

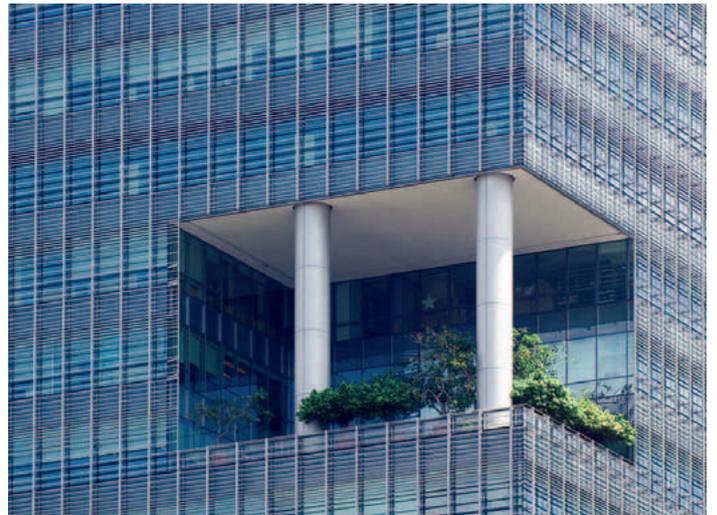


Heating / Ventilation / Air Conditioning Room Climate Control with ABB i-bus[®] KNX

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Heating / Ventilation / Air Conditioning Room Climate Control with ABB i-bus® KNX



In comparison with classic installations, the intelligent building control system ABB i-bus KNX offers noticeable advantages.

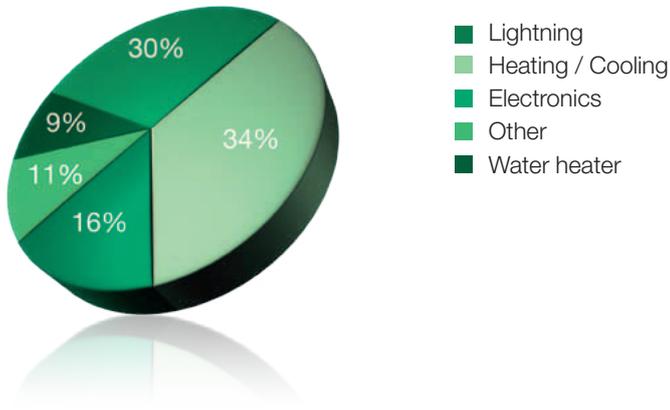
All the functional subsystems within the building are integrated via a data connection to a single communication network. This enables the optimal, energy efficient interaction of the subsystems, which is almost impossible with conventional technology.

ABB i-bus KNX optimizes the interaction of the networked applications like lighting control, heating and ventilation control, climate control, shutter control, alarm monitoring, energy management or central automation.

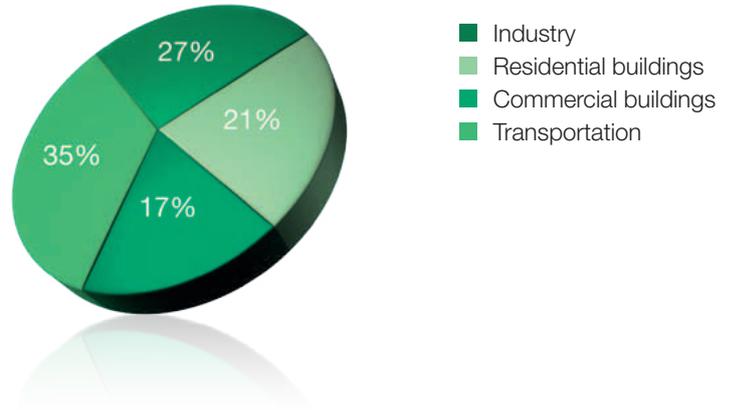
The Right Room Climate

Optimized and Efficient with ABB i-bus® KNX

Energy usage in buildings¹⁾



Share of primary energy consumption²⁾



Buildings account for about 40 percent of total energy consumed. In buildings the energy is mainly used for heating, cooling and air conditioning. Depending on the climate region and the season, the main focus of controlling (Heating, Cooling, Ventilation) and the applications (Fan Coil Unit, Air Conditioning System, hot-water heating system, etc.) can be different. Many optimisation possibilities in new and renovated buildings are provided by ABB i-bus KNX through networking of all the building engineering systems. The

calculations, on which the European Standard EN 15232 is based, spectacularly prove this fact with the demonstrated potential savings of thermal energy.

1) Source: Office Buildings end usage (U.S. Average)
2) Source: www.architecture2030.org

The following diagram shows the differences in energy consumption for three building types in the energy efficiency classes A, B and D relative to the basis values in rating C. For example, by using class A, 30 % of the thermal energy can be saved in offices.

Building Automation and Control (BAC) efficiency classes to EN 15232	Efficiency factor for thermal energy			Efficiency factor for electrical energy		
	Office	School	Hotel	Office	School	Hotel
A High energy performance building automation and control system (BACS) and technical building management (TBM)	0.70	0.80	0.68	0.87	0.86	0.90
B Advanced BACS and TBM	0.80	0.88	0.85	0.93	0.93	0.95
C Standard BACS	1	1	1	1	1	1
D Non energy efficient BACS	1.51	1.20	1.31	1.10	1.07	1.07

Around the world new legislation is promoting the use of energy efficient technologies. The European Standard EN 15232 ("Energy performance of buildings – Impact of Building Automation, Controls and Building Management") was compiled in conjunction with the Europe-wide implementation of the directive for energy efficiency in buildings (Energy Performance of Buildings Directive EPBD). The standard describes methods for evaluating the influence of building automation and technical building management on the energy consumption of buildings.

