Microprocessor-based controller µCelsitron baelz 6490B, baelz 6490B-y and baelz 6590B

Universal three-position step controller

Industrial controller with special PID step controller algorithm

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

- ❑ Easy operation
- ❑ User-defined operating level
- ❑ Digital displays for process variable and setpoint
- ❑ Indication of the manipulated variable (at 6490B-y with additional bargraph display)
- ❑ Control structure PI and PID
- ❑ Two-position control
- ❑ Three-position control
- ❑ Setpoint ramp
- ❑ Robust self-optimisation
- ❑ Measurement input Pt100
- ❑ Serial interface
- ❑ Alarm functions
- ❑ Control via digital inputs
- ❑ Manual/automatic switch over
- ❑ Degree of protection Front IP 65
- ❑ Semiconductor memory for data protection
- ❑ Plug-type terminals
- ❑ Rail-mounting (option)

052'+3/2 E3By CW,Ro,Bö

W. Bälz & Sohn GmbH & Co. Koepffstraße 5 D-74076 Heilbronn Telefon (07131) 1500-0 Telefax (07131) 1500-21

Contents

* option

⚠ **Warning:**

When operating electrical equipment, certain parts of this equipment automatically carry dangerous voltages. Failure to observe these instructions could therefore lead to serious injury or material damage. Therefore the warning notes, included in the following sections of these operating instructions, must be observed accordingly. Persons 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.

1. Function overview

Basic device

Analog input Pt100	Analog input for the process variable PV
Relay OPEN	Controller output OPEN: opens the actuator
Relay CLOSE	Controller output CLOSE: closes the actuator
Relay ALARM	Alarm relay operates on the base of the idle current principle

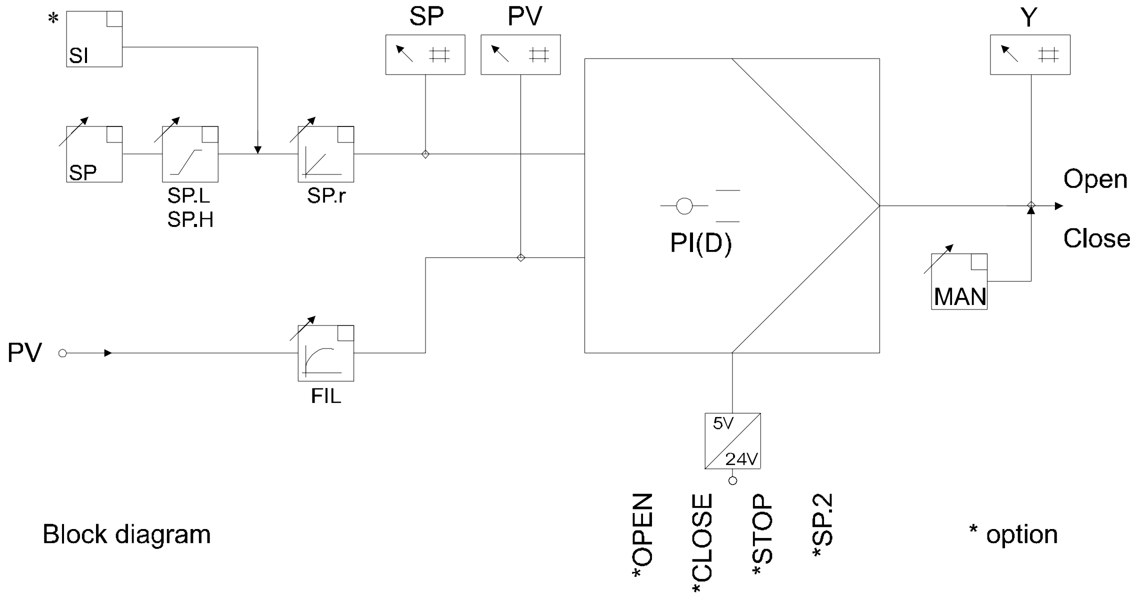
Additional functions (option*)

Serial interface RS 485	Data transfer in accordance with modbus protocol.
Supply voltage 24 V DC	For 24 V DC digital input and also 2-wire-transmitter at current input*

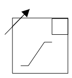
The optional digital input is definable to one of these functions by software:

Digital input OPEN	Actuator opens ...	not in manual mode
Digital input CLOSE	Actuator closes ...	
Digital input STOP	Actuator persists in its current position ...	
Digital input SP.2	To switch over to the second setpoint SP.2 ...	

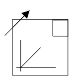
... if connecting 24 V DC (active state) to the appropriate digital input.
Priority: 1. STOP (highest priority), 2. CLOSE, 3. OPEN, 4. SP.2



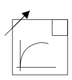
Block diagram



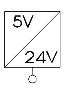
Setpoint limiting. Minimum value SP.L (setpoint low), maximum value SP.H (setpoint high). Only setpoints within the setpoint limiting can be set via front keyboard.



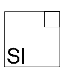
Setpoint ramp SP.r. Setpoint change per minute or hour (gradient). Can be specified for internal and external setpoints by the setpoint ramp.



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



* **Digital inputs**, voltage range 0/12-24 V DC.



* **Serial interface** RS 485 (modbus, RTU-mode).

* option

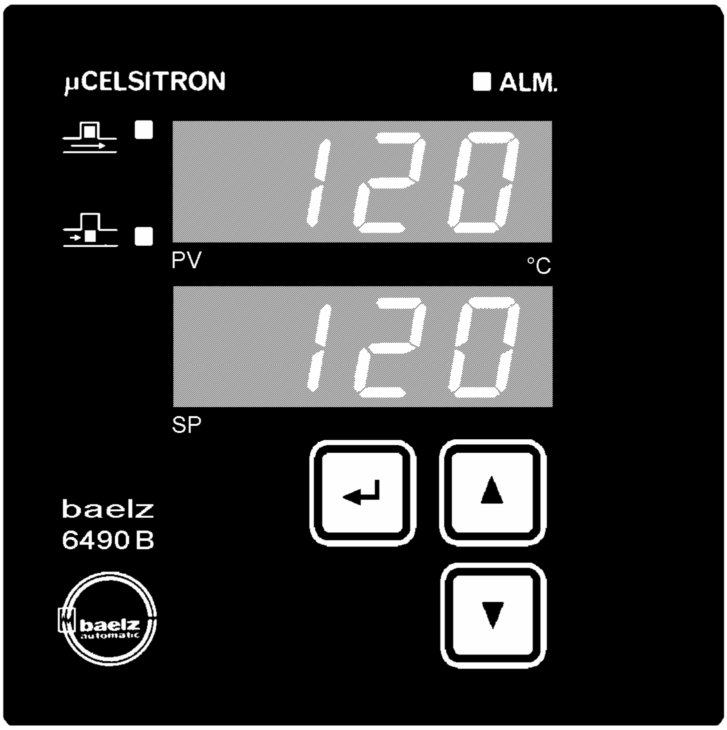
2. Operating and setting

Operating level: 6490B

Actuator opens

Actuator closes

At the 6590B symbols and displays have the same meaning.



Alarm

Process variable or manipulated variable Y or modbus communication display

other phys. units available as labels

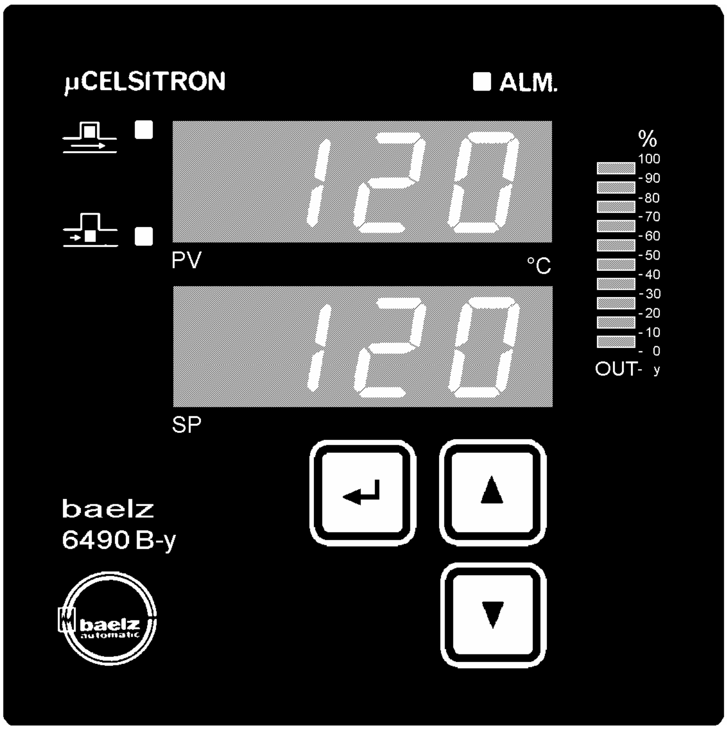
Setpoint display with actual status display for:

StOP = STOP DI active
CLOS = CLOSE DI active
OPEn = OPEN DI active
tunE = optimisation running
rAMP = Setpoint ramp running
SP_2 = Second setpoint active

If one of these functions is active, the SP-display is alternating between the status display with the highest priority and the setpoint. StOP has got the highest priority and SP_2 the lowest priority.

Operating level 6490B-y:

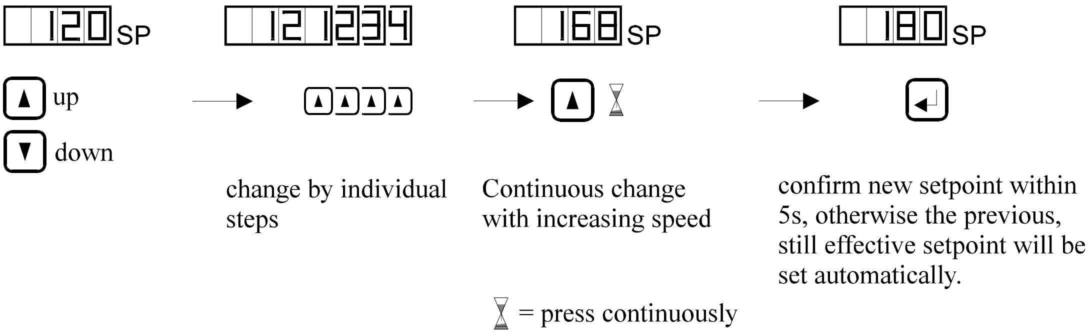
The 6490B-y is equipped with an additional bargraph display on the right hand side of the front-plate, showing the current manipulated variable Y.
The bargraph can be turned off by the configuration point Y.SY (see 3.28 Y.SY).



