Smarter Small Buildings Campaign

Setpoints & Scheduling

for packaged rooftop unit controls

Generated using Canva AI

smartersmallbuildings.lbl.gov

Table of Contents

The Importance of Setpoints & Scheduling

- Space temperatures are an important aspect of occupant thermal comfort.
- Setpoints and schedules have direct impact on rooftop unit (RTU) runtimes and thus, energy use.
- It has been estimated that **10%-20% energy savings**[1] can be achieved in most small and medium-sized buildings through proper management of setpoints and schedules while maintaining occupant thermal comfort.

Source: Lawrence Berkeley National Laboratory

Occupant Thermal Comfort

- Thermal comfort is subjective and based on six factors[2]:

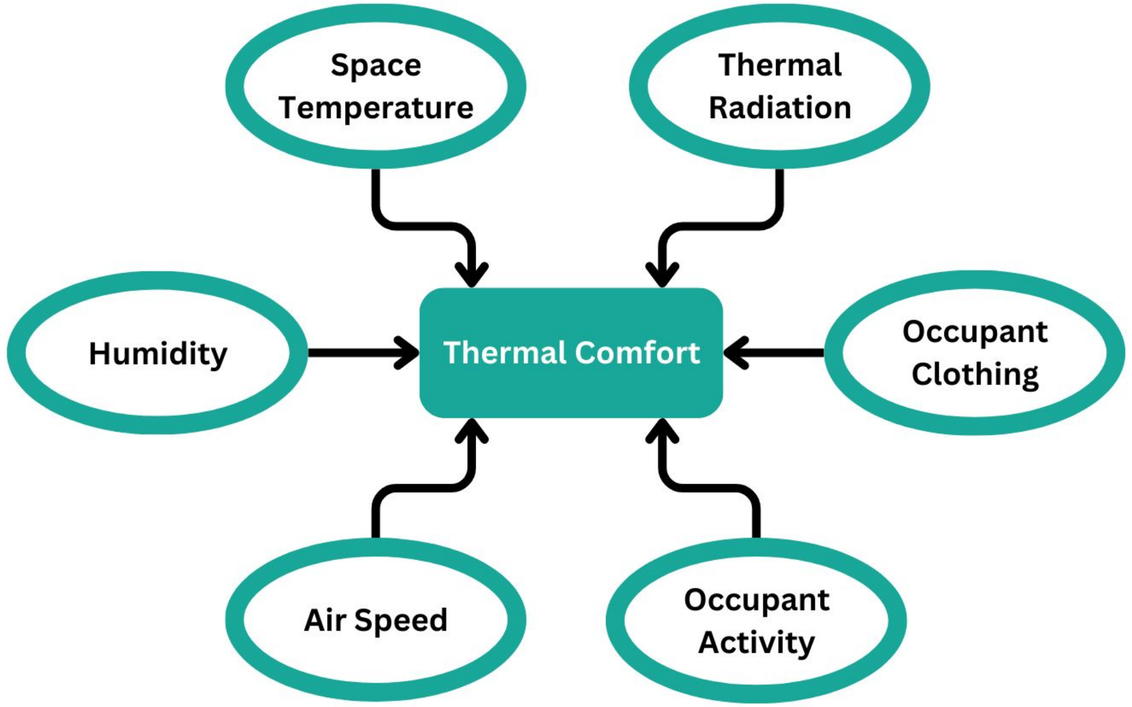


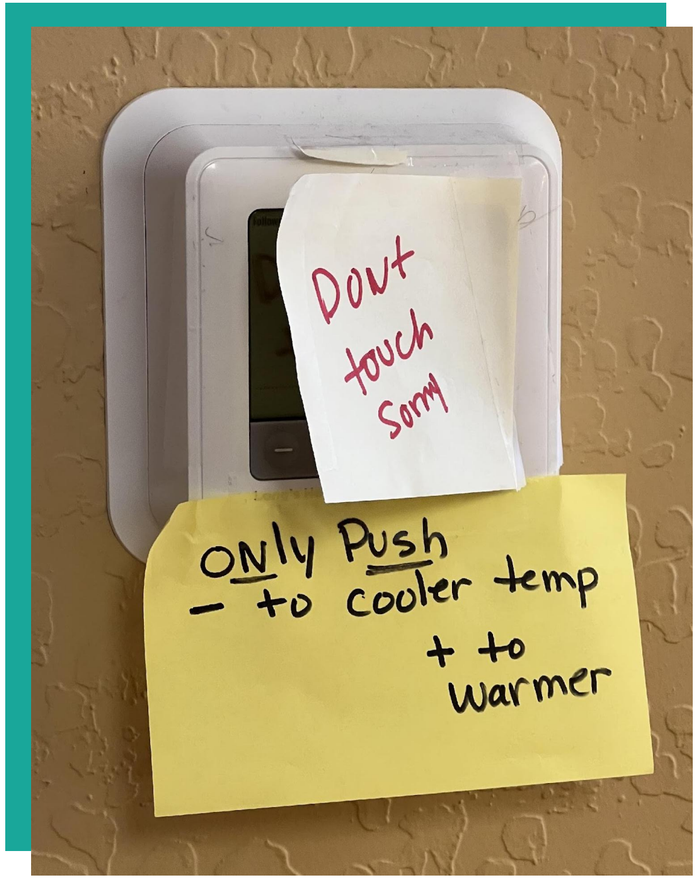
Figure 1: Six factors of thermal comfort[2]

- Aim to satisfy the majority of occupants in the space since thermal comfort may vary among occupants.
- It is beneficial to complete an occupant comfort survey to determine occupant satisfaction.
- The following can negatively impact occupant thermal comfort:
  - Building drafts/infiltration
  - Inadequate airflow
  - Poorly insulated building envelopes
  - Thermostat location
  - HVAC zoning
  - Incorrectly sized HVAC equipment

Getting Started with an Operational Policy

What are the steps?

- Establish acceptable ranges of setpoints and their schedule.
  - Occupied vs. unoccupied
  - May vary by building or zone