Four efficiency classes A to D have been introduced to this purpose. After a building has been equipped with building automation and control systems, it will be assigned one of these classes. The potential savings for thermal and electrical energy can be calculated for each class based on the building type and building purpose. The values of the energy class C are used as the reference for comparing the efficiency.

Function list and assignment to energy performance classes (section from table 1 of the EN 15232:2007 [D])

	Heating / Cooling control	Ventilation/ Air conditioning control	Sun protection	Lighting
A	<ul style="list-style-type: none"> – Individual room control with communication between controllers – Indoor temperature control of distribution network water temperature – Total interlock between heating and cooling control 	<ul style="list-style-type: none"> – Demand or presence dependent air flow control at room level – Variable set point with load dependant compensation of supply temperature control – Room or exhaust or supply air humidity control 	<ul style="list-style-type: none"> – Combined light/blind/HVAC control 	<ul style="list-style-type: none"> – Automatic daylight control – Automatic occupancy detection, on/off
B	<ul style="list-style-type: none"> – Individual room control with communication between controllers – Indoor temperature control of distribution network water temperature – Partial interlock between heating and cooling control (dependent on HVAC system) 	<ul style="list-style-type: none"> – Time dependent air flow control at room level – Variable set point with outdoor temperature compensation of supply temperature control – Room or exhaust or supply air humidity control 	<ul style="list-style-type: none"> – Motorized operation with automatic blind control 	<ul style="list-style-type: none"> – Manual daylight control – Automatic occupancy detection, on/off
C	<ul style="list-style-type: none"> – Individual room automatic control by thermostatic valves or electronic controller – Outside temperature compensated control of distribution network water temperature – Partial interlock between heating and cooling control (dependent on HVAC system) 	<ul style="list-style-type: none"> – Time dependent air flow control at room level – Constant set point of supply temperature control – Supply air humidity limitation 	<ul style="list-style-type: none"> – Motorized operation with manual blind control 	<ul style="list-style-type: none"> – Manual daylight control – Manual on/off switch + additional sweeping extinction signal – Manual on/off switch
D	<ul style="list-style-type: none"> – No automatic control – No control of distribution network water temperature – No interlock between heating and cooling control 	<ul style="list-style-type: none"> – No air flow control at room level – No supply temperature control – No air humidity control 	<ul style="list-style-type: none"> – Manual operation for blinds 	<ul style="list-style-type: none"> – Manual on/off switch

Optimised Energy Efficiency and well-being Room Climate A Task for the Planning Process



The European directive on the energy performance of buildings (2010/31/EU) promotes the improvement of the energy performance of buildings, taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. Therefore the parameters for a comfortable room climate like room temperature, air humidity and air quality must be taken into account by planning of buildings and evaluating their energy efficiency.

An optimised building performance, which requires the different specifications of investors, carriers and users, can only be reached by a networked structure of all technical appliances of the building. In this application field ABB i-bus KNX provides a flexible, economical and reliable solution which is proven in many references.

Regulation of Room Temperature und Air Quality

Influencing Variables on Room Climate

Influencing Variables on Room Temperature

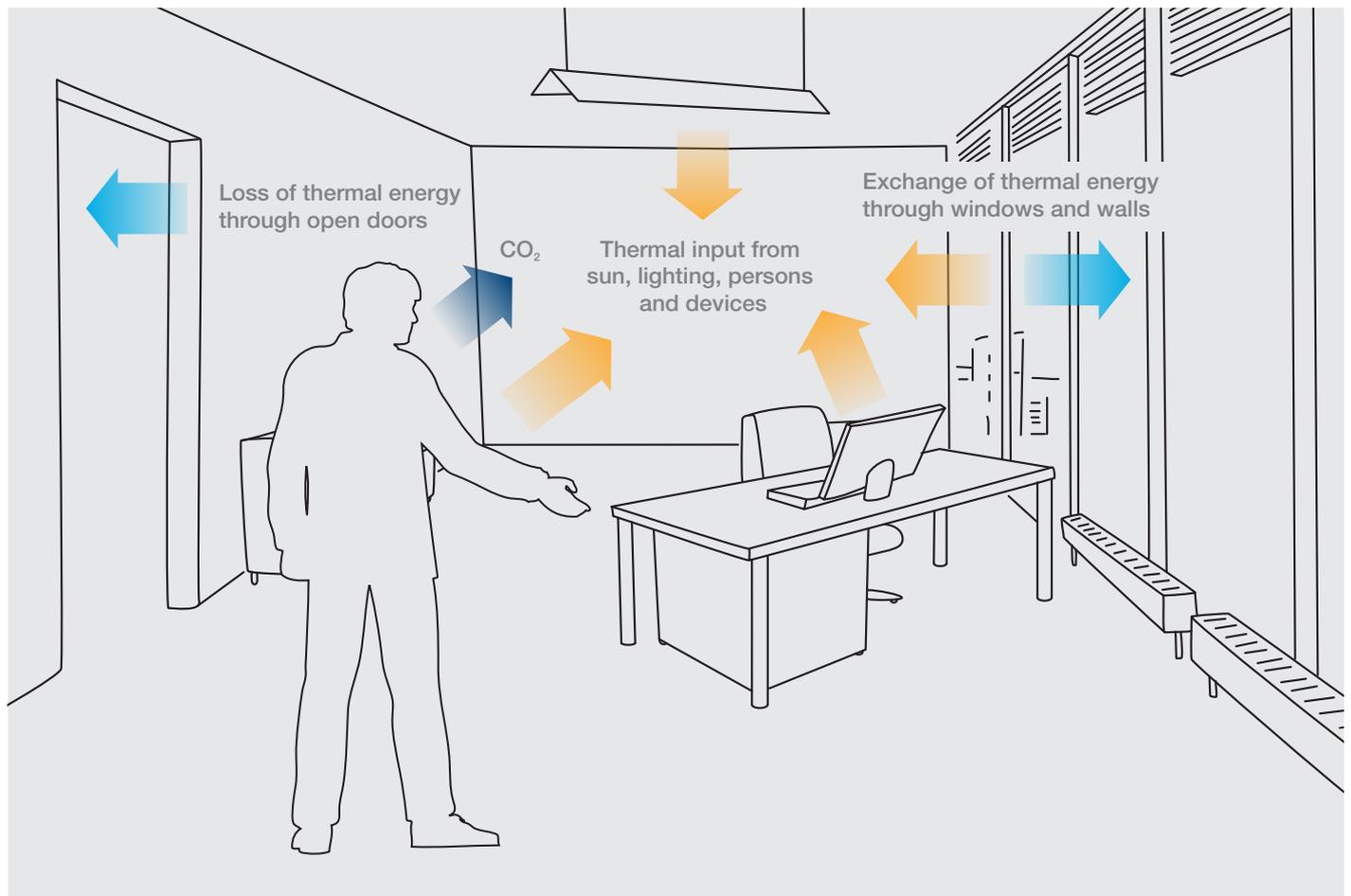
Internal and external factors have an effect on the thermal conditions in a room or a building. As an external factor the solar radiation is important for the indoor temperature – particularly with regard to modern architecture with glass fronts. Besides this, the room temperature is strongly affected by the exchange of thermal energy through windows and walls as well as the loss of thermal energy through open doors and windows.

