



PMATune

Optimization of PID controllers

For all BluePort® controllers,
KS 92, KS 94, KS98, KS 800/816 range

Considerably reduced commissioning time

Robust controller design for every controller type:
Continuous, 2-point, 3-point, and 3-point stepping

For control loops of any order, with and without self-regulation

Also suitable for loops with dominant dead time

Safe and reliable determination of PID parameters

Minimum intervention in process

Adaptation during start-up or at setpoint

Optimizing criteria, value of excitation pulse,
and switch-off point adjustable

PROFILE

A standard feature of PMA controllers is the determination of optimum control parameters during start-up, with excellent results 2nd-order loops. Using T_u and V_{max} the controller calculates the settings for X_p , T_n and T_v without interrupting or delaying the heating phase.

This self-tuning procedure provides extremely precise PID settings, for fastest possible process line-out without overshoot.

For 90% of all control loops, PMA's established automatic self-tuning procedures are ideal, and hard to beat. Previously, only unsatisfactory results were obtained (if at all) in difficult cases. e.g. with $T_g/T_u < 10$; higher-order loops, with dominant dead time or insufficient delay time.

Now, however, PMATune determines „robust“ PID parameters safely and on-site, with just a single excitation pulse.

Typically difficult conditions are found e.g. with thermal processes, furnaces, casting plants, pressure and flow control, etc. Frequently, the problem can be reduced in advance by means of master/slave arrangements or using other strategies.

But once commissioning has started, it is usually too late to implement such alternatives, because further delays cannot be accepted.

PMATune is used mainly where either:

- ⊕ Conventional methods fail
- ⊕ Manual optimization on site is too time-consuming or risky, or
- ⊕ Robust control behaviour is required for stability also with varying process dynamics (e.g. non-linearity).

PMATune is not suitable for processes that tend to oscillate even without controller action (manual operation), as well as processes with a pronounced „non-minimal phase“ (temporary opposed reaction >10% of the controlled variable).

DESCRIPTION

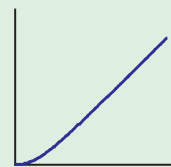
PMATune is a PC-based optimization program. The PC (laptop) is connected to the front interface of the PMA controller via an adapter cable. When communication has been established, PMATune automatically recognizes the controller version and the configured control mode.

Selection of the optimization properties (control mode, step response value, max. excursion of the controller output) as well as controller operation (auto/manual switch-over, setpoint, and manual settings) is done via PMATune.

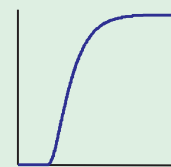
PMATune is always successful with the following processes:



Self-regulating



Not self-regulating



Self-regulating

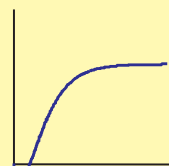


Not self-regulating

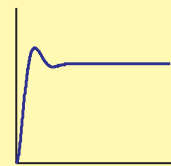
Process with low order

Process with large dead time

PMATune still suitable



Slight non-minimal phase

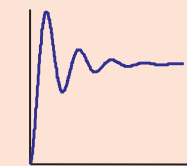


Slightly oscillating

PMATune not suitable !



Strong non-minimal phase



Strongly oscillating

To determine the process characteristics (step response), an excitation pulse is applied manually either during start-up or at setpoint. Hereby, the pulse height and its direction are selectable. The pulse is switched off as soon as the controlled variable exceeds a predefined threshold value (upwards or downwards). Excitation phase and response time are displayed in a window.

During the attempt, linear drifting of the controlled variable is taken into account, and process disturbances (noise) are filtered out.

The attempt is considered as completed, when the controlled variable has returned to about half its excursion. The computed control parameters are displayed in a window, from where they can be transferred to the controller at the push of a button. It is also possible to select the control response at a later time, and then transfer the resultant PID parameters to the controller.

Similarly, the control mode PI / PID can be changed subsequently.