The bargraph displays the manipulated variable Y in 10% steps:

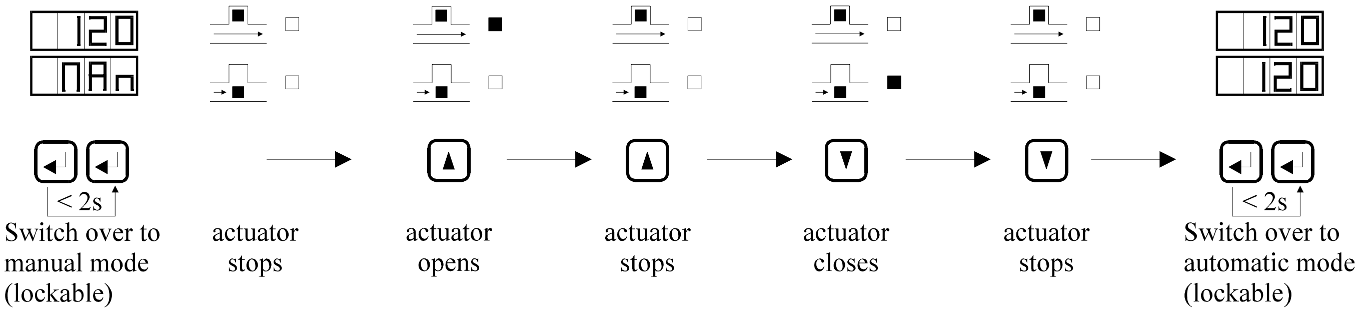
0% all bargraph LEDs off
>0% lowest LED on
≥10% following LED on
...
≥90% all LEDs on

2.1 Setting setpoint in automatic mode

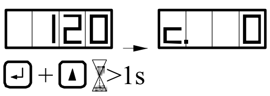


Setting range: SP.L to SP.H
Fixed setpoint if S2.d is assigned to a digital input which is active (setpoint fixed to SP.2) or if S.C = 1 (settings via modbus, only).

2.2 Opening/closing the actuator in manual mode



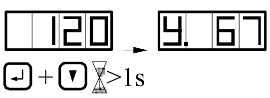
2.3 Modbus communication display via PV-display



To switch over to the modbus communication display, hold down the ↵ - key and the ▲ - key simultaneously for at least 1 second until "c." is displayed in the left segment of the display. The other 3 segments show the communication display as a 1-byte counter with a range of 0 to 255. With each valid modbus package it counts up one unit. When the counter reaches 255 it wraps around with the next modbus package and starts counting up from 0 again. If the display does not change the controller is not addressed via modbus.

To return to the process variable display, hold down the ↵ - key and the ▲ - key simultaneously again until the process variable is displayed.

2.4 Displaying the manipulated variable Y via PV-display



To switch over to the manipulated variable Y display, hold down the ↵ - key and the ▼ - key simultaneously for at least 1 second until "Y." is displayed in the left segment of the display. The other 3 segments show the manipulated variable Y as a numerical value (0...100) in percent.

To return to the process variable display, hold down the ↵ - key and the ▼ - key simultaneously again until the process variable is displayed.

2.5 Switch over to configuration level

181 PV
180 SP
Operating level

↵ >2s press at least 2s

without password (see 3.34 PAS) → OPt
first configuration point

with password
without second
operating level (see 3.33 OL.2) → Cod XXXX → OPt
first configuration point

up / down → ↵
set password (input procedure like changing setpoint at 2.1)

valid password: Switch over to configuration level. For valid password see 9. Overview of configuration level at password PAS

invalid password: back to operating level

with password
with second
operating level → OPt* A 1.A* HY. 1* SP.2* SP.r* → Cod XXXX → OPt
first configuration point

↵ → ↵ → ↵ → ↵ → ↵

second operating level (see 3.33 OL.2)

* if selected for the user-defined operating level

up / down → ↵
set password (input procedure like changing setpoint at 2.1)

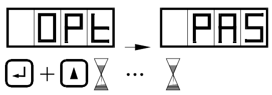
valid password: Switch over to configuration level. For valid password see 9. Overview of configuration level at password PAS

invalid password: back to operating level

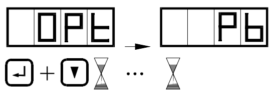
↵ >2s Back to operating level, possible at any time

2.6 Changing the scrolling direction in the configuration level

In the second operating level as well as in the configuration level it is possible to inverse the scrolling direction.
The forward scrolling direction mode is automatically set with every power off-power on.
The selected scrolling mode is valid as long as it is not changed or until a power failure.



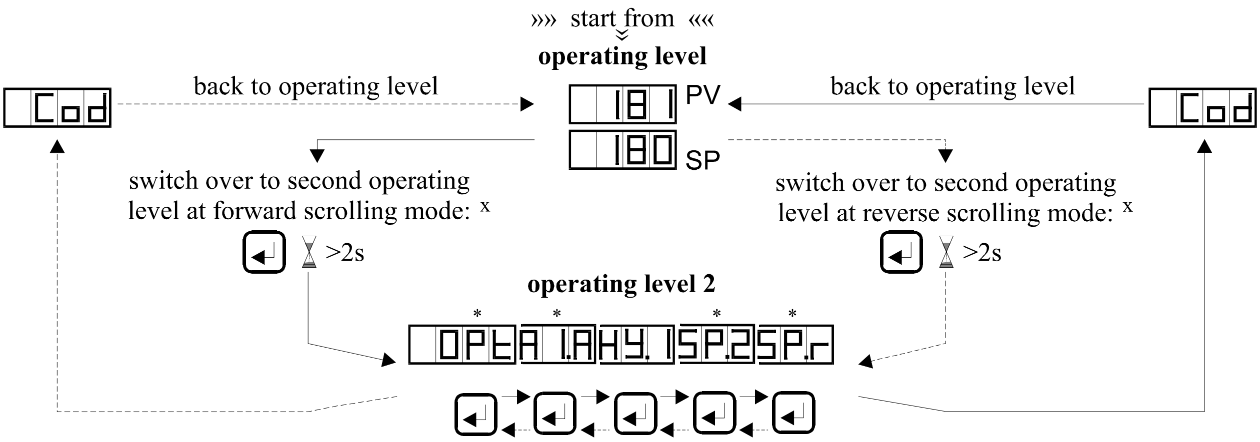
To switch to the reverse scrolling direction mode, hold down the ↵ - key and the ▲ - key simultaneously until the previous configuration point is displayed.
Now scrolling inside the configuration level works in reverse mode.



To switch to the forward scrolling direction mode, hold down the ↵ - key and the ▼ - key simultaneously until the next configuration point is displayed.
Now scrolling inside the configuration level works in forward mode.

2.7 Switch over to second operating level (user-defined operating level)

How to switch over from the operating level to the second operating level is described in the following diagram. Which configuration point of the second operating level will be called up first depends on the selected scrolling mode x. Configuration points that have been selected for the second operating level (see 3.33 OL.2) can be called up and adjusted without entering the password. In case access to the configuration level is protected by a password, see 3.34 PAS.

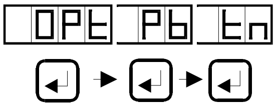


* if this function has been selected for the user-defined operating level and the access to the configuration level has been interlocked by the password.
x changing the scrolling direction see 2.6.

For the second operating level the following settings can be adjusted:

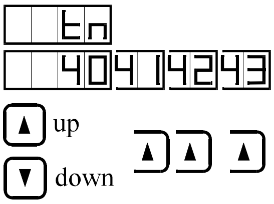
- optimisation OPt
- alarm (i.e. A1.A, HY.1)
- serial communication S.C
- second setpoint SP.2
- setpoint ramp SP.r

2.8 Setting configuration points



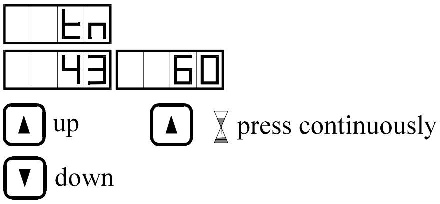
1 Select configuration point

▼



2a Set new value by change in individual steps and...

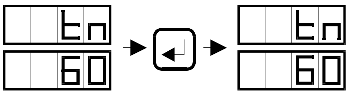
▼ respectively



▲

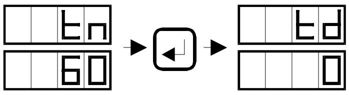
2b Set new value by continuous change with increasing speed and...

▼

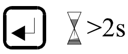


3 ...confirm new value within 5s, otherwise the previous, still effective value will be set again automatically.

▼



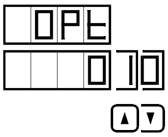
4 After the new value has been confirmed by pressing ↵ , press ↵ again to call up the next configuration point



Back to operating level, possible at any time

3. Configuration level

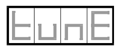
For access to this level press ↵ >2s (see 2.5).
To switch to the next/previous configuration point (depending on the scrolling direction mode) press ↵ .
Inside the configuration level it is not possible to switch over to the manual mode.

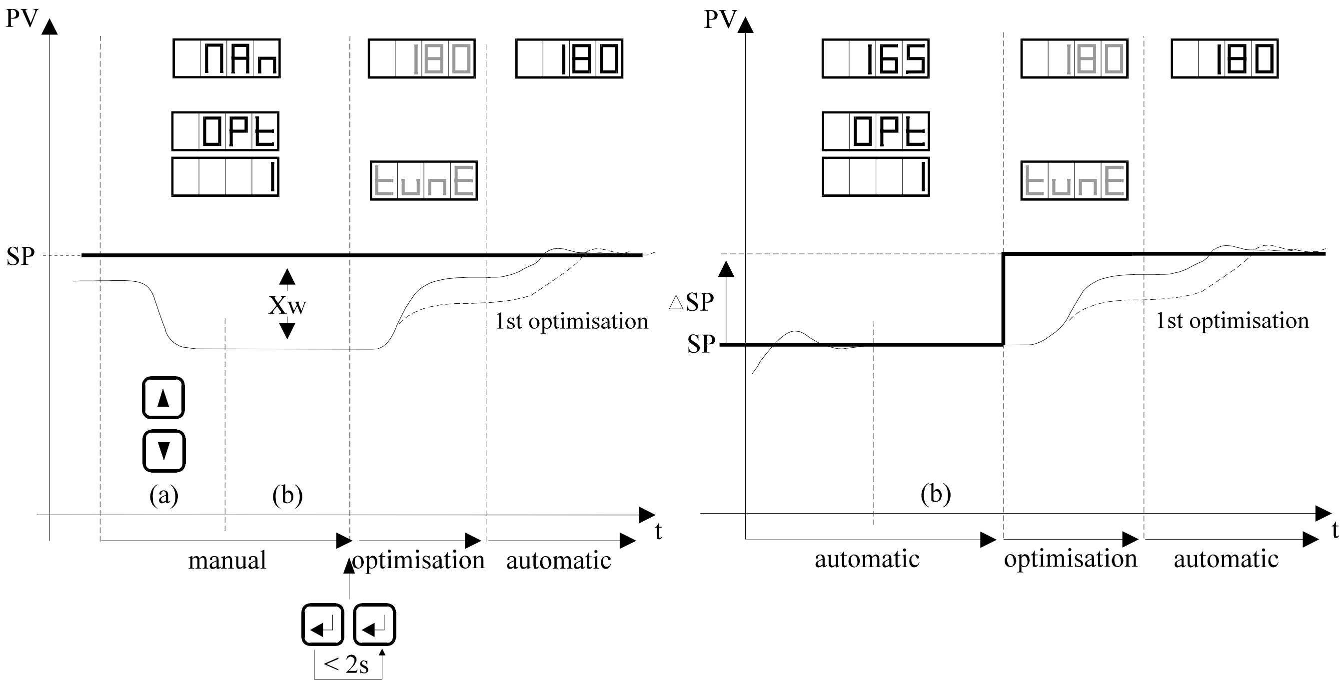


3.1 Optimisation for automatic determination of favourable control parameters.

Selection: 0 No optimisation
1 optimisation activated

Optimisation is triggered by:
- manual mode: switch over to automatic mode by pressing ↵ twice within two seconds
- automatic mode: changing the setpoint SP (not for external setpoint)

