HVAC APPLICATIONS

INTRODUCTION

Quality of living	**04**
HVAC with Ekinex®	**05**
The KNX standard	**06**
Products	**08**

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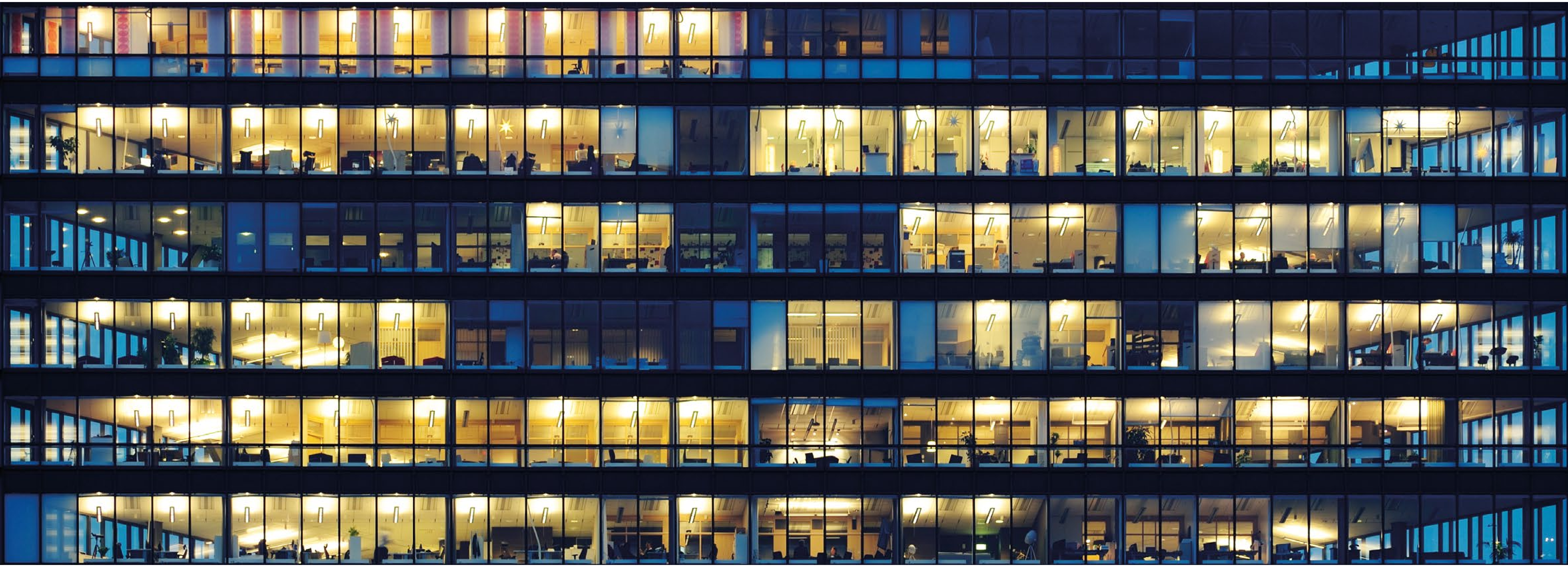

Quality of living

The quality of living at home has become increasingly important in recent years, both for the general improvement of living conditions, which has greatly increased the needs, and for the time spent daily by people inside buildings, which in many cases exceeds 90% of the total.
The combination of thermal, visual, acoustic comfort and indoor air quality is the discipline that guides the design, construction and evaluation of contemporary buildings: it is the concept known today as IEQ or Indoor Environmental Quality.
The quality of indoor environments has important relationships and effects with the well-being experienced by end-users at the home, with productivity and health in the workplace and with the energy performance and sustainability of buildings. Among the four dimensions of IEQ, the climatic quality of the building - understood as the combination of thermo-hygrometric conditions and air quality - is taken over by the HVAC functions and is of fundamental importance for its energy implications.

HVAC with Ekinex®

Ekinex®, the Italian company specialized in the realization of KNX devices, offers advanced solutions for the control of room climatization. The Ekinex® KNX product range includes pushbuttons with integrated temperature sensor and thermostat function, room thermostats (also in the version with relative humidity sensor), multisensors with temperature, relative humidity and air quality control function, touch-displays, actuators/controllers for fan-coils and electrothermal drives, controllers for mixing groups, gateways to VRF systems and other standard protocols in the HVAC sector (such as Modbus, BACnet and M-Bus). Ekinex® also offers the Delégo supervision system with a user-friendly App for the control and monitoring of the entire home automation system via smartphone (iOS or Android) and the innovative voice control by means of the popular home speakers with voice assistant. All devices are ideal for use in existing or new buildings to increase energy efficiency and ensure highest comfort.

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The KNX standard

Great developments in the field of home and building automation were made possible especially thanks to an open, modular and interoperable standard like KNX. This innovative standard was born from the merging of three European systems (EIB, BatiBUS and EHS), developed and brought to the market in the early 90's. The diffusion of the system was facilitated by an intense work of cooperation at normative level in the standard committee at European level. For this reason, too, KNX is a standard characterized by a total conformity with norm EN 50090 on electronic systems for the control of homes and buildings (HBES, Home and Building Electronic Systems).
The presence on the market of this standard since 1991 offers the best guarantee in terms of reliability and consolidation of the technology used. The openness of the standard and that of the KNX Association, on the other hand, ensure availability of products in the long run and a constant development, both in terms of technology and offering of products, functions and applications.

The vitality of KNX proposals is witnessed by the sustained expansion of the association, seeing the entry of manufacturers, coming from many different areas, and from the tens of thousands of technicians who chose it to specialize in the field of building automation.

Achievable savings with the adoption of the KNX system for Home & Building control:

- 40% over shutters control
- 50% over individual ambient control
- 60% over ambient lighting control
- 60% over ventilation control

For customers, the variety and availability of KNX products has no comparison in other technological areas, and the system openness translates into the highest free choice, thereby avoiding the disadvantageous dependence of having to buy from a single supplier. Thanks to the modularity of the system, a project can be extended in time, starting with a basic configuration and adding more functions later. The native interoperability of KNX products is fundamental to technicians, as it allows to design a system by always choosing the most suitable technical options, reducing compromise and ties caused by proprietary systems which do not communicate with one another.
Moreover, the system offers new professional opportunities to designers and system integrators, making it possible to receive a consistent and high-level technical training and become certified KNX Partners.

KNX®

The KNX standard is entirely compliant with norm EN 50090 on HBES (Home and Building Electronic Systems) systems)

Products

4-fold pushbutton with room thermostat function (FF series)
4-fold KNX pushbutton (max. 8 independent bus functions), with integrated temperature sensor and room thermostat function, for controlling loads, dimming luminaires, controlling blinds and shutters or other programmable bus functions. Configurable LEDs available in two colour combinations (blue / green or white / red). Flush-mounting on round wall box. Power supply via KNX bus.

To be completed with:
- square or rectangular rockers (plastic, aluminium or Fenix NTM®)
- optional frame of form or flank series (plastic or aluminium)

Art.-Nr.
EK-ED2-TP

4-fold pushbutton with room thermostat function (71 series)
4-fold KNX pushbutton (max. 8 independent bus functions), with integrated temperature sensor and room thermostat function, for controlling loads, dimming luminaires, controlling blinds and shutters or other programmable bus functions. Configurable LEDs available in two colour combinations (blue / green or white / red). Flush-mounting on wall box. Power supply via KNX bus.

To be completed with:
- square or rectangular rockers (plastic, aluminium or Fenix NTM®)
- plate with 60x60 mm window (plastic, aluminium or Fenix NTM®)
- optional frame of form or flank series (plastic or aluminium)

Art.-Nr.
EK-E13-TP

4/8-fold pushbutton with backlit text / symbols and proximity sensor - 20venti series
KNX 4/8-fold pushbutton for on/off control of electrical devices, dimming of luminaires, control of motorized drives for roller shutters or other programmable switching and controlling bus functions. Thanks to the integrated temperature sensor, the device can act as a temperature controller for a room or zone. RGB LED for backlight of each rocker. The switch has an integrated KNX bus communication module and is designed for installation in a flush-mounted wall box.

To be completed with:
- 4 or 8 rectangular 30 x 15 mm plastic rockers with or without backlit text/symbol
- Deep or Surface plate with window 30 x 60 mm (4 rockers) or 60 x 60 mm (8 rockers)

Art.-Nr.
EK-E2E-TP-4L (4 rockers left)
EK-E2E-TP-4D (4 rockers right)
EK-E2E-TP-8 (8 rockers)

Signum
KNX pushbutton based on IPS 2.65" touch display (162 x 320 pixel RGB), 262K colours with haptic feedback. Operating graphical surface (corresponding to virtual rockers) freely customisable via dedicated app. Up to 4 rockers per screen and up to 3 different screens can be configured for lighting and shading control. Choice of two or more graphic themes (skins). A set of attributes for each rocker (e.g. colours, symbols and labels) can be modified even after initial installation. Bluetooth (BLE) module for connection to the programming app.

Wall mounting on 60 mm flush-mounted box. Power supply via KNX bus.

To be completed with:
- Deep or Surface plate with 30 x 60 mm window

Art.-Nr.
EK-EV3-TP
EK-EV3-V1-TER (thermostat voucher)
EK-EV3-V1-AUD (audio voucher)

Room thermostat (serie FF series)
KNX room thermostat with 2-point (ON / OFF) or proportional (PWM or continuous) control in combination with KNX actuators. Heating and cooling modes with local or via bus switching. 4 operating modes: comfort, standby, economy and building protection with separate setpoints for heating and cooling. Integrated temperature sensor (also available with relative humidity sensor), two freely configurable inputs, LCD display with adjustable backlighting and configurable LEDs in two colour combinations (blue/green or white/red). Flush-mounting on round wall box. Power supply via KNX bus.

