model estimation should be started in a "nearly static" operating point and should end in a different but also "nearly static" operating point. The reason herefore is that during the transition from a static to a dynamic phase and also during the transition from a dynamic to a static phase the "best process information" can be transferred to the process model (see figure 5.6).

A consequent fine tuning optimization (based on an already existing process model) can also be started in the course of a dynamic transition without impairing the resulting control quality.

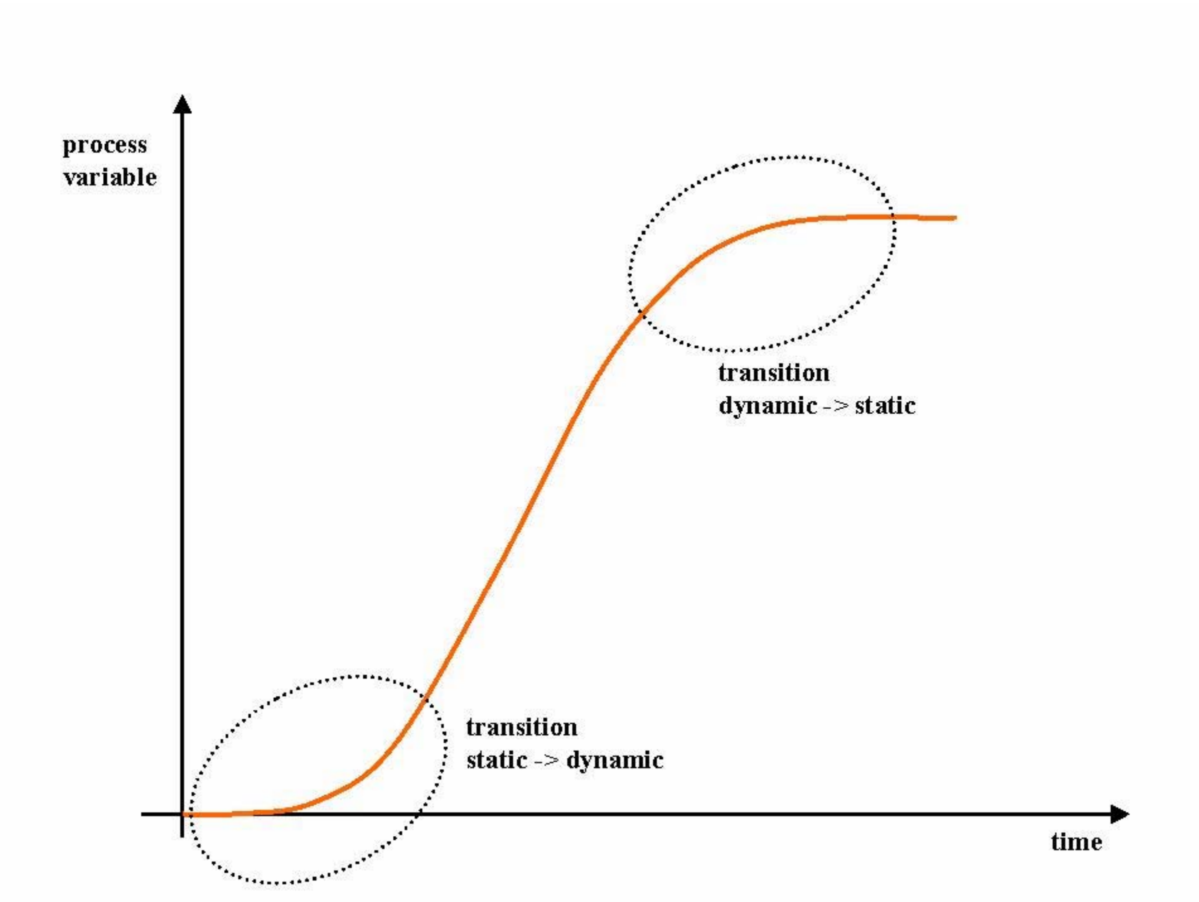

Figure 25: Transition phases with essential information

- If a controller is operated in the continuously adapting mode then it makes sense to limit the change rate of the manipulated variable (OPROCLM). Assumed that no limitation is introduced the manipulated variable can get into a oscillating state if a wrong process model – despite all checks – is conveyed to the optimization procedure (this should happen very rarely, but it can not be guaranteed that it never happens). A high-frequent oscillation can lead to a static process variable which in turn means that no process information can be extracted from the process variable, i.e. the model can no longer be improved and the control algorithm is locked.