Depending on the intensity, all this interactions influence also the energy efficiency of a building and have therefore to be optimised. Internal thermal inputs from lighting, devices or persons have also an influence on the room climate. By planning a heating, ventilation or air conditioning system all this internal and external factors have to be considered.

Influencing Variables on Air Quality

The indoor climate in living and working areas has a scientifically proven impact on health, job performance and well-being of people. A suitable indicator for determination of the room air quality is the CO₂ concentration. In addition the values for room temperature and air humidity must be controlled to meet the requirements for a comfortable room climate.

Studies have shown, that high CO₂ concentration in the air influences the well-being as well as the performance and learning ability of people. Besides the normal CO₂ concentration in the air, human respiration is an important factor increasing the CO₂ concentration in a room. Therefore it is important to measure the CO₂ concentration in rooms where many persons are present (schools, conference rooms, open-plan offices). Monitoring of thresholds enables fans to be switched via ABB i-bus KNX allowing automatic control of the CO₂ concentration and sufficient supply of fresh air.



Networked Blind Control for optimised Climate Control

Concerning the question of energy efficiency in buildings, blind control plays an important role with regard to climate control. An intelligent blind control system has an optimising effect on building climate control and supports the user in a conservative and cost-optimised energy usage. **The best results are achieved by networking the blind control with the systems for room climate control.**

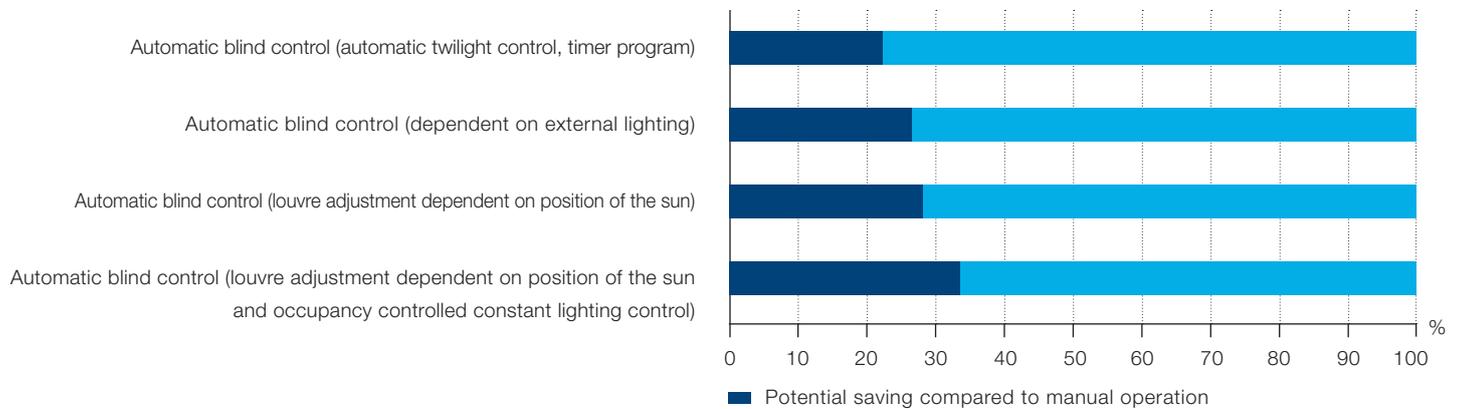
Closing the blinds on the facades of the building on which the sun is shining in summer, can prevent the rooms from heating up – saving energy that would be needed to cool the working areas.

In winter the opposite is true. Here it is useful to capture as much solar heat as possible in the rooms – this saves energy when heating rooms.

In both cases it is necessary to balance the “climate control” of the blinds with the presence of people in a room. As long as someone is working in a room, the light-dependent blind control should have priority, particularly with PC workstations, but also in schools or conference rooms. All ABB i-bus KNX blind actuators feature a heating/cooling automatic as standard for climate control of the blinds. For optimisation of the usage of daylight, an additional Shutter Control Unit JSB/S can be used.

A study from the Biberach University of Applied Sciences shows, that a climate control involving the blinds reduces the electrical energy required by the air conditioning system by up to 30 %.

