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Technical Paper

HVAC control by Siemens:
Saving considerable amounts of energy without sacrificing comfort

Synco is the name of the extremely versatile and modular range of controllers from Siemens for any kind of application in the field of heating, ventilation, air conditioning and refrigeration (HVAC). All types of Synco controller offer built-in energy saving features and provide optimum preconditions to ensure compliance with energy efficiency class A. This means that, for example, a cost- and energy-efficient HVAC control system can be straightforwardly installed and set up with no need for programming. Even on existing plants, the relevant functions can be activated with no major programming effort. Thanks to intelligent and integrated building and room automation features, energy savings and CO_2 reductions of up to 30 percent can be achieved without sacrificing indoor comfort.

By Hanspeter Steffen *

The special importance of energy-efficient products in building automation and the resultant huge saving potential are demonstrated by the fact that buildings worldwide consume about 41 percent of primary energy, 85 percent of which is required for space heating and cooling.

For this reason, Siemens places great emphasis on intelligent, energy-saving products, including the standard HVAC controllers. In addition to the classical application-specific functional units, the modular Synco controllers of the 700-series provide energy saving features conforming to EN 15232, which need simply be configured and activated at the time of commissioning. These are energy saving functions implemented in the range of ventilation controllers (Synco RMU) and heating controllers (Synco RMH and RMK). A brief description is given below:

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- Demand-controlled ventilation
- Heat recovery
- Night cooling
- Optimization of heating circuit control
- Quick setback of heating circuit
- Demand-based production of heating and cooling energy

Demand-controlled ventilation

The fan and the air handling processes – heating, cooling, humidification and dehumidification – are the major energy users in ventilation and air conditioning plants. For this reason, the fan should be switched off whenever possible and operated only when there is demand for ventilation resulting from inadequate indoor comfort conditions, using the lowest possible fan speed. Switching on and increase of the amount of outside air delivered to the space take place via demand-dependent control (by means of indoor air quality (IAQ) sensors for acquiring CO_2/VOC), presence-dependent control (with the help of presence detectors) or resulting from the sustained mode function for controlled variables such as temperature, humidity, etc. The process runs until the required operating state is reached. Then, the plant is shut down again.

Heat recovery

Heat recovery equipment in ventilation systems can help save considerable amounts of energy. The heat recovery process is controlled in sequences. This means that, first, the maximum amount of heat is recovered and only then will the heating or cooling sequences be activated. In addition, the operating action of the heat recovery equipment is adapted on the basis of a comparison measurement of extract air and outside temperature. The efficiency of heat recovery is monitored to ensure that, in the event of a failure, the lack of supply by the heat recovery equipment will not be compensated for by the air heating or air cooling coil, which would lead to extra energy consumption. If the efficiency drops below a certain limit, a fault status message is delivered.

Night cooling

During the night when the rooms are not normally occupied, they are cooled down with cool outside air. Expensive generation of cooling energy during the day can thus be minimized. Night cooling is activated via a comparison measurement of outside and room temperature and remains in operation until the required switch-off temperature for the room is attained.

Optimization of heating circuit control including optimum start / stop control

The objective of optimum start control is to reach the Comfort or Precomfort setpoint at the beginning of the scheduled occupancy period. For that purpose, the heating circuit is switched on a

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certain period of time before occupancy starts, depending on the outside temperature. If a room temperature sensor is installed, the controller also takes into consideration to the room temperature when calculating the forward shift. If no room temperature sensor is available, the optimization functions make use of a room model, which calculates the required room temperature based on the outside temperature, the building time constant and the rate of room temperature rise.
Optimum stop control switches the heating circuit off as early as possible to ensure that the room temperature will lie just below the Comfort or Precomfort setpoint when the change from Comfort or Precomfort to Economy mode is made. Optimum stop control can be provided only if a room temperature sensor is present.

Quick setback of heating circuit

When the room operating mode changes from Comfort or Precomfort to Economy or Protection, quick setback is activated, the heating circuit pump is switched off, and the mixing valve is closed. The heating circuit remains shut down until the required room temperature is reached. As a result, the pump's number of operating hours are considerably reduced. The function is ended when the room temperature reaches the new setpoint, or when the room operating mode changes to Comfort or Precomfort.

Demand-based production of heating and cooling energy

A heating boiler or refrigeration machine should operate only when there is indeed a demand for heating or cooling energy.
Based on the information received from the heating, cooling or DHW zones, the Synco controllers automatically exchange data via the KNX bus. Using this information from the zones, the controllers calculate the required setpoints and switch on the respective heating or cooling sources depending on the demand. This makes certain that aggregates or pumps do not constantly operate, thus minimizing the number of operating hours.