To be completed with:
- set of 2 square rockers with symbols (plastic, aluminium or Fenix NTM®)
- optional frame of form or flank series (plastic or aluminium)

EP2

EQ2

Art.-Nr.
EK-EP2-TP
EK-EQ2-TP (with relative humidity sensor)
EK-ER2-TP (Easy-Version)

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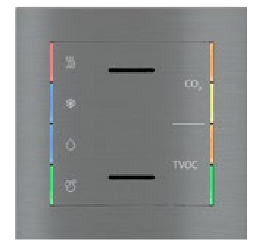
Room thermostat (71 series)
KNX room thermostat with 2-point (ON / OFF) or proportional (PWM or continuous) control in combination with KNX actuators. Heating and cooling modes with local or via bus switching. 4 operating modes: comfort, standby, economy and building protection with separate setpoints for heating and cooling. Integrated temperature sensor and LCD display with adjustable backlighting. Flush-mounting on wall box. Power supply via KNX bus.

To be completed with
- plate with 60x60 mm window (plastic, aluminium or Fenix NTM®)
- optional frame of form or flank series (plastic or aluminium)

Art.-Nr.
EK-E73-TP



Multisensor with thermostat function
KNX multisensor can be used as probe or controller for temperature, relative humidity and air quality (CO2 equivalent, TVOC). 2-point (ON / OFF) or proportional (PWM or continuous) room temperature control in combination with KNX actuators; threshold control of relative humidity, CO2 (equivalent) and TVOC, LEDs for signalling operation mode (heating / cooling), R.H., CO2 and TVOC thresholds. Wall mounting on flush-mounted box. Power supply via KNX bus.

Versions:
EK-ET3-... for T, R.H., CO2 equiv.
EK-ES3-... for T, R.H., CO2 eq., TVOC
To be completed with:
- front cover with symbols (plastic, aluminium or Fenix NTM®)
- plate with 60x60 mm window (plastic, aluminium or Fenix NTM®)
- optional frame from form or flank series (plastic or aluminium)

ET3

ES3

Art.-Nr.
EK-ET3-TP
EK-ES3-TP (TVOC Werte)

Touch & Control Display Unit
KNX display and control unit for operating, dimming, controlling and displaying bus functions. 4" touchscreen operating surface with graphic page sequence. The device is equipped with an LED that can be used for night orientation or to inform users of any alarms, which in combination with the integrated proximity sensor allows the screen to be automatically activated or deactivated. Wall mounting on flush-mounted box. Power supply via KNX bus, 30 Vdc auxiliary power supply required.

Versions:
EK-EI2-TP-4 (nero)
EK-EI2-TP-4-W (bianco)

To be completed with:
Two terminals for connection to the bus line and auxiliary power supply are included in the scope of supply.

EI2

Art.-Nr.
EK-EI2-TP-4
EK-EI2-TP-4W

Sensori di presenza
The Ekinex® range of real presence and occupancy sensors enables the automation of control of bus functions, such as lighting or room climate control. All versions contain a KNX communication module inside. SG2 versions are suitable for indoor ceiling mounting.

Wall-mounted version EK-SN2-TP to be completed with:
- 50x50 mm window plate (made of plastic, aluminum or Fenix NTM®)

SG2-TP-M

SG2-TP-P

Art.-Nr.
EK-SG2-TP-M (KNX Secure multifunctional occupancy sensor)
EK-SG2-TP-P (KNX Secure multifunctional real presence sensor)
EK-SN2-TP

SN2

Delégo Server

Delégo server is a device that enables supervision and control systems for KNX-standard installations, for mobile devices (smartphones and iOS and Android tablets), stationary devices (PCs and Macs), and in combination with the Delégo-panel series of in-wall touch-screen panels.

Delégo Mini is the Ekinex supervisory system for small installations based on the KNX system.

Art.-Nr.

EK-DEL-SRV01 (Delégo Server)
EK-DEL-SRV01-M (Delégo Server mini)
EK-DEL-UPG01 (Voucher, 500 KNX addresses)
EK-DEL-UPG02 (Voucher, unlimited number of KNX addresses)

Delégo

Complete system for supervision and control of a KNX-standard system. Developed with web-oriented technologies, it presents a uniform interface with high graphical impact on every platform with local and remote connection.

Art.-Nr.

EK-DEL-5PAN Delégo Panel 5" Basic
EK-DEL-5PAN-P Delégo Panel 5" Premium
EK-DEL-4PAN-S Delégo Panel 4" Smart
EK-DEL-8PAN-S Delégo Panel 8" Smart
EK-DEL-10PAN-S Delégo Panel 10" Smart
EK-DEL-5FR-G... Frame for Delégo Panel 5"

NTC temperature sensors

NTC sensors (10 kΩ at 25°C, ß = 3435) for measuring the temperature of the room air mass or the heat transfer fluid in the heating / cooling system; in combination with Ekinex® KNX devices dedicated to HVAC functions, they optimise the operation of the building's heating / cooling system, increasing the level of comfort and exploiting all opportunities for energy saving. Versions: external (E), immersion (I), contact (C), air mass (L).

Art.-Nr.

EK-STx-10K-3435 (x = E, I, C, L)

Actuator / controller for fan-coils

KNX module that can be used as an actuator (in combination with a KNX room thermostat) or actuator / controller (receiving the temperature value from a KNX sensor, another KNX device or an NTC temperature sensor connected to an analogue input). Versions for controlling 3-speed fan units or with brushless motor and inverter board (control voltage 0...10V). For systems with 2- or 4-pipe hydraulic distribution. ON / OFF control of one or two electrothermal valve drives. The outputs not used for the control of fan-coils can be used as outputs to carry out other bus functions. Panel mounting on DIN rail EN 60715 (4 MU).

HA1

HB1

HC1

Art.-Nr.

EK-HA1-TP (3-speed fan, 2-pipe distribution)
EK-HB1-TP (0...10V fan control, 2-pipe distribution)
EK-HC1-TP (3-speed fan or 0...10V fan control, 2- or 4-pipe distribution)

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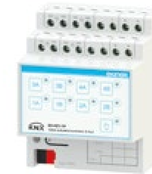


Actuator / controller for electrothermal drives

KNX module that can be used as an actuator (in combination with a KNX room thermostat) or actuator / controller (receiving the temperature value from a KNX sensor or other KNX devices). For systems with 2- or 4-pipe hydraulic distribution, with 8 TRIAC outputs for ON / OFF control of electrothermal drives or motors for zone valves. Panel mounting on DIN rail EN 60715 (4 MU).

Art.-Nr.

EK-HE1-TP

Mixing group controller

KNX controller for fluid mixing group. Control of a motor for mixing valve (3-point floating or with 0...10V signal) and control of a circulating pump. Inputs for acquisition of flow and return temperatures (warm and cold water) and external air temperature. Control of the flow temperature of the heat transfer fluid with separate control functions for heating and cooling. Panel mounting on DIN rail EN 60715 (8 MU).

Art.-Nr.

EK-HH1-TP

4 IN interface configurable with thermostat function

4-channel KNX input configurable for connecting potential-free contacts or passive NTC 10 kΩ temperature probes at 25°C, to be ordered separately. 4 output channels for controlling low-power LEDs. Room thermostat function for channels configured for connection to NTC probes (up to 4 independent zones). Flush mounting in wall box or on DIN EN 60715 rail using EK-SMG-35 bracket (to be ordered separately). Power supply via KNX bus.

Art.-Nr.

EK-CG2-TP

4 IN / 2 OUT (5A relay) interface with thermostat function

4-channel KNX input for connection of potential-free contacts including 1 configurable for connection of a temperature sensor (NTC 10 kΩ at 25°C, to be ordered separately) and 2-channel output with 5A relay for command and control of utilities. 4 output channels for control of low-power LEDs. Room thermostat function for the channel configured for connection to NTC probe. Recessed mounting in wall box or on DIN EN 60715 rail via EK-SMG-35 bracket (to be ordered separately). Power supply via KNX bus.

CG2

CE2

Art.-Nr.

EK-CE2-TP

Gateway Modbus - KNX
General-purpose gateway for protocol conversion between a Modbus RTU network and a KNX bus system (TP). Available for RS485 or TCP/IP Modbus RTU serial networks. Master function on the Modbus network. Panel mounting on DIN rail EN 60715 (4 UM).

TCP

485

Art.-Nr.

EK-BH1-TP-485 (serial RS485)
EK-BH1-TP-TCP (TCP / IP)

Gateway BACnet - KNX
General-purpose gateway for protocol conversion between a BACnet* network and a KNX bus system (TP). Available for MS / TP (master-slave / token-passed) or RS485 serial network. Panel mounting on DIN rail EN 60715 (4 UM).

*) Trade Mark of ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers).

IP

MS/TP

Art.-Nr.

EK-BJ1-TP-IP (IP over Ethernet)
EK-BJ1-TP-MSTP (MS / TP over RS485)

Gateway M-Bus - KNX
General-purpose gateway for protocol conversion between an M-Bus network and a KNX bus system (TP). Available for 20, 40, 80 and 160 M-Bus meters. Master function on the M-Bus network. Panel mounting on DIN rail EN 60715 (4 UM).

Art.-Nr.