  The value for a limited change rate of the manipulated variable depends on the dynamic behavior of the process and on the requirements on the control quality of the loop. A generally valid value can not be indicated.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

- If a process contains a significant deadtime characteristic then the manually entered deadtime value (DTIME) should always be lower as or equal to the real process deadtime. If the indicated deadtime is too low the control quality diminishes very slowly. However if it is too high the quality of the control loop is strongly affected.
- If process characteristics show a defined difference in certain transitions (e.g. a temperature process where heating up takes more time than cooling down) the faster transition should be the basis for a process model estimation and a subsequent controller optimization. In the example above (provided that cooling down shows faster dynamics) the system should first be heated up with the adaptation turned off. Then the adaptation should be turned on and the system should be cooled down. The resulting controller (with constant tuning parameters) is capable of handling both the heating up and cooling down phase.
- If the controller is acting too strong on the process, i.e. it produces an oscillating controller output (manipulated variable) and thereby approaches stability limits, the following actions should be taken (in that order):
    - Reduce the sensitivity factor (SENS) – if necessary to -100.
    - Limit the change velocity (OPROCLM) of the manipulated variable (controller output). The value to be entered depends on the process dynamic. As a first guess the value can be adjusted so that a 100% change of the controller output is possible within one oscillation period. E.g. if the oscillation period of the instable or nearly instable control loop is 0.5 min then OPROCLM can be set to 200.
- If the controller is acting too sluggish on the process then the following actions can be taken (in that order):
    - Increase the change velocity (OPROCLM) of the manipulated variable (controller output) or set it to 0 to disable the limitation completely.
    - Increase the sensitivity factor (SENS) – if necessary to 150.

4.2 Summary of Parameters

4.2.1 Common Regulatory Control Parameters

As mentioned above, the ADAPCTL FB is very similar to the REGCTL:PID/REGCTL:PIDFF FBs. Hence, a lot of parameters of the ADAPCTL FB you will find already described in the Knowledge Builder's REGCTL section. The next table lists all of these parameters, that are identical with the REGCTL:PID/REGCTL:PIDFF parameters in alphabetical order.

ADVDEVALM.FL ADVDEVALM.PR ADVDEVALM.SV ADVDEVALM.TP ADVDEVOPT ADVDEVOPT ADVSP ADVSPP ALMDB ALMDBU ARWNET ARWOP ASTEPID	BACKCALCCONN BACKCALCIN BACKCALCOUT BADCTLALM.FL BADCTLALM.PR BADCTLALM.SV BADCTLFL BADCTLOPT	CASREQFL CONTROLREQ CTLINIT CV CVEUHI CVEULO	DELCV DESC DEV DEVHIALM.FL DEVHIALM.PR DEVHIALM.SV DEVHIALM.TP DEVLOALM.FL DEVLOALM.PR DEVLOALM.SV DEVLOALM.TP	ESWENB ESWFL.AUTO ESWFL.BCAS ESWFL.CAS ESWFL.MAN ESWPERM EUDESC
FBORSTS	HIALM.PR HIALM.SV HIALM.TYPE HOLDOPT HOLDRATE HOLDVAL	INALM INITMAN INITREQ INITVAL	LASTGOODPV LASTMODEREQ LASTOPREQ LASTOPTYPE LASTRATEREQ LASTREQFL LASTSPREQ LASTSPTVREQ LASTSTEP	MODE MODEAPPL[1..4] MODEATTR MODEATTRFL.NORM MODEATTRFL.OPER MODEATTRFL.PROG MODEFL.AUTO MODEFL.BCAS MODEFL.CAS MODEFL.MAN MODEFL.NORM MODEPERM MODEREQ MODETRACK
NORMMODE NORMMODEATTR NUMONESHOT NUMPR NUMPROPREQ NUMSEC	OP OPBIAS OPBIAS.FIX OPBIAS.FLOAT OPEU OPEUX OPEXHIFL OPEXHILM OPEXLOFL OPEXLOLM OPHIALM.FL OPHIALM.PR OPHIALM.SV OPHIALM.TP OPHIFL OPHILM OPLOALM.FL	PV PVCONN PVEUHI PVEULO PVFORMAT PVMANOPT PVP PVSTS PVSTSFL.BAD PVSTSFL.MAN PVSTSFL.NORM PVSTSFL.UNCER PVTRAKOPT PVVALSTS	REDTAG RESTARTOPT	SAFEOP SECINITOPT SIALM.FL SIALM.PR SIALM.SV SIALMOPT SIFL SIOPT SP SPCONN SPEUHI SPEULO SPFORMAT SPHIFL SPHILM SPLOFL SPLOLM