When **tunE** is shown cyclically in the setpoint display SP then the optimisation process is running. 



optimisation from manual mode **optimisation from automatic mode**

Procedure of optimisation:

- Set target setpoint SP
- Switch to manual mode
- By opening/closing the actuator the actual value PV is set on a higher/lower value than the target setpoint (a)
- Wait until PV is in a stable state (b)
- Switch over to configuration level
- Set "OPt = 1"
- To optimise a PI-controller set derivation action time "td = 0"; to optimise a PID-controller set "td ≠0"
- If known, set process gain "P.G" (usual setting: P.G = 100%)
- Back to operating mode
- Switch over to automatic mode. Thereby optimisation is

- Set initial setpoint SP
- Wait until PV is in a stable state (b)
- Switch over to configuration level
- Set "OPt = 1"
- To optimise a PI-controller set derivation action time "td = 0"; to optimise a PID-controller set "td ≠0"
- If known, set process gain "P.G" (usual setting: P.G = 100%)
- Back to operating mode
- Set target setpoint SP. Thereby optimisation is started, "tunE" and the manipulated variable appear alternate, actuator changes
- During the optimisation process no inputs or switch over are tolerated

started, “tunE” and the manipulated variable appear alternate, actuator changes

- During the optimisation process no inputs or switch over are tolerated
- Optimisation is finished as soon as “tunE” does not appear anymore. Now the controller works in automatic mode.
- The calculated parameters “Pb”, “tn”, “td” and also the process gain “P.G“ have been calculated and saved in the configuration level. “OPt = 0” is set again automatically
- In case it was the first optimisation process, better results are available by another optimisation run (because of the process gain P.G, already calculated during the first run)

- Optimisation is finished as soon as “tunE” does not appear anymore. Now the controller works in automatic mode.
- The calculated parameters “Pb”, “tn”, “td” and also the process gain “P.G“ have been calculated and saved in the configuration level. “OPt = 0” is set again automatically
- In case it was the first optimisation process, better results are available by another optimisation run (because of the process gain P.G, already calculated during the first run)

Problems with optimisation and solutions

1. Setting “OPt = 1” is not possible

Reasons:

a) Digital input (OPEN, CLOSE, STOP) is active.
Solution: Deactivate the digital input or take it out of the configuration level (= 0).

b) Sensor does not work (display “Err”).
Solution: Make sure there is a valid actual value PV (check measuring lines and sensor).

2. Optimisation does not start (no alternating “tunE” and manipulated variable in the setpoint display SP)

By switching from manual to automatic mode or by changing the setpoint in the automatic mode, the optimisation is not started.

Reasons:

a) In the configuration level the “OPt” setting is not “1” (anymore). “OPt = 0” is set automatically in case of:
- optimisation is finished (no flashing „tunE“)
- digital input (OPEN, CLOSE, STOP) is still active or was active for a short moment
- sensor failure permanently or for a short moment in the past

Solution: Deactivate digital input (OPEN, CLOSE, STOP), remove sensor failure (see 1.a), 1.b)).
Set “OPt = 1”. Try again.

b) Digital input SP.2 is active. Optimisation with or on SP.2 is impossible.
Solution: Deactivate digital input or take it out of the configuration level (= 0).

c) The control error between actual value and target setpoint is less than 3.125% of the entire measuring range.
I.e. a 0°C…300°C module is used the minimum control error has to be at least 9.4°C.
When a 0°C…400°C module is used it has to be at least 12.5°C.
Solution: Magnify the difference between actual value and target setpoint up to at least 3.125% of the measuring range before starting the optimisation.
The bigger the deviations the better the optimisation results (see also 6.a), 6.b)).
When optimising from manual mode, the actuator has to be changed as long as the difference between actual value and target setpoint is big enough.
When optimising from automatic mode, an initial setpoint, which has to have the necessary difference to the target setpoint, has to be defined.

d) A modbus RAM-setpoint is used. Optimisation with or on the modbus RAM-setpoint is impossible.
Solution: Deactivate the RAM-setpoint via the modbus (see "Modbus documentation").

3. Target setpoint is not reached during the optimisation

Immediately after the optimisation is finished (“tunE” does not appear anymore) the actual value is not close to the target setpoint. It is recommendable to reach the target setpoint as exactly as possible at the end of the optimisation to get really good results.

Reasons:

a) The process gain P.G, defined before starting the optimisation, did not correspond to the actual process gain P.G of the process. Frequently this happens during the first optimisation when the process gain P.G is still set to the standard value = 100%.

Solution: Restart optimisation. The setpoint value will be reached more exactly this time, because the process gain P.G, which was also calculated during the previous optimisation process, is used as a base of the following optimisation process. If the process gain is known or measured, it can be adjusted manually already before starting the first optimisation run.
Measuring the process gain P.G in manual mode:
Change the actuator about a fixed rate ΔY (%) and determine the given change of the actual value ΔPV.
Then the process gain can be calculated by P.G = (ΔPV / ΔY) * 100%. If the controlled system has got a linear behaviour, the process gain is constant all over the entire control range.
I.e. the actuator is changed from 30% to 70% → ΔY = 40%. Thereby the actual value rises from 50°C to 110°C → ΔT = 60°C. At a measuring range of 0°C…300°C this corresponds to the change of the actual value ΔPV = 20%. The process gain can be calculated then by P.G = (20% / 40%) * 100% = 50%.
Depending on the process gain, the controller calculates the necessary change of the actuator at start of the optimisation for reaching the target setpoint at the end of the optimisation.
A small process gains causes a bigger change of the actuator instead of a bigger process gain.
If the temperature rises up to a not permitted high value, it could be necessary to cancel the optimisation (see also 5.).

b) In non-linear controlled systems, even by proceeding a following optimisation, the target setpoint can not be reached exactly enough.

Solution: Let the optimisation run a couple times until the target setpoint is reached exactly enough. The process gain will be defined then by an iterative method, what means, with every run the process gain comes closer to the actual process gain.
In non-linear controlled systems for different sub-ranges within there will be optimised, different optimisation results will be created. Therefore it is necessary to determine the most important range for the control which should be optimised. If all ranges do have the same importance, we recommend you to optimise the sub-range with the slowest time behaviour (see also 6.a) and 6.b)).

c) The prime energy is not sufficient to reach the target setpoint.

Solution: Increase prime energy or chose a target setpoint that can definitely be reached.

d) The actuator does not move to the new position given by the controller.

Solution: Check function of the actuator and its control.

4. The optimisation “does not” finish or just after 42 minutes respectively

The maximum time of optimisation is limited up to 42 minutes. In case that the conditions to finish the optimisation are not given even after 42 minutes, the optimisation process will be cancelled automatically.

Reasons:

a) The limited time of 42 minutes for optimisation might be too short for several, very slow processes.

Solution: Switch over to the configuration level just before the 42 minutes are elapsed and change the setting “OPt = 1” to “OPt = 0”. Therefore the optimisation is cancelled manually and the control parameters will be recalculated.

b) At processes with no stable state (drift, post heating, ...) cancelling the optimisation after 42 minutes is possible just as a later ending.

Solution: The movement of the actual value has to be observed to recognize the approximate end of the settling.
Afterwards in the configuration level the setting “OPt = 1” has to be changed to “OPt = 0” to cancel the optimisation with recalculation of the control parameters.
If there is a drift, the optimisation has to be started from the manual mode before the drift starts.

c) Because of the change of the manipulated variable at start of the optimisation, the change of the actual value ΔPV is too small, so the balance of the controlled system is not recognized.
The change of the actual value ΔPV has to be at least 1/4 of the difference between target setpoint and actual value at beginning of the optimisation.

I.e. actual value at start of the optimisation = 60°C, target setpoint = 100°C which is a difference of ΔT = 40°C.
The needful change of the actual value can be calculated then by $\Delta PV = 1/4 * \Delta T = 1/4 * 40K = 10K$.
The optimisation can only be finished when the actual value is at least 60°C + 10K = 70°C.
Cause is a process gain which does not fit (see also 3.a) and 3.b)).
Solution: Cancel or finish the optimisation (see 5.).
Reduce the process gain P.G in the configuration level (e.g. 1/2).
Restart optimisation.

5. Cancelling the optimisation premature

An already running optimisation shall be cancelled without recalculation of the control parameters.
A reason for that could be e.g. a not permitted rise of the temperature over the tolerated limits during the optimisation.
After a cancel the process gain P.G can be magnified manually to get a smoother temperature change within the next optimisation (see also 3.a) and 3.b)).

Cancelling by:
a) activating manual mode
b) setting a setpoint once more
c) activating a digital input (OPEN, CLOSE, STOP, SP.2)
d) activating the modbus RAM-setpoint (see "Modbus documentation")

Cancelling the optimisation premature, including recalculation of control parameters and process gain, can be realized by changing "Opt = 1" to "Opt = 0" in the configuration level during process of optimisation.

6. The optimisation results are not satisfying

Reasons:
a) The optimisation did not run within the range the control is working after.
I.e. the range between 60°C and 80°C was optimised, but the following control works with a setpoint change from 50°C to 100°C.
Solution: At beginning of the optimisation the actual value should correspond to the first point and the initial setpoint to the other (target setpoint) of the desired control range (see also 2.c)).
b) Processes with strongly different time behaviour (e.g. fast heating up, slow cooling down) where the change of the actual value during the optimisation worked reverse to the following control.
I.e. optimisation from 100°C to 50°C but the following control from 50°C to 100°C.
Solution: If possible, optimise in the same direction the control is working after. If it has to be controlled in both directions, the more important direction has to be optimised. Do both directions have the same relevance, the slower process has to be optimised.
c) The actual value has not been in a stable state before starting the optimisation.
Solution: Wait until the actual value is in a stable state before starting the optimisation. If the actual value can not get stabilized in the automatic mode (oscillation), an optimisation started from the manual mode is necessary.
d) The target setpoint could not be reached at the end of the optimisation.
Solution: see 3)
e) During the optimisation the actuator must not run over the limits → neither 0% nor 100%. Nevertheless a completely closed actuator at start of the optimisation would be tolerated, i.e. in case that a de-energized plant (with closed actuator) drives immediately to the target setpoint at start of the optimisation.
Solution: Set a bigger process gain and restart optimisation or just set another target setpoint.
f) Power supply is not stable because of too many peripherals.
Solution: Optimisation only at times when a stable energy supply is guaranteed.
g) Controlling the process is almost impossible because the actuator does not fit (e.g. valve is over-sized).
Solution: Check dimensions of the actuator, change it if necessary.
h) The process can not be controlled perfectly with the chosen type of controller.
Solution: Let the optimisation run with another type of controller (PI or PID) and compare.