EK-BM1-TP-20 (up to 20 M-Bus meters)
EK-BM1-TP-40 (up to 40 M-Bus meters)
EK-BM1-TP-80 (up to 80 M-Bus meters)
EK-BM1-TP-160 (up to 160 M-Bus meters)

VRF control interface with KNX communication
VRF KNX control interface from Ekinex for two-way communication with Inverter/VRF units. Integration between KNX building automation system and plug and play VRV/VRF air conditioning unit. Bidirectional data exchange occurs with confirmed actions and statuses and error detection.

Art.-Nr.

EK-AI6-TP-DA0 (Daikin residential)
EK-AI6-TP-DA1 (Daikin VRV)
EK-AI6-TP-MEL (Mitsubishi Electric)
EK-AI6-TP-SA2 (Samsung Nasa)
EK-AI6-TP-PA0 (Panasonic Residential)
EK-AI6-TP-PAN (Panasonic PACi-ECOi)
EK-AI6-TP-TOS (Toshiba)
EK-AI6-TP-LGE (LG)

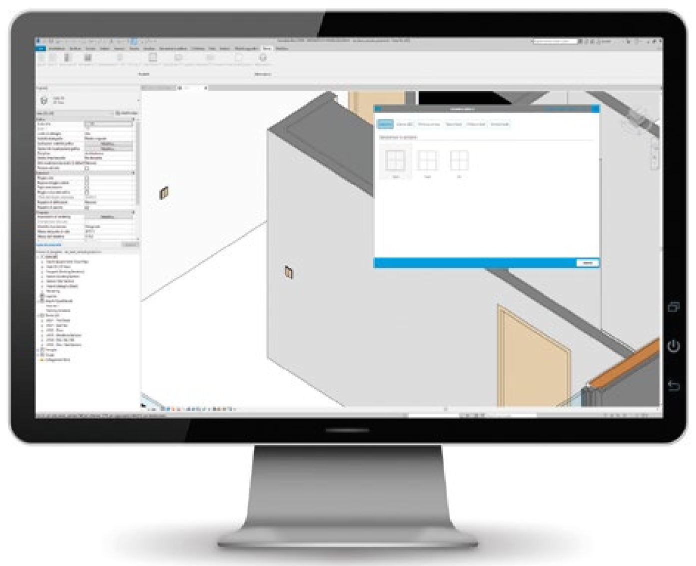
BIM ready

BIM stands for Building Information Modeling and indicates a methodology to optimize and better manage the phases of design and construction of a building. BIM is used to follow a working method that involves the generation of a building model that can also manage the data of the entire life cycle through multi-dimensional virtual models generated digitally by means of specific software.
The main benefit of adopting the BIM methodology is the 3D representation at the design stage, which speeds up processes, reduces delivery times and allows errors and inaccuracies to be detected first. The greater efficiency in sharing information and a more precise control over all the processes involved, also make it possible to contain costs and schedule in advance maintenance operations.

BIM is a standard process for all buildings and is being integrated into legislation across Europe following the transposition of Directive 2014/24/EU on public procurement which requires its inclusion in the procurement procedures of the Member States. In Italy, the transposition of the directive took place with Decree no. 560 of December 1, 2017, which established the methods and time schedules for the progressive introduction of electronic modelling methods and tools for construction and infrastructure. The decree provides for the obligation to operate with the BIM methodology from January 1, 2019 for works worth more than 100 million euros and then from 2019 to 2025 will be introduced in Italy the obligation for all contracts for new public works.

BIM Ekinex® database
Ekinex® is "BIM ready": the BIM product database is available in Autodesk Revit® 2019 / 2021 format for download at www.ekinex.com
The Ekinex® BIM Content Creator software is a true advanced configurator of the product range that will be enriched with future updates and expansions.

References
Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement



Planner

Planner is a useful tool that Ekinex® makes available on the website www.ekinex.com to create your own project, define the requirements of a home automation system, choose the most suitable finishes and give a personal touch to the control points of the system. There are four simple steps to use the Planner:

1) CREATE YOUR PROJECT
Configures the product with the possibility of inserting a plan in which to place the several elements

2) CHOOSE
Allows you to select devices, versions, materials and finishes

3) OBTAIN
Produces a complete list of codes to forward the request for quote

4) SAVE
Allows you to manage the list of projects according to individual needs

HVAC WITH EKINEX®

Application examples

Heating body systems	15
Fan coil systems	16
Control of a mixing unit	18
Radiant floor system in residential building	20
Radiant ceiling system in residential building	22
Radiant ceiling system in tertiary building	24
Fresh air system using VMC unitsVMC	26
Fresh air system by means of VAV cassettes	27
Interfacing of VRF systems	28
Delégo control and supervision	29
Monitoring of technological systems	30

Insights

Indoor Environmental Quality (IEQ)	31
Thermo-hygrometric comfort	32
Air quality	32
Building automation and European directives	33
Building energy efficiency classification	34
Energy classification of radiant systems (UNI/TR 11619)	36
Certification of sustainability	36

Heaters system

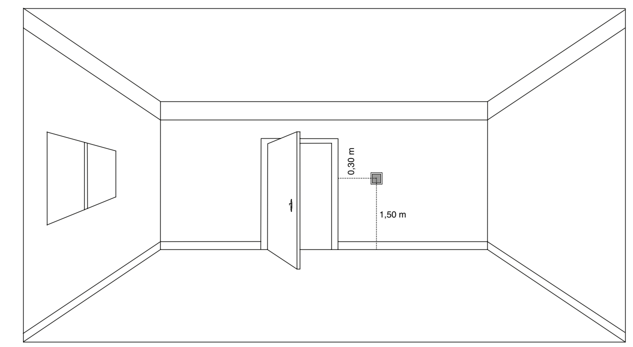
Heating bodies, in the different formal variants of radiators, decorative radiators and towel warmers, represent the most common heat exchange terminals in residential buildings. By means of heating bodies, a hydronic system for space heating only is realized, using small terminals for heat exchange predominantly by natural convection, due to a marked thermal jump between the temperatures of the heat transfer fluid and the ambient air. The system shown in the example is for a residential building and involves zone distribution of the heat transfer fluid using two distribution manifolds.

Control with Ekinex

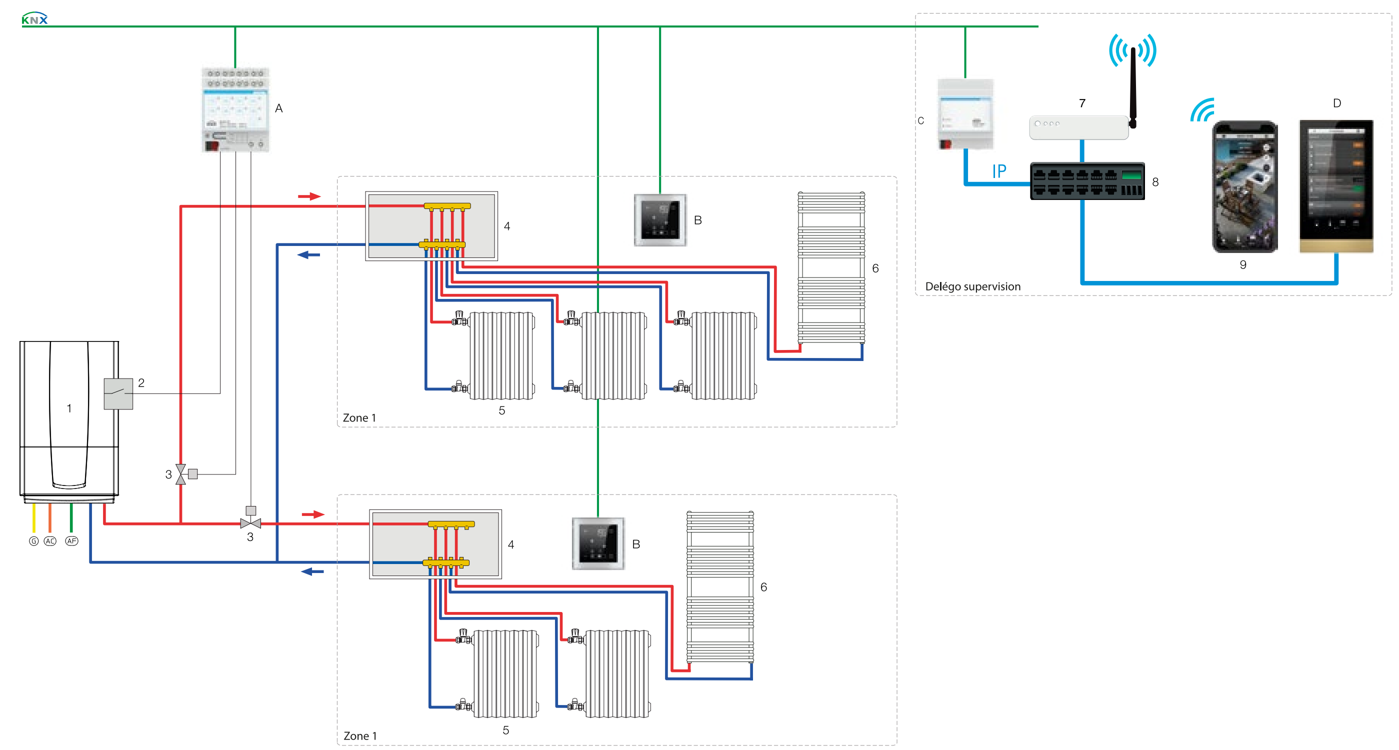
Room temperature is controlled by means of EK-E73-TP room thermostats **(B)**, arranged in the pilot rooms of the two zones, in combination with the EK-HE1-TP actuator **(A)**, which controls the ON / OFF servomotors of the zone valves **(3)**. Optional supervision using the Delégo Server **(C)** enables monitoring and control of the home automation system via a mobile device App **(9)** and/or a Delégo touch-panel **(D)**.