Potential savings for cooling using automatic blind control *



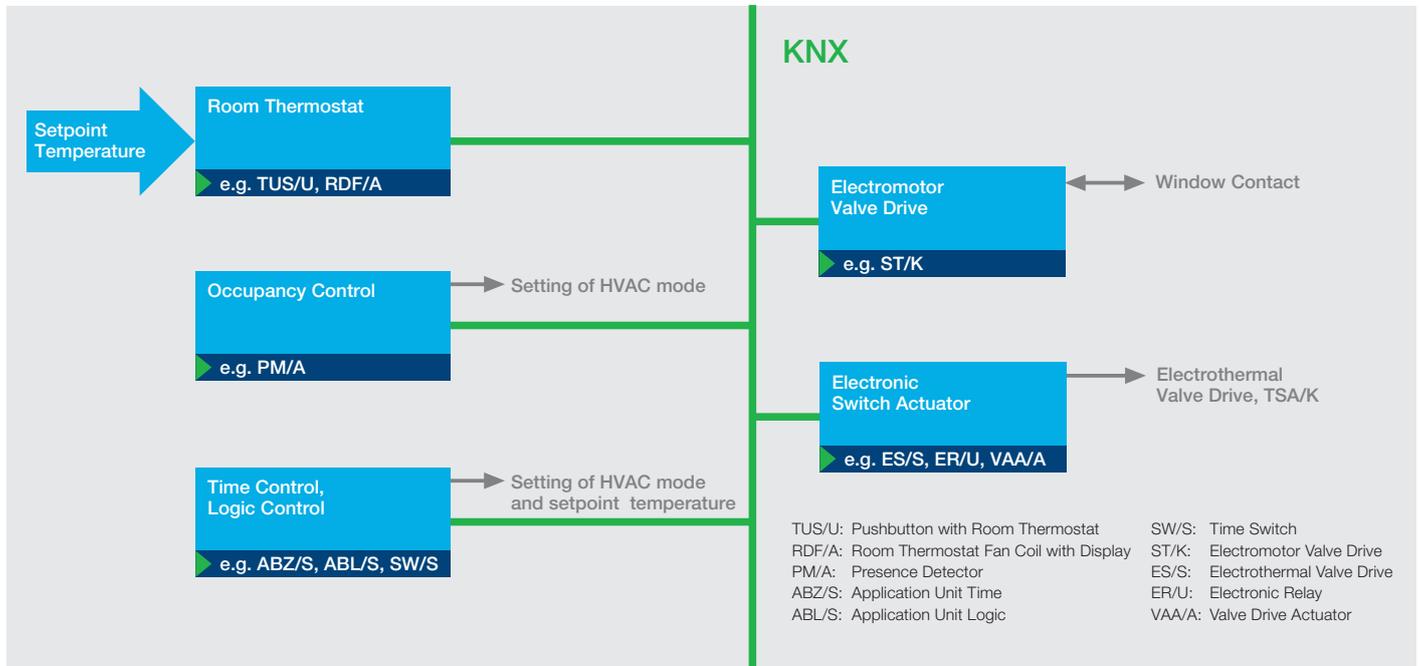
*Determined by the Biberach University of Applied Sciences with ABB i-bus® KNX components for usage profile “open-plan office” (usage profile 3 [DIN V 18599-10:2005-07]) in an example building (classical office building) with the 5S IBP:18599 program. The potential savings relate to the energy consumption.

The research results are included in the study “Energy saving and efficiency potential through the use of bus technology as well as room and building automation”, which was undertaken in 2008 for ABB.



Room Temperature Control with Electromotor Valve Drive or Electrothermal Valve Drive