- Determine who can override setpoints and schedules and establish guidelines.
- Share operational policies with building staff and occupants to gain buy-in.
- Complete quarterly reviews to check that schedules match occupancy.
- Track energy consumption and occupant complaints and make adjustments as required.



Heating & Cooling Setpoints

The goal of developing an operational policy for setpoints is to be energy efficient while maintaining occupant comfort.

Owner Considerations

- It is advised to start with the recommended setpoints in Table 1 and adjust based on occupant feedback.
- There is no one size fits all standard for occupied and unoccupied setpoints.
- The right setpoint depends on multiple factors such as building type and factors related to occupants.

Table 1: Recommended setpoints for small/medium office buildings[3]

Mode	Unoccupied*	Occupied
Cooling	80° F	75° F
Heating	65° F	70° F

*Note: Unoccupied setpoints are sometimes referred to as “setback” setpoints.

Deadband

Deadband is the temperature range between the cooling and heating setpoints.

Owner Considerations

- If the unoccupied deadband is too large, the HVAC equipment may have difficulty returning the space temperature to the occupied setpoint prior to occupancy. This is particularly true in the winter because the morning warm up period coincides with the highest heating loads.
- If the occupied deadband is too small, the unit could cycle between heating and cooling.
- ASHRAE Standard 90.1 recommends a minimum deadband of 5°F[4]