	OPLOALM.PR OPLOALM.SV OPLOALM.TP OPLOFL OPLOLM OPMINCHG OPREQ OPROCLM OPROCNEGFL OPROCPOSFL OPSECDATA.ARWSTS OPSECDATA.EUHI OPSECDATA.EULO OPSECDATA.INITREQ OPSECDATA.INITVAL OPSECDATA.ONESHOT OPSECDATA.ORFBVAL OPSECDATA.OROFFSET OPTYPE OPX ORDERINCM			SPP SPRATEREQ SPREQ SPTV SPTVNORMRATE SPTVOPT SPTVP SPTVREQ STARTOPT STARTRATE STARTVAL STOPOPT STOPRATE STOPVAL
TMOUTFL TMOUTMODE TMOUTTIME				

Table 1: Parameters, similar in PID/PIDFF and ADAPCTL FBs

In the next table you will find such parameters, which are close to their originals.

Parameter	Distinctive in ADAPCTL FB
ALMTM	Range: 0..3600
ADVDEVALM.DB ADVDEVALM.TM	Individually configurable in project mode. Individually configurable in project mode. Range: 0..3600
DEVHIALM.DB DEVHIALM.TM DEVLOALM.DB DEVLOALM.TM	Individually configurable in project mode. Individually configurable in project mode. Range: 0..3600 Individually configurable in project mode. Individually configurable in project mode. Range: 0..3600
OPBIAS.RATE	Parameter is always equal to 0.0.
OPHIALM.DB OPHIALM.TM OPLOALM.DB OPLOALM.TM	Individually configurable in project mode. Individually configurable in project mode. Range: 0..3600 Individually configurable in project mode. Individually configurable in project mode. Range: 0..3600
SPTVDEVFL SPTVDEVMAX SPTVRATE SPTVSTATE SPTVTIME	Will not be processed if SPTVMODE = SIMPLE.

Table 2: Parameters, marginal different in ADAPCTL

Unique in ADAPCTL are the following items:

Item	Remark
Write access to CV	Writing to CV has no effect, because CV will be calculated inside the adaptation algorithm in every execution cycle.
Recursive propagation of Secondaries' data to the Primaries	Recursive propagation is not implemented due to the undefined behavior of the Primaries by connecting ADAPCTL and REGCTL FBs. But each primary ADAPCTL will fetch the data from its Secondary inside the execution cycle. Background: The ADAPCTL does not belong to the REGCTL family! In the Control Builder's library tree you will find the PID and PIDFF FBs inside the REGCTL section, but the ADAPCTL FB is part of the ADAPCTL branch. **Note:** It is not allowed to use an ADAPCTL as Primary for a REGCTL!

Table 3: Unique items in ADAPCTL

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

4.2.2 Adaptation Control Specific Parameters

Parameter Name:	**ABUF1**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) A1 process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**ABUF2**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) A2 process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**ABUF3**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) A3 process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**ADAPTATION**
Specific to Block:	ADAPCTL
Description:	This switch turns the adaptation ON or OFF
Data Type:	BOOLEAN
Range:	0 OFF
	1 ON
Default:	OFF
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	MODELSTATE, MODELCONFIG, IDENT, VAL_M
Remarks:	Displays the adaptation status of the controller.

Parameter Name:	**AZ**
Specific to Block:	ADAPCTL
Description:	Buffer with the actual (A1, A2, A3) process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**BBUF1**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) B1 process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Parameter Name:	**BBUF2**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) B2 process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**BBUF3**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) B3 process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**BLESSTFR**	
Specific to Block:	ADAPCTL	
Description:	If the “bumpless transfer option” is turned ON the controller output (OP) is processed through a temporary low pass filter whenever a state transition (e.g. MANL to AUTO or OPTRAKOPT from ON to OFF) is initiated	
Data Type:	BOOLEAN	
Range:	0	OFF
	1	ON
Default:	OFF	
Config Load:	No	
Access Lock:	Engineer	
Residence:	CEE	
Related Parameters:		
Remarks:	Displays the “bumpless transfer option”.	