Selectable control response:

- Slow: aperiodic (critically damped) response
- Normal: up to 10% overshoot (only once)
- Fast: up to 25% overshoot (only once)

Simulation and full version

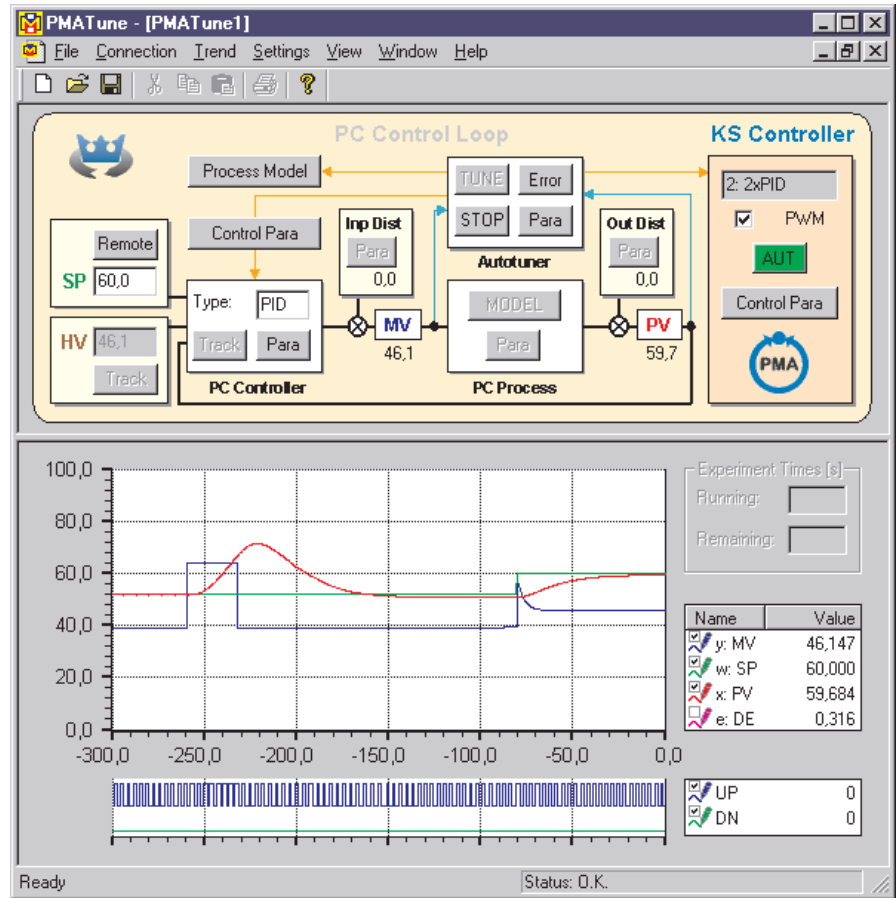
PMATune automatically determines the PID parameters for PMA controllers fitted with a front interface. The licensed full version permits realtime optimization via the controller's front interface.

The free demonstration version can be downloaded from PMA's website (without license), and permits unrestricted testing and optimization experiments in connection with PMA Simulation programs (BlueControl, SIM/KS 94, SIM/KS 98, ...). However, the interface to the hardware is disabled.

