Advanced – Heating/Cooling circuit control

ClimaECO – Optimization of a supply setpoint temperature

Team Application Engineering
Advanced - HCC/S 2.x.x.1

Device characteristics: Controller

With a heating/cooling circuit controller, the supply flow temperature of a heating/cooling circuit is controlled. A mixing valve and a pump can be controlled or connected per channel in the heating/cooling circuit. Sensors connected to the HCC/S can be used to detect the supply flow temperature and return flow temperature and send it to the KNX bus.

**Basic requirements for a closed loop control:**

- the current measured supply flow temperature of the heating/cooling circuit
- an independent device provides a supply setpoint temperature via KNX
Advanced - HCC/S 2.x.x.1

Device characteristics: Controller

- **KNX supply setpoint temperature**
- **Supply flow temperature**
- **Pump control**
- **Mixing valve control**

Heating/Cooling Circuit

Distributor

Collector
**Advanced - HCC/S 2.x.x.1**

Device characteristics: Controller

The HCC/S can work as an actuator device and as a controller. The function of the device as a controller is the main application. As soon as there are at least two heating circuits it makes sense to use the HCC/S.

The HCC/S has a classic PI closed loop control (continuous) per channel. This generates the control value for the connected 3-way mixing valve. The mixing valve is responsible for generating the desired supply setpoint temperature based on supply and return flow.

The pump connected to the HCC/S has the task of distributing the mixed medium in the system. As a result, there are no significant temperature differences in the heating/cooling circuit. Via a relay output the HCC/S switches the supply voltage of the pump on or off, depending on the control value of the mixing valve.

**The HCC/S can also be used as a single device (Stand-Alone)!**
Despite the fact that many pumps have their own pressure-dependent control, these can be connected to the HCC/S. Three binary inputs are available to evaluate different pump status.
Optimization of the supply setpoint temperature in a heating circuit

Based on the Stand-Alone version of the heating/cooling circuit controller, the system can be optimized and expanded with an application controller AC/S 1.x.1.

The following energy saving optimizations are applicable individually or in combination.

- Calculated weather compensated
- Economy mode
- Room involvement

Any kind of optimization is a dynamical adjustment of the supply setpoint temperature.
Optimization of the supply setpoint temperature in a heating circuit

A heating circuit control in the optimization level “Calculated weather compensated or Economy mode” works independently of a room automation!

A heating circuit control in the optimization level “Room involvement” works depending on a room automation!
As the first and easiest way of optimization, an outside temperature-dependent calculation of the supply setpoint temperature can be realized. A heating curve which is defined in the AC/S passes this temperature to the heating/cooling circuit controller. This type of optimization happens independently of the boiler.
Advanced - HCC/S 2.x.x.1 & AC/S 1.x.1
Optimization: Calculated weather compensated

Outside temperature

Supply flow temperature

Pump control

Mixing valve control

Heating/Cooling Circuit

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supply setpoint temperature
Optimization: Calculated weather compensated

- AC/S
- HCC/S

- Receiving the outside temperature via a sensor
- Sensor value
  Supply flow temperature
- Control value heating / cooling
  Mixing valve
- Pump control
- Supply setpoint temperature heating / cooling
  AC/S
  HCC/S
- Receiving the outside temperature via a sensor
Advanced - HCC/S 2.x.x.1 & AC/S 1.x.1

Optimization: Calculated weather compensated

Detail view AC/S WebUI (ASM Heating Distribution Circuit)
The values that are marked in red affect the calculation of the heating curve. These values have to be coordinated with the planner/engineer of the system!

Settings

Heating curve

<table>
<thead>
<tr>
<th>Nominal outside temperature</th>
<th>-16.0 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal room temperature</td>
<td>20.0 °C</td>
</tr>
<tr>
<td>Nominal supply temperature</td>
<td>80.0 °C</td>
</tr>
<tr>
<td>Nominal return temperature</td>
<td>60.0 °C</td>
</tr>
</tbody>
</table>

Max. supply temperature

<table>
<thead>
<tr>
<th>Radiator exponent</th>
<th>Radiator to DIN 4703 (1.30)</th>
</tr>
</thead>
</table>

Start heating curve at outside temperature

| 19.0 °C |

Optimization: Calculated weather compensated
This example shows the heating curve at 10 °C outside temperature. This results in a supply setpoint temperature of 40.2 °C.
The view above shows a cooling curve with an individual setting of the value pairs.

The cooling curve must be defined manually by these value pairs!
In addition to optimizing the supply setpoint temperature (Calculated weather compensated), it is possible to include the operating modes (Comfort, Standby, Economy and Building Protection) in the calculation of the heating curve.

