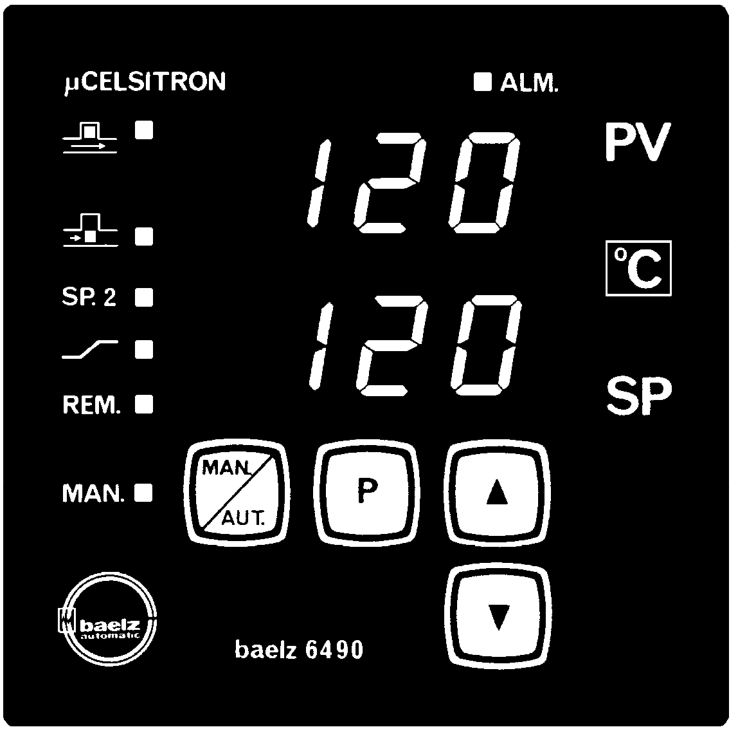
Operating Instructions OI 6490 / 6590

Microprocessor - based controller µCelsitron baelz 6490 / baelz 6590
Universal three - position step controller

Industrial controller with special PID - step controller algorithm



- ❑ Easy operation
- ❑ User - defined operating level
- ❑ Digital displays for process variable and setpoint
- ❑ Control structure PI and PID
- ❑ Two - position control
- ❑ Three - position control
- ❑ Measurement inputs for Pt 100, current and protection voltage signals
- ❑ Manual -/ automatic changeover
- ❑ Two adjustable setpoints
- ❑ Remote setpoint
- ❑ Setpoint ramp
- ❑ Control via digital inputs
- ❑ Serial interface
- ❑ Robust self - optimization
- ❑ Semi - conductor memory for data
- ❑ Plug - type terminals
- ❑ Degree of protection Front IP 65

- ❑ Compact design 96mm x 96mm x 135mm
- ❑ Compact design 48mm x 96mm x 140mm

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Contents

⚠ Warning:

During electrical equipment operation, the risk that several parts of this unit will be connected to high voltage is inevitable. Improper use can result in serious injuries or material damage.

The warning notes included in the following sections of these operating instructions must therefore be observed accordingly. Personnel working with this unit must be properly qualified and familiar with the contents of these operating instructions.

Perfect, reliable operation of this unit presupposes suitable transport including proper storage, installation and operation.

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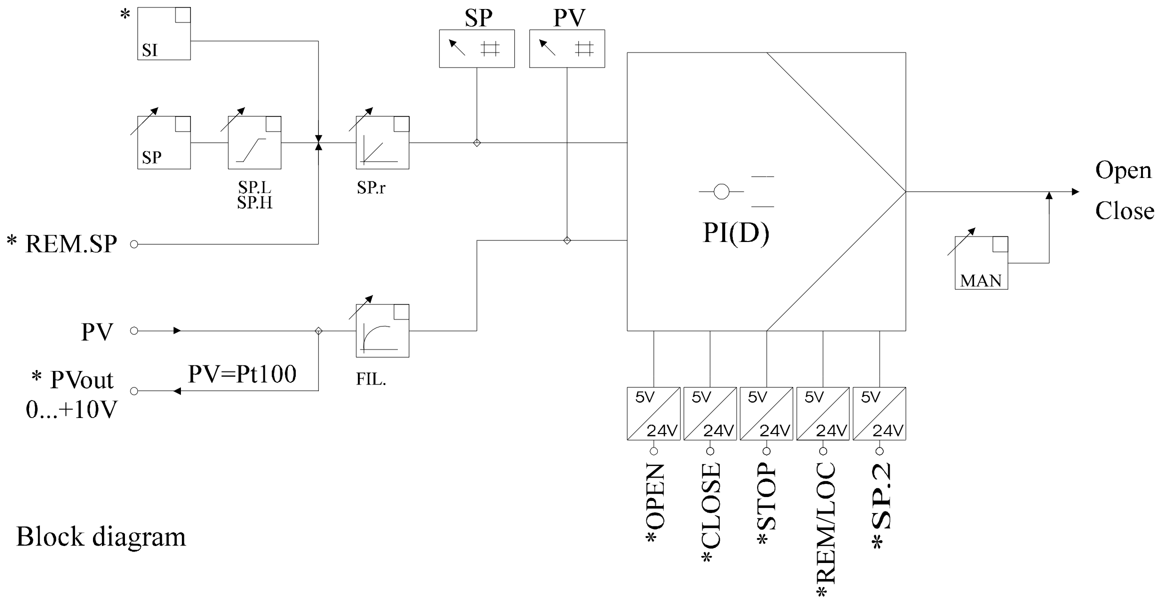
1. Function overview

Basic device

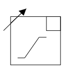
Analog input Pt100	The analog inputs can be used optionally as a process variable input PV
Analog input 0/2 to 10V	or as an input for an analog, remote setpoint SP
Analog input 0/4 to 20mA	
Relay OPEN	Controller output OPEN, opens the controlling element
Relay CLOSE	Controller output CLOSE, closes the controlling element
Relay ALARM 1 and ALARM 2	Selectable alarm. The alarm relay operates on the basis of the normally closed contact principle.
Digital input REM/LOC	For remote -/ local selection
Supply voltage 24 V DC	For two-wire transmitter and digital inputs

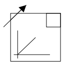
Additional functions (option*)

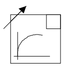
Serial interface RS 485	Data transfer in accordance with MODBUS protocol
Process variable output 0 to + 10 V	Only with Pt 100 as process variable sensor PV
Digital input OPEN	The actuator opens } not in manual mode
Digital input CLOSE	The actuator closes } not in manual mode
Digital input STOP	The actuator stops in its current position } not in manual mode
Digital input REM/LOC	For remote -/ local selection
Digital input SP.2	To change over to second setpoint SP.2
	- connecting 24V DC to the corresponding digital input
	- priority: 1. Stop 2. Close 3. Open 4. SP.2 5. Rem/Loc 1. = highest priority

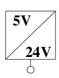


Block diagram


Setpoint limitation minimum value SP.L - setpoint low, maximum value SP.H - setpoint high. Only setpoints within the setpoint limits can be set by way of the keyboard.


Setpoint ramp SP.r. The setpoint change per minute (gradient) can be specified for local and remote setpoints with the aid of the setpoint ramp.


Filtering FIL of the process variable input PV. Interference signals and small process variable fluctuations can be smoothed by an adjustable software filter.



* Digital inputs, voltage range 0 / 12 - 24 V DC
Internal or external voltage source possible.

* Serial interface

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2. Operating and setting

Operating level

Alarm

Actuator opens

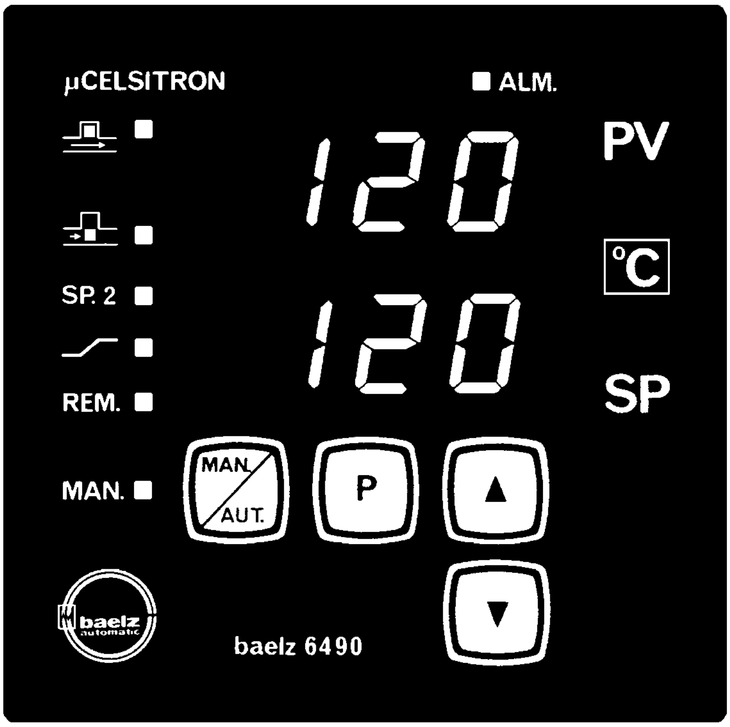
Actuator closes

2nd setpoint effective, setpoint 2 or Alarm 2

Setpoint ramp active

Remote setpoint effective, or serial communication remote setpoint

Manual mode



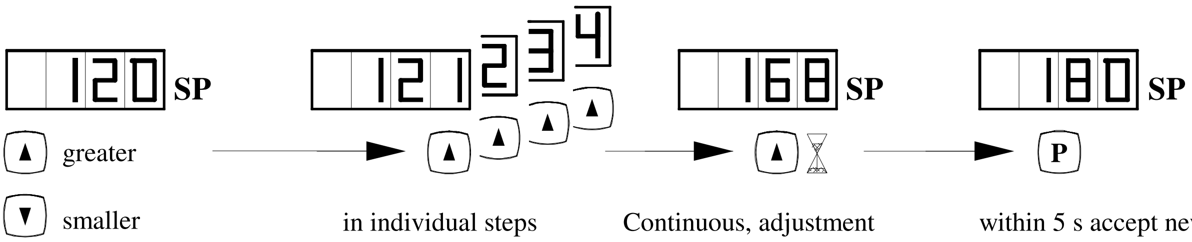
Process variable display

Other phys. units available as stickers

Setpoint display

At the device 6590 the same designations for the adequate functions are valid, only the positioning differs.