Conclusion

Thanks to the integrated energy saving features provided by the standard HVAC controllers, Siemens offers decisive extra benefits in terms of cost savings and environmental protection. As a result, HVAC applications can be planned without special effort, focusing on energy efficiency right from the start. Straightforward activation of the energy saving functions optimizes operation and increases the value of the plant.
All energy saving features are targeted at demand-based operation of HVAC plant and ensure adequate indoor comfort levels for users of the buildings or the individual rooms.

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List of illustrations

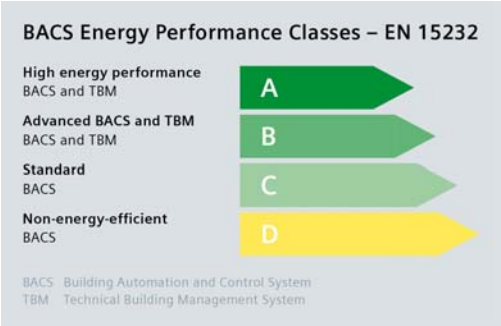

Illustration 1

BACS Energy Performance Classes according to EN 15232: energy efficiency of buildings – impacts of building automation and building management
Synco provides important preconditions to ensure compliance with energy efficiency class A, achieving
energy savings of up to 30 percent in office spaces in comparison with standard systems, for example.

Illustration 2

Modular HVAC controller Synco 700 with integrated energy saving features

Illustration 3

Modular HVAC controller Synco 700 with extension modules and detached operation

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Illustration 4

IAQ sensor to optimize comfort and energy consumption with the help of demand-controlled ventilation

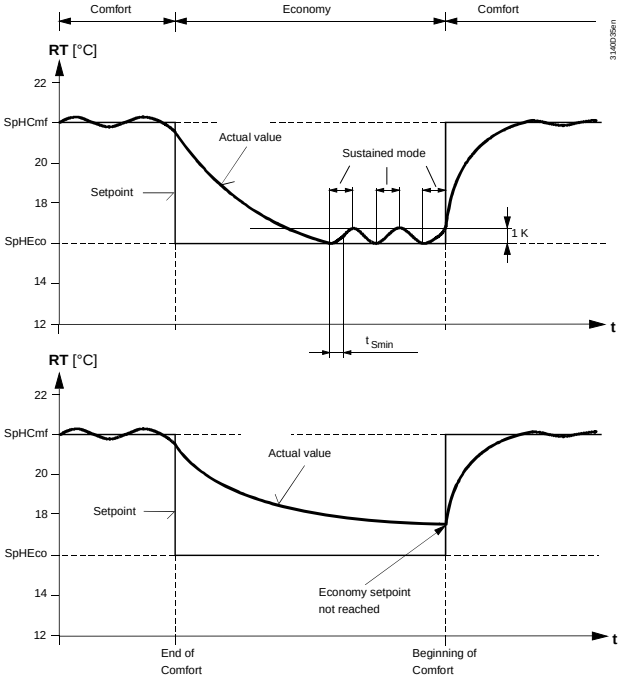

Illustration 5

Variant:
Operating principle “Sustained heating mode” with demand-controlled ventilation

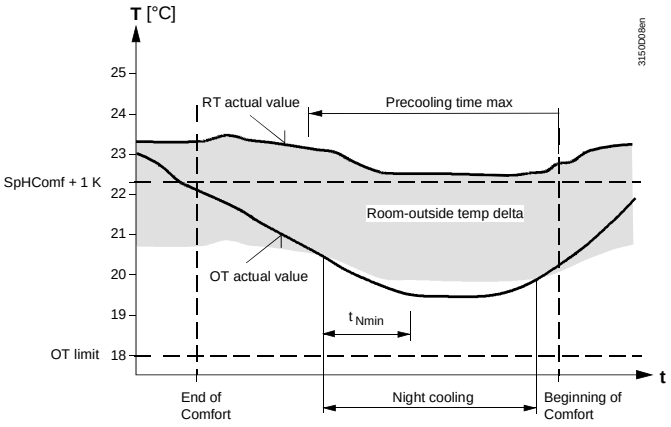

Illustration 6

Operating principle “Switch-on criterion for night cooling“

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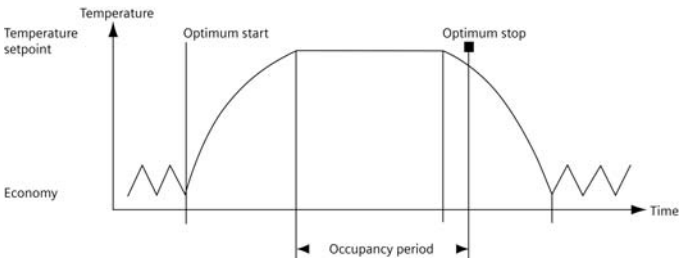

Illustration 7

Operating principle “Optimization of heating circuit control“

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