SCHNEID

Boiler House Controller
for standard facilities

Modern Life - Modern Solutions

General Documentation

SCHNEID GesmbH

www.schneid.at

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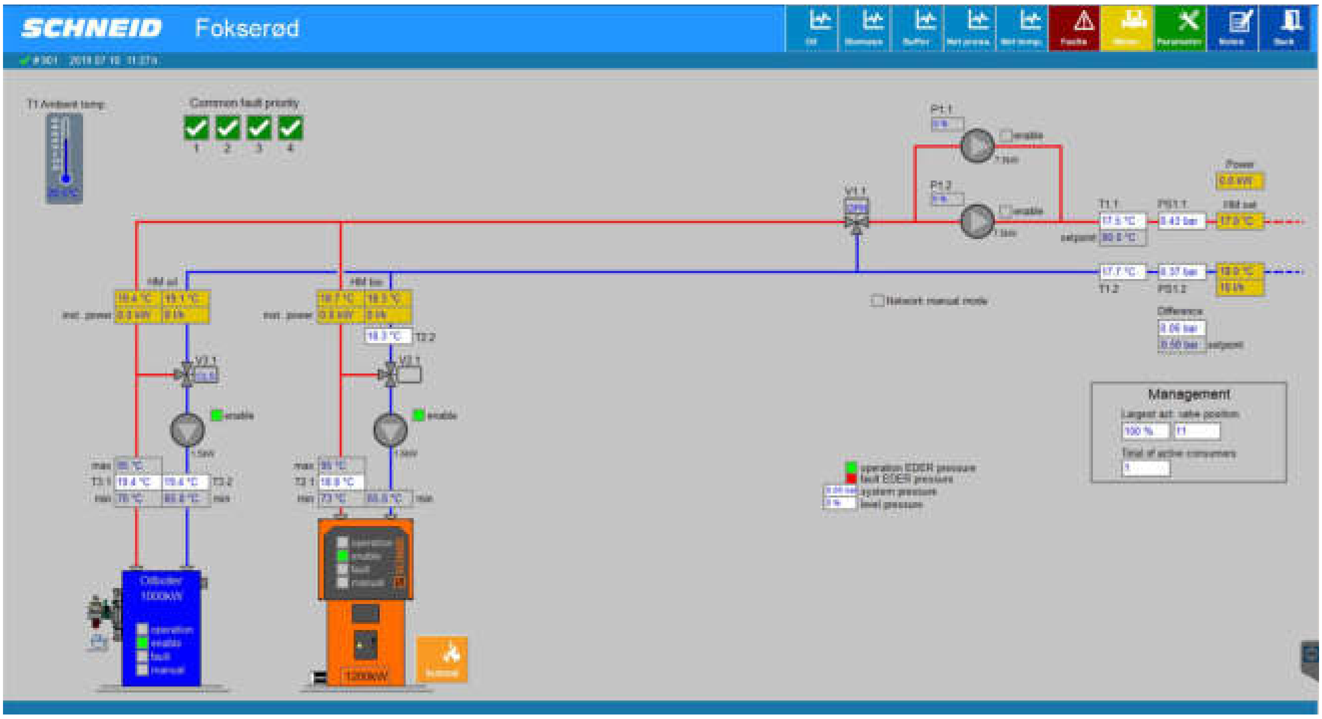
Introduction

This documentation describes all standard functions of a central heating system, which is equipped with ***SCHNEID*** control and control technology.

The control of a central heating system consists essentially of 5 main groups:

1. Control of the outlet temperature (flow temperature)
2. Control of pressure and flow
3. Control and regulation of all producers
4. Buffer management
5. Standby boiler circuit



Did you know that ...

a large part of the functions described here were developed back in the 1990s and have therefore been providing energy efficiency for hundreds of systems for more than 20 years.

Contents

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Parameter overview

The parameter overview can be opened by clicking on the parameter button.

On this page, there is a table for each SCHNEID PLC with the links to the individual detail pages.

The overview is divided into several groups:

- Detail pages of the o.g. main groups
  see respective chapter

- basic settings
  Contains all service settings of the PLC

  ⚠ The adjustment of these parameters should be done by control personnel or in the presence of control personnel, since an incorrect setting can lead to data loss!

- Inputs and outputs
  Shows all digital and analog inputs and outputs of the PLC

- additional modules
  Shows all I / O add-on modules, that communicate via the internal BUS

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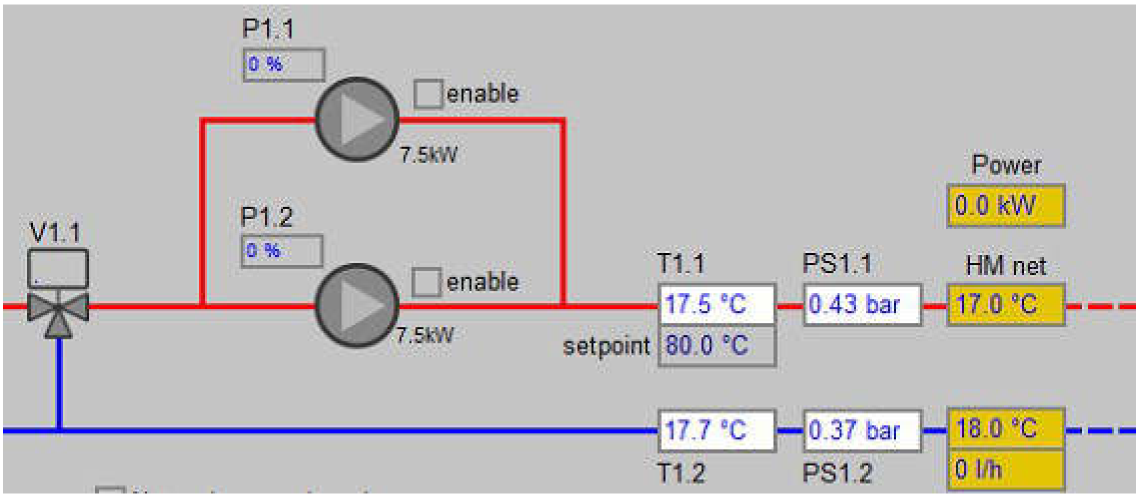
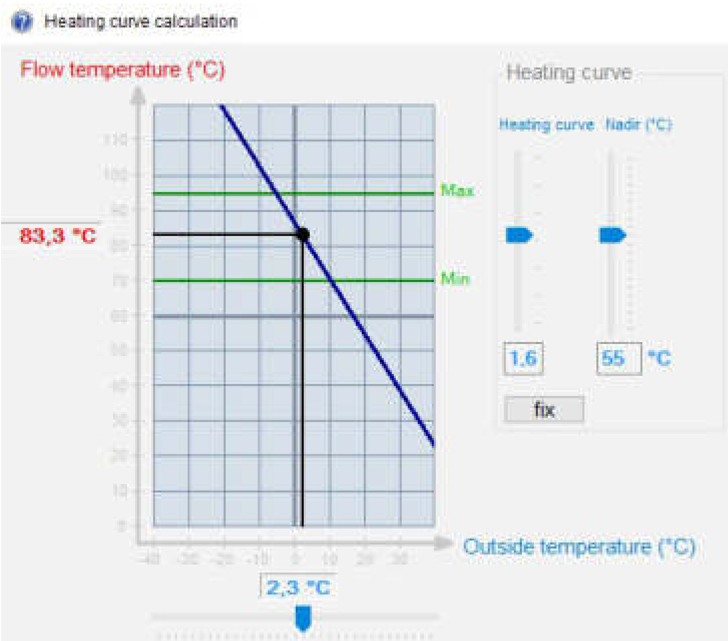
1 Control of the outlet temperature (flow temperature)