Mounting location of room thermostats

For optimal regulation, Ekinex room thermostats should preferably be installed on an interior wall at a height of 1.5 m and at least 0.3 m away from doors. Thermostats cannot be installed near heat sources such as radiators or household appliances or in locations subject to direct sunlight. If necessary, a weighted average between the temperature value measured by the sensor built into the thermostat and the value received via the bus from another device (e.g., from an Ekinex pushbutton or multisensor) can be used for control.



Example



Ekinex devices

A) Actuator-controller for electrothermal drives EK-HE1-TP
B) Room thermostat EK-E73-TP
C) Delégo server EK-DEL-SRV01
D) Delégo touch-panel EK-DEL-xPAN...

Other components

1) Thermal generator
2) Consensus contact
3) Zone valve with ON / OFF servomotor
4) Distribution manifold
5) Radiator
6) Towel warmer
7) Wi-Fi LAN access point
8) IP switch
9) Smartphone with Delégo App (Apple iOS or Android)

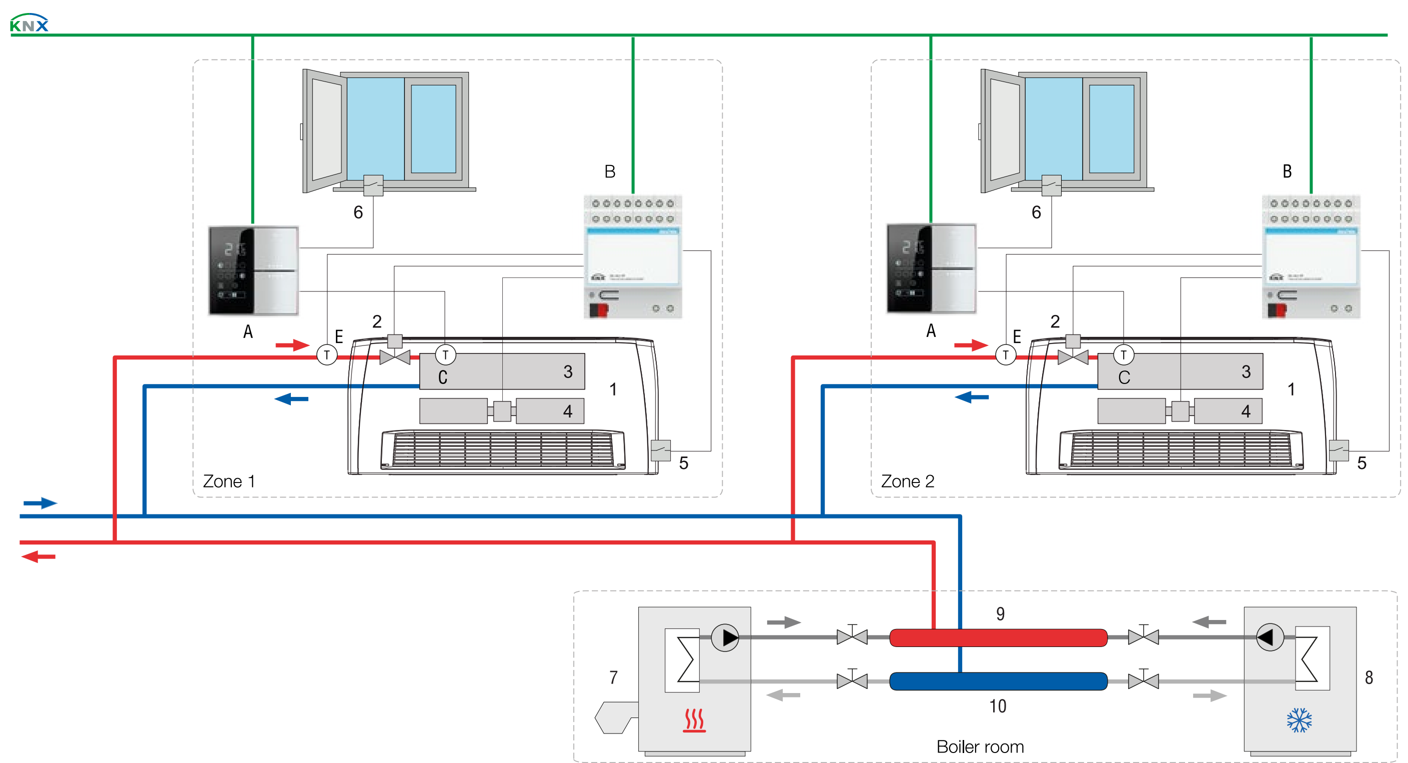
Fan-coil systems

Fan coil units are terminal units that find wide application in tertiary, commercial, hotel and hospital environments and, in general, in medium to large buildings.
By means of fan coil units, a hydronic system for space heating and cooling is realized using small-sized terminals for forced convection heat exchange. This is provided by one or two coils for water-to-air heat exchange, a fan unit and the actuating devices (2- or 3-way valves with electrothermal or servomotor actuation) to regulate the flow rate of heat transfer fluid to the exchange coil. Some versions can be equipped with an electrically powered auxiliary heating coil.
Machines with traditional 3-speed discrete fan units have been joined by versions with brushless motor and inverter board that allow continuous control of fan speed by means of 0-10V control voltage.
In terms of construction, fan coil units can take different forms: cabinet or for recessed mounting in the ceiling or wall; ceiling versions can be stand-alone or connected to air ducts arranged in the plenum.

Control with Ekinex

The application examples show two different and widely used system configurations.
In the first case (example I), fan coils **(1)** are equipped with a 3-speed discrete fan assembly and connected to a 2-pipe heat transfer fluid distribution system. Hot fluid or cold fluid circulates alternately in the heat exchange coil **(3)**, and the inflow is controlled by valve **(2)**. Room temperature is controlled by EK-EP2-TP room thermostats **(A)** and EK-HA1-TP fan coil actuator-controllers (B). To the room thermostats **(A)** are connected window opening contacts **(6)** and EK-STC-10K-3435 contact temperature probes **(C)**, while to the actuators **(B)** are connected condensate water drip tray signaling contacts **(5)** and EK-STI-10K-3435 immersion temperature probes **(D)** arranged on the heat transfer fluid discharge piping.
In this application, switching between heating and cooling can be done automatically by measuring the temperature of the incoming heat transfer fluid from the heating plant using the immersion temperature probe **(E)** connected to an actuator input **(B)**. Alternatively, Ekinex devices can receive switching from the bus (centralized manual switching mode).

Example I (2-pipe distribution)



Ekinex devices
A) Room thermostat EK-EP2-TP
B) Actuator-controller for fan coil units EK-HA1-TP
C) EK-STC-10K-3435 contact temperature probe
D) EK-STI-10K-3435 immersion temperature probe

Other components
1) Fan coil unit
2) Valve with ON / OFF servomotor
3) Heat exchange coil
4) Fan unit
5) Condensate drain pan signaling contact
6) Window opening contact
7) Thermal generator (hot fluid)
8) Thermal generator (cold fluid)
9) Central manifold (supply)
10) Central manifold (return)

In the second case **(Example II)**, the fan coils **(1)** are equipped with two heat exchange coils **(3, 5)** and a fan unit with a brushless motor controlled by an inverter board. The units are connected to a 4-pipe heat transfer fluid distribution system. With this type of distribution, if both fluids are available from the thermal power plant, there can be heated and cooled rooms in the same building at the same time; the inflow is controlled by two valves with ON / OFF servomotor **(2, 4)**. Room temperature control is by means of EK-EQ2-TP room thermostats **(A)** and EK-HC1-TP fan coil actuator-controllers **(B)**, which have the required 0-10V voltage output to continuously control the fan speed, achieving all the advantages of these terminals: more precise response to changing heat loads, greater temperature stability, reduced noise and high efficiency even at part load with consequent reduction in power consumption. Temperature attenuations can be recalled automatically in the absence of people, thanks to the EK-SG2-TP-P **(D)** real presence sensor. Automatic switching between heating and cooling, based on measured temperature and setpoint values, can prove advantageous in this application. Alternatively, and with fluids both available, switching can also be done locally on the room thermostat in manual mode.
In both cases numerous utility functions for comfort, energy efficiency, and system maintenance can be added depending on the needs of principals and end users: a few examples are given below.