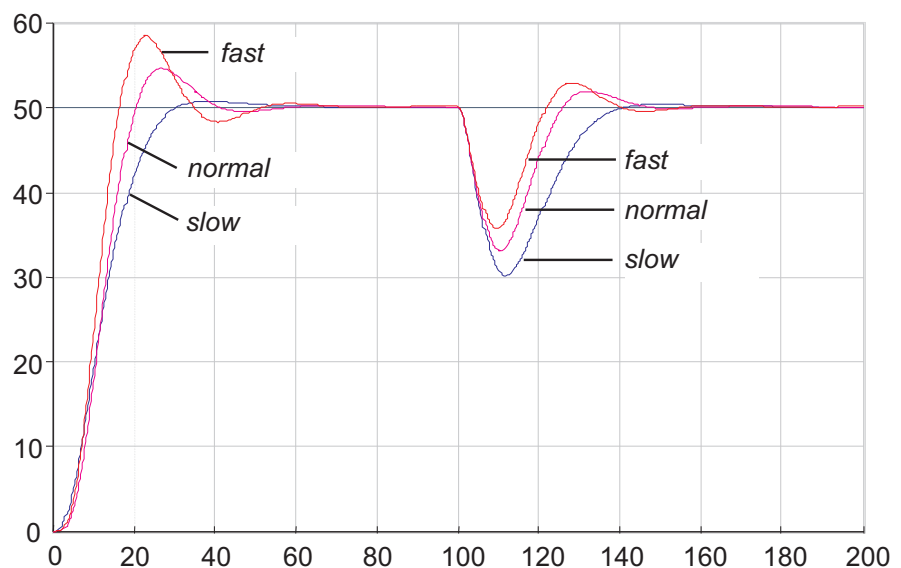
PMATune for testing and training

Apart from simulation with PMA's Engineering Tools, PMATune also contains the process simulation package PCProcess (2nd-order loop with dead time). Together with the PC Controller package (also contained), PMATune can be used for testing and training purposes without a PMA controller or PMA Engineering Tools.

Operation and trend display of PMATune
Shown below: Excitation pulse followed by a step change of the setpoint



Step response and disturbance reaction



TECHNICAL DATA

GENERAL

Controllable process types

- Loops of any order, with large dead times
- Loops with dominant dead time
- Loops of any order, without self-regulation (integral behaviour)
- Loops without dead time

PMATune is not suitable for oscillating processes or processes with non-minimal phases (temporary opposed reaction > 10%)!

Supported PMA products

BluePort® controllers, KS 92, KS 94, KS 98, KS 800/816 range

Supported controller types

Automatic detection when communication is established: Continuous, 3-point, 3-point (e.g. heating/cooling with separate tuning for each working point), 3-point stepping.

Control response (selectable)

Slow:

without overshoot (< 5%; rarely)

Normal:

only one overshoot < 10%

Fast:

only one overshoot < 20%

(can also be selected at a later time)

Control mode

PI or PID (can also be selected at a later time).

Process excitation

Excitation pulse: started in manual operation

Pulse height

Δy : -100...0...100 % adjustable

Pulse duration:

depends on the selected switch-off point Δx

Switch-off point Δx :

adjustable in engineering units

Steady state condition

$\Delta x/\Delta t$ = constant during optimization; switch controller to manual operation and wait until process is steady.

Drift detection

Can be activated if $\Delta x/\Delta t$ is not 0.

Estimation time adjustable (according to process dynamics; preset value: 10 s)

Disturbance (noise) filter

Always active. Estimation time is adjustable (preset value: 2 s, recommended: < 10 s)

Calculated control parameters

Proportional gain K_p (range = X_p)

Derivative time T_v (t_d)

Integral time T_n (t_i)

Shortest switching duty cycle $T_p(t_1)$

The control parameters are calculated for all selectable control modes (subsequent changes possible without renewed optimization!).

Scanning cycle

100 ms

Hardware and software requirements

IBM compatible PC, Pentium processor 400 MHz

At least 64 Mbytes memory (RAM)

At least 10 Mbytes free space on hard disk

VGA graphics card 800 x 600 pixels, 256 colours, and suitable monitor

CD ROM drive

Operating system: Windows 95/98/ME/NT4 (Service Pack 3 or higher)/2000/XP

Mouse or other pointer device

Languages

English, German, Czech

(selection is made during program installation)

Operating instructions (*.pdf)

Accessible in the selected language after program installation via <Main menu> <Help>.

ORDERING DATA

The following information must be provided when ordering:

- User's name
- Company name and address
- User's e-mail address

| | |
|--|---|
| PMATune | Order no. |
| PID optimization program | |
| Demonstration version (free download) | http://www.pma-online.de/en/products/download.html#pmatune or on the PMA CD |
| Single user license | 9407-999-06601 |
| Multi-user license (5) | 9407-999-06611 |
| <hr/> | |
| Accessory | Order no. |
| PC adapter | 9407-998-00001 |

Licensing data (name & code) are supplied exclusively via e-mail!

The latest software is available on PMA's website or on the PMA CD:

<http://www.pma-online.de/en/products/download.html>



PMA

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