2.1 **Setting setpoint** in automatic mode



in individual steps

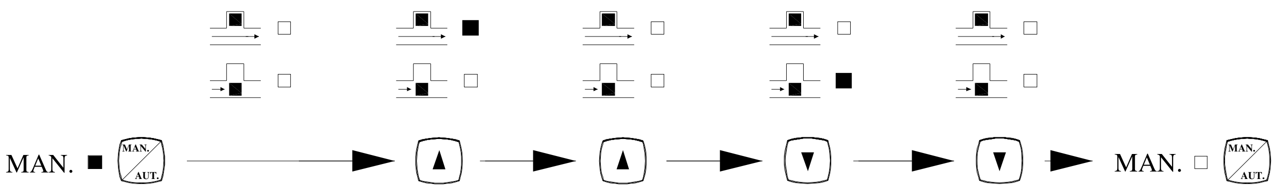
Continuous, adjustment at increasing speed

= press continously

within 5 s accept new setpoint, otherwise back to the old, still effective setpoint

Setting range: SP.L to SP.H
Locked setpoint input at SP.2 or REM. and S.C = 1

2.2 **Opening / closing actuator** in manual mode



Change over to manual mode (lockable) | actuator stops | actuator opens | actuator stops | actuator closes | actuator stops | Change over to automatic mode

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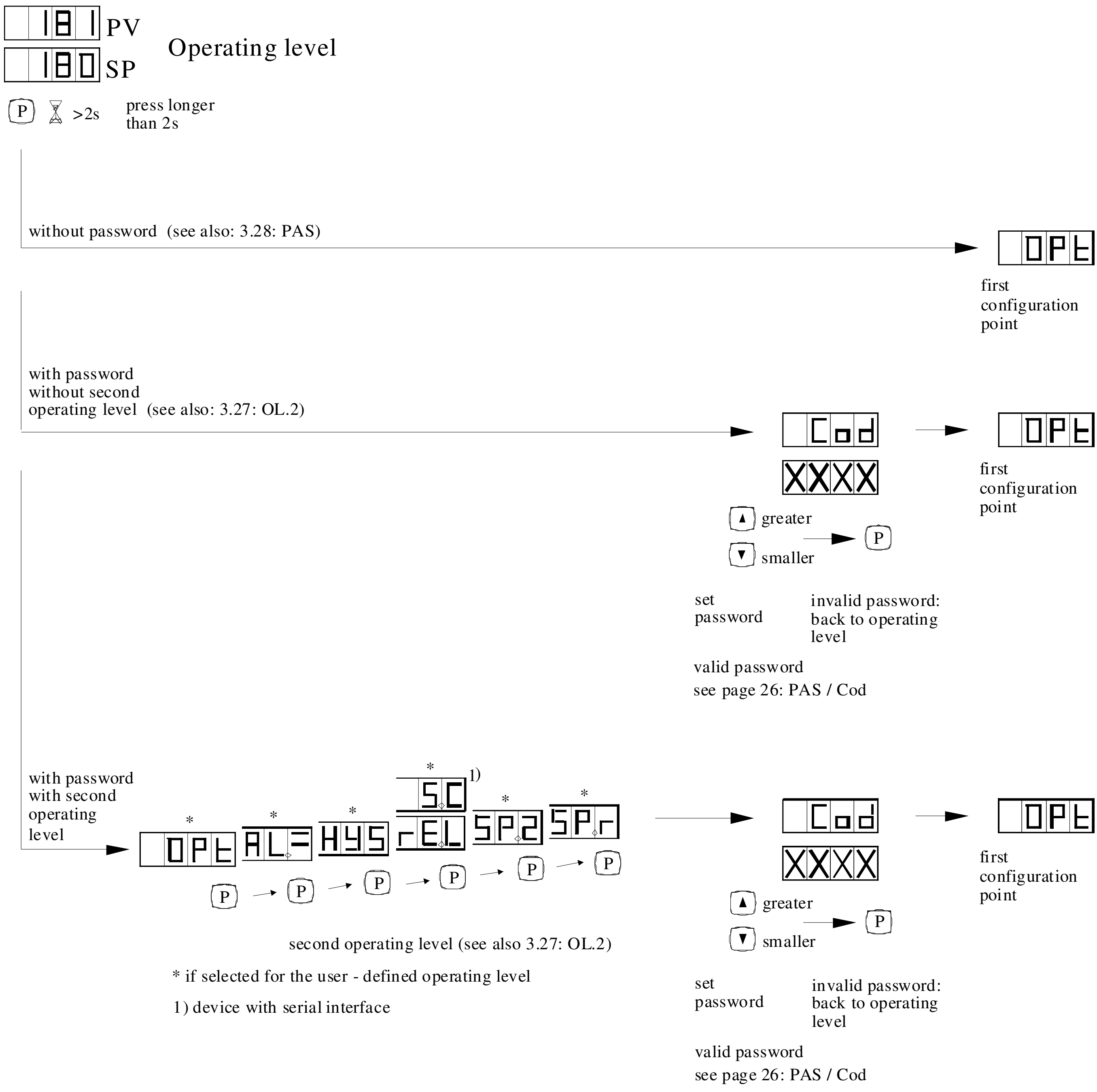
2.3 Branch to parameterization -/ configuration level



P >2s Back to operating level possible at any time

MAN/AUT Manual -/ automatic changeover possible at any time

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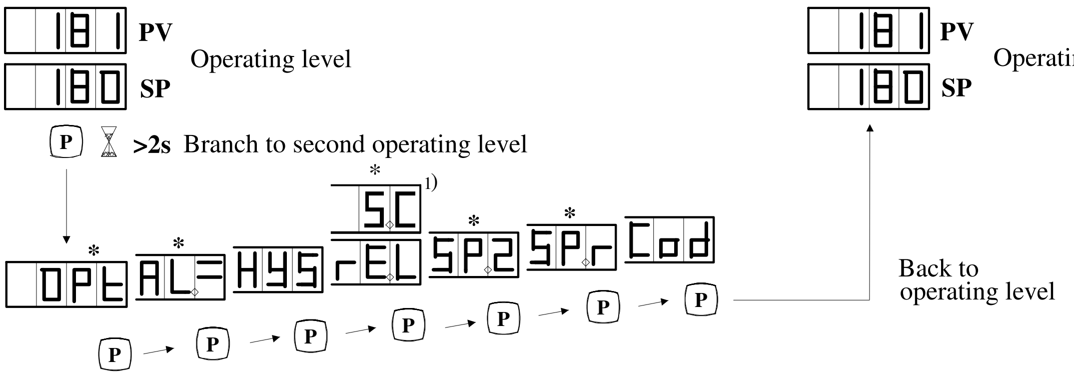
2.4 Branch to second operating level (user - defined operating level)

Parameters and configuration points that have been selected for the second operating level (see also 3.27: OL.2) can be called up and set without entering the password, in case access to the parameterization -/ configuration level is protected by a password (see also 3.28: PAS).

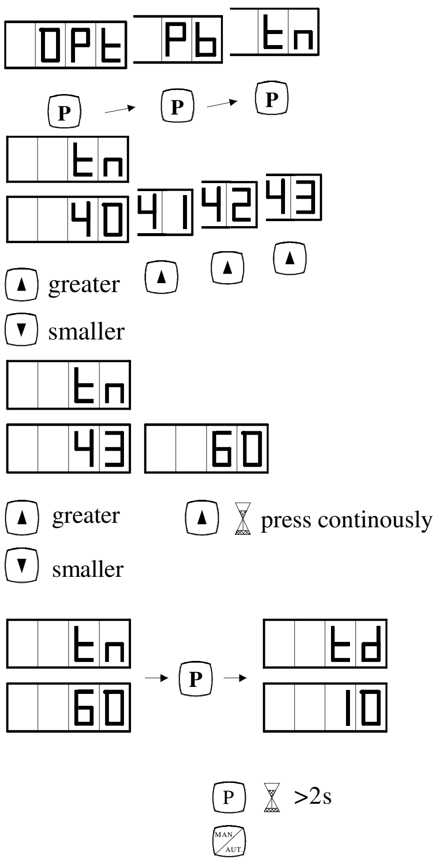


*if this function has been selected for the user-defined operating level and the access to the parameterization -/ configuration level has been interlocked by means of the password.
1) device with serial interface

The following can be set as an option on the second operating level:

- self-optimization OPt
- alarm AL.,HYS
- remote -/ local changeover r.EL or serial communication S.C
- second setpoint SP.2
- setpoint ramp SP.r

2.5 Set parameters / configuration points



Select parameter / configuration point

Set new value in individual steps

Set new value continuously,
at increasing speed

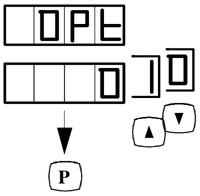
Within 5s accept new value and
call up next variable

Back to operating level possible at any time

Manual -/ automatic changeover possible at any time

3. Parameterization -/ configuration level

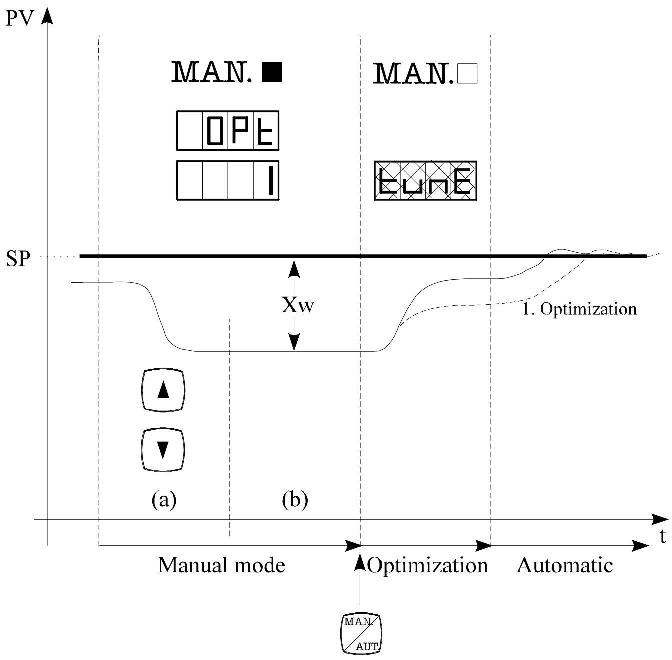
3.1 Optimization for automatic determination of favourable control parameters..