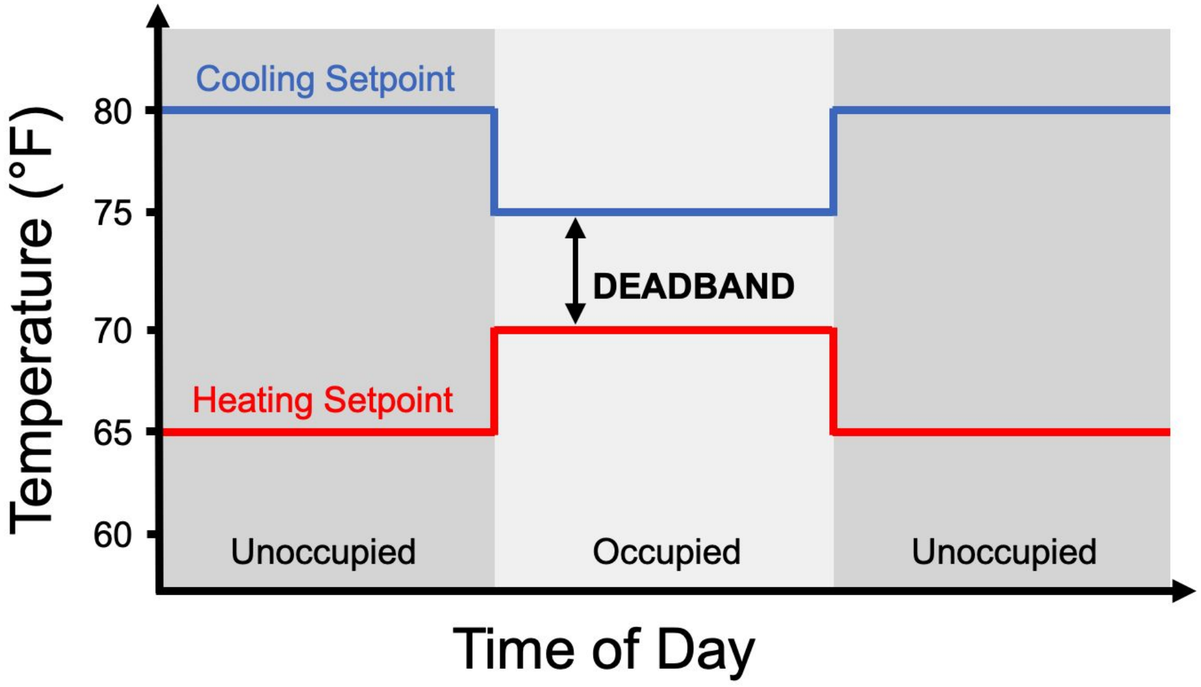


Figure 2: Heating and cooling setpoint schedule with a minimum deadband of 5°F

Thermostat Placement & Temperature Sensors

- Avoid installing thermostats:
  - In direct sunlight
  - On exterior walls
  - Near sources of heat (e.g., office equipment)
  - Under ceiling diffusers or in other areas that experience drafts
  - In areas lacking air circulation (e.g, behind doors)
- When multiple RTUs are serving adjacent zones without a physical barrier between them, avoid placing thermostats near other thermostats
  - Differences in sensor accuracy and/or zone setpoints can result in one RTU providing cooling at the same time a second RTU serving an adjacent zone is providing heating

- Consider using remote sensors:
  - Incorporating one or more remote temperature sensors with the thermostat provides an estimate of “average” space conditions
  - Controlling based on the average temperature can help promote better occupant comfort and enable the use of a larger deadband

Source: Lawrence Berkeley National Laboratory

Thermostat Controls

- Today's thermostats typically come with a wide array of scheduling options:
  - Occupied/Unoccupied schedules
  - Weekday/Weekend schedules
  - Daily schedules
  - Special event schedules
  - Holiday schedules

Source: Lawrence Berkeley National Laboratory

- Additional capabilities found in modern thermostats:
  - Automatic Override of Setpoint Changes
    - Resetting back to setpoint (operational policy for the building)
    - Establish user control override parameters (e.g., occupant can adjust by up to ±5°F [2] and override will hold for 4 hours)
  - Enable/Disable changes to thermostat settings
  - Use of occupancy sensors to establish mode (occupied vs. unoccupied)
  - Create schedule groups for global scheduling changes so you don't have to edit individual thermostats
- Note that these features are dependent on control vendor technology.

Scheduling Fan Operation

Fan operation affects indoor air quality and energy use.

- Be sure you are aware of how your fan is operating:
  - During occupied periods[5], the fan should run continuously to provide ventilation air necessary for a healthy indoor environment.
  - During unoccupied periods, outdoor air can be turned off, and the fan should cycle on and off with the heating and cooling to meet the demand, and reduce energy use.
- Some thermostats or unit controllers have fan modes that change fan operation automatically based on scheduled occupancy
- Others require the fan mode to be manually scheduled