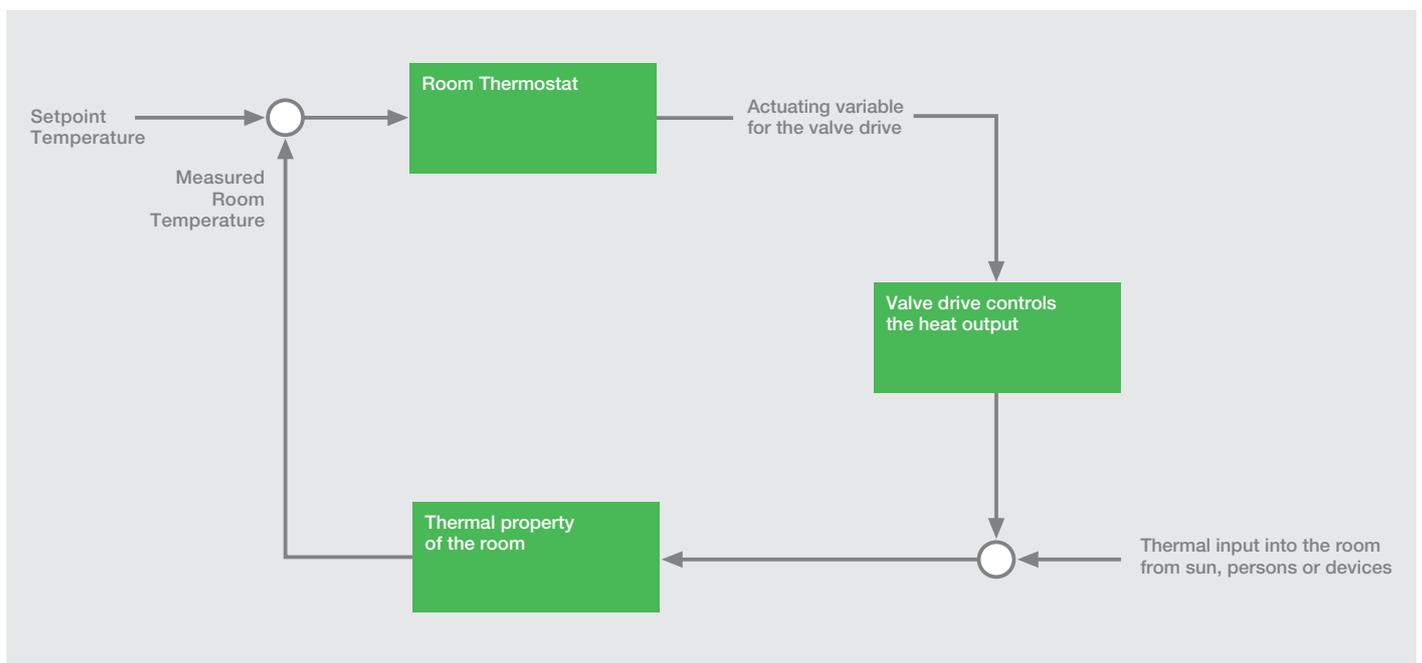
Heating
Cooling



The room thermostat (RT) allows the regulation of the desired room temperature (Setpoint temperature). Each HVAC operating mode (Comfort, Stand-by, Night, Frost Protection) has its own setpoint temperature. With the integrated temperature sensor, the RT constantly assesses the current room temperature and

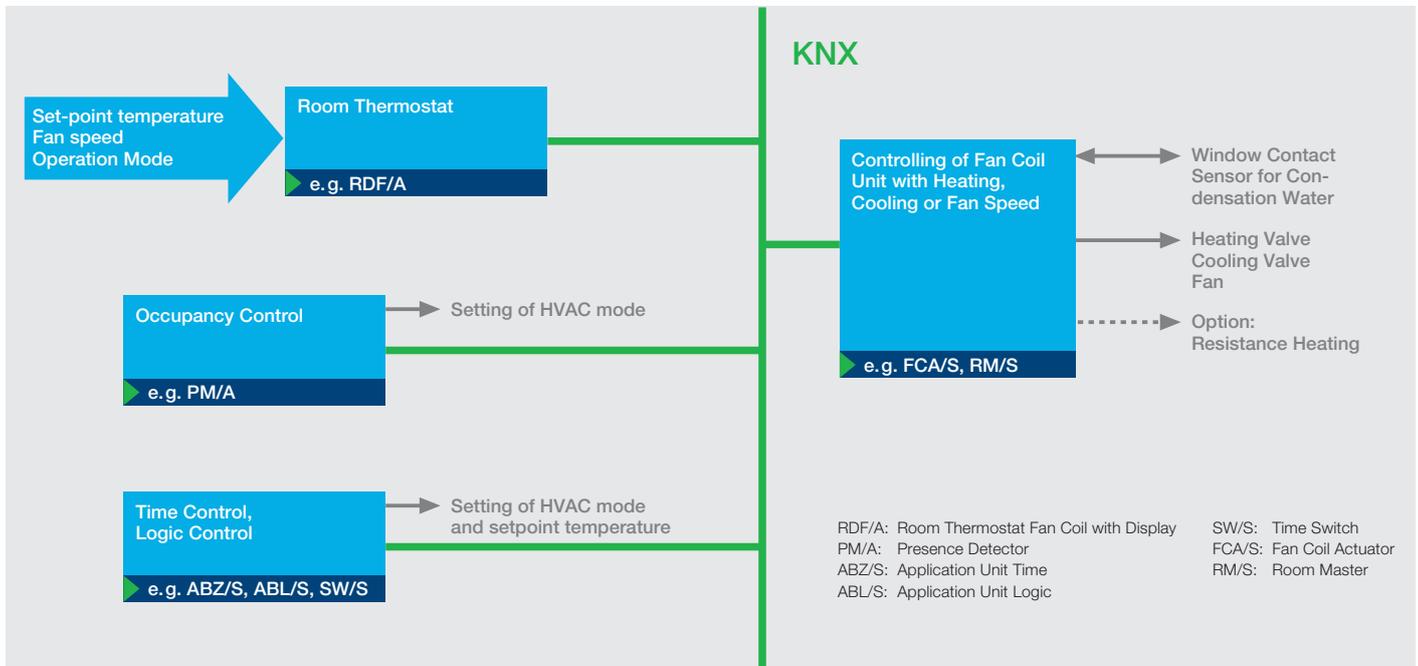
controls the valve drives to increase or decrease the temperature according to the user-defined setting. Due to the requirements of energy efficiency a window contact should be implemented in the room temperature control. As long as a window is opened, the HVAC mode is then changed to Frost Protection.