1.1 General description

The outlet temperature of the heating system is controlled by a mixing valve (mains mixer), which admixes the cold water from the return flow of the district heating network to the flow temperature.
The mixing valve can be controlled via an analogue signal (0-10V) or via 3-point control via 2 relays (OPEN / CLOSE)!

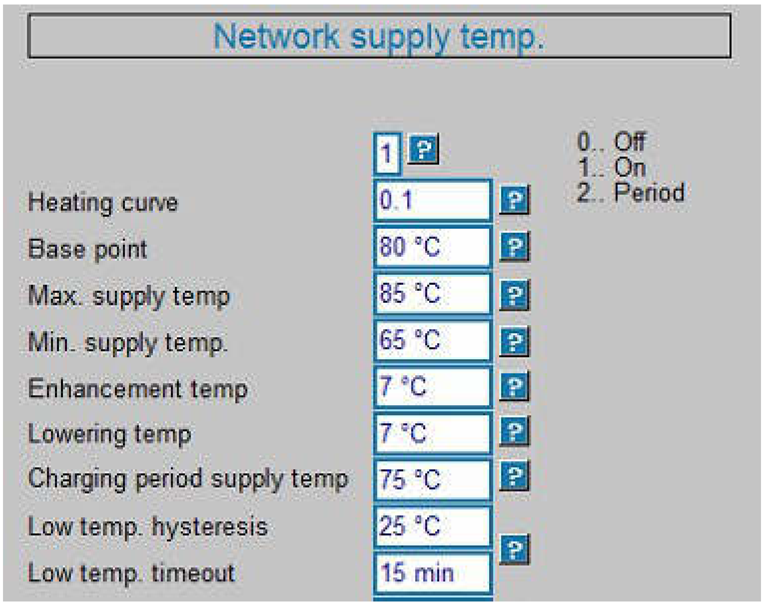


1.2 Calculation of the set flow temperature (heating curve)



The set flow temperature is calculated by a heating curve as a function of the outside temperature.

1.3 Parameter main supply temperature



1.3.1 Operating mode network

This parameter is used to select the operating mode of the entire heating system.
(0) Mains control is deactivated (set flow temperature = -33 ° C)
(1) Network control is active
(2) Network control is only active within the set charging periods *(see 1.4 Parameter periods)*

1.3.2 Heating curve

This parameter indicates the negative slope of the heating curve. Together with the foot point results in a scheme that is adapted to the outside temperature.
Increasing the value causes the setpoint to increase rapidly as the outside temperature drops.

1.3.3 Base point

The base point shifts the heating curve up or down in parallel. The set value applies to an outside temperature of 20 ° C. Increasing the value causes a fixed increase of the setpoint at all outside temperatures.

1.3.4 Max. and Min. flow temperature

These parameters limit the exit temperature up and down regardless of the result of the heating curve or the decrease and increase periods. A fixed setpoint can be achieved by setting both limits to the same value.

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1.3.5 Increase- and decrease temperature

The target flow temperature is increased or decreased by this hysteresis within the active increase and decrease periods.

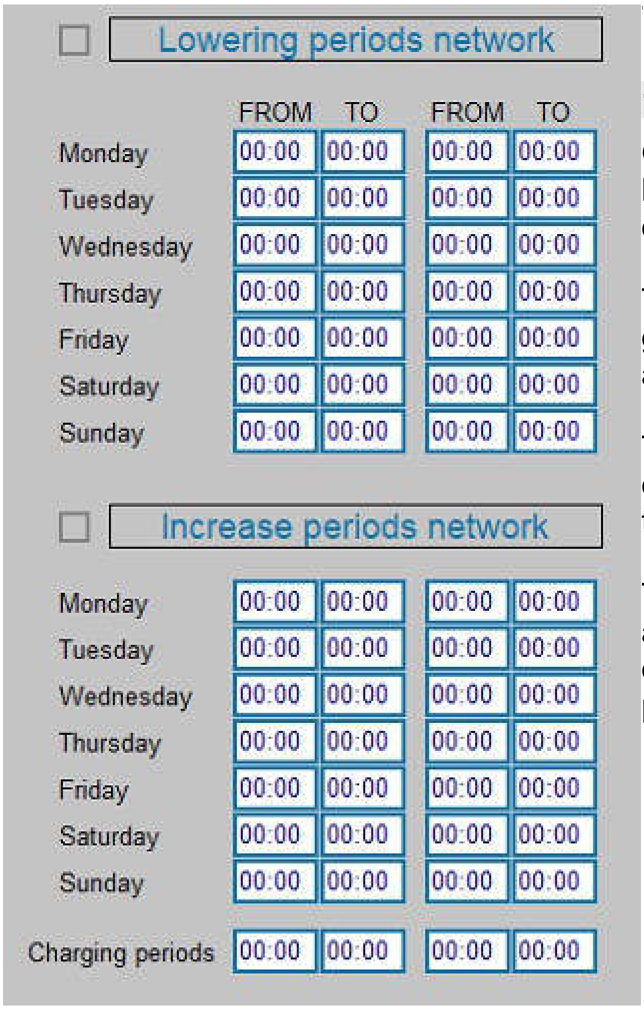
1.3.6 Flow temperature in the loading periode

The set flow temperature is set to this fixed value regardless of the outside temperature when the charging period is active.