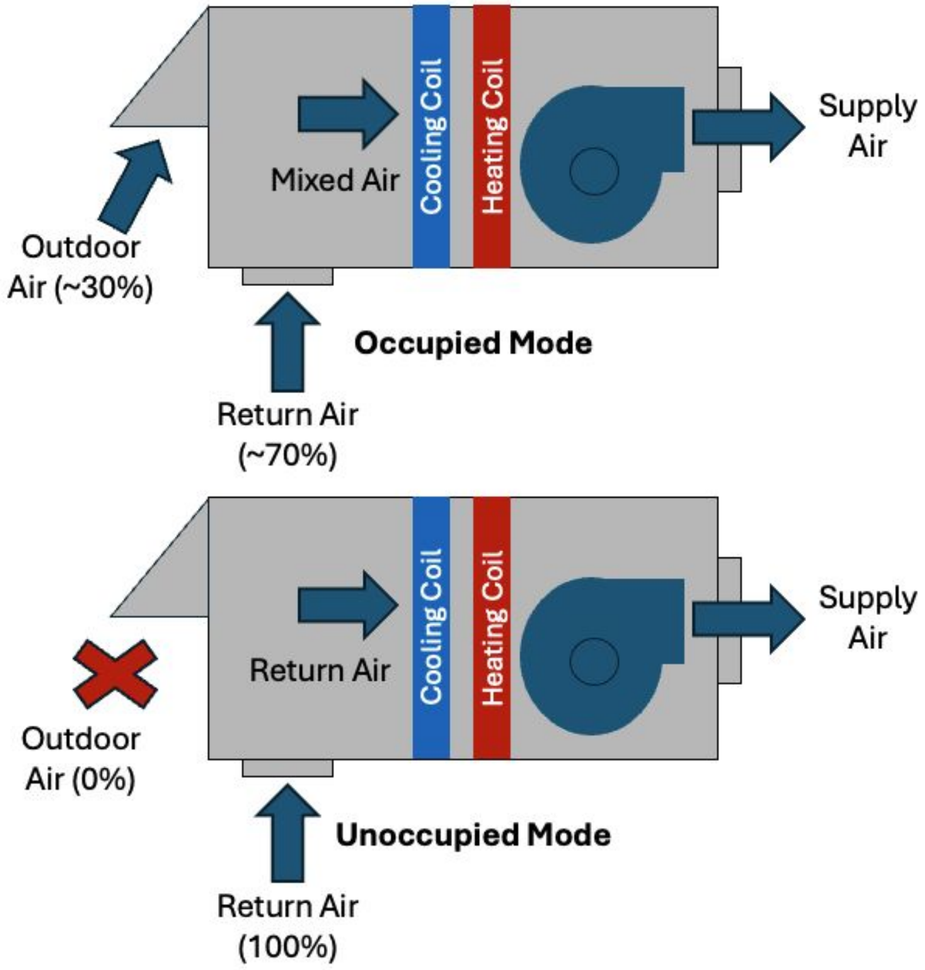


Figure 3: Occupied vs Unoccupied Mode in RTUs

References

[1] Fernandez, N., Katipamula, S., Wang, W., Xie., Y., Zhao, M., and Corbin, C. 2017. Impacts of Commercial Building Controls on Energy Savings and Peak Load Reductions. PNNL-25985, May 2017. Pacific Northwest National Laboratory, Richland, Washington. https://buildingretuning.pnnl.gov/publications/PNNL-25985.pdf

[2] ASHRAE. 2023. ASHRAE Standard 55-2023: Thermal Environmental Conditions for Human Occupancy. American Society of Heating Refrigerating and Air Conditioning Engineers. Atlanta, GA.

[3] Thornton B. A., W. Wang, Y. Huang, M. D. Lane, and B. Liu. 2010. Technical Support Document: 50% Energy Savings for SMALL Office Buildings. PNNL-19341, Pacific Northwest National Laboratory, Richland, WA. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-19341.pdf

[4] ASHRAE. 2022. ASHRAE Standard 90.1-2022: Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings. American Society of Heating Refrigerating and Air Conditioning Engineers. Atlanta, GA.

[5] ASHRAE. 2022. ASHRAE Standard 62.1-2022: Ventilation and Acceptable Indoor Air Quality. American Society of Heating Refrigerating and Air Conditioning Engineers. Atlanta, GA.

Generated using Canva AI

SmarterSmallBuildings

- Visit the website (smartersmallbuildings.lbl.gov) or contact SSBC-Controls@lbl.gov
- Free **technical assistance** and **recognition opportunities** to help building owners and managers achieve practical advanced rooftop control solutions

Benefits:

- Advanced rooftop unit controls can save buildings 10-20% on energy consumption
- Digital systems optimize building comfort and efficiency
- Efficient building control reduces energy waste and improves air quality
- Reduces maintenance costs and extends component life

Authors

Nora Hart, Lawrence Berkeley National Lab

Ashleigh Papakyriakou, Lawrence Berkeley National Lab

John House, Lawrence Berkeley National Lab Affiliate

Eliot Crowe, Lawrence Berkeley National Lab

Jessica Granderson, Lawrence Berkeley National Lab

October 2024