Regulation of room temperature



Room Temperature Control with Blower Convector or Fan Coil Units

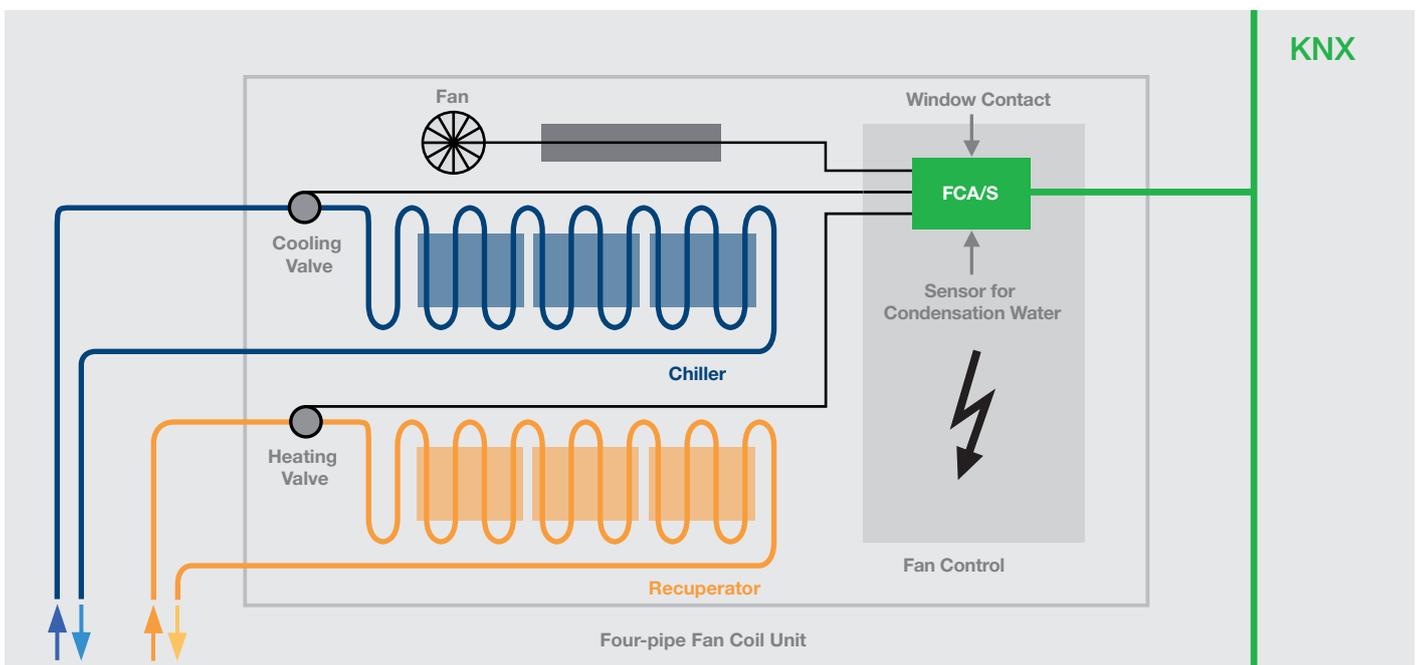
- Heating
- Cooling
- Ventilation
- Climatisation



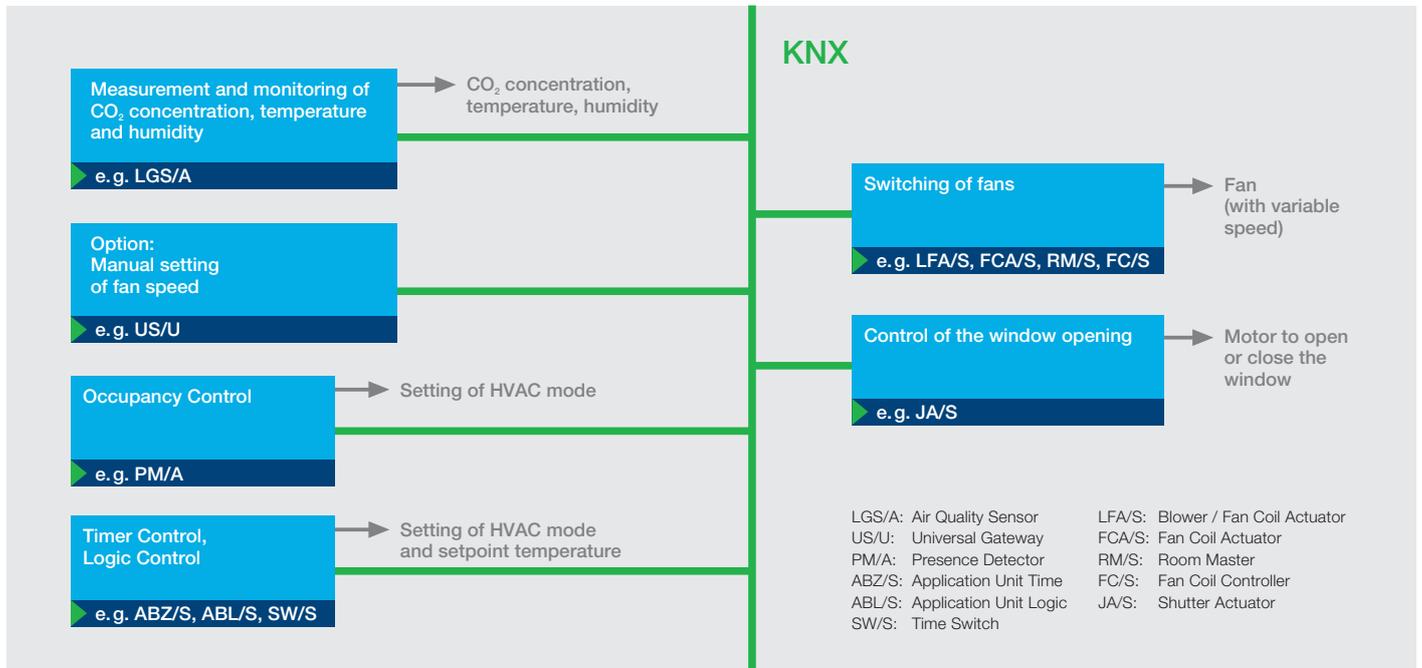
Blower convectors are heat exchangers where the flow of water is controlled by a valve just as in radiators and underfloor heating. Warm or cold air is blown into the room generally using a fan. This forced convection allows the room to heat up or cool down quickly.

Mainly in warmer climate zones heating is often provided by electric or resistance heating using a filament that becomes hot when electric current is caused to pass through it.