Comfort

The contact temperature probe arranged on the heat exchange coil allows the fan unit **(4)** to be started only when the temperature of the heat transfer fluid is comfortable for users (warm-start). If the probe is missing, the function can also be carried out by setting a simple start-up delay. **(Ex. Application I)**
In rooms with great height and volume (lobbies, gyms, commercial rooms), air stratification can occur, wasting energy and discomforting occupants. To limit this effect, a temperature probe **(C)** is connected to the thermostat **(A)** and a maximum temperature gradient not to be exceeded is configured. **(Ex. Application II)**

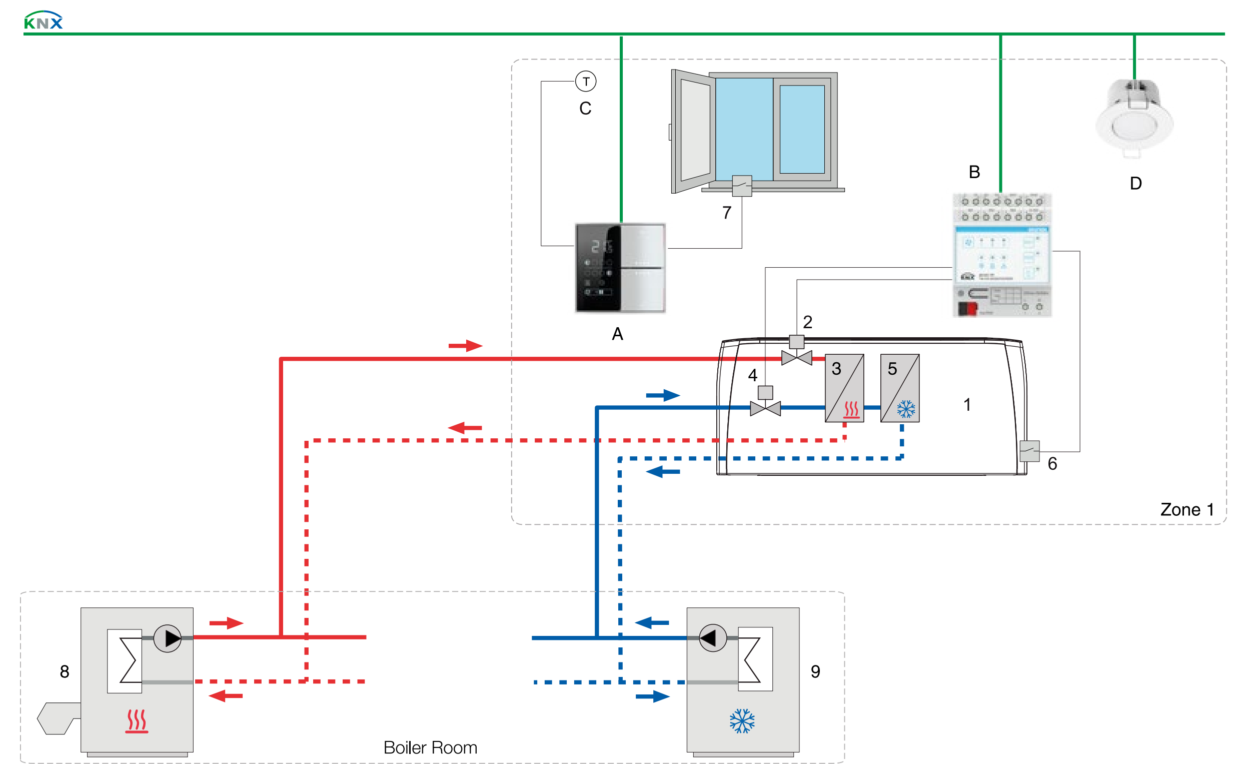
Energy saving

The window-opening contact **(6)** detected by a thermostat input **(A)** automatically determines the switching of the operating mode from comfort to building protection, avoiding dissipation of heating and cooling energy outside the building.

Maintenance

The actuator-controller **(B)** has an operating hours counter that increments the count when the fan unit **(4)** is at least in first speed. When the set time interval is reached, a signal for replacement of the fan coil filter is activated.

Example II (4-pipe distribution)



Ekinex devices
A) Room thermostat EK-EQ2-TP
B) Actuator-controller for fan coil units EK-HC1-TP
C) Temperature probe for measurement in air EK-STL-10K-3435
D) EK-SG2-TP-P real presence sensor

Other components
1) Fan coil unit
2) Valve with ON / OFF servomotor (hot fluid)
3) Heat exchange coil (hot fluid)
4) Valve with servomotor ON / OFF (cold fluid)
5) Heat exchange coil (cold fluid)
6) Window opening contact
7) Contact from condensate drip tray float switch
8) Thermal generator (hot fluid)
9) Thermal generator (cold fluid)

Control of a mixing group

More and more often in systems designed for room heating, cooling and ventilation there are simultaneously heat exchange, air handling or air renewal terminals with different operating principles (such as radiators, radiant floor or ceiling panels, fan-coils, dehumidifiers, mechanical ventilation units with integration of the sensible contribution for cooling, etc.) that make it necessary to produce heat transfer fluid at different temperatures. This can be done directly in the boiler room or locally, by controlling a mixing group.

Control with Ekinex

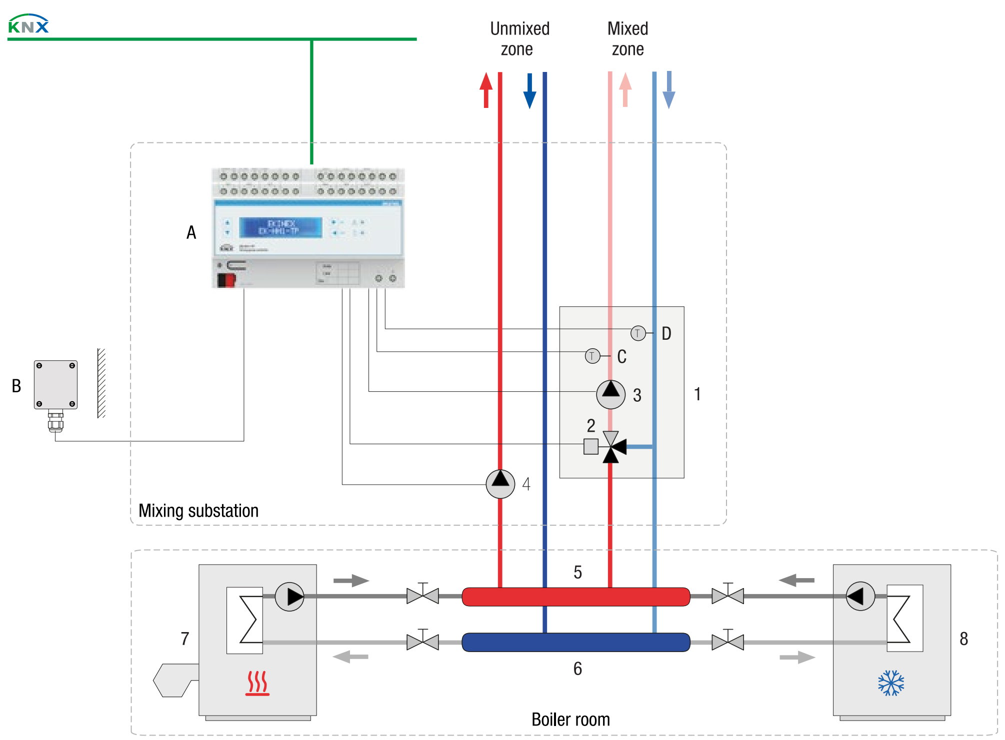
The unmixed zone directly serves the heat exchange terminals with heat transfer fluid at the temperature produced in the heating plant. The EK-HH1-TP controller **(A)** controls the mixing unit **(1)** by adjusting the flow temperature of the heat transfer fluid for the mixed zone. For this purpose, the mixing valve **(2)** equipped with a servomotor and the circulator **(3)** of the mixed zone are controlled, acquiring the flow temperature by means of an immersion probe **(C)**. Optionally, the return temperature can also be detected by means of a second immersion probe **(D)**. The outdoor temperature probe **(B)** measures the outdoor air temperature for climate-compensated control.

In the case of radiant panel systems that are also used for summer cooling, the ideal use of the controller **(A)** is in combination with up to 16 EK-EQ2-TP room thermostats equipped with temperature and relative humidity sensors to achieve effective integration between central (primary) and room or zone (secondary) control.

In this way, the switching on and off of the system as well as the optimal flow temperature of the heat transfer fluid are automatically selected according to the actual indoor conditions of the building; in cooling, the optimal flow temperature with active protection from condensation phenomena can also be selected.

Control options	Heating	Cooling
Fixed point	√	√
Climatic compensation	√	√
Adjusting to internal conditions	√	-
Adjusting to return temperature	√	-
Climatic compensation and adjusting to internal conditions	√	-
Adjusting to internal thermo-hygrometric conditions	-	√
Climatic compensation and adjusting to internal thermo-hygrometric conditions	-	√

Example



Ekinex devices
A) EK-HH1-TP controller for mixing assembly
B) EK-STE-10K-3435 outdoor temperature probe
C) EK-STI-10K-3435 immersion temperature probe
D) EK-STI-10K-3435 immersion temperature probe

Other components
1) Mixing unit
2) Mixing valve with servomotor
3) Circulator (mixed zone)
4) Circulator (unmixed zone)
5) Central manifold (flow)
6) Central manifold (return)
7) Thermal generator (hot fluid)
8) Thermal generator (cold fluid)

Focus on the EK-HH1-TP mixing group controller

The EK-HH1-TP controller **(A)** is a KNX device, fully programmable via ETS, which allows the flow temperature of the heat transfer fluid to be regulated in heating and cooling hydronic systems.

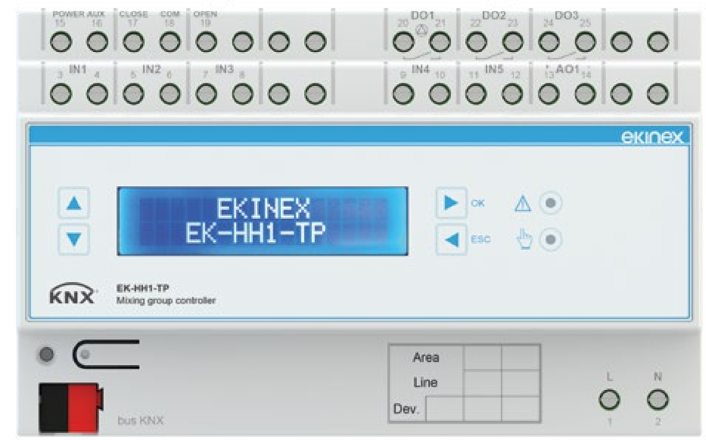
The device can be used as a stand-alone unit or in combination with one or more Ekinex® room thermostats to create single-zone or multi-zone systems (up to a maximum of 16 zones), controlling the servomotor of a 3-point floating mixing valve, powered at 230 Vac or 24 Vac, or with 0-10V signal and controlling the circulating pump of the mixed circuit in run / stop mode. The device manages over-temperature (in heating) and under-temperature (in cooling) alarms.