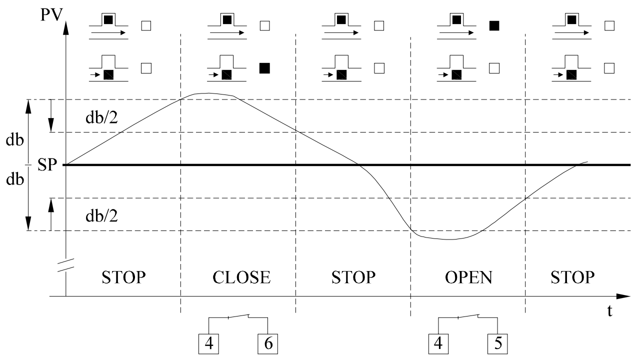
3.2 Proportional band Pb

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

3.2.1 Three-position controller

Pb = 0.0
tn > 0

Control action adjustable via dead band db
(see also 3.5 db)



3.2.1 Three-position controller

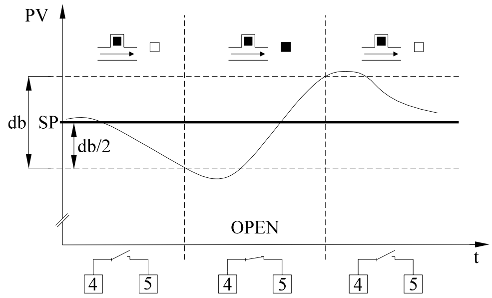
3.3 Integral action time tn

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

3.3.1 Two-position controller

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

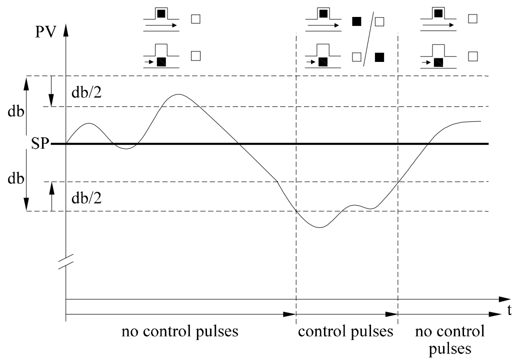
Derivative action of the PID three-position step controller

Setting range: 1s to 255s

3.5 Dead band db

No actuating pulses if control deviation is smaller than db
Hysteresis: db/2
Setting range:
  0 to 10th part of the scope of the measuring range [phys. units]
  0 to + scope of the measuring range [phys. units] at dP = 3

(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 setting range 0% to 100% (stroke) at constant OPEN or CLOSE pulse

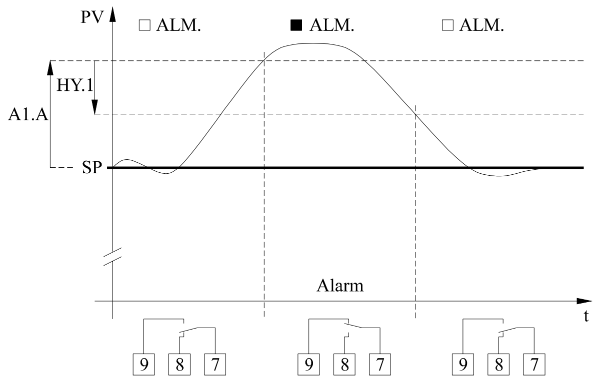
⚠ Setting the valve actuating time t.P has got a very important meaning. It has to be ascertained as exact as possible for each valve and set to the controller. A bad valve actuating time causes a wrong manipulated variable.

3.7 Basic alarm type description

The controller has got three basic types of alarms called type A, type B and type C.

3.7a Alarm type A

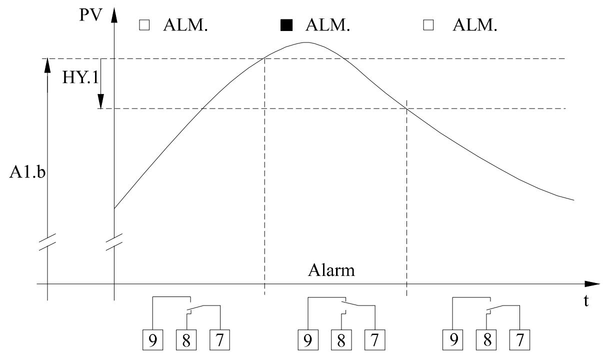
Alarm at a limit value based on the setpoint SP. Alarm at over-temperature if alarm setting A1.A is positive. Alarm at under-temperature if alarm setting A1.A is negative. At positive setting the alarm is triggered if PV is bigger than SP + A1.A . At negative setting the alarm is triggered if PV is smaller than SP - |A1.A| . The algebraic sign of the alarm value A1.A only indicates the direction of effect (over- or under-temperature).
The hysteresis defines a span between alarm state and switching back to normal state. At positive setting of A1.A returning to normal state is at SP + A1.A - HY.1 . At negative setting of A1.A returning to normal state is at SP - |A1.A| + HY.1 .



Alarm type A

3.7b Alarm type B

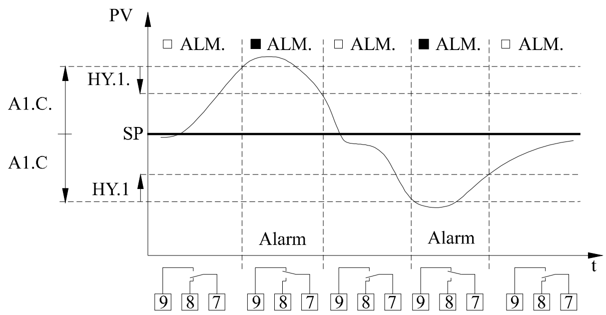
Alarm at a fixed limit value of PV.
If AL.1 = 2, alarm is triggered if the value set at A1.b is reached or exceeded.
The hysteresis defines a span between alarm state and switching back to normal state. Returning to normal state is at A1.b - HY.1 .
If AL.1 = 4, alarm is triggered if the value set at A1.b is reached or dropped below.
The hysteresis defines a span between alarm state and switching back to normal state. Returning to normal state is at A1.b + HY.1 .



Alarm type B

3.7c Alarm type C

Alarm at leaving a band around the setpoint SP. The lower half of the band is defined by A1.C , the higher one by A1.C. .
The value entered at A1.C is always negative because the process variable PV has to be smaller than SP - |A1.C| to trigger the alarm.
The value entered at A1.C. is always positive because the process variable PV has to be bigger than SP + A1.C. to trigger the alarm.
The hysteresis defines a span between alarm state and switching back to normal state. For the lower band returning to normal state is at SP - |A1.C| + HY.1 . For the higher band returning to normal state is at SP + A1.C. - HY.1. .



Alarm type C

At all three types (A, B, C) alarm is always triggered in case of sensor failure.

AL.1
0...4

3.7.1 Alarm type selection for alarm relay

The alarm relay operates on the base of the idle current principle.

AL.1 **= 0:** no alarm selected
also not in case of sensor failure, see also 3.18 SE.b

A 1.A

AL.1 **= 1:** selects Al.A alarm type A (see description 3.7a)
Setting range: 0 to ± scope of the measuring range [phys. units]

HY.1

Alarm hysteresis HY.1 for A1.A
Setting range: 0 to 10th part of the scope of the measuring range [phys. units]
0 to + scope of the measuring range [phys. units] at dP = 3

A 1.b

AL.1 **= 2:** selects Al.b alarm type B (see description 3.7b)
Setting range: measuring range [phys. units]

HY.1

Alarm hysteresis HY.1 for A1.b
Setting range: 0 to 10th part of the scope of the measuring range [phys. units]
0 to + scope of the measuring range [phys. units] at dP = 3

AL.1 **= 3:** selects Al.C and Al.C. alarm type C (see description 3.7c)

A 1.C

Lower half of the band around the setpoint (negative setting)
Setting range: 0 to - scope of the measuring range [phys. units]

HY.1

Alarm hysteresis HY.1 for A1.C
Setting range: 0 to 10th part of the scope of the measuring range [phys. units]
0 to + scope of the measuring range [phys. units] at dP = 3

A 1.C

Upper half of the band around the setpoint (positive setting)
Setting range: 0 to + scope of the measuring range [phys. units]

HY.1

Alarm hysteresis HY.1. for A1.C.
Setting range: 0 to 10th part of the scope of the measuring range [phys. units]
0 to + scope of the measuring range [phys. units]at dP = 3

A 1.b

AL.1 **= 4:** selects A1.b alarm type B, version 2 (see description 3.7b)
Setting range: measuring range [phys. units]

HY.1

Alarm hysteresis HY.1 for A1.b
Setting range: 0 to 10th part of the scope of the measuring range [phys. units]
0 to + scope of the measuring range [phys. units] at dP = 3

dP

0...3

3.8 Decimal point for LED displays

Selection:
0 Display without decimal point: ####
1 Display with decimal point (1 decimal): ###.#
2 Display with 2 decimals: ##.##
3 Display with 3 decimals: #.###

After any change of the decimal point the process variable display PV has to be rescaled (see 3.9 dI.L, dI.H). By changing the decimal point, several other inputs of the configuration level are concerned. Because of the high degree of accuracy of some inputs approximation errors may be possible.

3.9 Scaling the process variable display PV

dI.L

Display low: enter zero point of the measuring range.
Defines the starting point for the PV indication related to the measuring range whereat dI.L < dI.H.
Setting range (depending on dP): -999 ... 9999 [phys. units] at dP = 0
-0.999 ... 9.999 [phys. units] at dP = 3. See also 3.8 dP.
Standard value: **0**°C and **32**°F respectively

dI.H

Display high: enter final point of the measuring range.
Defines the final point for the PV indication related to the measuring range whereat dI.H > dI.L
Setting range (depending on dP): -999 ... 9999 [phys. units] at dP = 0
-0.999 ... 9.999 [phys. units] at dP = 3. See also 3.8 dP.
Standard value: **300**°C and **572**°F respectively

⚠
- When changing dI.L or dI.H, all values entered as physical units are rescaled expressed as percentage
- When a Pt100 sensor is used, dI.L and dI.H have to correspond to the Pt100 measuring range of the device (see type plate)
  baelz 6490B / 6490B-y / 6590B - 2.4 - ... : dI.L = 0, dI.H = 300
  baelz 6490B / 6490B-y / 6590B - 2.2 - ... : dI.L = 0, dI.H = 400

3.10 Setpoint limiting

SP.L

Setpoint low: lowest setpoint which can be set
Setting range: dI.L to SP.H [phys. units] (see also 3.9 dI.L)
Effective for the setpoint adjustable via front keyboard.