Parameter Name:	**BZ**
Specific to Block:	ADAPCTL
Description:	Buffer with the actual (B1, B2, B3) process model parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**CBUF**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) offset (process model) parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameters.

Parameter Name:	**CGLZ**
Specific to Block:	ADAPCTL
Description:	Actual offset (process model) parameter
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process model parameter.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Parameter Name:	**COUNTER1**
Specific to Block:	ADAPCTL
Description:	Counter for valid lag models; counts back from 10 to 0, i.e. 10 subsequent valid lag models have to be estimated before the model is conveyed to the controller optimization procedure; any invalid model sets the counter back to 10
Data Type:	INT32
Range:	0 … 10
Default:	10
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays counter to show the progress of the process model estimation procedure.

Parameter Name:	**COUNTERI**
Specific to Block:	ADAPCTL
Description:	Counter for valid integrating models; counts back from 10 to 0, i.e. 10 subsequent valid lag models have to be estimated before the model is conveyed to the controller optimization procedure; any invalid model sets the counter back to 10
Data Type:	INT32
Range:	0 … 10
Default:	10
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays counter to show the progress of the process model estimation procedure.

Parameter Name:	**CTLACTN**	
Specific to Block:	ADAPCTL	
Description:	Control action (basic process behavior)	
Data Type:	ENUM	
Range:	0	REVERSE
	1	DIRECT
Default:	DIRECT	
Config Load:	No	
Access Lock:	Engineer	
Residence:	CEE	
Related Parameters:		
Remarks:	REVERSE means that an increasing output (OP) decreases the PV. DIRECT means that an increasing output (OP) increases the PV. This value is used for process model validation purposes.	

Parameter Name:	**D**
Specific to Block:	ADAPCTL
Description:	Buffer containing the so-called information matrix; the content of the matrix is built by means of controller output (OP) and process variable (PV) values; from this matrix the process model parameters are derived
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays values of the information matrix.

Parameter Name:	**DTIME**
Specific to Block:	ADAPCTL
Description:	Dead Time in [min]; time delay between a controller output (OP) modification and the start of a process reaction (PV)
Data Type:	FLOAT64
Range:	>= 0.0
Default:	0.0
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	
Remarks:	Displays dead time in [min].

Parameter Name:	**FB_VERS**
Specific to Block:	ADAPCTL
Description:	FB Version Number
Data Type:	INT32
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	In the “Parameters (Project)” form the template version will be shown, while in the „Parameters (Monitoring)“ form the code version is displayed.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Parameter Name:	**GAINZ**
Specific to Block:	ADAPCTL
Description:	Actual process gain factor
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	az, bz
Remarks:	Displays actual gain factor.

Parameter Name:	**GBUF**
Specific to Block:	ADAPCTL
Description:	Buffer with the most recent (6) process gain factors
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays process gain factors.

Parameter Name:	**IDENT**	
Specific to Block:	ADAPCTL	
Description:	Process model identification ON/OFF	
Data Type:	BOOLEAN	
Range:	0	OFF
	1	ON
Default:	OFF	
Config Load:	No	
Access Lock:	View Only	
Residence:	CEE	
Related Parameters:		
Remarks:	Displays if the process model estimation procedure (adaptation) can extract information out of dynamic transitions of OP as well as of PV. It can only turn ON if ADAPTATION is activated.	

Parameter Name:	**KMATZ**
Specific to Block:	ADAPCTL
Description:	Actual control parameters
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays control parameter values.

Parameter Name:	**MODELCONFIG**	
Specific to Block:	ADAPCTL	
Description:	Model Configuration	
Data Type:	ENUM	
Range:	0	EMPTY
	1	PASSED
Default:	0	
Config Load:	No	
Access Lock:	View Only	
Residence:	CEE	
Related Parameters:	ORIG_M, VAL_M, IDENT	
Remarks:	Algorithm:	IF (ORIG_M == 1) AND (VAL_M == 0) AND (IDENT == 0) THEN MODELCONFIG := PASSED ELSE MODELCONFIG := EMPTY
	This parameter takes part in the export/import procedure. After an import the “Parameters (Project)” form indicates, if the imported model is configured or not.	