The controller has a backlit LCD text display, four membrane buttons for navigating through the display menu and two LEDs for alarms and switching to manual mode.

The display allows the operating parameters to be monitored; some control parameters can also be modified with respect to the initial configuration carried out with ETS. The switch-over of the system conduction mode (heating / cooling) can be done from the bus, from a digital input (configured for this purpose) or manually from the front keyboard. Alarms from anti-condensation probes can be managed.

The digital outputs, not used to activate a circulating pump, can be configured to control a zone valve servomotor located on a circuit dedicated to fan-coil units or dehumidifiers.

To create automation logic, the device is also equipped with 2-channel logic functions (16 inputs per channel) with exclusive AND, OR, NOT and OR blocks and delayed activation of the corresponding output.



Inputs and outputs

Terminal no.	Label	Connection
3-4	IN1	Input 1 (flow temperature sensor)
5-6	IN2	Input 2 (return temperature sensor)
7-8	IN3	Input 3 (outdoor temperature sensor)
9-10	IN4	Input 4 (configurable as AI or DI)
11-12	IN5	Input 5 (configurable as AI or DI)
13-14	AO1	0-10 V control output for servomotor
15-16	POWER AUX	TRIAC power supply (230 Vac or 24 Vac)
17	CLOSE	Control output for servomotor (closing)
18	COM	Control output for servomotor (common)
19	OPEN	Control output for servomotor (opening)
20-21	DO1	Circulator control relay output
22-23	DO2	Relais output (additional functions)
24-25	DO3	Relais output (additional functions)

Switching the seasonal conduction mode

The seasonal (heating / cooling) mode can be switched in three ways:

- from the KNX bus;
- via the front keypad of the controller;
- by means of a switch connected to an input of the controller.

If switching from the KNX bus is selected, the controller receives the conduction mode from another bus device (via a communication object), such as an Ekinex® room thermostat, which has been assigned the master function for seasonal switching.

Switching can be carried out manually using the keypad and the display on the front of the device: in this case, it is the EK-HH1-TP controller that performs the master function of seasonal switching for all Ekinex® devices (sensors, actuators) that are on the same system or part of a system served by the controller.

Switching via a switch connected to input IN5 (configured as DI) is suitable for stand-alone applications in which there is no need for integration between the boiler room (primary adjustment) and the rooms or zones (secondary adjustment). The switch can be the same as the external selector used in the boiler room for switching the operation of heat generators or shut-off valves of fluids.

The current operating mode is stored in the non-volatile memory of the controller.

Activating the mixing group

The mixing group can be activated in three ways:

- from the KNX bus;
- from a controller input;
- from a controller input and the KNX bus.

By selecting the activation from the KNX bus, the controller connects in logical OR the flow requests coming from a maximum of 16 Ekinex® room thermostats. To activate the mixing group it is sufficient that a single room thermostat requires flow.

The activation from an input is suitable for stand-alone applications in which there is no need for integration between the boiler room (primary adjustment) and the rooms or zones (secondary adjustment). A time programmer can be connected to input IN4 to activate the group according to scheduled time slots or the request of a stand-alone room thermostat. In systems with distribution manifolds, the limit switches of the electrothermal drives mounted on the individual valves can be connected in parallel.

An intermediate solution, on the other hand, involves activation both from the binary input and from the KNX bus. The input can have priority over the flow requests coming from the zones via bus (for example an external time zone programming device) or it behaves as an additional zone (without priority).

In all cases it is possible to set an activation delay (from 1 to 255 seconds) for the start of mixing; in fact, it is advisable to wait for the electrothermal drives to bring the valves into the open position to prevent the circulating pump from exerting pressure on hydraulically closed circuits.

Floor radiant system in residential buildings

The floor radiant system is a widespread hydronic system for heating and cooling rooms. The heat transfer fluid circulates inside circuits made up of plastic pipes placed under the surface covering of the floor; in the most common version, the pipes are laid on an insulating layer and embedded in the cement base. The system is invisible and uses the whole surface of the floor as a large terminal for the heat exchange prevailing at radiation. In both seasons the system works with a very limited temperature difference between the heat transfer fluid and the room air; for this reason it is also defined as a"low-temperature difference" heating and cooling system.

The system shown in the example is intended for a residential building. It is a combined system, i.e. it combines the radiant floor panels with one or more fan-coil units, mainly for the integration of sensible loads in cooling conduction mode.

Control with Ekinex

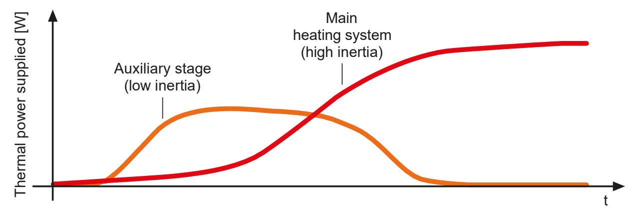
The need to produce heat transfer fluid at two different temperatures for the combined system (radiant floor/ fan coil) is solved by controlling a mixing unit by means of the EK-HH1-TP controller **(D)**. The device controls the mixing valve **(9)** and the circulator **(10)**; by means of the two EK-STI-NTC-3435 probes **(L, I)** it can acquire the flow and return temperatures of the heat transfer fluid. On the unmixed circuit it can also control either a circulator **(7)** or a zone valve as required.

Room temperature is controlled by means of EK-EQ2-TP **(C)** thermostats, which can measure temperature and relative humidity, in combination with EK-HE1-TP **(N)** actuator-controllers for electrothermal drives and EK-HC1-TP **(A)** actuator-controllers for fan coil units. The thermostats are capable of calculating and sending to the bus the dew temperature; in case the thermo-hygrometric conditions of the environment approach those critical for the formation of condensation on the cooled surfaces, it is possible to implement one of the protection strategies provided by the Ekinex thermoregulation platform (see side table); for example, recalibration of the flow temperature of the thermovector fluid by means of the EK-HH1-TP controller **(D)**.

Optional supervision using the Delégo Server **(G)** enables monitoring and control of the home automation system via a mobile device App **(6)** and/or a Delégo touch-panel **(M)**.

Two-stage system (main / auxiliary)

In the system configuration of the example, the room thermostat EK-EQ2-TP **(C)** allows you to easily realise a two-stage heating / cooling system. When the main stage consists of a radiant panel system, the high inertia (especially typical of the version with cement base), makes it rather slow in the start-up phase to achieve comfort conditions. In this case, it is possible to configure the fan-coils as an auxiliary stage; thanks to their much lower inertia, they contribute in the initial phase to quickly heat or cool the room and then stop their action when the difference between the measured and setpoint temperatures can be satisfactorily addressed by the main stage alone. The auxiliary stage works in automatic mode with a configurable offset with respect to the temperature setpoint set for the radiant floor (main stage).



Prevention of condensation in cooling conduction mode

In summer cooling operation, the latent loads (due to the increase in the humidity level in the room) are taken care of by the air handling integration.

If this is not done satisfactorily, or in the event of a sudden change in thermohygrometric conditions (e.g. due to accidental stopping of the machines or opening of windows), additional safety measures must be taken to prevent or limit the formation of condensation on cold surfaces. The EK-EQ2-TP **(C)** room thermostats provide various active and passive protection strategies depending on the system configuration and the presence of home automation devices.

Type	Mode	Action
Passive	With condensation sensor (13) connected to an input of the room thermostat (E)	Closing of the circuit serving the involved room by means of the actuator (O)
	With condensation sensor communicating with the thermostat (E) via KNX bus	Closing of the circuit serving the involved room by means of the actuator (O)
Active	Comparison between flow temperature (fixed design value, ETS parameter) and dew temperature calculated by the room thermostat (E)	Closing of the circuit serving the involved room by means of the actuator (O) when the flow temperature is lower than the dew temperature
	Comparison between flow temperature (measured value received from the KNX bus) and dew temperature calculated by the room thermostat (E)	Closing of the circuit serving the involved room by means of the actuator (O) when the flow temperature is lower than the dew temperature
	The dew temperature from the thermostat (E) is sent via KNX bus to the mixing group controller (I)	Calibration of the cold fluid flow temperature by the controller (I) and maintenance of the opening of the circuit serving the involved room by the actuator (O)