1.3.7 Network low temperature fault

A fault is generated, if the outlet temperature deviates ***continuously*** from the setpoint by the set hysteresis for the specified time. This acknowledges automatically as soon as the setpoint has been reached again!

1.4 Parameter – time periods



1.4.1 Configuration of the periods

Over these periods, the supply to the district heating network can be adapted to the actual or forecast consumption of the customers.

The LED display on the left shows at a glance whether one of the periods is currently active.

The set flow temperature is increased or decreased by an adjustable hysteresis within the active increase and decrease periods.

The set flow temperature is set to an adjustable fixed value regardless of the outside temperature when the charging period is active.

1.4.2 Example periods

The example shown here causes the following behavior:

From Monday to Friday, the outdoor temperature-dependent setpoint will be reduced by 5 ° C during the daytime from 10:30 to 12:15, as well as from 22:30 at night to the following day at 04:00. A period can be deactivated by setting VON and BIS to the same value! Due to the adjustment from 00:00 o'clock to 00:00 o'clock therefore no lowering takes place between Saturday 04:00 o'clock and Monday 10:30 o'clock!

During the peak hours, the set point is increased by 3 ° C between 05:30 and 09:00, as well as 18:00 and 21:00 during the day.

In this example, there are also large customers or companies in the district heating network, which require a secondary flow temperature of 88 ° C at the start of work. For this reason, the setpoint of the outlet temperature is set daily between 06:30 o'clock and 08:00 o'clock independent of the outside temperature on 95 ° C!

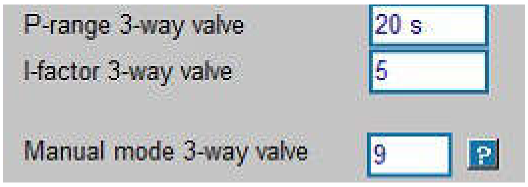
The loading period is also valid on weekends!

The setpoint will never be lower than 75 ° C or higher than 95 ° C, regardless of the current outdoor temperature or summer and winter time!

1.5 Parameter – Mixing valve (network mixer)

The mixing valve can be controlled via an analog signal (0-10V) or via 3-point control via 2 relays (OPEN / CLOSE)!

1.5.1 Sliding (0-10V)



1.5.1.1 Manual operation

By entering a valve position of 0-100%, the valve can be controlled to a fixed position. If 101% is entered, the automatic control mode applies to the setpoint temperature.

The control is carried out by a PI controller → control by 0-100%!

1.5.1.2 P-Area

This parameter influences the aggressiveness of the valve control → increasing the value causes a slower control behavior.

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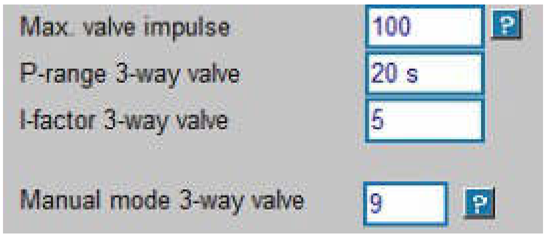
1.5.1.3 I-Factor

This parameter influences the aggressiveness of the valve control → increasing the value leads to a more aggressive control behavior.
The adjustment of P-range and I-factor should be done by control personnel or in the presence of control personnel, since a faulty setting can cause large fluctuations and influence the optimization!

1.5.2 3-point regulation



1.5.2.1 Manual operation

The mixing valve can be opened by entering 1, closed by entering 2, or stopped by entering 0 in the current position. If you enter 9, the automatic control mode applies.
<u>The control is carried out by a PD controller → clocking the digital outputs (relay).</u>

1.5.2.2 Timer

The timer indicates how often the calculation is to be carried out for a correction of the valve position → the lengthening of the pause time causes a sluggish behavior!
Ideally, the outlet temperature temperature sensor is located directly after the mixing valve so that changing the valve position has a direct effect on the temperature.
The longer it takes for the temperature mixed from flow and return to reach the set point, the longer the response time of the PD controller should be set.
If the operation has been optimized by this parameter, it should be adjusted when changing between summer and winter operation.

1.5.2.3 I-Factor

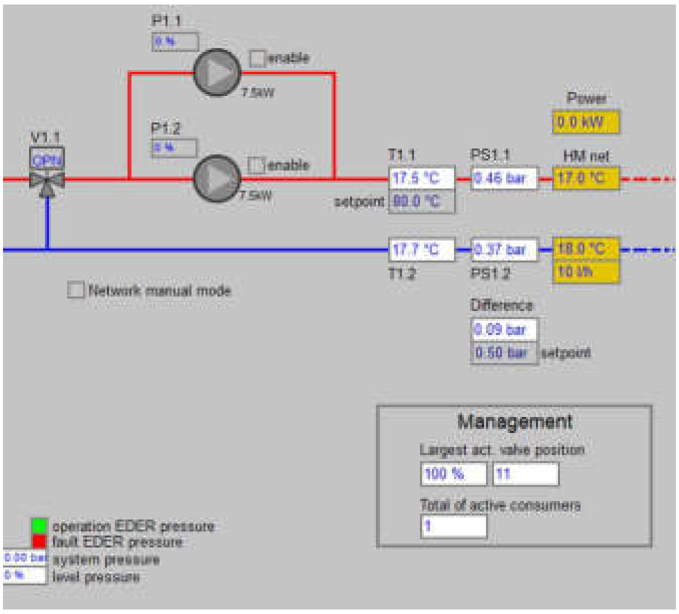
This parameter influences the aggressiveness of the valve control → increasing the value leads to a more aggressive control behavior.

1.5.2.4 Max. Impuls

Specifies the maximum duration of an on- or off-pulse for the network mixer → increasing the value will result in more aggressive control behavior.
The adjustment of these parameters should be carried out by control personnel or in the presence of control personnel, as a faulty setting can cause strong fluctuations and influence the optimization!
The appropriate default settings for summer and winter operation can be found in the help text of the question mark next to the parameter.