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Parameter Name: **MODELSTATE**
Specific to Block: ADAPCTL
Description: Model Configuration
Data Type: ENUM
Range: 0 NO_MODEL
1 UNCERTAIN
2 INCOMPLETE
3 VALID
Default: 0
Config Load: No
Access Lock: View Only
Residence: CEE
Related Parameters: ORIG_M, VAL_M, IDENT
Remarks: Algorithm:

ORIG_M	VAL_M	IDENT	ModelState	
1	0	1	1	uncertain
1	1	1	2	incomplete
1	0	0	3	valid
all other combinations			0	no_model

This parameter takes part in the export/import procedure. After an import the "Parameters (Project)" form indicates, if the imported model is configured or not.

Parameter Name: **NO_VAL**
Specific to Block: ADAPCTL
Description: Process model validation turned on or off
Data Type: BOOLEAN
Range: 0 OFF
1 ON
Default: OFF
Config Load: No
Access Lock: Engineer
Residence: CEE
Related Parameters:
Remarks: An estimated process model is only relayed to the controller optimization procedure if a series of checks is passed. By means of NO_VAL these checks can be turned off (NOCHECK). However this should very rarely be necessary.

Parameter Name:	**OPHILMEU**
Specific to Block:	ADAPCTL
Description:	OP High Limit in EUs
Data Type:	FLOAT64
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the OPHILM value in EUs.

Parameter Name:	**OPLOLMEU**
Specific to Block:	ADAPCTL
Description:	OP Low Limit in EUs
Data Type:	FLOAT64
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the OPLOLM value in EUs.

Parameter Name:	**OPSTART**
Specific to Block:	ADAPCTL
Description:	Initial OP Value in EUs
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	
Remarks:	Displays the OPSTART value in EUs.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Parameter Name:	**OPSTARTEU**
Specific to Block:	ADAPCTL
Description:	Initial OP Value in EUs
Data Type:	FLOAT64
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the OPSTART value in EUs.

Parameter Name:	**OPSTBOPT**	
Specific to Block:	ADAPCTL	
Description:	Adaptive controller in ACTIVE/STANDBY mode	
Data Type:	BOOLEAN	
Range:	0	OFF
	1	ON
Default:	OFF	
Config Load:	No	
Access Lock:	Engineer	
Residence:	CEE	
Related Parameters:	OPSTBVAL	
Remarks:	The adaptive controller can be operated in parallel to another active controller (standby mode). In this case the OP of the other control concept has to be fed into the adaptive controller (OPSTBVAL). This parameter displays the corresponding mode.	

Parameter Name:	**OPSTBVAL**
Specific to Block:	ADAPCTL
Description:	OP Standby Value in EUs
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	OPSTBOPT
Remarks:	The adaptive controller can be operated in parallel to another active controller (standby mode). In this case the OP of the other control concept has to be fed into the adaptive controller. This parameter displays the corresponding active controller output value.

Parameter Name:	**OPSTBVALEU**
Specific to Block:	ADAPCTL
Description:	OP Standby Value in EUs
Data Type:	FLOAT64
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the OPSTBVAL value in EUs.

Parameter Name:	**OPTRAKOPT**	
Specific to Block:	ADAPCTL	
Description:	Adaptive controller in output (OP) track mode	
Data Type:	BOOLEAN	
Range:	0	OFF
	1	ON
Default:	OFF	
Config Load:	No	
Access Lock:	Engineer	
Residence:	CEE	
Related Parameters:	OPTRAKVAL	
Remarks:	The adaptive controller output can be forced to track a defined block input value (OPTRAKVAL). This parameter displays the track mode.	

Parameter Name:	**OPTRAKVAL**
Specific to Block:	ADAPCTL
Description:	OP Track Value in EUs
Data Type:	FLOAT64
Range:	
Default:	NaN
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	OPTRAKOPT
Remarks:	Displays the OPTRAKVAL value in EUs.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Parameter Name:	**OPTRAKVALEU**
Specific to Block:	ADAPCTL
Description:	OP Track Value in EUs
Data Type:	FLOAT64
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the OPTRAKVAL value in EUs.

Parameter Name:	**ORIG_M**	
Specific to Block:	ADAPCTL	
Description:	Ready to be turned to automatic	
Data Type:	INT32	
Range:	0	NOT_READY
	1	READY
Default:	NOT_READY	
Config Load:	No	
Access Lock:	View Only	
Residence:	CEE	
Related Parameters:	MODELSTATE, MODELCONFIG	
Remarks:	Before the adaptive controller can be turned to automatic a (first) valid model has to be available. This parameter displays the status.	