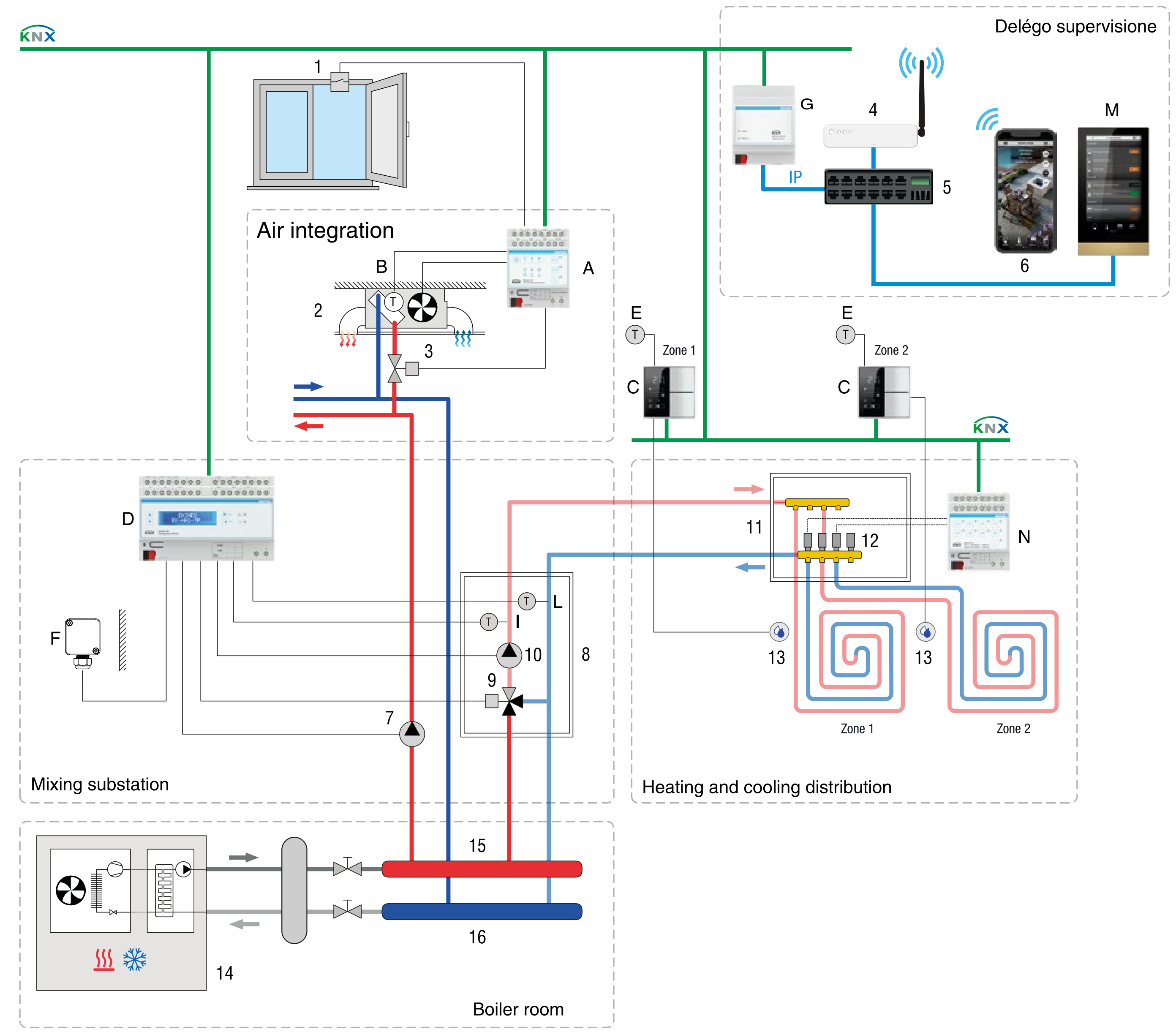
Active protection is always preferable, as the intervention tends to prevent the conditions of formation of condensation, while passive protection intervenes when the formation of condensation has already begun.

Surface temperature limitation

In some cases it is advisable to limit the surface temperature when the radiant floor system is used as an auxiliary stage for heating; the dispersions to the outside of the building are handled by the main heating system, while the auxiliary stage works only to maintain the temperature of the floor at a pleasant level in the bathrooms of residential buildings or in the rooms of sports centres, spas, etc. This limitation is also included in the EN 1264 standard (Underfloor heating, Part 3) which defines the maximum allowed temperature (TS_{max}) for the surface of the floor from a physiological point of view as follows:

- TS_{max} ≤ 29°C for areas of normal occupancy of the rooms;
- TS_{max} ≤ 35°C for the peripheral areas of the rooms.

Example



Ekinex devices
A) Actuator-controller for fan coil unit EK-HC1-TP
B) EK-STC-NTC-3435 contact temperature probe
C) EK-EQ2-TP room thermostat
D) Controller for mixing unit EK-HH1-TP
E) Temperature probe for air measurement EK-STL-NTC-3435
F) Outdoor temperature probe EK-STE-NTC-3435
G) Delégo server EK-DEL-SRV01
H) Controller for mixing unit EK-HH1-TP
I) Immersion temperature sensor (flow) EK-STI-NTC-3435
L) Immersion temperature probe (return) EK-STI-NTC-3435
M) Delégo touch-panel EK-DEL-xPAN...
N) Actuator-controller for electrothermal drives EK-HE1-TP

Other components
1) Window opening contact
2) Fan coil unit
3) Valve with ON / OFF servomotor
4) Wi-Fi LAN access point
5) IP switch
6) Smartphone with Delégo App (Apple iOS or Android)
7) Circulator for unmixed circuit
8) Mixing unit
9) Mixing valve with servomotor
10) Circulator for mixed circuit (radiant floor)
11) Distribution manifold for low-temperature circuits
12) ON / OFF electrothermal drives
13) Anti-condensation probe (with signaling contact)
14) Thermal generator (hot and cold fluids)
15) Central manifold (supply)
16) Central manifold (return)

Ceiling radiant system in residential buildings

The ceiling radiant system is a hydronic system for room heating and cooling, which was added to the floor version over time; in common it maintains the characteristic of having a low temperature difference between the heat transfer fluid and the room air. The heat transfer fluid circulates inside circuits made up of metal or plastic pipes integrated in a suspended false ceiling; the series of panels are fed by distribution manifolds installed above the circuits served. In residential applications, the false ceiling has a plasterboard finish towards the rooms, suitable for civil buildings, and an insulation layer towards the top. The system is invisible and uses the whole surface of the ceiling as a large terminal for the thermal exchange prevailing at radiation. As in the case of the floor radiant system, the ceiling radiant panels only handle the heat loads of a sensible type; in general, the ceiling solution offers a higher yield in cooling.

The radiant ceiling system shown in the example is used to heat and cool the rooms of a residential building. This particular system is a combined system; it combines the ceiling radiant panels with one or more units for energy recovery ventilation (ERV), whose basic function is the renewal of the room air with high efficiency heat recovery. In this case, moreover, they are complete machines for the air handling of the rooms, able to support the operation of the system in summer cooling, also performing the functions of dehumidification (with reduction of the cooling latent load) and handling of part of the sensible cooling load.

Usually these machines do not serve a single room, but several rooms or an area of a building. In the residential sector, for example, it is common to use one machine for the living zone and a second one for the night zone. The installation is typically made in a central position with respect to the served zone, for example recessed in the false ceiling in the hallway or in the corridor.

Control with Ekinex

The EK-EQ2-TP room thermostat **(C)** provides temperature and relative humidity measurement and is installed in a position sensitive to the airflow generated by the machine **(1)**. In heating or cooling operation, at the request of the thermostat the actuator-controller EK-HE1-TP **(B)** provides control in opening the zone valve **(8)** of the radiant ceiling. Where necessary, an additional NTC temperature sensor **(D)** can be connected to the thermostat **(C)** to perform control based on a weighted temperature value.

At seasonal switching to cooling, the actuator-controller **(B)** commands the seasonal valve **(5)** to close in order to avoid supplying the towel heaters with cold heat transfer fluid.

The contacts for consent to cooling integration **(2)** and dehumidification **(3)** are activated by binary output EK-FE1-TP **(A)**. Cooling integration is activated when the temperature measured by the room thermostat **(C)** exceeds the setpoint value by a predefined offset value (for example: 1.5 °C). Dehumidification is activated when the relative humidity measured by the room thermostat **(C)** exceeds the predefined setpoint value (for example: 50%).

A probe for the detection of condensation formation **(10)** can be connected to the room thermostat **(C)** in cooling operation; this expedient makes it possible to bring the system to safety, closing the circuits concerned by means of the zone valve **(8)** in case thermo-hygrometric conditions give rise to the beginning of condensation on the cooled surfaces.

The optional delégo supervision (not represented in the diagram) allows monitoring and control of the entire home automation system via a smartphone App.

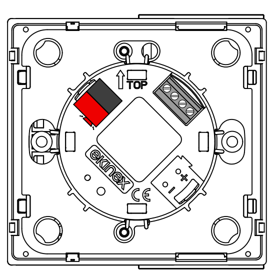
Focus on the EK-EQ2-TP thermostat

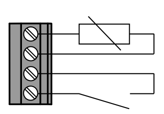
The Ekinex® room thermostat EK-EQ2-TP **(C)** allows the measurement of the temperature and relative humidity of the room air mass by means of integrated sensors with the possibility of sending values on the KNX bus. The relative humidity measurement significantly expands the room air conditioning functions and increases the comfort and safety of the room. Thanks to the calculation of the dew temperature, it is possible to carry out active strategies to protect against the formation of condensation when using radiant panel systems for summer cooling. In combination with the Ekinex® actuators-controllers for HVAC functions, the device allows a complete independent climatization for each room or zone, adding to the function of controller for heating and cooling the possibility to effectively control the dehumidification and humidification of the rooms. The display also allows you to view a series of information such as:

- temperature (measured and setpoint in °C or °F);
- relative humidity (measured and setpoint in %);
- CO_2 concentration (received by the KNX bus in ‰);
- perceived temperature (calculated according to the Humidex index in °C);
- outdoor temperature (received by the KNX bus or a NTC sensor in °C o °F).