2 Regulation of pressure

2.1 General description



- ➔ The energy transport into the district heating network is made by the network pumps, whose speed is regulated depending on the current energy demand of all consumers.
- ➔ Depending on the design, the network pumps are logically rearranged due to load levels, faults or protective mechanisms.
- ➔ The current flow as well as the differential pressure at the outlet of the heating system serve as reference values for the current energy requirement!
- ➔ The speed control of the network pumps can be done in two different ways. The control of the ***differential pressure*** at the outlet of the heating system is the most common variant, the setpoint being calculated by the set pipe network characteristic as a function of the current flow.
- ➔ In this control mode, the efficiency of ***SCHNEID Valve and Pump Management*** can be significantly increased by correcting the calculated desired differential pressure up or down based on the highest valve position in the district heating network. With valve and pump management, the control system is even better adapted to the actual needs, which usually results in a huge increase in efficiency and electricity savings.
- ➔ The second variant is a ***low-point control***, which regulates the pumps to the lowest pressure in the district heating network.

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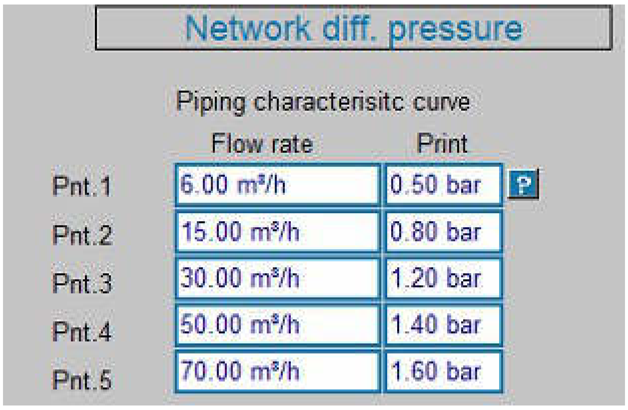
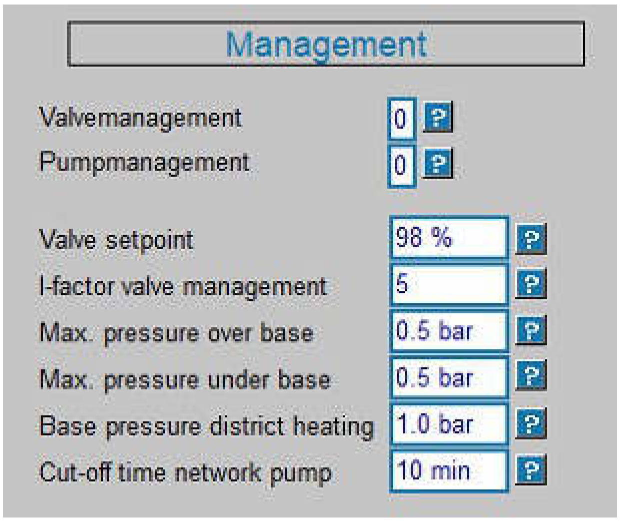
2.2 Parameter Pipe network characteristic



Depending on the current flow rate, the pipe network characteristic curve calculates the differential pressure at the outlet of the heating system in order to supply all consumers with sufficient power. When the energy demand increases and the primary valves of the consumers open, the flow increases immediately, while the network pressure decreases due to the pressure losses across the heat exchangers.
The set point is calculated between the 5 points, where the value of point 1 is the minimum value and the value of point 5 is the maximum value.

2.3 Parameter – Valve and pump management



If the network pumps regulate the differential pressure at the outlet of the heating system, the control can be optimized by activating the ***valve and pump management***. In this case, the visualization determines the number of transfer stations with active energy demand, as well as the transfer station at which the valve is opened the furthest.

⚠ Prerequisite for this functionality is a complete and consistent data acquisition of all consumers or transfer stations in the district heating network as well as the PLC of the heating system!

2.3.1 SCHNEID-Pump management

This feature completely disables energy production and distribution on hot summer days, saving power and other resources.

2.3.1.1 Pump management

If this option is activated, the network pumps will be taken out of operation, if all transfer stations are inactive and there is no energy requirement!

2.3.1.2 Caster pump

The pumps remain in operation for the set overrun time after the switch-off condition has occurred.

2.3.2 SCHNEID-valve management

If this option has been activated, the calculated target differential pressure is corrected upwards or downwards due to the highest valve position in the district heating network.

2.3.2.1 Valve position

The setpoint is slowly increased when the highest valve position in the network is greater than this limit. If the value is undershot, the setpoint is reduced again!

2.3.2.2 I-Factor

This parameter influences the aggressiveness or the influence of the function → increasing the value causes a faster change of the setpoint.

2.3.2.3 Max. Pressure above and below base

The maximum correction of the pipe network characteristic can be set by these two hystereses.

2.3.2.4 Basic pressure (district heating management)

Base pressure from which is increased or decreased.

2.4 Parameter - Bad point control

If all control devices of the transfer stations are recorded on the cutting visualization, the operating personnel can use special tools to evaluate which transfer station or which sub-line is supplied with the least energy.
For a bad point control, a pressure sensor must be installed at exactly this station, which is forwarded via the visualization to the PLC of the heating center.
By activating the bad point control in the heating system, the mains pumps no longer regulate the pressure at the outlet of the heating system, but try to keep the negative pressure at the setpoint.
The network pumps then only push as much energy into the network as is absolutely necessary to supply all consumers with sufficient power!

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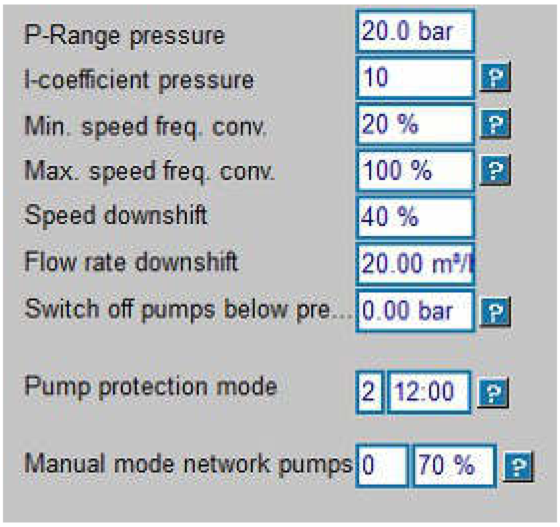
This operating mode significantly improves the performance of the pumps and thus the power consumption!