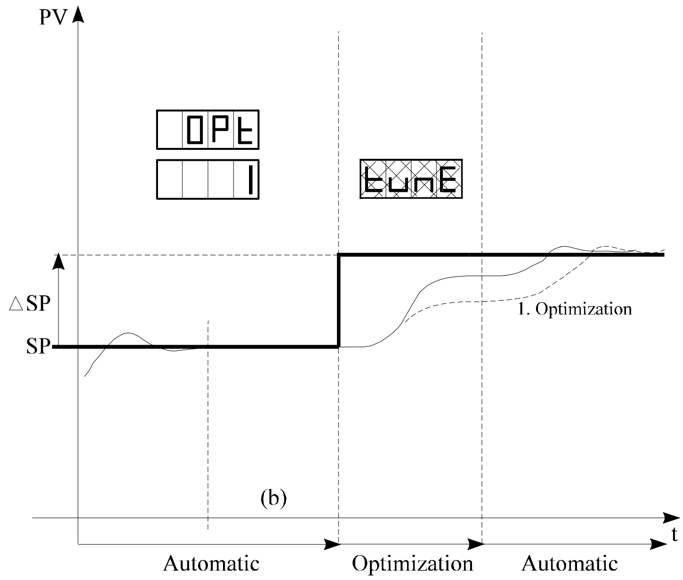
Selections: 0 No self – optimization
1 Self - optimization activated

Self - optimization is triggered by:

– a change in the setpoint SP (not for remote setpoint)
– a change in the setpoint SP.2 on the parameterization -/ configuration level, if SP.2 is the effective setpoint (see also 3.13: SP.2)
– a changeover from manual to automatic mode



Optimization from manual mode



Optimization in automatic mode

Procedure during optimization:

From the manual mode:

- Set the setpoint SP
- Switch over to manual mode
- Set the process variable PV greater / smaller than the setpoint SP by opening / closing the controlling element (a)
- Wait until PV is stable (b)
- Branch to parameterization -/ configuration level
- Set OPt = "1"
- If known, enter process gain P.G. (standard setting: P.G = 100%)
- Back to operating level
- Switch over to automatic mode

In the automatic mode:

- Wait until PV is stable (b)
- Branch to parameterization -/ configuration level
- Set OPt = "1"
- If known, enter process gain P.G. (standard setting: P.G = 100%)
- Back to operating level
- Set the setpoint

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Self - optimization starts upon manual -/ automatic changeover (for optimization from the manual mode) or upon setpoint change ΔSP (for optimization in the automatic mode). During the optimization procedure, the **tunE** display is shown cyclically in the setpoint display SP. The determined parameters (Pb, tn, Td, P.G) are accepted automatically at the end of the self - optimization procedure.

The optimisation routine will not be started, if the control deviation Xw (manual mode) or the setpoint change ΔSP (automatic mode) is less than 3.125% of the measuring range PV at the beginning of the optimization procedure. The change in the process variable PV or the setpoint must, during optimization, run in the same range and in the same direction in which the process is controlled following optimization, which means that the optimization procedure must correspond to the later control procedure as far as possible. If, during a control process, sequences of the process show extreme differences in time behaviour (e.g. rapid heating, slow cooling), the more important part of the process should be optimized.
If the process sequences are equivalent, the slower procedure has to be optimized.

For systems with linear transfer behaviour (constant process gain P.G = $\frac{\Delta\,PV}{\Delta\,Y}$ over the entire control range), one optimization procedure will always provide the optimum control parameters.
If the transfer behaviour of the system is non-linear (e.g. process gain P.G = $\frac{\Delta\,PV}{\Delta\,Y}$ changes with the setpoint SP to be controlled), the variable process gain P.G will have a significant effect on the control parameters. In this case, the process variable PV should come close to achieving the target setpoint during the optimization procedure.
Otherwise, an additional optimization procedure must be carried out. The process gain P.G in the working point was determined automatically in the preceding optimization procedure.
If the process gain P.G in the working point is known, it can be entered manually prior to optimization. (see also 3.16: P.G).
The configuration point OPt is reset to 0 automatically following each optimization procedure.
An optimization procedure can be interrupted anytime by pressing the hand - key or the P - key briefly.

NO ENTRIES OR CHANGEOVER OPERATIONS MUST BE MADE DURING THE OPTIMIZATION PROCEDURE !

Additional explanations for self-optimization of three - position step controllers

The optimization of a temperature control with a low initial temperature and a higher final temperature serves as an example.

- **The temperature difference of the initial temperature and the aim temperature must be more than 12.5 °C.**
  (At Pt100- measuring range 2.2: 0 to 400 °C, more than 12.5 °C
  at Pt100-measuring range 2.4: 0 to 300 °C; more than 9.5 °C)
  But it is more favourable, if there is a larger difference between initial temperature and final temperature.
  If heat - up action is optimized the initial temperature should correspond to the temperature of the cold plant, the aim temperature to the setpoint of the temperature control.

- **The temperature should be stable before starting the optimization.**
  For that purpose set the controller`s setpoint to the initial temperature and wait until the temperature has balanced at this value.
  Actual value and setpoint do not have to be equal absolutely.
  If the controller is not able to keep the initial temperature stable in automatic mode, e.g. in case of temperature oscillation the initial temperature has to be adjusted in manual mode.
  Position the motorized valve via the CLOSE - key and the OPEN - key to reach the initial temperature approximately.

- **At beginning of optimization the motorized valve must not be closed completely.**

- **The optimization is started at changing the setpoint or at change - over from manual mode to automatic mode.**
  Assumption: configuration point OPt = -1-

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- **At beginning of optimization the controller automatically opens the motorized valve for a certain amount.**
  How far the motor valve is opened depends on the difference of actual value ond aim setpoint and of the adjusted process gain P.G (initial value P.G = 100%)
  The motorized valve remains in this position up to the end of optimization.
  Allways check the position displacement on site at the motorized valve.

- **During optimization the motorized valve must not be opened completely.**
  The stroke of the control valve must be smaller than 95%.
  Check the position of the motorized valve on site.

- **The opening of the motorized valve causes a rise of temperature.**
  Depending on the amount of temperature rise and its temporal progress the controller determines the parameters proportionalband Pb, integral action time tn, derivative action time td and the real progress gain P.G.

- **The controller automatically finishes the optimization as soon as the temperature is balanced on the higher value.**
  The parameters are calculated at the end of optimization.

- **The controller ceases the optimization if the temperature is not yet balanced on the higher value after 42 minutes.**
  Ceasing the optimization, no parameters are determined.
  This break is possible in plants with a very slow time behaviour.
  This break is possible in plants without balance
  (e.g. continuous rise of temperature at constant valve position, temperature drift)

- **In these cases optimization can be finished manually by switching over configuration point OPt from -1- to -0- within 42 minutes.**
  The parameters are calculated when configuration point OPt is switched over from -1- to -0-
  A manually finished optimization delivers favourable parameters
  - in plants with slow time behaviour, if the temperature approached the stable final value but did not yet reach it entirely. The approachement to a stable end-value is recognized by the strong reducement of speed in change of temperature as against to the first half of the optimization - time.
  - in plants with continuous temperature drift (no stable initial - and final temperature) if the rate of temperature rise during optimization is essentially higher than during the normal temperature drift. Optimization is ceased manually when temperature rise slides over to normal temperature drift

- **Therefor optimization can also be started if the temperature is not balanced before optimization but has a continuous drift rate.**
  In this case optimization has to be finished manually (see above).

- **The change of temperature during optimization must be more than 25% of the difference between actual value and setpoint (difference at start of optimization).**
  With smaller temperature changes no parameters are determined at the end of optimization.

- **If the change of temperature is too small, the setting of the parameter P.G (process gain) has to be decreased manually and afterwards a further optimization has to be done.**
  This causes a larger change of temperature during the following optimization.

- **If the change of temperature during optimization is too large and optimization is interrupted manually (overtemperature) the setting of the parameter P.G (progress gain) has to be increased manually.**
  This causes a smaller change of temperature during the following optimization.

- **If the temperature does not approximately reach the aim setpoint at the end of optimization (possible in plants with unlinear transfer behaviour) a further optimization is convenient.**
  The controller runs through a learning process and determines the real process gain P.G. During the next optimization actual value and setpoint come closer together.

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3.2 Proportional band Pb

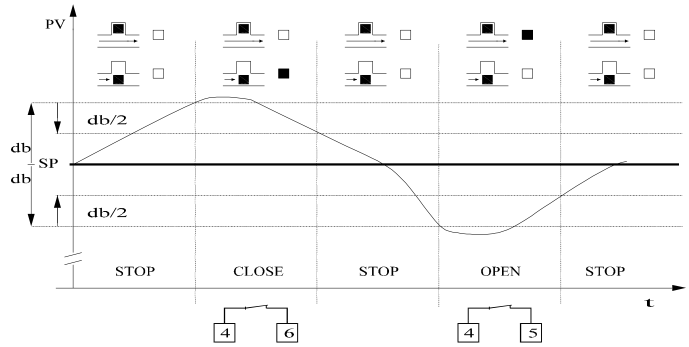
Setting range: 1.0 % to 999.9%
Proportional action of the PI(D) three - position step controller

3.2.1 Three - position controller

by settings: **Pb = 0.0**
tn > 0

Control action adjustable via dead band db.