Each operating mode is associated with a freely definable room setpoint temperature configured in the AC/S. Depending on the current operating mode, the supply setpoint temperature is raised or lowered and sent to the HCC/S 2.x.x.1.
Advanced - HCC/S 2.x.x.1 & AC/S 1.x.1

Optimization: Economy mode
Optimization: Economy mode

Detail view AC/S WebUI (Based on Scheduler)

Status
- Outside temperature: 5.0 °C
- Room setpoint temperature Comfort: 24.0 °C
- Room setpoint temperature Standby: 19.0 °C
- Room setpoint temperature Economy: 17.0 °C
- Room setpoint temperature Building Protection: 5.0 °C
- Operating mode: Comfort

Settings
- Heating curve
  - Nominal outside temperature: -14.0 °C
  - Max. supply temperature: 80.0 °C
  - Nominal room temperature: 20.0 °C
  - Radiator exponent
    - Radiator to DIN 4703 (1.30)
  - Nominal supply temperature: 80.0 °C
  - Start heating curve at outside temperature: 19.0 °C
  - Nominal return temperature: 60.0 °C

Graphs showing temperature variations for Comfort, Standby, Economy, and Building Protection modes.
The values marked in red (the room setpoint temperatures and the operating mode) are deposited in the AC/S. The values cannot be changed in this detailed view.

The optimization “Economy mode” can be done both automatically via a time schedule or based on room setpoint temperatures.
When optimizing with “Economy mode – Based on Scheduler”, the heating curve in principal is based on the first optimization “Calculated weather compensated”. The respective heating curves of the operating modes (Comfort, Standby, Economy and Building Protection) and the corresponding supply setpoint temperatures at 5°C are shown in different colors.
Based on the previous optimizations, there is another way to include the actual room demand by using the control values of the valves in the heating curve calculation.

In the now fully optimized calculation of the supply setpoint temperature via the AC/S 1.x.1, the control values from the rooms of the individual heating/cooling circuits are included. This results in much more energy savings.

This type of optimization is the most efficient!
Basic - HCC/S 2.x.x.1 & AC/S 1.x.1

Optimization: Room involvement

- Outside temperature & Operating mode
- Supply setpoint temperature
- Control value
- Supply flow temperature
- Pump control
- Mixing valve control

Distributor
Collector
Advanced - HCC/S 2.x.x.1 & AC/S 1.x.1

Optimization: Room involvement

“Why isn’t it ideal if the control value of a heater is very low over a long period of time?”

If a heater is driven over a longer period of time with a low control value, this is a sign that a higher supply flow temperature is available than required.

„What additional requirements has my system to fulfill?“

This type of optimization requires room automation in all rooms associated with the heating circuit. Otherwise, it is not possible to provide the control values of the valves for the Application Controller.

Control values must be provided via KNX.
Optimization: Room involvement

Detail view AC/S WebUI (ASM Heating Distribution Circuit)
The values marked in red show the possibilities of parametrization for the room involvement.

The „Max. room control value“ is the highest control value that is sent back from the rooms. The value „Room involvement“ is the effective difference to the calculated supply setpoint temperature.
This example shows the heating curve at 10 °C outside temperature. This results in a supply setpoint temperature of 36,2 °C with the optimization.
Total package of optimizations

### Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside temperature</td>
<td>-3.0 °C</td>
</tr>
<tr>
<td>Room setpoint temperature Comfort</td>
<td>20.0 °C</td>
</tr>
<tr>
<td>Room setpoint temperature Standby</td>
<td>19.0 °C</td>
</tr>
<tr>
<td>Room setpoint temperature Economy</td>
<td>17.0 °C</td>
</tr>
<tr>
<td>Room setpoint temperature Building Protection</td>
<td>3.0 °C</td>
</tr>
<tr>
<td>Max. return temperature</td>
<td>50.0 %</td>
</tr>
<tr>
<td>Max. supply temperature</td>
<td>60.0 °C</td>
</tr>
<tr>
<td>Max. return temperature</td>
<td>80.0 °C</td>
</tr>
<tr>
<td>Operating mode</td>
<td>Comfort</td>
</tr>
</tbody>
</table>

### Settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating curve</td>
<td></td>
</tr>
<tr>
<td>Nominal outside temperature</td>
<td>-34.0 °C</td>
</tr>
<tr>
<td>Nominal room temperature</td>
<td>20.0 °C</td>
</tr>
<tr>
<td>Nominal supply temperature</td>
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<tr>
<td>Radiator exponent</td>
<td>Radiator to DIN 4703 (1.3)</td>
</tr>
</tbody>
</table>

### Room Involvement

- Increase supply temperature: 10.0 K
- Decrease supply temperature: -10.0 K
- Optimum room control value: 70.0 %
- Controller proportional factor Xp: 30.0 %

**Graph:**

- Comfort: 63.1
- Standby: 51.7
- Economy: 58.5
- Building Protection: 26.6

**Legend:**

- Current value without optimization (Room involvement): 63.3
- Current value with optimization (Room involvement): 56.6
Advanced - HCC/S 2.x.x.1 & AC/S 1.x.1

Summary

- Trends & scheduler in the AC/S
- WebUI access to the different curves
- „Single source system“
- Energy savings
- Integrable in existing facilities
You will find further valuable information on the topic of "ClimaECO" in the

Engineering Guide Database

FAQ Tool