Prerequisite for this functionality is a complete and consistent data acquisition of all consumers or transfer stations in the district heating network as well as the PLC of the heating system!

2.5 Parameter – Pumps



2.5.1 Manual operation

Basically, a manual operation is provided for each possible operating mode or combination of all pumps. It can be selected whether the speed is calculated automatically, or fixed by hand.

2.5.2 Speed control

The control is carried out by a PI controller → control by 0-100%!

2.5.2.1 P-Area

This parameter influences the aggressiveness of the pressure control → increasing the value causes a slower control behavior.

2.5.2.2 I-Factor

This parameter influences the aggressiveness of the pressure control → increasing the value leads to a more aggressive control behavior.

The adjustment of P-range and I-factor should be done by control personnel or in the presence of control personnel, since a faulty setting can cause large fluctuations and influence the optimization!

2.5.2.3 Min. and Max. pump speed

These parameters limit the speed in automatic control mode down and up.

2.5.3 Load level control

If there is more than one pump, the pumps are switched in several load stages due to the current requirement. The parallel operation of two or more pumps is only possible if the said pumps have the same electrical power!

A common example would be
Load level 1 → summer pump ON, winter pumps OFF
Load level 2 → Summer pump OFF, a winter pump ON
Load level 3 → summer pump OFF, two winter pumps ON

The calculated speed always applies to all pumps equally! Even if the speed of all pumps is controlled by a separate analogue signal.
The load level is increased as soon as the speed of the currently active pump (s) is continuously at the set maximum speed for 2 minutes!

2.5.3.1 Downshift speed and flow

The load level is reduced as soon as the speed of the currently active pump (s) is continuously below the downshift speed for 2 minutes or the flow at the heating unit outlet is continuously below the return flow rate!

2.5.4 Pump protection

In order to operate the pumps in the best possible way there are various protection mechanisms!

2.5.4.1 Min. absolute pressure network OFF

The mains pumps are deactivated when the supply pressure drops below this value.

2.5.4.2 Pumps protection function / Weekly reordering

The pump series is important if two or more mains pumps are available. On the entered day is in each case to the next pump, or at the same time running to the next pump group lined up.
The first parameter specifies the day on which the reordering takes place. This parameter is set with the number 1 to 7, which corresponds to the weekdays Monday to Sunday. The second parameter specifies the time at which the reordering should take place on the selected day of the week.

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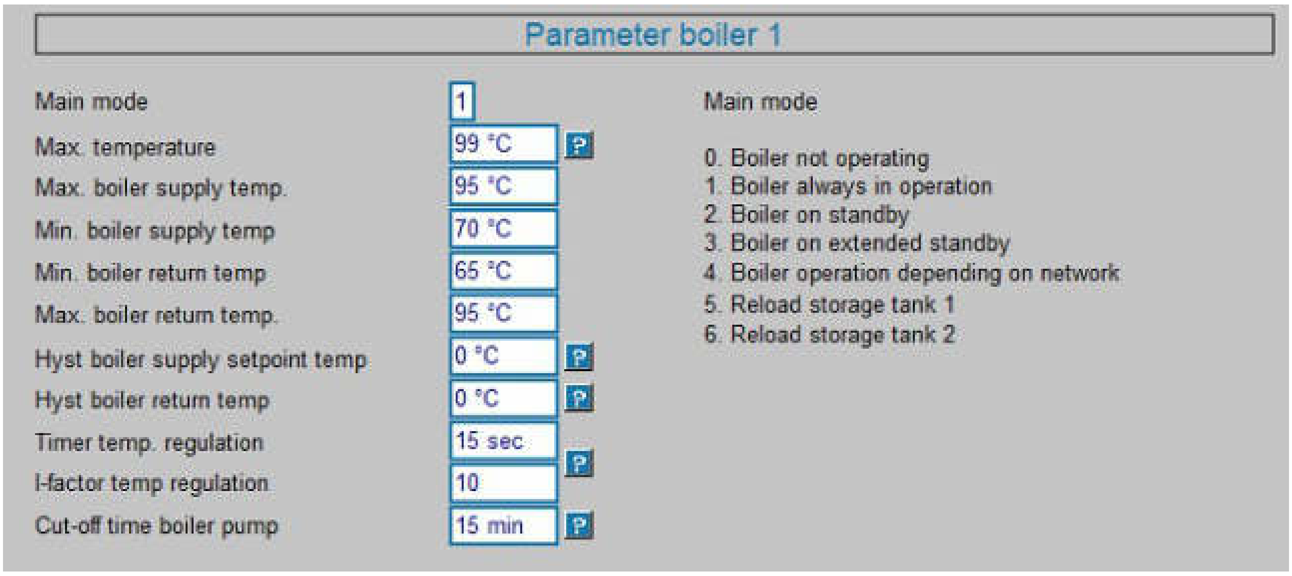
3 Control and regulation of all producers



3.1 Boiler release

Basically, a distinction is made as to whether a generator is operated as a base load or peak load or failure reserve.
The following operating modes are available to producers:

3.1.1 Boiler out of service / boiler always in operation

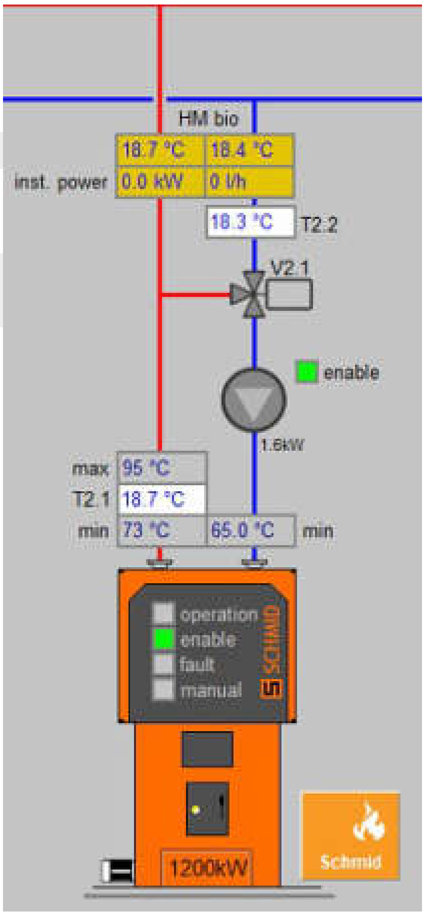
The boiler is permanently in operation or deactivated!