(see also 3.5: db)



3.2.1 Three - position controller

3.3 Integral action time tn

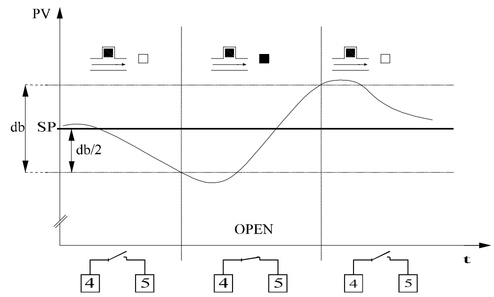
Setting range: 1s to 2600s
Integral action of the PI(D) three - position step controller

3.3.1 Two - position controller

by setting **tn = 0**

Control action adjustable via dead band db.

(see also 3.5: db)



3.3.1 Two - position controller

3.4 Derivative action time td

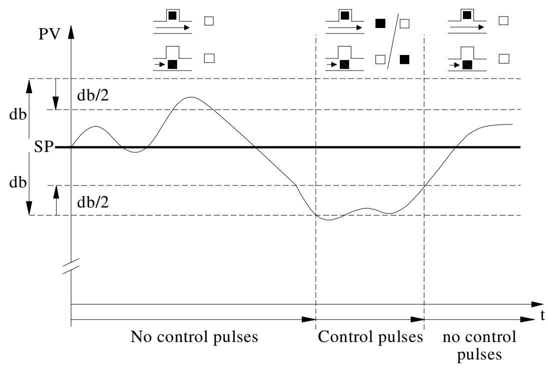
Setting range: 1 to 255s
Derivative action of the PID three - position step controller
By setting td = 0: PI three - position step controller

3.5 Dead band db

Setting range: 0 to extent of measuring range
[phys. units] (x0,1 at dP = 0)
Hysteresis: db/2

No control pulses at control deviation smaller db.

(see also 3.2.1 three - position controller
3.3.1 two - position controller)



3.5 Dead band

3.6 Actuating time t.P (Valve actuation time)

Setting range: 5s to 300s
Time to pass through the correcting range 0 to
100 % (stroke) at constant OPEN or CLOSE – pulse

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3.7 Alarm (at 6490 /0 /1 /2 and 6590 /0 /1 /2)

AL
0 1 2 3

P

The alarm relay operates on the basis of the normally closed contact principle.

Selection AL = 0:
No alarm, also not in case of sensor failure (see also 3.20: SE.b)

AL.=

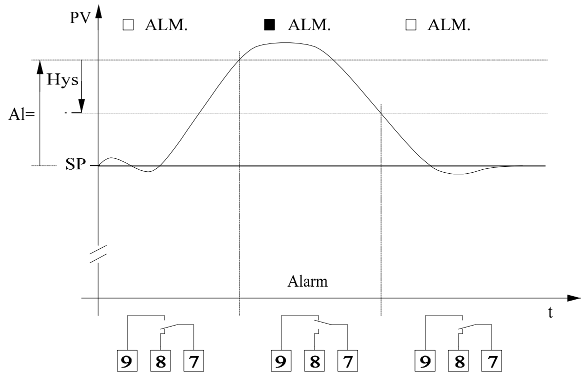
P

Selection AL = 1:
Alarm at a limit value based on the setpoint SP (Type A).
and in case of sensor failure.
Alarm at SP ± **AL.=**
Setting range: 0 to ± extent of measuring range [phys. units.]

HYS

P

Alarm hysteresis HYS,
reset hysteresis of alarm relay
Setting range: 0 to extent of measuring range [phys. units] (x 0,1 at dp = 0)



Selection AL = 1 (Type A)
In case of sensor failure: Alarm independent of the adjusted limit value

AL.¯

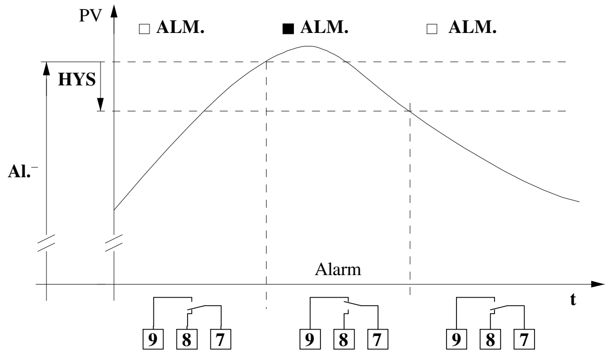
P

Selection AL = 2:
Alarm at fixed limit value (Type B).
and in case of sensor failure.
Alarm at **AL.¯**
Setting range: measuring range [phys. units]

HYS

P

Alarm hysteresis HYS,
reset hysteresis of alarm relay
Setting range: 0 to extent of measuring range [phys. units] (x 0,1 at dp = 0)



Selection AL = 2 (Type B)
In case of sensor failure: Alarm independent of the adjusted limit value

Selection AL = 3:
Alarm at leaving a band by the setpoint SP (Type C).
and in case of sensor failure
Alarm at SP - **AL.≡** and SP + **AL.≡**

AL.≡

P

Lower band half :
setting range: 0 to - extent of measuring range [phys. units]
Alarm at SP - **AL.≡**

HYS

P

Alarm hysteresis HYS (-),
lower band half, reset hysteresis of alarm relay.
Setting range: see before

AL.≡

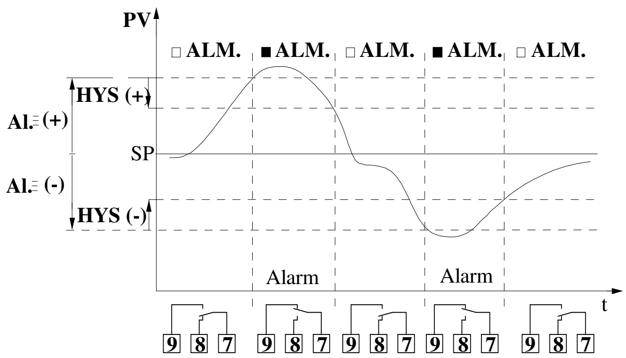
P

Upper band half :
setting range: 0 to + extent of measuring range [phys. units]
Alarm at SP + **AL.≡**

HYS

P

Alarm hysteresis HYS (+),
upper band half, reset hysteresis of alarm relay. Setting range: see before.



Selection AL = 3 (Type C)
In case of sensor failure: Alarm independent of the adjusted limit band

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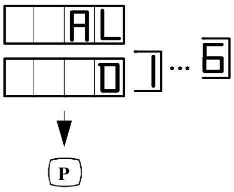


3.8 Alarm relays (at 6490 /3 /4 /5 and 6590 /3 /4 /5)

The alarm relays operate on the basis of the normally closed contact principle.

3.8.1 Alarm Type A

Alarm at a limit value based on the setpoint SP

3.8.1.1 Alarm 1 at **SP ± AL.$^=$**

3.8.1.2 Alarm 2 at **SP ± AL.$_=$**

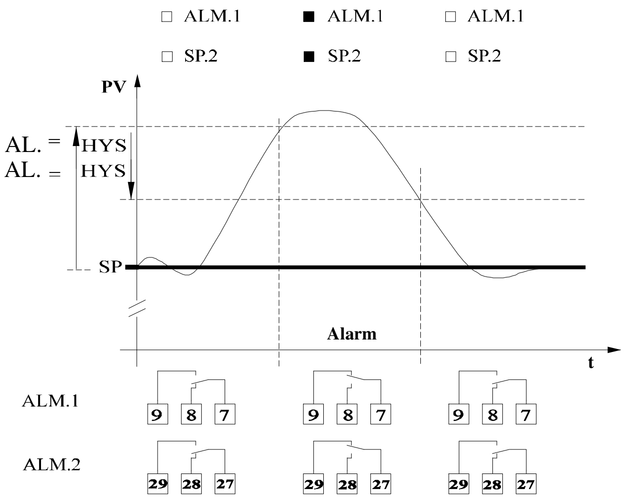
Setting range: 0 to ± extend of measuring range [phys. unit]

Reset hysteresis of alarm relays:

3.8.1.3 End of alarm 1 at SP ± AL.$^=$ ∓**HYS** (HYS displayed after AL.$^=$)

3.8.1.4 End of alarm 2 at SP ± AL.$_=$ ∓**HYS** (HYS displayed after AL.$_=$)

Setting range: 0 to extend of measuring range [phys. unit] (x 0,1 at dp = 0)



3.8.2 Alarm Type B

Alarm 1 at a fixed limit value

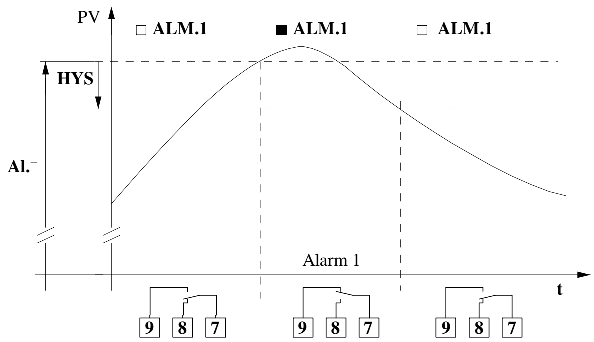
3.8.2.1 Alarm 1 at **AL.$^-$**

Setting range: measuring range [phys. Unit]

Reset hysteresis of alarm relay 1:

3.8.2.2 End of alarm 1 at AL.$^-$ **- HYS** (HYS displayed after AL.$^-$)

Setting range: 0 to extend of measuring range [phys. Unit] (x 0,1 at dp = 0)



Alarm Type B for alarm relay 1

3.8.3 Alarm Typ C

Alarm 1 at leaving a band by the setpoint SP.