SP.H

Setpoint high: highest setpoint which can be set
Setting range: SP.L to dI.H [phys. units] (see also 3.9 dI.H)
Effective for the setpoint adjustable via front keyboard.

⚠
- If the range of dI.L/dI.H is changed, SP.L/SP.H is automatically set according to it expressed as percentage.
- When SP.L = SP.H, the setpoint is fixed to this value. Changing the setpoint is not possible.
- When SP.L > SP.H, only between these two values can be switched via front keyboard. After setting SP.L > SP.H, the last entered setpoint is displayed in the operating level.
  The two fixed setpoints can be selected by pressing ▲ or ▼ and adjusted by pressing ↵ .

SP.2

3.11 *Second setpoint SP.2 at 6x90B(-y) /1 /4 /4-i

Setting range: dI.L to dI.H [phys. units] (see also 3.9 dI.L, dI.H)

When the digital input assigned to SP.2 is active, the corresponding value becomes the actual setpoint (see also 3.21-3.25 Assigning the digital inputs).

* option

SP.r

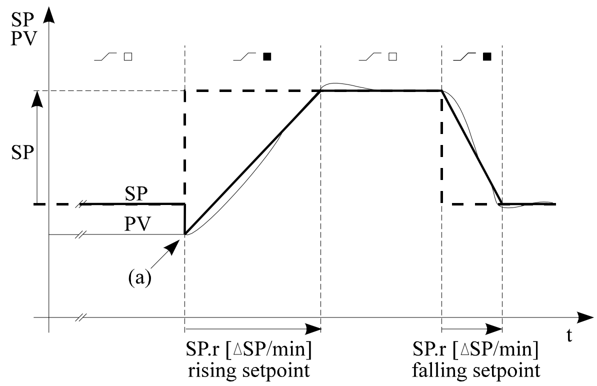
3.12 Setpoint ramp SP.r

Defines the ramp of the setpoint SP via time (gradient)

Setting range: 0 to scope of the measuring range in PV/minutes or hours (see below 3.13 rA.d); PV [phys. unit] e.g. K/min or hour (at dP = 0)

Setting SP.r = 0: no setpoint ramp.

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



3.12 Setpoint ramp SP.r

The setpoint ramp is triggered after:

- switching on the device or after a power failure
- sensor failure
- any setpoint change
- switching over to the second setpoint SP.2
- a control function STOP, CLOSE, OPEN (via digital input)
- switching from manual mode to automatic mode

rA.d

0...6

3.13 Ramp direction

Setting the direction of effect and time behaviour of the setpoint ramp SP.r (if SP.r > 0, see also 3.12 SP.r)

Selection:

0 Ramp with SP.r as *physical unit/min, at falling and rising setpoint changes.
1 Ramp with SP.r as *physical unit/min, only at rising setpoint changes.
2 Ramp with SP.r as *physical unit/min, only at falling setpoint changes.
3 Ramp is deactivated (similar to setting SP.r = 0).
4 Ramp with SP.r as *physical unit/hour, at falling and rising setpoint changes.
5 Ramp with SP.r as *physical unit/hour, only at rising setpoint changes.
6 Ramp with SP.r as *physical unit/hour, only at falling setpoint changes.

* physical unit see 3.9 adjusting dI.L, dI.H

dSP

3.14 Delta setpoint

Setting range: 0 to ± scope of measuring range [phys. units]

dSP = 0 No delta setpoint.
dSP ≠ 0 As soon as the STOP command is deactivated by an assigned digital input the setpoint will be changed by the value [phys. unit] set in dSP.

Assigning the control function STOP to a digital input, see 3.24.

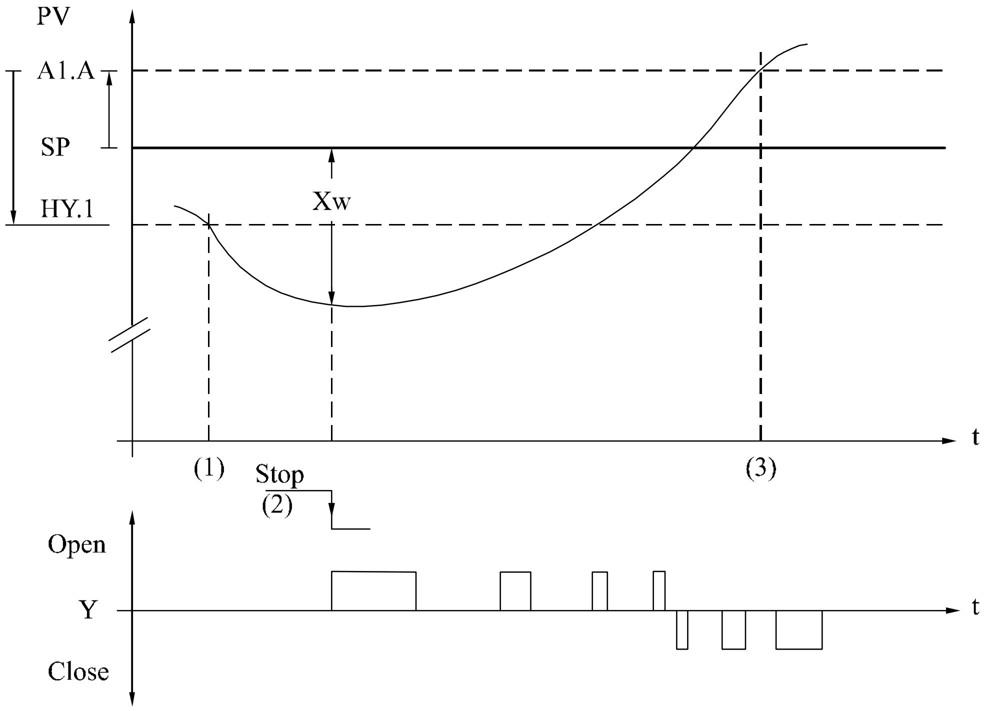
3.15 Delta setpoint description

3.15.1 Remarks concerning the start up behaviour of tenters

Improving the start up behaviour by using the delta setpoint dSP and/or a setpoint ramp SP.r.

3.15.2 Start up behaviour without delta setpoint or setpoint ramp

Fig. 1)

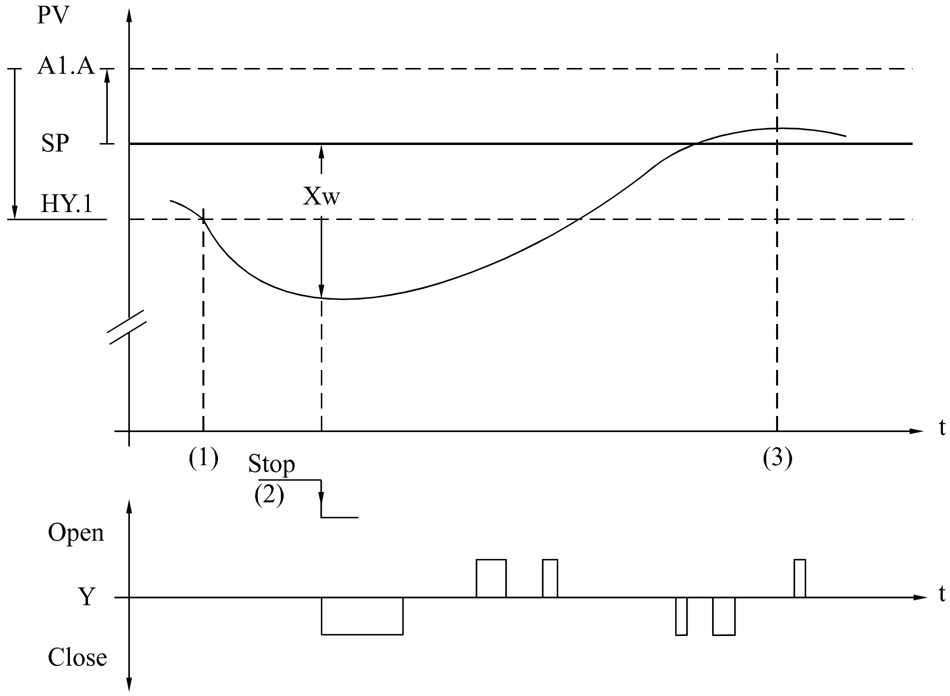


After the plant has been switched off, the temperature in the tenter has to drop below the hysteresis of the alarm relay until the control of the burner is released again (1).
Then the burner can be moved to its ignition position and be started. As soon as the STOP command is inactive the controller switches to the automatic mode (2).

Problem: As a result of the given ignition position of the mixer, during the ignition phase of the burner the thermal energy put into the plant is considerable. However, this does not immediately result in a measurable rise of temperature due to the time delay of the plant.
As soon as the STOP command is inactive the controller immediately generates a longer OPEN pulse because of the under-temperature Xw.
The addition of these processes (quantity of heat of the ignition + quantity of heat of the first OPEN pulse) results in a temperature overshoot which, in turn, can trigger the alarm relay (3).
This causes switching off the plant and a restart of the procedure.

3.15.3 Start up behaviour with delta setpoint dSP

Fig. 2)



Because of the delta setpoint, as soon as the STOP command is inactive, the first OPEN pulse is either shortened according to the adjusted setpoint lowering and the control deviation Xw, or a CLOSE pulse may even be given (2).

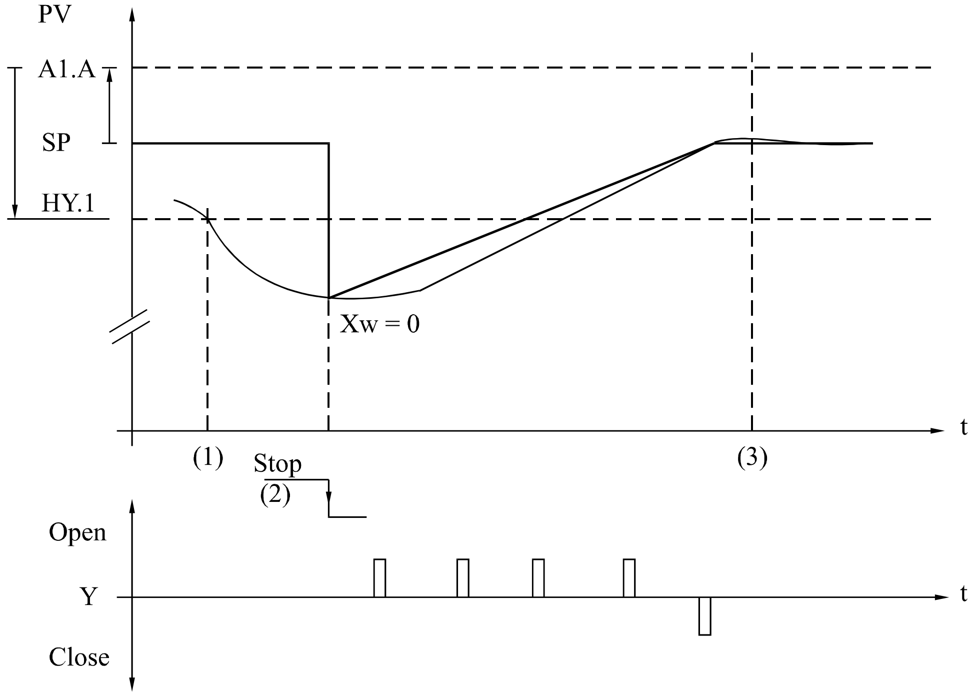
Example: There is a control deviation of Xw = 15 K. The delta setpoint dSP is adjusted to a setpoint lowering of -10 K.
As soon as the STOP command is inactive the controller generates only an OPEN pulse according to the under-temperature of 5 K, instead of an OPEN pulse according to an under-temperature of 15 K.