Parameter Name:	**P_MAT**
Specific to Block:	ADAPCTL
Description:	Buffer containing the actual (recursive) control parameter optimization matrix
Data Type:	FLOAT64
Range:	
Default:	0.0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the control parameter matrix values.

Parameter Name:	**PROC_TYPE**
Specific to Block:	ADAPCTL
Description:	Process model type (no process type, lag process, integrating process)
Data Type:	INT32
Range:	0 NO_PR_TYPE 1 LAG 2 INTEGR
Default:	0
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the basic process model type.

Parameter Name:	**RESET**
Specific to Block:	ADAPCTL
Description:	Adaptive controller reset
Data Type:	BOOLEAN
Range:	0 OFF 1 ON
Default:	OFF
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	
Remarks:	If the adaptive controller is reset it loses all the process information gathered before. As a consequence of that the adaptation mode is automatically turned on.

Parameter Name:	**SAFEOPEU**
Specific to Block:	ADAPCTL
Description:	Safe OP Value in EUs
Data Type:	FLOAT64
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the SAFEOP value in EUs.

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de

Parameter Name:	**SAMPLE_T**
Specific to Block:	ADAPCTL
Description:	Sample time in [sec]
Data Type:	FLOAT64
Range:	
Default:	
Config Load:	No
Access Lock:	View Only
Residence:	CEE
Related Parameters:	
Remarks:	Displays the sample time in [sec].

Parameter Name:	**SENS**
Specific to Block:	ADAPCTL
Description:	Sensitivity of the adaptive controller
Data Type:	FLOAT64
Range:	-100 … 150
Default:	50
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	
Remarks:	An increasing sensitivity value means that the controller is also increasing its impact on the corresponding process. In general this means that the controller is using more energy to bring the process variable (PV) back to the desired setpoint.

Parameter Name:	**SPTVMODE**	
Specific to Block:	ADAPCTL	
Description:	SPTV Ramp Mode	
Data Type:	ENUM	
Range:	1	PID-COMPATIBLE
	2	SIMPLE
Default:	1	
Config Load:	Yes	
Access Lock:	Application Developer	
Residence:	CEE	
Related Parameters:	SPTV, SPTVDEVFL, SPTVDEVMAX, SPTVNORMRATE, SPTVOPT, SPTVP, SPTVRATE, SPTVSTATE, SPTVTIME	
Remarks:	PID-COMPATIBLE: Target value processing will be performed similar to the PID FB. SIMPLE: Target value processing is active, if SPTVOPT = ENABLE and SPTVNORMRATE contains a value greater then 0.0. It works in MAN mode as well as in AUTO mode. The following parameters will not be processed: SPTVDEVFL, SPTVDEVMAX, SPTVRATE, SPTVSTATE, SPTVTIME.	

Parameter Name:	**TTIME**
Specific to Block:	ADAPCTL
Description:	Transition time of the process in [min]
Data Type:	FLOAT64
Range:	>= 0.0
Default:	0.0
Config Load:	No
Access Lock:	Engineer
Residence:	CEE
Related Parameters:	
Remarks:	This input indicates how long it takes (approximately) for a process to go from state A to B. This value is used to determine the internal scan time so that an acceptable PV value difference between two succesive scans can be processed.

Parameter Name:	**VAL_M**	
Specific to Block:	ADAPCTL	
Description:	Indicates a valid process model	
Data Type:	BOOLEAN	
Range:	0	OFF
	1	ON
Default:	OFF	
Config Load:	No	
Access Lock:	View Only	
Residence:	CEE	
Related Parameters:	MODELSTATE, MODELCONFIG	
Remarks:	The estimated process model has to pass several tests before it is accepted and conveyed to the controller optimization procedure. This parameter indicates the status.	

Ingenieurbüro für Prozeßautomations- und Steuerungssysteme • Inhaber: Dipl.-Ing. Bernhard Wurm
An der Landwehr 6 • D-60437 Frankfurt • Telefon (0 69) 95 04 18 - 0 • Fax (0 69) 95 04 18 – 19
E-Mail : service@ipas-systeme.de http : www.ipas-systeme.de