3.1.2 Boiler in standby mode / Boiler in extended standby mode

The boiler is put into operation when the flow temperature at the outlet of the heating system falls below the setpoint for an adjustable time by an adjustable hysteresis (= standby level 1). The boiler release stands for an adjustable minimum running time and goes out as soon as the flow temperature reaches a minimum value.

If the set flow temperature has still not been reached after the switch-on time has elapsed, the timer will start running again. If the setpoint for this time continues to fall below continuously, is increased to Standbystufe 2.

Boilers in extended standby mode are only put into operation at standby level 2!



3.1.3 Boiler only in operation when mains is in operation

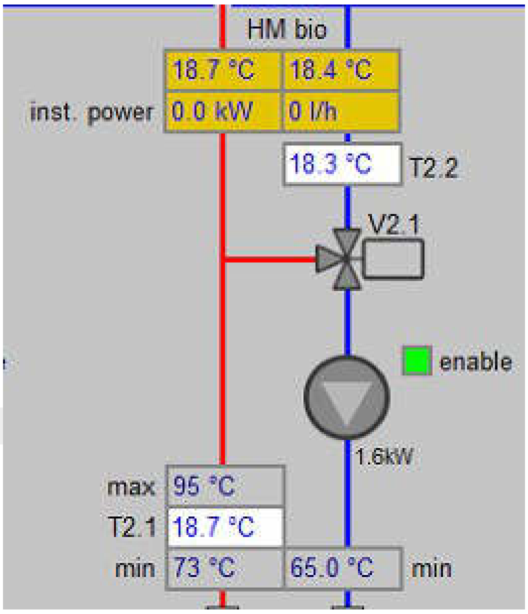
The release of the boiler is always active when the set flow temperature at the heating system outlet is above 0 ° C.

3.1.4 Boiler in buffer recharge mode 1/2

This option is only available if a buffer is present!
Boiler release occurs when a buffer sensor drops below a certain temperature and goes out when another buffer sensor exceeds a set temperature. The sensors as well as temperatures are separately adjustable for Modbus 1 and 2 (for details see buffer management).

3.2 Boiler circuit control

In most cases, the boiler pump as well as the mixing valve in the boiler circuit are controlled by the SCHNEID PLC. Depending on whether the power or the outlet temperature is regulated, there are different variants of the control.



If the temperature and power control is carried out by the boiler itself, the external control is usually given the required power and / or the temperature by 0-10V signal.

3.2.1 Setpoints and temperatures

Essentially, each boiler has 3 set temperatures:

3.2.1.1 Maximum boiler flow temperature (overtemperature)

The mixing valve opens if the boiler overheats and the flow temperature rises above this limit.

3.2.1.2 Minimum boiler flow temperature

To prevent the boiler pumps from feeding cold water when the boiler is started, the mixing valve is not opened until the flow temperature exceeds this minimum value.

3.2.1.3 Minimum boiler return temperature

The desired outlet temperature of the boiler is usually set on the boiler control itself, the power of the boiler is then controlled so that this value can be maintained. The colder the return temperature that is fed to the boiler, the higher its output power. Accordingly, the boiler output can also be regulated without specification of 0-100% by setting the minimum boiler return temperature e.g. corrected upwards and downwards depending on the state of charge of the buffer. The temperature set here is the absolute minimum and the output value for the return temperature increase (see buffer management).

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3.2.1.4 Hysteresis boiler flow and return temperature

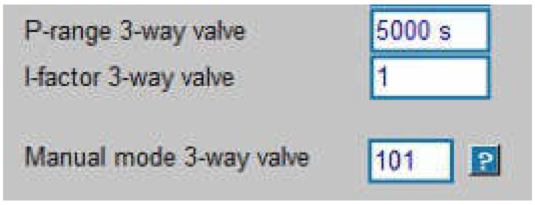
The flow hysteresis is added to the current set flow temperature at the outlet of the heating system and gives the setpoint for the outlet temperature at the boiler (only if the setpoint temperature is specified for the boiler via 0-10V signal).

The return hysteresis is added to the set minimum value.

3.2.2 Mixing valve

The mixing valve can be controlled via an analog signal (0-10V) or via 3-point control via 2 relays (OPEN / CLOSE)!

3.2.2.1 Sliding (0-10V)



3.2.2.1.1 Manual operation

By entering a valve position of 0-100%, the valve can be controlled to a fixed position. If 101% is entered, the automatic control mode applies to the setpoint temperatures.

<u>The control is carried out by a PI controller → control by 0-100%!</u>

3.2.2.1.2 P-Area

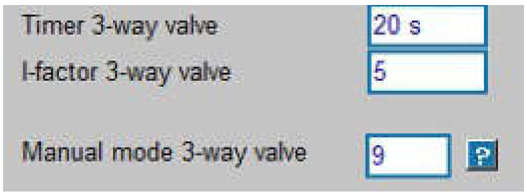
This parameter influences the aggressiveness of the valve control → increasing the value causes a slower control behavior.

3.2.2.1.3 I-Factor

This parameter influences the aggressiveness of the valve control → increasing the value leads to a more aggressive control behavior.

⚠ The adjustment of P-range and I-factor should be done by control personnel or in the presence of control personnel, since a faulty setting can cause large fluctuations and influence the optimization!

3.2.2.2 3-point regulation



3.2.2.2.1 Manual operation

The mixing valve can be opened by entering 1, closed by entering 2, or stopped by entering 0 in the current position. If you enter 9, the automatic control mode applies. This only applies if there are own hand parameters for the boiler pump. Details on manual operation can be found in the respective visualization.

<u>The control is carried out by a PD controller → clocking the digital outputs (relay).</u>

3.2.2.2.2 Timer

The timer indicates how often the calculation is to be carried out for a correction of the valve position → the lengthening of the pause time causes a sluggish behavior!
The longer it takes for the temperature mixed from flow and return to reach the set point, the longer the response time of the PD controller should be set.

3.2.2.2.3 I-Factor

This parameter influences the aggressiveness of the valve control → increasing the value leads to a more aggressive control behavior.

⚠ The adjustment of these parameters should be carried out by control personnel or in the presence of control personnel, as a faulty setting can cause strong fluctuations and influence the optimization!