Example: There is a control deviation of Xw = 10 K. The delta setpoint dSP is adjusted to a setpoint lowering of -15 K.
As soon as the STOP command is inactive the controller generates a CLOSE pulse according to the over-temperature of 5 K, instead of an OPEN pulse according to an under-temperature of 10 K.
Because of the high energy input during the ignition stage the temperature can still rise after a possible CLOSE pulse.

Temperature overshoot is limited by delta setpoint (3). However, its effectiveness depends on the correct dSP setting like shown in the examples.

3.15.4 Start up behaviour with setpoint ramp SP.r

Fig. 3)



A soon as the STOP command is inactive the setpoint SP is automatically equated with the current temperature PV (2).
Therefore no control deviation Xw is given for the controller and no OPEN pulse is generated.
Then the setpoint returns to the adjusted setpoint SP according to the setpoint ramp SP.r.
If the speed of the setpoint ramp SP.r (gradient) is adjusted 0.75 to 0.5 times of the natural temperature rise rate (temperature change in fig. 1), the setpoint will be reached within a very short time without any considerable overshoot.

3.15.5 Start up behaviour with delta setpoint dSP and setpoint ramp SP.r

It is possible to combine delta setpoint and setpoint ramp.
A soon as the STOP command is inactive the setpoint SP is equated with the current temperature and an OPEN or CLOSE pulse is given according to the adjusted setpoint lowering value dSP.
Then the setpoint returns to the adjusted setpoint SP according to the setpoint ramp SP.r.

P.G

3.16 Process gain P.G

Setting range: 1% to 255%

$$\text{Process gain of the controlled system P.G} = \frac{\text{Change of the process variable PV}}{\text{Change of the manipulated variable Y}} = \frac{\Delta \text{PV}}{\Delta \text{Y}}$$

Δ PV [% of the measuring range of PV]
Δ Y [% of the setting range 0-100]

e.g. $\text{P.G} = 50\%: \frac{\Delta \text{PV}}{\Delta \text{Y}} = 0{,}5$	Changing the valve position ΔY for 10% causes a change of the process variable PV of 5%.
$\text{P.G} = 100\%: \frac{\Delta \text{PV}}{\Delta \text{Y}} = 1{,}0$	Changing the valve position ΔY for 10% causes a change of the process variable PV of 10%.
$\text{P.G} = 125\%: \frac{\Delta \text{PV}}{\Delta \text{Y}} = 1{,}25$	Changing the valve position ΔY for 10% causes a change of the process variable PV of 12.5%.

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

FIL

3.17 Measured value filter for the process variable PV

Software 1st order low-pass filter with adjustable time-constant Tf for suppressing interference signals and smoothing fast fluctuations of the actual value.

Formula :
Tf = -0.04/ln(input/256)

Setting range : 0 to 255
At FIL = 0 : no software filter is active

The following assignment applies:

Input:	255	254	252	250	240	230 *	220	200	0
Tf [s]:	10.22	5.10	2.54	1.69	0.62	0.37	0.26	0.16	off

* standard setting

SE.b
0...2

3.18 Behaviour in case of sensor failure for PV

Reaction of the actuator in automatic mode in case of sensor short circuit or sensor break.

Selection: 0 actuator closes
1 actuator opens
2 actuator persists in its current position

In case of a transmitter/sensor failure the error message **Err** (error) appears in the display PV.
Alarm message if alarm A, B or C is configured, independent on the adjusted alarm limit.
After the error is no longer present, the controller automatically returns to the automatic mode.

Err PV

MAn
0 1

3.19 Interlocking the manual/automatic switch over

Selection: 0 Switch over via front keyboard, possible at any time
1 Interlocking the current state, switching to the other mode is not possible
MAn.= -1- in automatic mode: permanent automatic mode
MAn.= -1- in manual mode: permanent manual mode

dir
0 1

3.20 Direction of effect of the controller

Selection: 0 Heating controller: the actuator closes with process variable PV > setpoint SP
1 Cooling controller: the actuator opens with process variable PV > setpoint SP

S2.d
0...5

3.21 Assigning the control function SECOND SETPOINT SP.2 to a *digital input
at 6x90B(-y) /1 /4 /4-i

Selection: 0 : No digital input is selected.
1 ... 5 : Defines the number of the digital input to activate the second setpoint SP.2 .

In case of a "high" signal at the selected input the controller switches to the second setpoint.
See also 3.25 Important information about setting digital inputs

OP.d
0...5

3.22 Assigning the control function OPEN to a *digital input at 6x90B(-y) /1 /4 /4-i

Selection: 0 : No digital input is selected.
1 ... 5 : Defines the number of the digital input to activate an OPEN command.

In case of a "high" signal at the selected input the actuator is set to permanent OPEN.
See also 3.25 Important information about setting digital inputs

CL.d
0...5

3.23 Assigning the control function CLOSE to a *digital input at 6x90B(-y) /1 /4 /4-i

Selection: 0 : No digital input is selected.
1 ... 5 : Defines the number of the digital input to activate a CLOSE command.
CLOSE function is assigned to digital input 1 by factory.

In case of a "high" signal at the selected input the actuator is set to permanent CLOSE.
See also 3.25 Important information about setting digital inputs

St.d
0...5

3.24 Assigning the control function STOP to a *digital input at 6x90B(-y) /1 /4 /4-i

Selection: 0 : No digital input is selected.
1 ... 5 : Defines the number of the digital input to activate a STOP command

In case of a "high" signal at the selected input the actuator is set to permanent STOP and persists in its current position. No OPEN or CLOSE pulses are given.
See also 3.25 Important information about setting digital inputs

3.25 Important information about setting digital inputs

⚠
- Possibly not all the adjustable software settings are supported by your device version. See 8. Ordering number. The software allows settings from 1 ... 5 in 3.21 to 3.24, even if your controller has got no or one single digital input.
- If one of the digital inputs is assigned to multiple control functions, e.g. CL.d = 1 and St.d = 1, only the function with the highest priority will be executed if active:
  1. STOP (highest priority), 2. CLOSE, 3. OPEN, 4. SP.2

3.26 Adjusting the digital inputs for the usage with INBAS

If the keywords "DIOPEN", "DICLOSE", "DISTOP" and "DISP2" shall be used, following adjustments for the digital inputs have to be set: OP.d = 1, CL.d = 2, St.d = 3, S2.d = 5.
INBAS-version ≥ 1.5 has to be used for 6490B / 6490B-y / 6590B controller types.

C.CO

3.27 Calibration correction for the process variable input PV

With C.CO, a calibration correction for the actual value can be defined.

Setting range: 0 to ± scope of the measuring range [phys. units]

C.CO = 0 : no calibration correction - the measured process variable is used.

* option

Y.SY
0...7

3.28 Synchronizing the manipulated variable Y-display

Y.SY defines the kind for synchronization of the manipulated variable at start of the controller.

Selection:

0 Mains power has been switched on: internal manipulated variable = 0%, CLOSE pulse during the valve actuating time t.P.
At mains failure: internal manipulated variable is not saved.
Note: Used when the actual valve position is allowed to stay in any position between 0% and 100%. The CLOSE command causes a synchronization of internal and actual manipulated variable. The synchronization is executed by restarting the plant as well as in case of a temporary power failure.
Disadvantage: The begin of the actual control of the system starts later, exactly like the valve actuating time is adjusted.

1 Mains power has been switched on: internal manipulated variable = 0%
At mains failure: internal manipulated variable is not saved.
Condition: The valve has to be closed, i.e. by an external control, before switching on the device. This condition must be kept when restarting the plant as well as in case of a temporary mains failure.
Advantage: The actual control of the system starts immediately.

2 Mains power has been switched on: internal manipulated variable = latest saved manipulated variable before the mains failure.
At mains failure: internal manipulated variable is saved.
Condition: The valve has to stay at the same position like at the last switch off when restarting the plant. In case of a temporary mains failure, controlling can be continued with a constant Y-display and valve position.

3 Mains power has been switched on: internal manipulated variable = saved manipul. variable.
At mains failure: internal manipulated variable is not saved.
Condition: Before switching on mains voltage, the valve has to be moved to the same position like the saved Y-display (%) to correspond with it.
This can be realized i.e. by an external control.
If the controller is switched on during the positioning of the valve, then it has to be stopped by a STOP command as long as the positioning is not finished yet.
Also after a temporary mains failure, the positioning has always to be done because the initial position of the valve does usually not correspond to the one that has been saved.
Procedure: In manual mode and at the setting "Y.SY=2" the desired percental manipulated variable will be adjusted using ▲ and ▼ (display manipulated variable with numerical display or bargraph display).
By turning off the controller, the adjusted manipulated variable will be saved.
After mains power has been switched on again and "Y.SY=3" is adjusted, this Y start position is valid at any mains recovery and it is also shown in the Y-display.

4 Without bargraph display for the manipulated variable (stays dark)
Synchronization like at Y.SY=0

5 Without bargraph display for the manipulated variable (stays dark)
Synchronization like at Y.SY=1

6 Without bargraph display for the manipulated variable (stays dark)
Synchronization like at Y.SY=2

7 Without bargraph display for the manipulated variable (stays dark)
Synchronization like at Y.SY=3

Note: When "Y.SY" is set to 4, 5, 6 or 7, the bargraph display (at 6490B-y) for the manipulated variable stays dark.
Displaying numerical manipulated variable in the operating level is, independent on the setting "Y.SY", possible at any time.

3.29 Important information about setting t.P in coherence with Y.SY at 6490B(-y)

Setting the valve actuating time t.P has got a very important meaning. It has to be ascertained as exact as possible for each valve and set to the controller. A bad valve actuating time causes a wrong manipulated variable (see 3.6 actuating time t.P).

bd
0...4

3.30 Baud rate for *serial interface at 6x90B(-y) /3 /4 /4-i

Serial interface RS 485, data transmission according to modbus protocol in RTU-mode.

Selection::				
	0	19200 baud	2	4800 baud
	1	9600 baud	3	2400 baud

If the baud rate is selected via front keyboard, the new setting is active immediately. A reset is not necessary. If the baud rate is changed via modbus, a reset (power off-power on) is necessary.