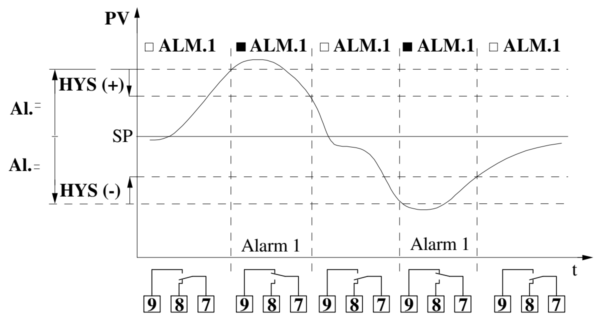
3.8.3.1 Alarm 1 at **SP ± AL.$^=$** and at **SP ± AL.$_=$** (s. also 3.8.1.1, 3.8.1.2)

Setting range: 0 to ± extend of measuring range [phys. unit]

Reset hysteresis of alarm relay 1:

3.8.3.2 End of alarm 1 at SP ± AL.$^=$ ∓**HYS** and SP ± AL.$_=$ ∓**HYS** (see also 3.8.1.3, 3.8.1.4)

Setting range: 0 to ± extend of measuring range [phys. unit] (x 0,1 at dp = 0)



Alarm Type C for alarm relay 1

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Selection AL = 0:
No alarms, also not in case of sensor failure (see also 3.20: SE.b)

Selection AL = 1: (Alarm relay 1 active)

Display	
AL.$^{=}$	Alarm relay 1 = Type A (see also 3.8.1.1) Alarm relay 1 in case of sensor failure independent of the adjusted setpoint.
HYS	Reset hysteresis of alarm relay 1 (see also 3.8.1.3)

Selection AL = 2: (Alarm relay 1 active)

Display	
AL.$^{-}$	Alarm relay 1 = Type B (see also 3.8.2.1) Alarm relay 1 in case of sensor failure independent of the adjusted setpoint.
HYS	Reset hysteresis of alarm relay 1 (see also 3.8.2.2)

Selection: AL = 3: (Alarm relay 1 and Alarm relay 2 active)

Display	
AL.$^{=}$	Alarm relay 1 = Type A (see also 3.8.1.1) Alarm relay 1 in case of sensor failure independent of the adjusted setpoint.
HYS	Reset hysteresis of alarm relay 1 (see also 3.8.1.3)
AL.$_{=}$	Alarm relay 2 = Type A (see also 3.8.1.2)
HYS	Reset hysteresis of alarm relay 2 (see also 3.8.1.4)

Selection: AL = 4: (Alarm relay 1 and Alarm relay 2 active)

Display	
AL.$^{-}$	Alarm relay 1 = Type B (see also 3.8.2.1) Alarm relay 1 in case of sensor failure independent of the adjusted setpoint.
HYS	Reset hysteresis of alarm relay 1 (see also 3.8.2.2)
AL.$_{=}$	Alarm relay 2 = Type A (see also 3.8.1.2)
HYS	Reset hysteresis of alarm relay 2 (see also 3.8.1.4)

Selection: AL = 5: (Alarm relay 1 and Alarm relay 2 active)

Display	
AL.$^{=}$	Alarm relay 1 = Type C (see also 3.8.3.1) Alarm relay 1 in case of sensor failure independent of the adjusted setpoint.
HYS	Reset hysteresis of alarm relay 1 at AL.$^{=}$ (see also 3.8.3.2)
AL.$_{=}$	Alarm relay 1 = Type C (see also 3.8.3.1) Alarm relay 1 in case of sensor failure independent of the adjusted setpoint. Alarm relay 2 = Type A (see also 3.8.1.2)
HYS	Reset hysteresis of alarm relay 1 at AL.$_{=}$ (see also 3.8.3.2) Reset hysteresis of alarm relay 2 (see also 3.8.1.4)

Selection: AL = 6: (Alarm relay 1 and Alarm relay 2 active)

Display	
AL.$^{-}$	Alarm relay 1 at **AL.**$^{-}$ or at SP ± AL.$_{=}$ Alarm relay 1 in case of sensor failure independent of the adjusted setpoint.
HYS	Reset hysteresis of alarm relay 1 at AL.$^{-}$ (see also 3.8.2.2)
AL.$_{=}$	Alarm relay 1 at AL.$^{-}$ or at **SP ± AL.**$_{=}$ Alarm relay 1 in case of sensor failure independent of the adjusted setpoint. Alarm relay 2 = Type A (see also 3.8.1.2)
HYS	Reset hysteresis of alarm relay 1 at AL.$_{=}$ (see also 3.8.1.4) Reset hysteresis of alarm relay 2 (see also 3.8.1.4)

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selection	alarm 1	alarm 2
0	-	-
1	A	-
2	B	-
3	A	A
4	B	A
5	A1 ∨ A2 (C)	A
6	B ∨ A2	A
sensor break	alarm	no alarm

∨ = logical OR

Alarm types for alarm relay 1 and alarm relay 2

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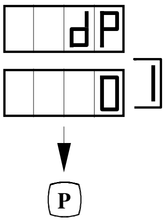
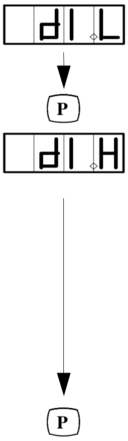


3.9 Decimal point for LED - displays

Selections: 0 Indication without decimal point
1 Indication with decimal point

At any time the decimal point has been altered, the process variable display PV has to be rescaled. (see also 3.10: dI.L, dI.H)



3.10 Scaling the process variable display PV

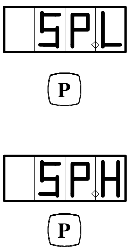
Display.Low Enter: Zero point of the transmitter
Indication at the LED - Display PV at start of measuring range
Setting range: -999 (-99.9 at dP = 1) ≤ dI.L ≤ dI.H-1 [phys. units] (dI.L must be less than dI.H)
standard value: **0**° C or **32**° F

Display.High Enter: End point of the transmitter
Indication at the LED - Display PV at end of measuring range
Setting range: dI.L+1 ≤ dI.H ≤ 9999 (999.9 at dP = 1) [phys. units] (dI.H must be greater than dI.L)
standard value: **300**° C or **572**° F

⚠ At In.P = 0, dI.L and dI.H have to correspond to the Pt 100 - measuring range of the supplied device (see type plate)
baelz 6490 / 6590 - 2.4 - ... : dI.L = 000(.0), dI.H = 300(.0)
baelz 6490 / 6590 - 2.2 - ... : dI.L = 000(.0), dI.H = 400(.0)
At In.P ≠ 0, dI.L and dI.H have to correspond to the measuring range of the connected transmitter.
(see also 3.17: In.P)

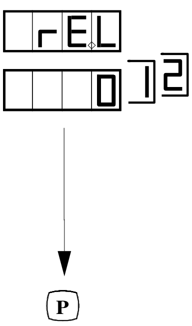
3.11 Setpoint limitation

Setpoint limitation applies to the setpoint SP which can be set via the keyboard
It is ineffective for - the second setpoint SP.2
- all remote setpoints



Setpoint.Low lowest setpoint that can be set
Setting range: dI.L to SP.H [phys. units] (see also 3.10: dI.L)
At SP.L = SP.H the setpoint has a fixed value.
Effective for the setpoint entered via the keyboard.

Setpoint.High highest setpoint that can be set
Setting range: SP.L to dI.H [phys. units] (see also 3.10: dI.H)
At SP.L = SP.H the setpoint has a fixed value.
Effective for the setpoint entered via the keyboard.

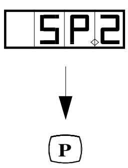


3.12 Remote -/ local changeover (at 6490 /1 /2 /5 and 6590 /1 /2 /5)

Changeover from remote to local setpoint and vice versa
At devices without serial interface.
Remote / Local Setpoint remote = external, local = internal

Selections: 0 only local setpoint and SP.2 effective
1 Changeover via digital input REM/LOC,
setpoint via analog input (see also 3.18: In.S)
2 jolt - free (smooth) remote -/ local changeover by tracking the local setpoint to the remote setpoint before remote -/ local changeover. SP loc. = SP rem.
otherwise as 1

In case of a signal error the internal setpoint is effective



3.13 Second setpoint SP.2 (at 6490 /2 and 6590 /2)

Setting range: dI.L to dI.H [phys. units] (see also 3.10: dI.L, dI.H)

Changeover to SP.2 via digital input SP.2

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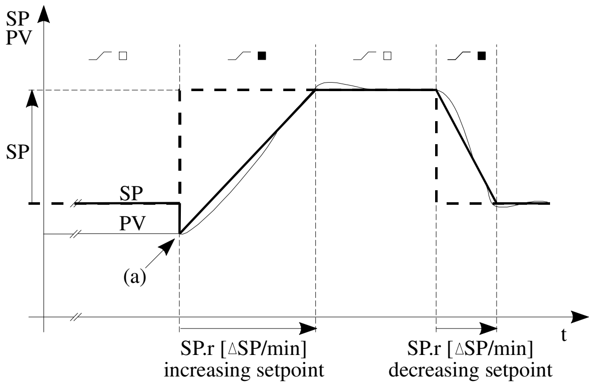
3.14 Setpoint ramp SP.r

Change rate of setpoint SP
(gradient)
Setting range: 1 (0.1 at dP = 1) to extent of measuring range in PV / min; PV [phys. unit]
e.g.: K / min
Setting SP.r = 0: no setpoint ramp, change of setpoint abruptly.
Effective for local and remote setpoints.
An analog, remote setpoint has to alter at least 0.2 % of measuring range PV to trigger the setpoint ramp.



3.14 Setpoint ramp SP.r

The setpoint ramp is triggered
- after switching on the device or after a power failure
- after sensor failure
- after every setpoint change (remote, local or SP.2)
- after switching over to the second setpoint SP.2
- after remote -/ local changeover and vice versa
- after a control function STOP, CLOSE, OPEN (via digital input)
- after switching over from manual mode to automatic mode

The start point of the setpoint ramp is always the current value of the process variable PV (a)
The current setpoint is displayed.