3.2.3 Boiler pump

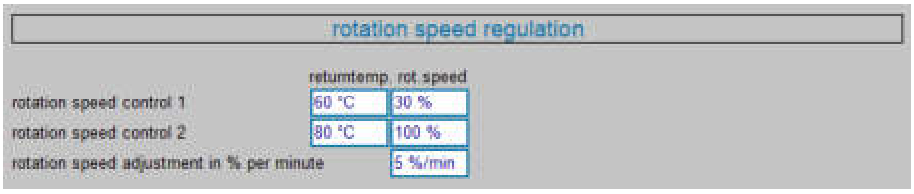
The boiler pump is started at the same time as the boiler and in any case remains in operation until the boiler is switched off and the release of the boiler is extinguished. In order to prevent the temperatures of the boiler from being too high when it is restarted, the boiler pump must remain in operation for an adjustable period after the operating message has expired.

⚠ Since base load boilers are usually very sluggish behavior, the follow-up time must be selected to be correspondingly high!

If the mixing valve is controlled in the same way or the speed of the boiler pump is regulated, there are separate manual parameters for the boiler pump. Details on manual operation can be found in the respective visualization.

3.2.3.1 Speed control boiler pump

In some cases, the speed of the boiler pump is regulated. The speed specification is usually done by defining a two-point curve as a function of the return temperature. The speed is calculated sliding between the two points.



3.2.4 Power specification via analogue signal

The power specification is defined by a two-point curve depending on the buffer charge state. The reference here is the difference between the buffer roll and buffer slice. The power is calculated sliding between the two points.

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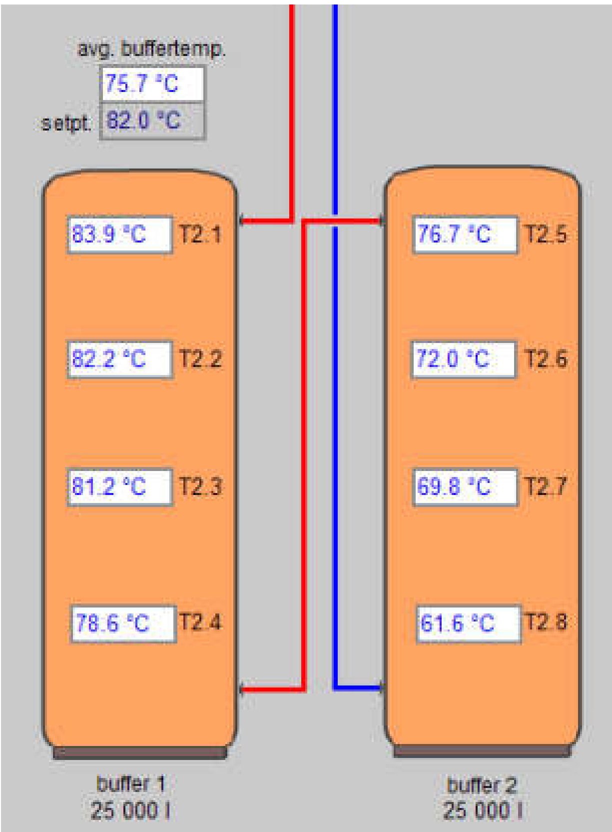
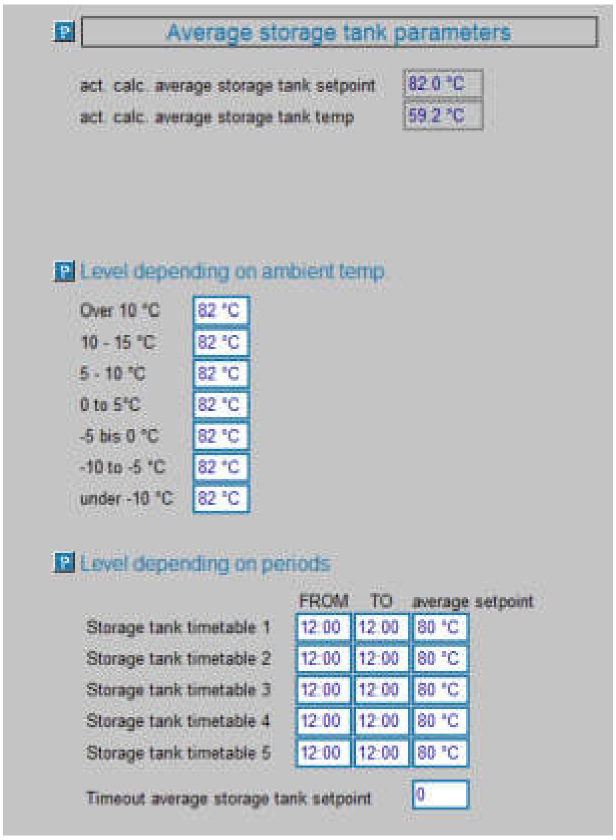
4 Buffer management

4.1 State of charge and temperatures

The buffer charge state is determined by its average temperature.





4.1.1 Buffer charging mode

When loading after buffer nominal cut (0), the desired target cut temperature is set. This is calculated as a function of the outside temperature, sliding between the 5 points.

For a loading according to buffer level (1), the buffer level (= buffer sensor) is specified at each point instead of the nominal cut, up to which the buffer is to be charged (see return increase after buffer charge state). By this option, a better stratification of the buffer memory can be effected in the e.g. is set that the upper 3 sensors should have about 85 ° C, while the setpoint for the lower 3 sensors is 60 ° C.

In addition, the set point can be increased or decreased on request at certain times.

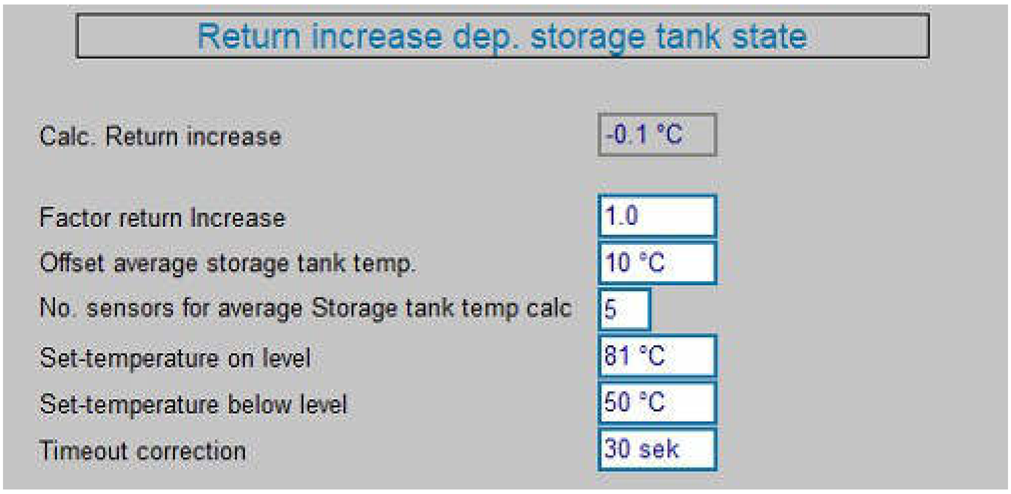
4.1.2 Timeout buffer roll cut

Since base load boilers usually have a very sluggish behavior, increasing and decreasing the target cut temperature is dampened by this factor.