Adr
01

3.31 Address of *serial interface at 6x90B(-y) /3 /4 /4-i

Defines the modbus address of the controller.

Setting range: 1 to 247

If the address is selected via front keyboard, the new setting is active immediately. A reset is not necessary. If the address is changed via modbus, a reset (power off-power on) is necessary.

S.C
01

3.32 *Serial communication at 6x90B(-y) /3 /4 /4-i

Selection: 0 Operation of the controller via front keyboard and modbus-master is possible.
1 Operation of the controller is only possible via modbus-master except configuration point S.C.

OL.2

3.33 Second operating level

The second operating level is only active if PAS = 1 (see below 3.34 PAS).

Select functions for the user-defined operating level.

Setting range: 0 to 255:

- 0 No second operating level
- 1 **Optimisation** (see also 3.1 OPt) can be activated in the second operating level
- 2 **Alarm** functions and their hysteresis (see also 3.7 Alarms) can be entered in the second operating level
- 4 Reserved, no function yet
- 8 **Second setpoint SP.2** (see also 3.11 SP.2) can be adjusted in the second operating level
- 16 **Setpoint ramp SP.r** (see also 3.12 SP.r) can be adjusted in the second operating level

To activate the various functions above, the index numbers on the left side have to be added and the result of it has to be entered.
The index numbers 4, 32, 64, 128 are reserved and have no function yet. If one or more exclusively reserved index numbers are adjusted, only **Cod** will be displayed in the second operating level.

PAS
01

3.34 Access to the configuration level

Selection: 0 No interlocking of the configuration level,
OL.2 is ineffective.

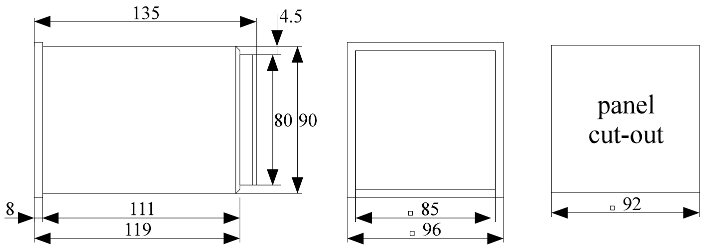
1 Access to the configuration level only by entry via password,
OL.2 is effective
(see above 3.33 OL.2; valid password see 9. Overview of configuration level at password PAS).

* option

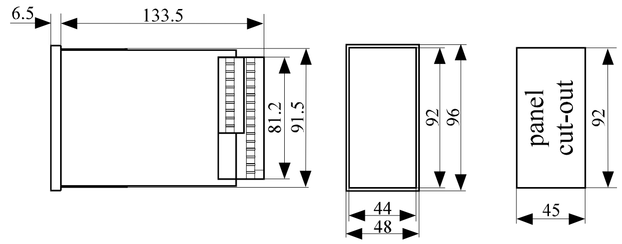
4. Mounting

The device is suitable for installations into front panels as well as into consoles in any position.
Insert the controller from the front into the prepared panel cut-out and fasten it with the supplied clamps.

⚠ The ambient temperature at the installation site must not exceed the permissible temperature for rated operation.
Adequate ventilation must be assured even when the devices are mounted very close to each other.
The device must not be installed within explosion-hazardous areas.



dimensions 6490B / 6490B-y

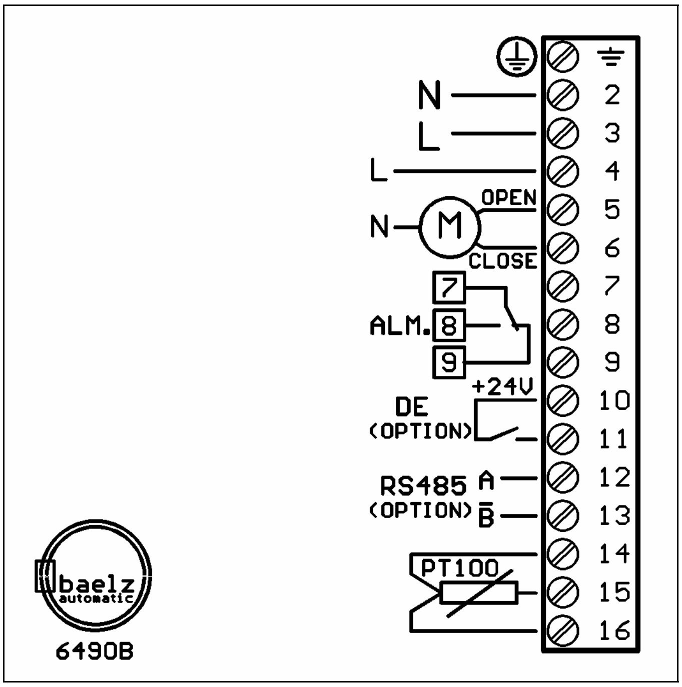


dimensions 6590B

5. Electrical connection

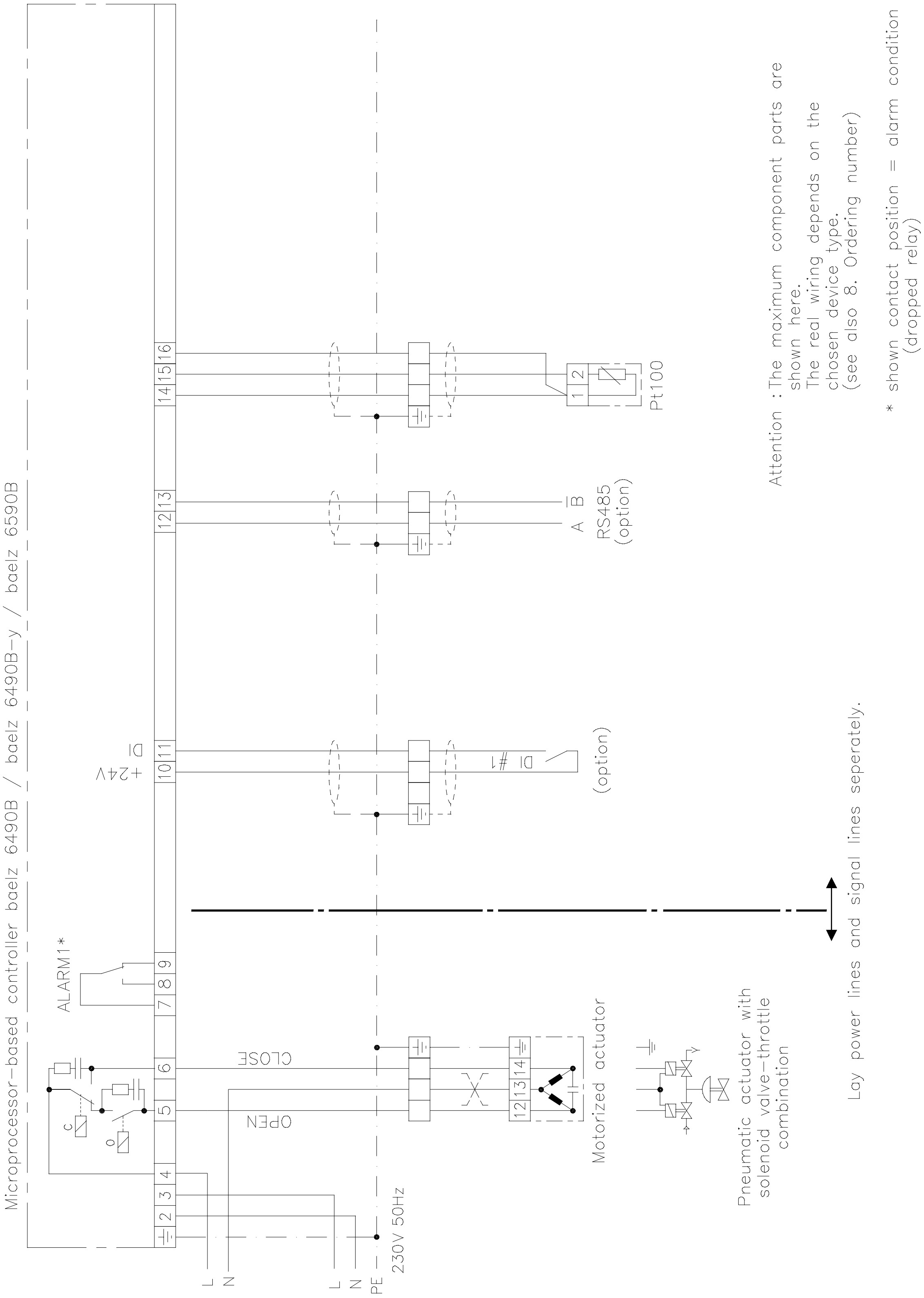
The wiring diagram is located on the backplane (6490B / 6490B-y) and on the top side (6590B) of the device respectively.
The plug-type terminals are located on the backplane of all devices.

⚠ The given national rules must be observed for installation (for Germany DIN VDE 0100).
The electrical connection has to conform to the connection diagram of the device.
For measurement and control leads (digital inputs) shielded cables must be used. Also in the switch cabinet these leads must be installed separately from the power systems with rated voltage.
Before the device is switched on make absolutely sure that the operating voltage, specified on the rating plate, conforms to the mains voltage.
The connecting terminals may only be disconnected from the device when the connected lines are in a de-energized state.