Control of a Fan Coil Unit with Fan Coil Actuator FCA/S



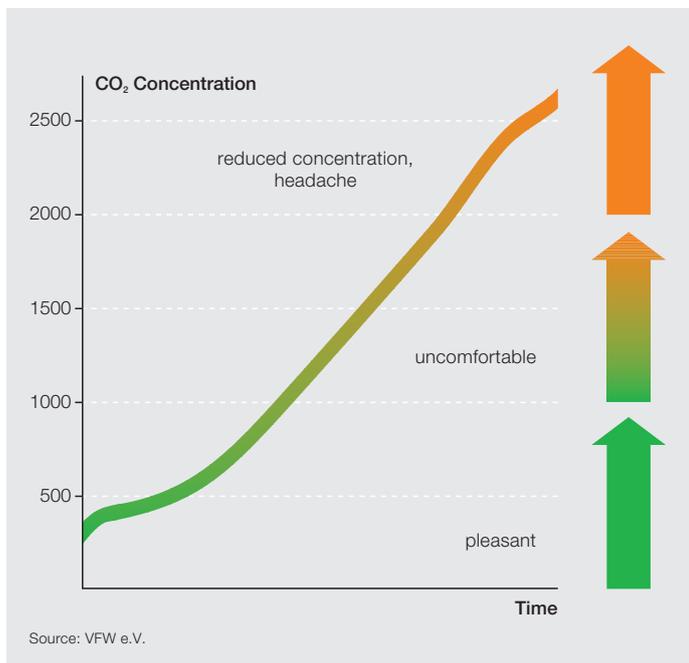
Controlling of Air Quality with Air Quality Sensor



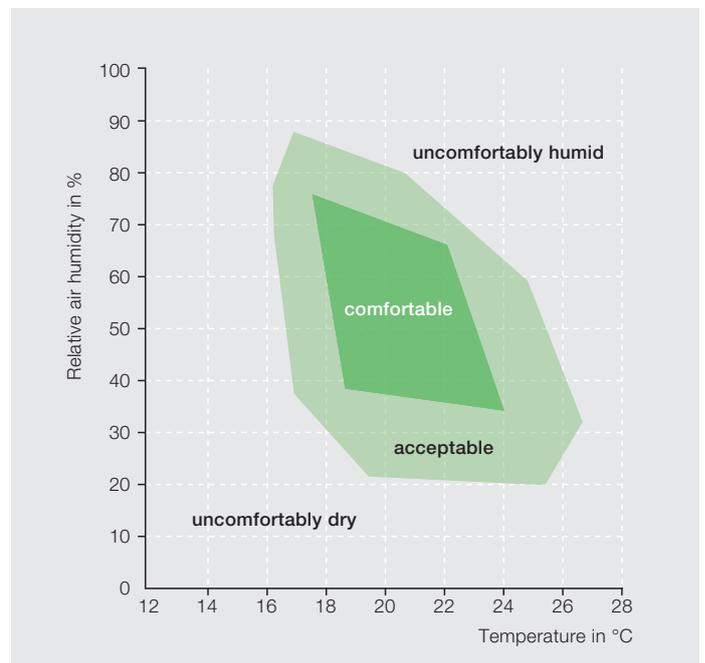
The ABB i-bus KNX Air Quality Sensor is a combined sensor for CO₂ concentration, air temperature and humidity (relative humidity) measurement. With the help of the measured values, efficient and precise room climate control can be implemented. Monitoring of

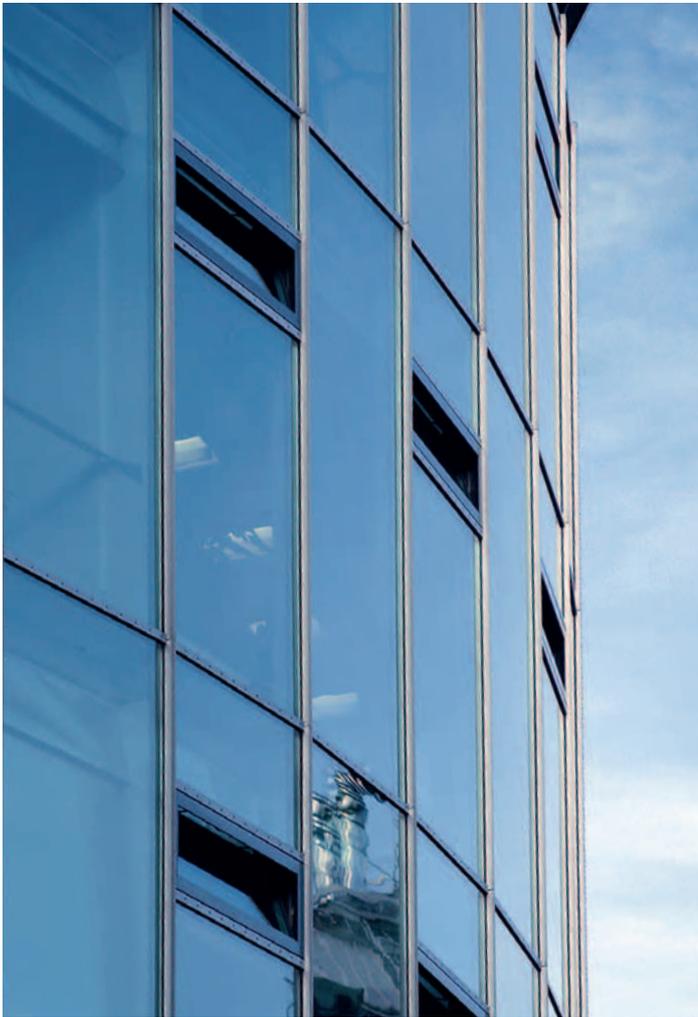
thresholds enables fans to be switched via KNX allowing automatic regulation of the CO₂ concentration. In addition to the CO₂ concentration, the values for room temperature and humidity must be controlled to meet the requirements for a comfortable room climate.

Influence of the CO₂ concentration on well-being of the people



Comfortable room climate in dependence on the room temperature and humidity





All applications integrated in the KNX technology

Functions in detail

ABB i-bus KNX is used on a daily basis by consultants, system integrators and electrical installers world-wide. Satisfied customers in their thousands enjoy the functional benefits that are provided by the implementation of KNX technology.