3.15 Ramp direction

Effective direction of setpoint ramp SP.r (at SP.r > 0)

Selections:
0 Setpoint ramp effective for increasing and decreasing setpoints
1 Setpoint ramp effective only for increasing setpoints
2 Setpoint ramp effective only for decreasing setpoints
(see also 3.14: SP.r)

3.16 Process Gain P.G

Setting range: 1 to 255%

$$\text{Gain of controlled process (system) P.G} = \frac{\text{Change in process variable PV}}{\text{Change in actuating variable Y}} = \frac{\Delta\,PV}{\Delta Y} \text{ in \%}$$

Δ PV [% of measuring range of PV]
Δ Y [% of actuating range (stroke) 0 - 100 %]

e.g.: P.G = 50%: $\frac{\Delta\,PV}{\Delta Y} = 0{,}5$ A change of 10% in the valve position ΔY will result in a change of 5% in the process variable PV.

P.G = 100%: $\frac{\Delta\,PV}{\Delta Y} = 1{,}0$ A change of 10% in the valve position ΔY will result in a change of 10% in the process variable PV.

P.G = 125%: $\frac{\Delta\,PV}{\Delta Y} = 1{,}25$ A change of 10% in the valve position ΔY will result in a change of 12.5% in the process variable PV.

The process gain P.G is required for self - optimization of the control parameters. If unknown, P.G is determined automatically during self - optimization (see also: 3.1: OPt)
In case of non - linear transfer behaviour of the system, the process gain changes with the working point (e.g. when controlling different setpoints).

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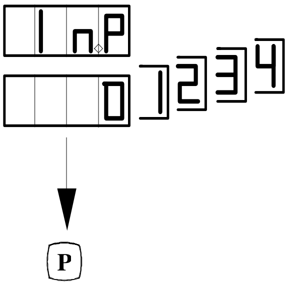
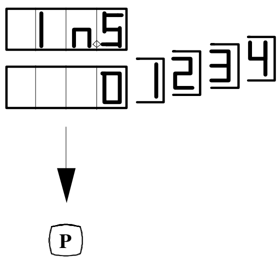


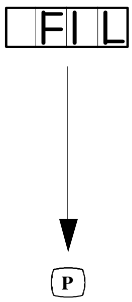
3.17 Input for process variable PV (input PV)

Selections:
0 PV is detected with a Pt100 sensor and connected to the terminals 14, 15, 16
1 PV is supplied as current signal 0-20 mA and connected to the terminals 12, 16*.
2 PV is supplied as current signal 4-20mA and connected to the terminals 12, 16*.
3 PV is supplied as voltage signal 0-10V and connected to the terminals 13, 16 .
4 PV is supplied as voltage signal 2-10V and connected to the terminals 13, 16
* Not if a transmitter is connected in two-wire technology
(see also 5.: Electrical connection)



3.18 Input for remote setpoint SP (input SP) (at 6490 /1 /2 /5 and 6590 /1 /2 /5)

Selections:
0 SP is detected with a Pt100 sensor and connected to the terminals 14, 15, 16
1 SP is supplied as current signal 0-20 mA and connected to the terminals 12, 16.
2 SP is supplied as current signal 4-20mA and connected to the terminals 12, 16.
3 SP is supplied as voltage signal 0-10V and connected to the terminals 13, 16 .
4 SP is supplied as voltage signal 2-10V and connected to the terminals 13, 16
By detected signal failure: changeover to internal setpoint.
(see also 5.: Electrical connection)



3.19 Measured value filter for process variable PV

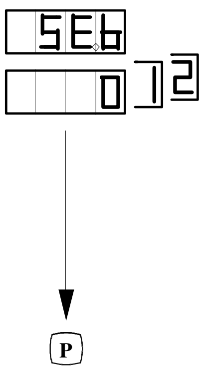
Software low-pass filter 1st order with adjustable time constant Tf to suppress interference signals and to smooth small process variable fluctuations.
Setting range: 100 to 255

Formula:
Tf = -0,04/ln(input/256)

Following assigments apply:

Input:	255	254	252	250	240	230*	220	200
Tf [s]:	10,22	5,10	2,54	1,69	0,62	0,37	0,26	0,16

*standard setting

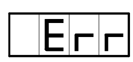


3.20 Response to sensor failure PV (sensor break)

Response of actuator in case of: sensor short-circuit, sensor break, too low or too high signal value at 4-20 mA and 2-10 V signals.

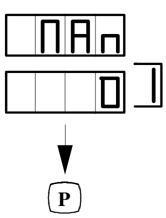
Selections: 0 Actuator closes
1 Actuator opens
2 Actuator stops in its current position

The error message **Err** is indicated in the LED - display PV in the case of a transmitter / sensor fault. Alarmmessage, when alarm A, B or C is configurated, independent of adjusted limit value.



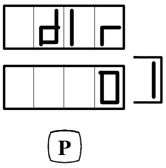
PV

Once the fault has been rectified, the controller reverts automatically to normal mode.
Monitoring is not possible in the case of electrical input signal without live zero point, 0-20 mA or 0-10 V.



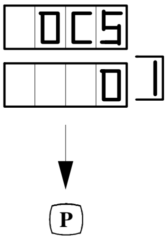
3.21 Interlocking manual -/ automatic changeover (manual)

Selections: 0 Changeover via keyboard possible at any time
1 Interlocking in current status
Changeover MAn. to -1- in automatic mode : always automatic mode
Changeover MAn. to -1- in manual mode : always manual mode



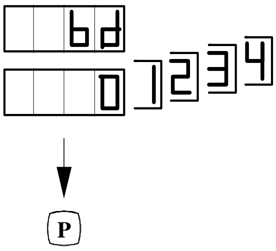
3.22 Direction of action of controller

Selections: 0 Heating controller: Actuator closes at increasing process variable PV
1 Cooling controller: Actuator opens at increasing process variable PV



3.23 Function of the digital inputs (Open, Close, Stop) (at 6490 /3 /4 and 6590 /3 /4)

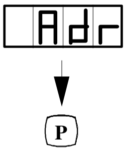
Selections: 0 No control function
Switch status of the digital inputs is transmitted via the MODBUS
1 Control function Open, Close, Stop
Switch status of the digital inputs is additionally transmitted via the MODBUS



3.24 Transmitting speed for serial interface (baud) (at 6490 / 3 /4 and 6590 / 3 /4)

Serial interface RS 485, data transmission in conformity with MODBUS protocol in RTU - mode.

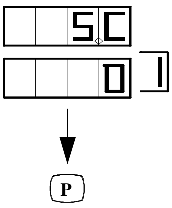
Selections: 0 19200 baud 3 2400 baud
1 9600 baud 4 1200 baud
2 4800 baud



3.25 Address for serial interface (at 6490 / 3 /4 and 6590 / 3 /4)

Setting range: 1 to 247

Address of the controller.



3.26 Serial communication (at 6490 / 3 /4 and 6590 / 3 /4)

Selections: 0 Operation from the controller and master is possible.
1 The controller can only be operated from the master (except configuration point S.C).
Local blocking of operation.

MODBUS initialization (at 6490 / 3 /4 and 6590 / 3 /4)

After the interface has been configured briefly disconnect the device from power supply.

This applies to a change in settings of:

3.24 Transmitting speed for serial interface
3.25 Address for serial interface
3.26 Serial communication

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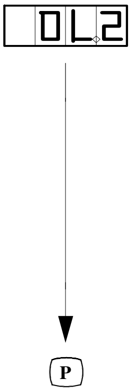


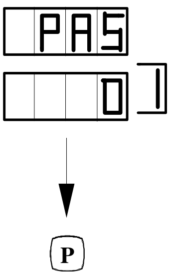
3.27 Second operating level (operating level 2)

Selecting the functions for the user - defined operating level.

Setting range: 0 to 31: **(at 6490 /0 /1 /2 /5 and 6590 /0 /1 /2 /5)**
- 0 No second operating level
- 1 Self - optimization can be activated at the 2nd operating level (see also 3.1: OPt)
- 2 Limit and hysteresis of the selected alarm can be entered at the 2nd operating level (see also 3.7 respectively 3.8: Alarms)
- 4 Remote / local changeover on the 2nd operating level is possible (see also 3.12: rE.L)
- 8 The second setpoint SP.2 is adjustable on the 2nd operating level (see also 3.13: SP.2)
- 16 The setpoint ramp SP.r can be set, switchend on and off on the operating level 2 (see also 3.14: SP.r)

Setting range: 0 to 31: **(at 6490 /3 /4 and 6590 /3 /4)**
- 0 No second operating level
- 1 Self - optimization can be activated at the 2nd operating level (see also 3.1: OPt)
- 2 Limit and hysteresis of the selected alarm can be entered at the 2nd operating level (see also 3.7 respectively 3.8: Alarms)
- 4 Serial communication can be definined on 2nd operating level (see also 3.26: S.C)
- 16 The setpoint ramp SP.r can be set, switchend on and off on the operating level 2 (see also 3.14: SP.r)

The distinctive numbers of the required functions are added, and the result is entered.
The password must have been activated. (see also 3.28: PAS)



3.28 Access to the parameterization / configuration level (password)

Interlocking the parameterization / configuration level via the password **Cod** prevents unauthorized access.

Selections: 0 No interlocking of the parameterization / configuration level. OL.2 ineffective.
1 Access to the parameterization / configuration level only after keyboard entry of the password. OL.2 effective.
(see also 3.27 OL.2; valid password: see page 26: PAS / Cod)

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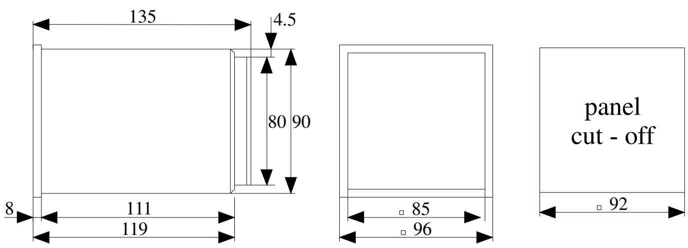
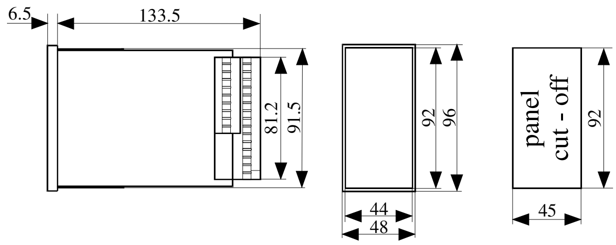
4. Mounting

The device is suitable for front panel installation and for integration in any position into consoles.
Insert the controller from the front into the prepared panel cut - off and secure with the supplied clamping tool.