Wiring diagram 6490B, 6490B-y and 6590B

5.1 Wiring diagram



6. Commissioning

Procedure:	Remedy in case of malfunctions:
☐ Unit properly installed ?	See 4. Mounting
☐ Electrical connection according to valid regulations and connection diagrams ?	See 5. Electrical connection
☐ Switch on mains voltage. When the unit is switched on, all display elements on the front plate light up for approx. 2 sec. (lamp test). Then the unit is ready for operation.	Compare operating voltage (indicated on the type plate) with mains voltage
☐ Switch over to manual mode.	See 2.2 Opening/closing the actuator in manual mode
• Does the actual value display PV correspond to the process variable at the measuring location ?	Check sensor, measuring line and electrical connection. See 5. Electrical connection
• Actual value display PV is fluctuating/jumping ?	Adjust measuring filter FIL. See 3.17 FIL Unit installed close to powerful electric or magnetic interference fields ?
• Connecting and setting *digital inputs	Check settings of the digital inputs (see 3.21-3.25) Check electrical connection (see 5.)
- Is the corresponding DI-state text displayed in the SP-display (e.g. "StOP", "CLOS", ...) ?	Check voltage supply for digital inputs, external switching contacts, signal lines and electrical connection. Consider the display priorities like explained in 2. Operating and setting.
• Open actuator - Heating controller: actual value PV rising ? - Cooling controller: actual value PV falling? • Close actuator - Heating controller: actual value PV falling ? - Cooling controller: actual value PV rising ?	See 2.2 Opening/closing the actuator in manual mode No response Check actuator and electrical connection controller ↔ actuator reverse response Change the actuator control OPEN and CLOSE See 5.1 Wiring diagram
• Is the bargraph rising while the actuator opens ? * - bargraph is not rising - all bargraph LEDs stay dark ?	See 3.28 Y.SY, Y.SY; has to be 0...3 to activate the bargraph
☐ Enter actuating time of connected actuator	See 3.6 Actuating time t.P
☐ Set controller parameters using optimisation	See 3.1 Optimisation for automatic determination of favourable control parameters OPt
☐ Automatic mode	
• Manual/automatic switch over	See 2.2 Opening/closing the actuator in manual mode
• Set setpoint SP	See 2.1 Setting setpoint in automatic mode
☐ Controller actuating pulses are too short, switching rate is too high ?	Adjust dead band db See 3.5 dead band

* Option / depending on type of device

7. Technical data

Line voltage	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 at	
- operation	0°C to 50ºC
- transport and storage	-25ºC to + 65ºC
Degree of protection	Front IP 65 according to DIN 40050
Design	For control panel installation 96 x 96 x 135 mm at 6490B, 6490B-y and 48 x 96 x 140 mm at 6590B (W x H x D)
Installation position	arbitrary
DI-feed voltage	24 V DC, Imax. = 20 mA
Analog inputs	Pt100, 2.4 = 0°C to 300°C or 2.2 = 0°C to 400°C Connection in three-wire system
Measuring accuracy	0.1% of the measuring range
Digital inputs	high active, low = n.c. / 0 V DC high = 15 V to 24 V DC
Displays	Two 4-digit 7 segment displays, LED red, character height (6490B, 6490B-y) = 13mm, character height (6590B) = 10mm
Alarm	Alarm types A, B, C (operation on the base of the idle current principle)
Relay	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 bit
Data protection	Semiconductor memory

8. Ordering number baelz 6490B / 6490B-y / baelz 6590B

```
Examples : 6490B   / 0 - 2.4 - 230 - 00.0
           6490B-y / 1 - 2.2 - 115 - 00.0
           6590B   / 4 - 2.4 -  24 - 00.0
```

baelz µCelsitron ______ / __ - ____ - ____ - ____

Type (see type-table)
6490B / 6490B-y / 6590B

Version (see type-table)
../0 **../1** **../3** **../4**
../4-i (only at 6590B)

Pt100-measuring range
0°C...300°C **2.4**
0°C...400°C **2.2**

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

special model
none **00.0**
prospectively special models **SX.X**

Device-type \ Equipment	Front panel housing 96 x 96	Front panel housing 96 x 48	Rail-mounting	Degree of protection Front IP 65	Without front keyboard, without LED-display	Bargraph for manipulated variable Y	PI(D) three-position step controller	Number of selectable analog inputs	Pt100, 3-wire-connection	DI-supply voltage	Number of digital inputs	Second setpoint SP.2 via digital input (DI)	OPEN command via digital input (DI)	CLOSE command via digital input (DI)	STOP command via digital input (DI)	Number of alarm relays	RS 485 interface (modbus, RTU-mode)	Standard temp. range 2.4, 0°C...300°C with 0.1% accuracy	Alternative temp. range 2.2, 0°C...400°C with 0.1% accuracy	Scalable linear input
6490B/0	■			■			■	1	■							1		■	■	■
6490B/1	■			■			■	1	■	■	1	S	S	S	S	1		■	■	■
6490B/3	■			■			■	1	■							1	■	■	■	■
6490B/4	■			■			■	1	■	■	1	S	S	S	S	1	■	■	■	■
6490B-y/0	■			■		■	■	1	■							1		■	■	■
6490B-y/1	■			■		■	■	1	■	■	1	S	S	S	S	1		■	■	■
6490B-y/3	■			■		■	■	1	■							1	■	■	■	■
6490B-y/4	■			■		■	■	1	■	■	1	S	S	S	S	1	■	■	■	■
6590B/0		■		■			■	1	■							1		■	■	■
6590B/1		■		■			■	1	■	■	1	S	S	S	S	1		■	■	■
6590B/3		■		■			■	1	■							1	■	■	■	■
6590B/4		■		■			■	1	■	■	1	S	S	S	S	1	■	■	■	■
6590B/4-i		■	■		■		■	1	■	■	1	S	S	S	S	1	■	■	■	■

■ = Feature/function present.

☐ = Feature/function not present.

1 = Feature/function present, with quantity.

S = Selectable by **S**oftware (which digital input will be assigned to which function). Selection not available in some controller modes.

9. Overview of configuration level, data list

Configuration point	Display	Setting		Remarks
Optimisation	OPt	0		No optimisation
		1		Optimisation active
Proportional band	Pb			1.0% to 999.9%
Three-position controller	Pb =	0	☐	tn > 0; db = dead band
Integral action time	tn			1s to 2600s
Two-position controller	tn =	0	☐	db conforms to switching hysteresis
Derivative action time	td			1s to 255s; PI-control at td = 0
Dead band	db			0 to 10th part of the scope of the measuring range [phys. units] 0 to + scope of the measuring range [phys. units] at dP = 3
Valve actuating time	t.P			5s to 300s
Alarm 1	AL.1	0	☐	No alarm, also not in case of sensor failure
		1	☐	Alarm A, depending on the setpoint, also in case of sensor failure
		2	☐	Alarm B, fixed limit value, also in case of sensor failure
		3	☐	Alarm C, band transgression around the setpoint, also in case of sensor failure
		4	☐	Alarm B, fixed limit value, alarm at under-temperature, also in case of sensor failure
Alarm 1, type A (at AL.1=1)	A1.A			0 to ± scope of measuring range [phys. unit]
Alarm 1, type B (at AL.1=2/4)	A1.b			measuring range: dI.L to dI.H [phys. unit]
Hysteresis for A1.A/A1.b	HY.1			0 to 10th part of the scope of the measuring range [phys. units] 0 to + scope of the measuring range [phys. units]at dP = 3
Alarm 1, type C lower limit (at AL.1=3)	A1.C			0 to - scope the of measuring range [phys. unit]
Hysteresis, lower limit for A1.C	HY.1			0 to 10th part of the scope of the measuring range [phys. units] 0 to + scope of the measuring range [phys. units]at dP = 3
Alarm 1, type C upper limit (at AL.1=3)	A1.C.			0 to + scope of the measuring range [phys. unit]
Hysteresis, upper limit for A1.C	HY.1.			0 to 10th part of the scope of the measuring range [phys. units] 0 to + scope of the measuring range [phys. units]at dP = 3
Decimal point	dP	0	☐	Display without decimal point e.g. 1234
		1	☐	Display with 1 decimal e.g. 123.4
		2	☐	Display with 2 decimals e.g. 12.34
		3	☐	Display with 3 decimals e.g. 1.234
Scaling low	dI.L			Displayed value at start of scale, -999 to dI.H-1 [phys. unit]
Scaling high	dI.H			Displayed value at full scale, dI.L+1 to 9999 [phys. unit]
Setpoint limiting low	SP.L			usually dI.L to SP.H [phys. unit] SP.L = SP.H: fixed setpoint } not valid for SP.2
Setpoint limiting high	SP.H			usually SP.L to dI.H [phys. unit] SP.L > SP.H: two setpoints } not valid for SP.2
Second setpoint *	SP.2			dI.L to dI.H [phys. unit], switch over via digital input SP.2
Setpoint ramp	SP.r			0 to scope of measuring range [phys. unit (°C) per min/hour]
Ramp direction, time unit	rA.d	0	☐	phys. unit/min, rising and falling setpoint ramp
		1	☐	phys. unit/min, only rising setpoint ramp
		2	☐	phys. unit/min, only falling setpoint ramp
		3	☐	Ramp deactivated (similar to SP.r = 0)
		4	☐	phys. unit/hour, rising and falling setpoint ramp
		5	☐	phys. unit/hour, only rising setpoint ramp
		6	☐	phys. unit/hour, only falling setpoint ramp

* option

Configuration point	Display	Setting		Remarks
Delta setpoint	dSP	[ ]		0 to ± scope of measuring range [phys. unit]
Process gain	P.G	[ ]		1% to 255%
Measured value filter	FIL	[ ]		0 to 255, complies with 0ms to 10s
Sensor break PV	SE.b	0	☐	Actuator closes [1]
		1	☐	Actuator opens [1]
		2	☐	Actuator persists in its current position [1]
				[1] only in automatic mode
Manual/automatic switch over	MAn	0	☐	Switch over via front keyboard
		1	☐	Interlocking in the current status “automatic“
			☐	Interlocking in the current status “manual“
Direction of effect of controller	dIr	0	☐	Heating controller
		1	☐	Cooling controller
Assign a function to the digital input		0 to 5 *		Defining the number of the digital input. 0 = inactive
Second setpoint	S2.d	[ ]		
OPEN	OP.d	[ ]		
CLOSE	CL.d	[ ]		
STOP	St.d	[ ]		
Calibration correction	C.CO	[ ]		0 to ± scope of measuring range [phys. unit]
Y-synchronization	Y.SY	0	☐	- Y-bargraph is displayed - actuator closes for the time of the valve actuating time - internal Y-position = 0% - actual Y-position is not saved in case of a mains failure
		1	☐	- Y-bargraph is displayed - actuator does not close for the time of the valve actuating time at mains recov. - internal Y-position = 0% - actual Y-position is not saved in case of a mains failure
		2	☐	- Y-bargraph is displayed - actuator does not close for the time of the valve actuating time at mains recov. - actual Y-position is saved in case of a mains failure - lastest saved Y-position is displayed at mains recovery
		3	☐	- Y-bargraph is displayed - actuator does not close for the time of the valve actuating time at mains recov. - actual Y-position is not saved in case of a mains failure - latest saved Y-position is displayed at mains recovery
		4	☐	- Y-bargraph is not displayed, synchronization like at Y.SY = 0
		5	☐	- Y-bargraph is not displayed, synchronization like at Y.SY = 1
		6	☐	- Y-bargraph is not displayed, synchronization like at Y.SY = 2
		7	☐	- Y-bargraph is not displayed, synchronization like at Y.SY = 3
Baud rate *	bd	0	☐	19200 baud
		1	☐	9600 baud
		2	☐	4800 baud
		3	☐	2400 baud
Address *	Adr	1 to 247 [ ]		Slave address at bus mode Address
Serial communication *	S.C	0	☐	Operation of the controller via front keyboard and modbus-master is possible
		1	☐	Operation of the controller is only possible via modbus-master except configuration point S.C

* option

Configuration point	Display	Setting		Remarks
Second operating level	OL.2	0	☐	No second operating level
		1	☐	Optimisation
		2	☐	Alarm functions and their hysteresis
		4	☐	Reserved, no function yet
		8	☐	Second setpoint SP.2*
		16	☐	Setpoint ramp SP.r
		[ ]		Result of added index numbers
Password	PAS	0	☐	No interlocking, OL.2 inactive
		1	☐	Access only after entry via password. OL.2 active, functions on OL.2 not interlocked
		1500		Code

* option

Notices :