Lighting

Lighting control and regulation

Climate control

Heating, air-conditioning systems and ventilation

Sun protection

Blind and roller shutter control

Security and Safety

Security and surveillance

Energy management

Energy and consumption management

Automation

Central automation and remote control technology

Communication

Remote access and communication gateways

Operation

Display, operation, monitoring

ABB i-bus® KNX: The integration of all functions

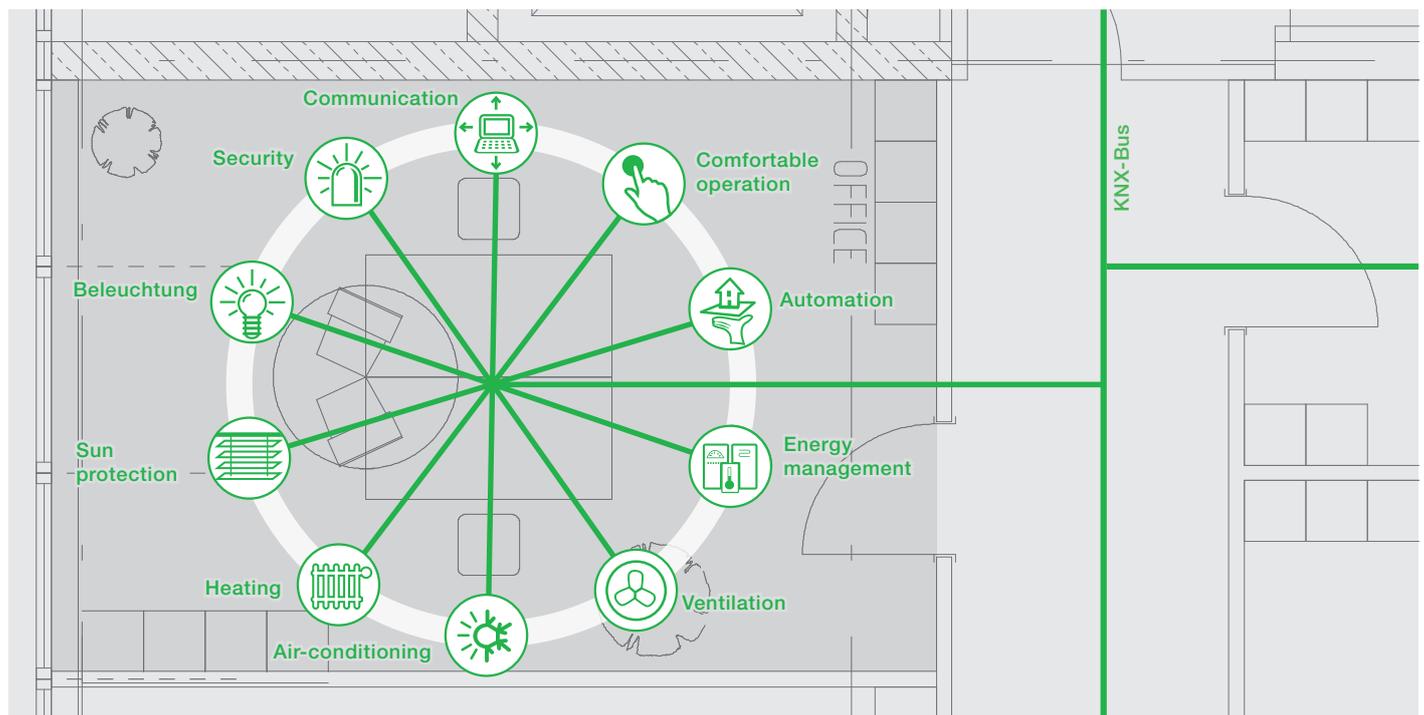


ABB i-bus® KNX – In use worldwide

Extract from our references

Pudong International Airport
Shanghai, China



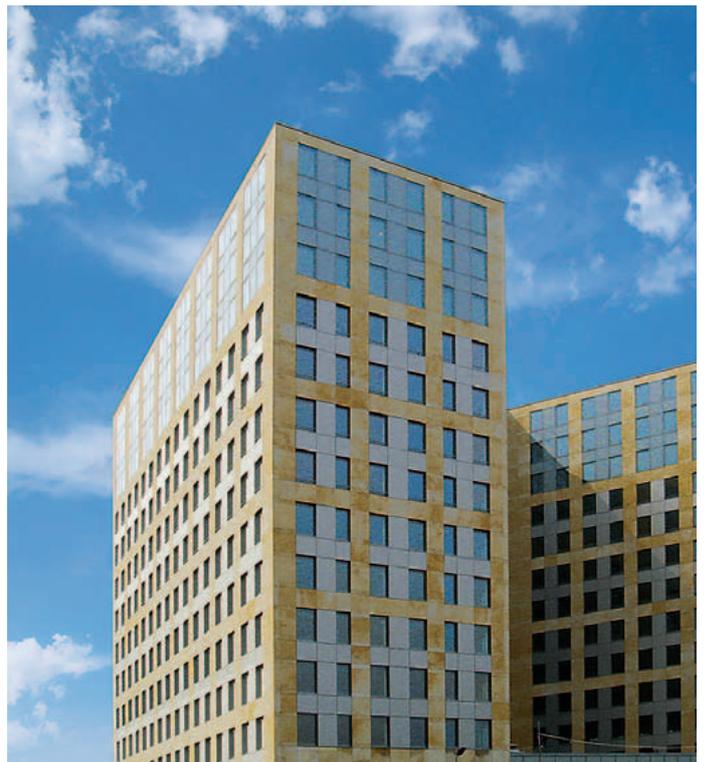
School complex
Neufahrn, Germany



Le Reve Tower, Apartments
Dubai, United Arab Emirates



Office building IO – 1
Warsaw, Poland



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