⚠ The ambient temperature at the point of installation must not exceed the permissible temperature for rated operation.
Adequate ventilation must be assured, even with a high device packing density.
The device must not be installed within explosion - hazardous areas.



Device dimensions 6490

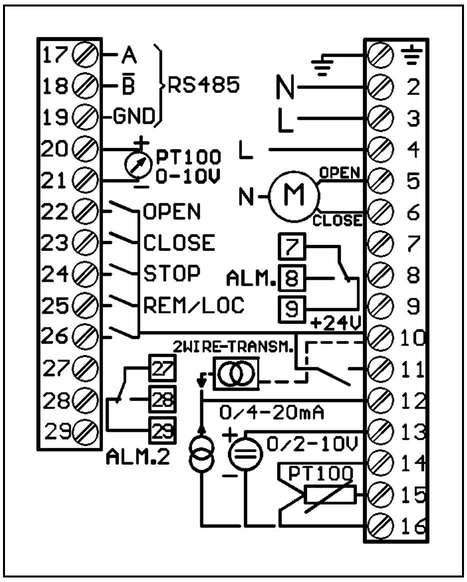


Device dimensions 6590

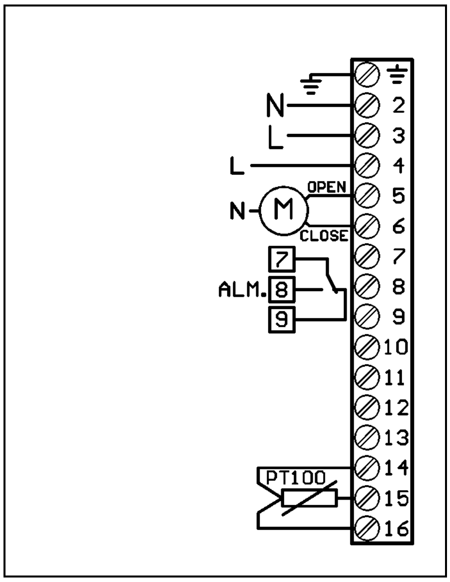
5. Electrical connection

The plug - type terminals and wiring diagram are located at the back of the device.

⚠ The given national rules must be observed for installation (in Germany DIN VDE 0100).
The electrical connection must be completed in conformity with the connection diagrams of the device.
Screened cables must be used for the measurement and control leads (digital inputs). These leads must be conducted separately from the power current cables in the switch cabinet.
It is essential to check before the device is switched on that the operating voltage specified on the rating plate conforms with the mains voltage.
The connecting terminals must only be disconnected from the device while the connected lines are in a de - energized state.



Maximum configuration (6490 / 4 and 6590 / 4)
(see also 8. Order number)



Minimum configuration (6490 /0 and 6590 /0)
(see also 8. Order number)

With 6490: Valid from device number 5000 onwards. See rating plate.

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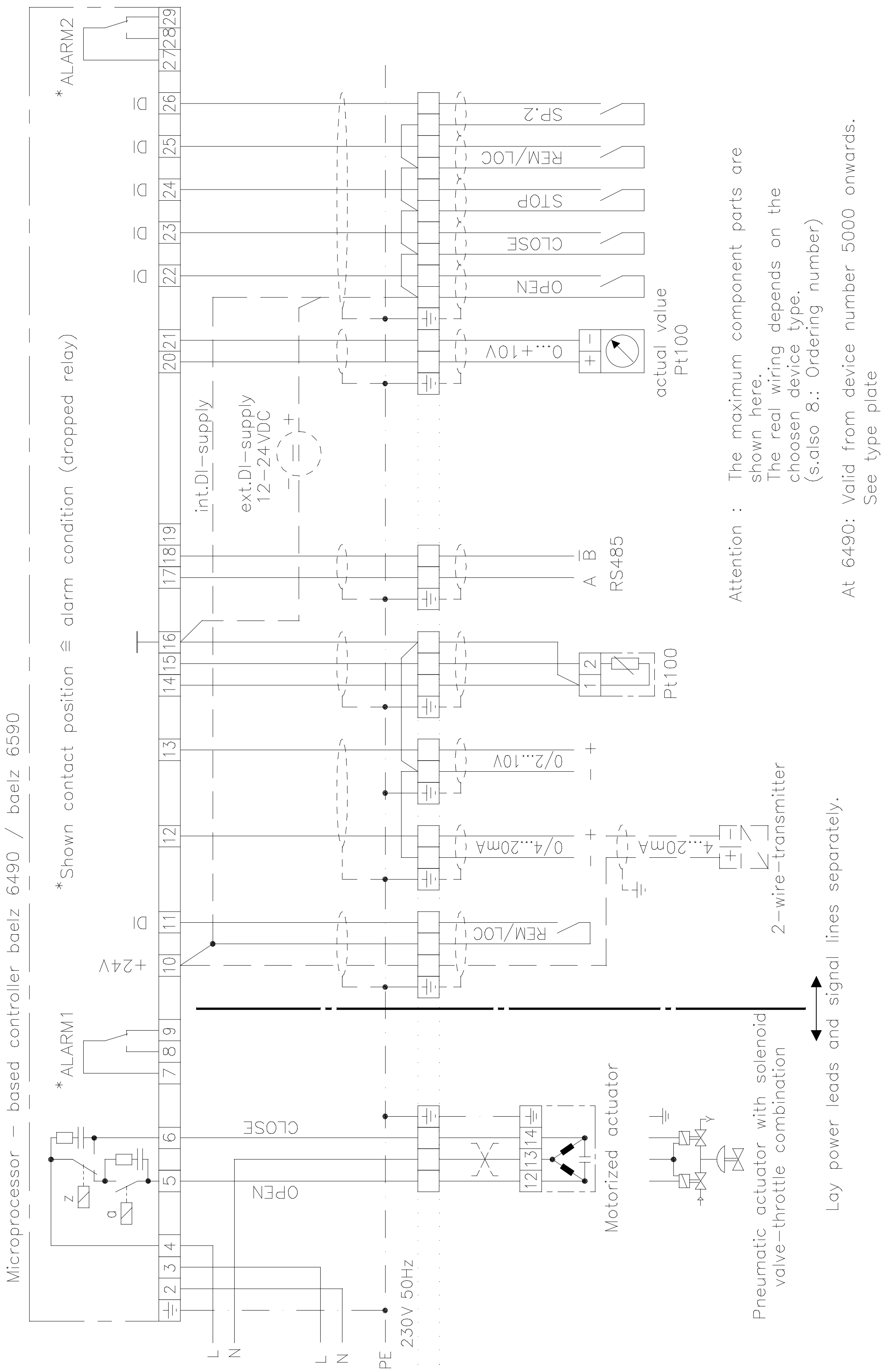
5.1 Wiring diagram



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6. Commissioning

Procedure:	Corrective measures in case of malfunctions
☐ Unit properly installed ?	see also 4.: Installation
☐ Electrical connection according to valid regulations and connection diagrams ?	see also 5.: Electrical connection
☐ Switch on mains voltage. When the unit is switched on, all display elements in the front plate will light up for approx. 2 sec. (lamp test). The unit is then ready for operation.	Compare operating voltage, indicated on the type plate, to mains voltage.
☐ Switch over to manual mode.	see also 2.2: Manual mode
• Does the actual value display PV correspond to process variable at measuring point ?	Check sensor, measuring line and electrical connection. see also 5.: Electrical connection
• Actual value display PV fluctuating / jumping ?	Adjust measuring filter FIL. see also: 3.19: FIL Unit in the immediate vicinity of powerful electrical or magnetic interference fields ?
• Connect digital inputs*	see also 5.: Electrical connection
- Are the corresponding LEDs on the front plate illuminated ?	Check voltage supply for digital inputs, remote switching contacts, signal lines and electrical connection. see also 5.1: Wiring diagram
• Supply remote setpoint and switch over to remote operation*	see also 3.18: In.S ; 3.12: re.L ; 3.26: S.C
- Is remote setpoint SP dispalyed correctly ?	Check setpoint transmitter, measuring line and electrical connection. see also 5.1: Wiring diagram
• Open actuator - Heating controller: Actual value PV increasing ? - Cooling controller: Actual value PV degreasing ? • Close actuator - Heating controller: Actual value PV decreasing ? - Cooling controller: Actual value PV increasing ?	see also 2.2: Manual operation No response: Check actuator and electrical connection controller - actuator reverse response: Interchange actuator drive OPEN and CLOSE see also 5.1: Wiring diagram
• Enter actuating time of connected actuator.	see also 3.6: t.P
• Set control parameters using self - optimization.	see also 3.1: OPt
☐ Automatic mode	
Manual -/ automatic changeover	see also 2.2: Manual mode
Set setpoint SP	see also 2.1: Setting the setpoint SP in the automatic mode
☐ Controller actuating pulses too short, switching rate too high	Adjust dead band db see also 3.5: db