4.2 Return lift after buffer charge

The power of the generators is regulated depending on the buffer charge state. In most cases we corrected the minimum return temperature up and down!

The return flow increase results from the difference between buffer setpoint and buffer section temperature.



4.2.1 Factor Return increase

This parameter defines how much the state of charge of the buffer should affect the output control of the generators.

The difference between the setpoint and the actual value of the buffer section is multiplied by this value and used for the return temperature increase. Increasing the value results in a more aggressive control behavior.

4.2.2 Offset Buffer actual average temperature

This offset is added to the buffer slice temperature before the difference is formed and multiplied by the factor.

Changing this value causes a linear change in the return lift. Increasing the value results in a permanent higher return lift and consequently lower boiler output.

4.2.3 Number of sensors for buffer section calculation

Here you set the number of buffer sensors to be included in the calculation of the mean value.

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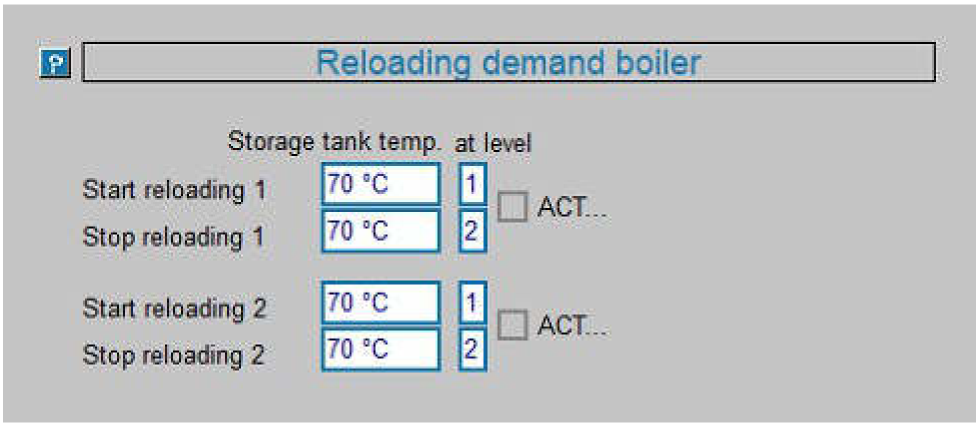
4.2.4 Timeout Buffer roll cut

Since base load boilers usually have a very sluggish behavior, increasing and decreasing the flyback correction is attenuated by this factor.

4.2.5 Setpoint temperature at and below buffer level

These parameters are only available if the buffer charging mode has been selected for loading by buffer level.

4.3 Buffer recharge mode



Boiler release occurs when a buffer sensor drops below a certain temperature and goes out when another buffer sensor exceeds a set temperature. In addition, the device is only switched on if the setpoint of the switch-off sensor has fallen below by at least 2 ° C. The sensors and temperatures are separately adjustable for Modbus 1 and 2.

5 Standby modus

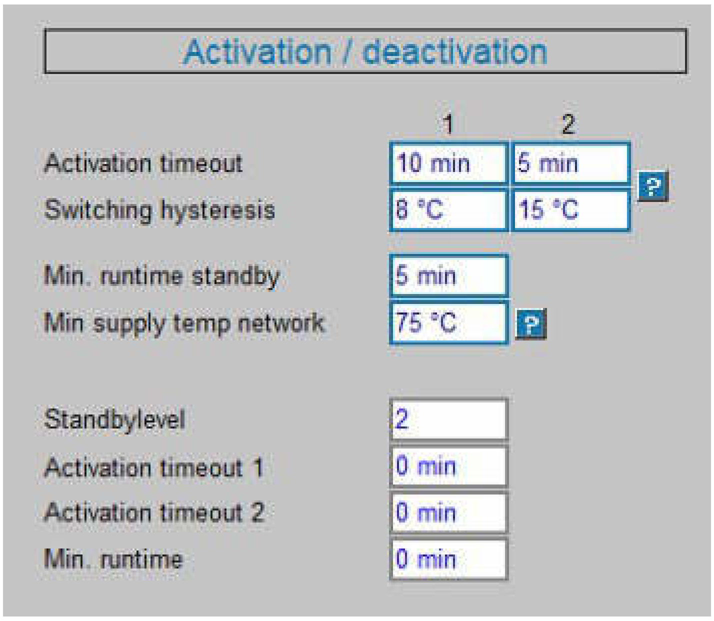
Standby mode 1 becomes active when the flow temperature at the outlet of the heating system falls below the setpoint value for an adjustable time by an adjustable hysteresis (= standby level 1).

If the set flow temperature has still not been reached after the switch-on time has elapsed, the timer will start running again. If the setpoint for this time continues to fall below continuously, is increased to Standbystufe 2.

The standby level is increased if condition (1) or condition (2) is true.

The release stands for an adjustable minimum running time and goes out as soon as the flow temperature reaches the set minimum temperature.

In this example, a release takes place when the setpoint is very far below for a short time or slightly deviates for a long time.



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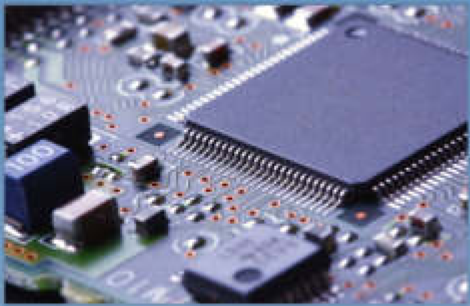

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Alles auf einen Blick

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Support
Ihre Anliegen sind uns wichtig

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