* Option

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7. Technical data

Power supply	230 V AC 115 V AC 24 V AC } -15 % / +10 %, 50 / 60 Hz
Power consumption	approx. 7 VA
Weight	approx. 1 kg
Permissible ambient temperature	
- Operation	0 to 50ºC
- Transport and storage	-25º to + 65ºC
Degree of protection	Front IP 65 according to DIN 40050
Design	For control panel installation 96 x 96 x 135 mm at 6490 and 48 x 96 x 140 at 6590 (W x H x D)
Installation position	arbitary
DI - feed voltage and measuring transducer feed voltage	24 V DC, Imax. = 60 mA
Analog inputs	Pt100, 2.4 = 0°C to 300°C or 2.2 = 0°C to 400°C Connection in three - wire system 0/4 to 20 mA, input resistance = 50 Ohm 0/2 to 10 V, input resistance = 100 KOhm
Accuracy	0.1% of measuring range
Digital inputs	high active, Ri = 1 k Ω; n.c. / 0V DC = low 12 V to 24 V DC = high
Analog output for process variable	0 to +10 V comply with 0° to 300°C (2.4) or 0° to 400°C (2.2), Imax. = 2 mA
Displays	Two 4 - digit 7- segment displays, LED ,red, digit height = 13 mm (6490), 10 mm (6590)
Alarm	Alarm type A, B, C; normally closed contact principle
Relays	Contact equipment: 1 change - over contact Switching capacity: 250 V AC / 3 A Spark quenching element
Serial interface	RS 485, MODBUS - protocol in RTU - mode 1200 to 19200 Baud 1 start bit, 8 data bits, 1 stop bit, no parity
Data storage	Semi - conductor memory

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8. Ordering number baelz 6490 / baelz 6590

```
Examples : 6490 / 0 -  2.4  -  230  - 00.0
           6590 / 3 -  2.2  -  115  - S7.1
```

baelz µCelsitron _____ / __ - _____ - _____ - _____

Type (see type - table)
6490 **6590**

Version (see type - table)
../0 **../1** **../2** **../3** **../4** **../ 5**

Pt 100 - measuring range
0...300°C **2.4** -30...+60°C **2.20**
0...400°C **2.2** -50...+250°C **2.50**

Mains - voltage
230 V AC **115** V AC **24** V AC

special model
none **00.0**
2 measuring inputs 0/4 ... 20 mA (no input 10 V) **S7.1**
2 measuring inputs 0/2 ... 10 V (no input 20 mA) **S8.1**

Type / version 6490.. and 6590.. **Equipment:**	**../0**	**../1**	**../2**	**../3**	**../4**	**../5**
PI(D) - three - position step -output	✓	✓	✓	✓	✓	✓
Alarm relay 1	✓	✓	✓	✓	✓	✓
1 measuring input Pt100	✓	✓	✓	✓	✓	✓
1 measuring input 0 / 4 ... 20 mA		✓	✓	✓	✓	✓
1 measuring input 0 / 2 ... 10V		✓	✓	✓	✓	✓
Measuring transducer feed voltage 24 V DC		✓	✓	✓	✓	✓
1 digital input (external setpoint)		✓				✓
3 digital inputs (open, close, stop)				✓	✓	
5 digital inputs (open, close, stop, ext. setpoint, setpoint 2)			✓			
1 Pt100 - process variable output 0...+10V			✓		✓	✓
1 Interface RS485 (MODBUS RTU)				✓	✓	
Alarm relay 2				✓	✓	✓

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9. Overview of parameterization -/ configuration level, data list

Parameter / configuration point	Display	Settings	Remarks	
Optimization	OPt	0	No self - optimization	
		1	Activate if required	
Proportional band	Pb	☐	1,0 to 999,9 %	
Three - position controller	Pb =	0 ☐	tn > 0; db comply with dead zone	
Integral action time	tn	☐	1 to 2600 s	
Two - position controller	tn =	0 ☐	db comply with dead zone	
Derivative action time	td	☐	1 to 255s; PI - control at td = 0	
Dead band (dead zone)	db	☐	0 to measuring range [phys. unit] (x 0,1 at dP = 0)	
Valve actuating time	tP	☐	5 to 300 s	
Alarm	AL	0 ☐	No alarm, also not in case of sensor failure	
at 6490 /0 /1 /2 and		1 ☐	Alarm A, dependent on setpoint	and in case of sensor
at 6590 /0 /1 /2		2 ☐	Alarm B, fixed limit value	failure independent of
		3 ☐	Alarm C, band transgression by setpoint	adjusted limit value
Alarm A	AL.=	☐	0 to ± extent of measuring range [phys. unit]	at AL = 1
Reset hysteresis	HYS	☐	0 to extent of measuring range [phys. unit] (x0,1 at dP = 0)	
Alarm B	AL.-	☐	Measuring range: dI.L to dI.H [phys. unit]	at AL = 2
Reset hysteresis	HYS	☐	0 to extent of measuring range [phys. unit] (x0,1 at dP = 0)	
Alarm C, lower limit	AL.≡	☐	0 to - extent of measuring range [phys. unit]	at AL = 3
Reset hysteresis, lower limit	HYS	☐	0 to extent of measuring range [phys. unit] (x0,1 at dP = 0)	
Alarm C, upper limit	AL.≡	☐	0 to + extent of measuring range [phys. unit]	at AL = 3
Reset hysteresis, upper limit	HYS	☐	0 to extent of measuring range [phys. unit] (x0,1 at dP = 0)	
Alarm	AL	0 ☐	No alarm, also not in case of sensor failure	
at 6490 /3 /4 /5 and		1 ☐	Alarm relay 1 = A, no alarm relay 2	Alarm relay 1 in case of
at 6590 /3 /4 /5		2 ☐	Alarm relay 1 = B, no alarm relay 2	sensorfailure independent of
		3 ☐	Alarm relay 1 = A, alarm relay 2 = A	adjusted limit value
		4 ☐	Alarm relay 1 = B, alarm relay 2 = A	
		5 ☐	Alarm relay 1 = C (A1 ∨ A2), alarm relay 2 = A	
		6 ☐	Alarm relay 1 = B ∨ A2, alarm relay 2 = A	
Alarm 1 = A	AL.=	☐	0 to ± extent of measuring range [phys. unit]	at AL = 1, 3, 5
Reset hysteresis	HYS	☐	0 to extent of measuring range [phys. unit] (x0,1 at dP = 0)	
Alarm 1 = B	AL.¯	☐	Measuring range: dI.L to dI.H [phys. unit]	at AL = 2, 4, 6
Reset hysteresis	HYS	☐	0 to extent of measuring range [phys. unit] (x0,1 at dP = 0)	
Alarm 2 = A	AL.=	☐	0 to ± extent of measuring range [phys. unit]	at AL = 3, 4, 5, 6
Reset hysteresis	HYS	☐	0 to extent of measuring range [phys. unit] (x0,1 at dP = 0)	
Decimal point	dP	0 ☐	Display without decimal point	
		1 ☐	Display with decimal point	
Scaling, low	dI.L	☐	Displayed value at start of measuring range, -999 to dI.H-1 [phys. unit]	
Scaling, high	dI.H	☐	Displayed value at end of measuring range dI.L+1 to 9999 [phys. unit]	
Setpoint limit, lower	SP.L	☐	dI.L to SP.H [phys. unit]	not valid for SP.2
Setpoint limit, upper	SP.H	☐	SP.L to dI.H [phys. unit]	and remote setpoints
Remote -/ local changeover*	rE.L	0 ☐	Only local setpoint	
		1 ☐	Changeover via digital input REM / LOC, setpoint via analog input	
		2 ☐	Jolt - free (smooth) remote -/ local changeover, by tracking SP loc. = SP rem., otherwise as 1	
Second setpoint *	SP.2	☐	dI.L to dI.H [phys. unit] Changeover via digital input SP.2	

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Parameter / configuration point	Display	Settings		Remarks	
Setpoint ramp	SP.r	[ ]		0 to measuring range [phys. unit per min]	
Ramp direction	rA.d	0	☐	Increasing and decreasing setpoint ramp	
		1	☐	Only increasing setpoint ramp	
		2	☐	Only decreasing setpoint ramp	
Process gain	P.G	[ ]		1 to 255 %, for self - optimization	
Process variable input PV	In.P	0	☐	Pt 100 2.4 = 0° to 300°C or 2.2 = 0° to 400°C	
		1	☐	0 to 20 mA	
		2	☐	4 to 20 mA	
		3	☐	0 to 10 V	
		4	☐	2 to 10 V	
Remote setpoint input *	In.S	0	☐	Pt 100 2.4 = 0° to 300°C or 2.2 = 0° to 400°C	by detected
		1	☐	0 to 20 mA	signal failure:
		2	☐	4 to 20 mA	changeover
		3	☐	0 to 10 V	to internal
		4	☐	2 to10 V	setpoint
Measured value filter PV	FIL	[ ]		100 to 255 comply with 42 ms to 10 s	
Sensor break PV	SE.b	0	☐	Actuator closes	
		1	☐	Actuator opens	
		2	☐	Actuator stops in its current position	
Manual -/ automatic changeover	MAn	0	☐	Changeover via keyboard	
		1	☐	Interlocking in current status automatic	
			☐	Interlocking in current status manual	
Direction of action of controller	dIr	0	☐	Heating controller	
		1	☐	Cooling controller	
Function of the digital inputs	OCS	0	☐	No control function	Switch status of the digital inputs is
		1	☐	Control function Open, Close, Stop	transmitted via the MODBUS.
Transfer rate *	bd	0	☐	19200 baud	
		1	☐	9600 baud	
		2	☐	4800 baud	
		3	☐	2400 baud	
		4	☐	1200 baud	
Adress *	Adr	1 bis 247		Slave address at bus - mode	
		[ ]		Adress	
Serial communication *	S.C	0	☐	The master only can read data from the controller	
		1	☐	The controller is operated and set using the master	
Second operating level	OL.2	0	☐	No second operating level	Add figures
		1	☐	Self - optimization	of desired
		2	☐	Limit value and hysteresis of alarm	functions
		4	☐	Remote -/ local changeover * or serial communication 1)	and set PAS
		8	☐	Second setpoint *	to 1
		16	☐	Setpoint ramp	
		[ ]		Result of added indentifier numbers	1) Device with serial interface
Password	PAS	0	☐	No interlocking, OL.2 deactive	
		1	☐	Access only after entry of the password, OL.2 active, Functions on OL.2 not interlocked	
* Option		1500		Code	

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