Using configurable inputs

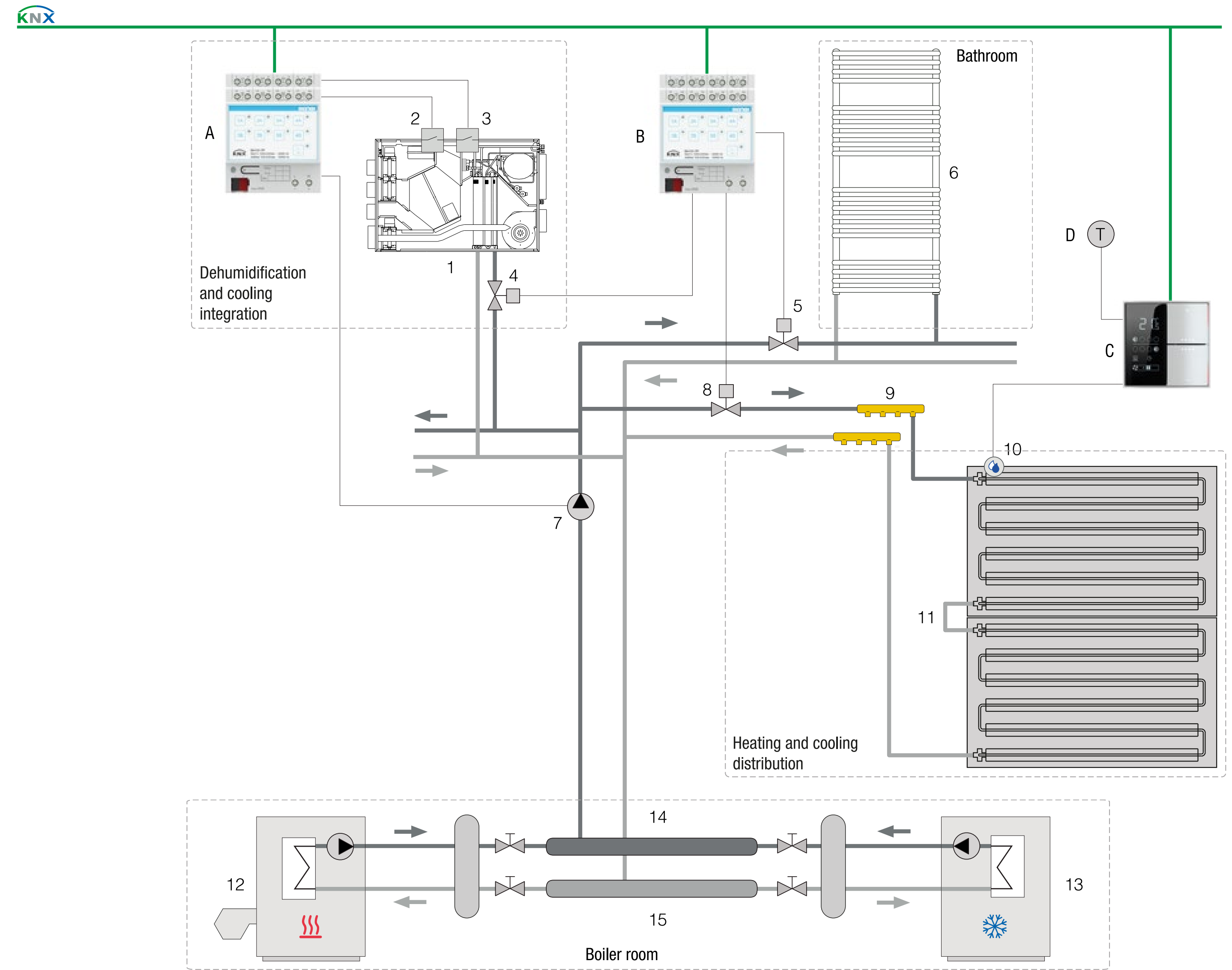
Thanks to the two configurable inputs of the device, the thermostat allows additional functions to be carried out that can increase comfort and energy saving, without the need for additional input bus devices. If configured as analogue, to the input is only allowed the connection of a NTC temperature sensor with characteristic resistance value 10 kΩ at 25°C, ß = 3435 (Ekinex® codes EK-STx-10K-3435 with x = E, I, C, L).





Input configuration	Predefined applications
Digital [DI]	window contact
	card holder contact
	condensation sensor
Analogue [AI]	heat exchange battery temperature sensor
	room temperature sensor
	stratification temperature sensor
	floor surface temperature sensor
	outside temperature sensor
	NTC generic temperature sensor

Example



Ekinex devices
A) Binary output EK-FE1-TP
B) Actuator-controller for electrothermal drives EK-HE1-TP
C) Room thermostat EK-EQ2-TP
D) Temperature probe for measurement in air EK-STL-10K-3435

Other components
1) VMC unit with dehumidification and cooling integration
2) Consensus contact for dehumidification
3) Consensus contact for cooling integration
4) Valve with servomotor ON / OFF
5) Seasonal valve (towel warmer) with servomotor ON / OFF
6) Towel warmer
7) Circulator
8) Zone valve (radiant ceiling) with servomotor ON / OFF
9) Distribution manifold for radiant ceiling circuits
10) Anti-condensation probe (with signaling contact)
11) Radiant ceiling panels (series)
12) Thermal generator (hot heat transfer fluid)
13) Thermal generator (cold heat transfer fluid)
14) Central manifold (supply)
15) Central manifold (return)

Ceiling radiant system in functional buildings

The ceiling radiant panel system is widely used in offices and, more generally, in large functional buildings such as hospitals, shopping malls, schools, universities, airports or stations.
In these cases, the suspended ceiling is made up of metal panels **(7)** that can be inspected completely similar to those usually used in these buildings, but with hydronic circuits applied to the upper part and possibly an insulating layer towards the plenum. The hydronic circuits consist of metal or plastic pipes and metal thermal diffusers that exchange heat between the pipes and the metal surface of the false ceiling.
The series of radiant panels are powered by distribution manifolds installed above the circuits served. The system is invisible and uses the entire surface of the ceiling as a large terminal for the heat exchange (prevailing as radiation). As in the case of the floor system, the ceiling radiant panels only handle the sensible heat loads; in general, the ceiling solution offers a higher yield in cooling.

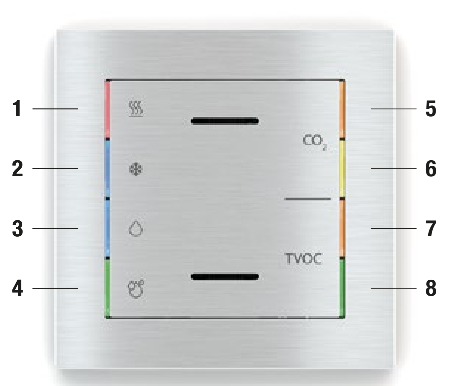
The ceiling radiant system shown in the example is used for heating and cooling the rooms of a functional building. The distribution is made with a 4-pipe system that make available both fluids at the same time to heat or cool the room. This type of distribution can be advantageous when it is expected that the thermal loads can vary greatly during the same day or depending on the different exposures of the building.
In this application, the air renewal and dehumidification functions are performed by a system with air centrally treated by an air handling unit and distributed in the rooms by means of ducted systems and diffusers. As an alternative to the diffusers, and in the absence of insulation towards the plenum, the micro perforation present on the metal panels can be used for the diffusion of renewal and dehumidified air in the rooms.

Control with Ekinex
Room air temperature control is carried out in each zone or room by means of a multisensor **(D)** in combination with the EK-HE1-TP actuator **(A)**, which controls the servomotors of the zone valves that regulate the inflow of hot or cold heat transfer fluid to the radiant panel arrays. By measuring relative humidity, the multisensor **(D)** can also calculate the dew temperature and send it via bus to higher-level systems (BMS) through appropriate gateways.
Where necessary, the multisensor **(D)** can receive a measured temperature value from an Ekinex EK-E13-TP series pushbutton **(C)**, normally used to control other functions such as lighting or shading, to make adjustments based on a weighted temperature value. This can typically be done in large or volumetric rooms, where the temperature value measured by the multisensor is not fully meaningful of the general temperature conditions in the room.
The EK-CD2-TP input interface **(F)** provides for the acquisition of signals from anti-condensation probes **(5)** and window opening contacts **(6)**. The anti-condensation probe **(5)** is installed in contact with the first heat exchange element served by the hydronic circuits so as to promptly detect any condensation when the system is in cooling mode and cause the actuator-controller **(A)** to close the corresponding valve **(4)**, bringing the system to safety.
To reduce energy consumption, the operating mode can be automatically switched according to the presence or movement of people within the zone by means of the real presence sensor EK-SG2-TP-P **(E)**, calling up temperature attenuations of opposite sign in the heating and cooling conduction modes.

Focus on the multisensor
The Ekinex® multisensor **(D)** is a complete device for controlling indoor room comfort that combines many functions usually distributed among several sensors and different controllers. The device measures temperature, relative humidity and air quality (parameters: TVOC concentration in ppb and/or equivalent CO_2 concentration in ppm) using the integrated sensors, with the possibility of sending values to the KNX bus, and can also act as a controller for each of the measured parameters. With a single compact device it is therefore possible to control both the thermohygrometric conditions and the quality of the room air mass.
In special cases (large or high rooms, in the presence of strong asymmetry in the temperature distribution or when the device is installed in an unsuitable position), the room air temperature can be controlled by using a weighted average between two temperature values: the first measured by the integrated sensor and the second received by the KNX bus. Two independent thresholds for relative humidity and three thresholds for CO_2 and TVOC concentration can be configured. To implement automation logic, combinatorial functions such as AND, OR, NOT and exclusive OR are available; thanks to these functions, it is possible to use the information available on the home automation system to control air renewal according to the actual need (DCV or Demand Controlled Ventilation).

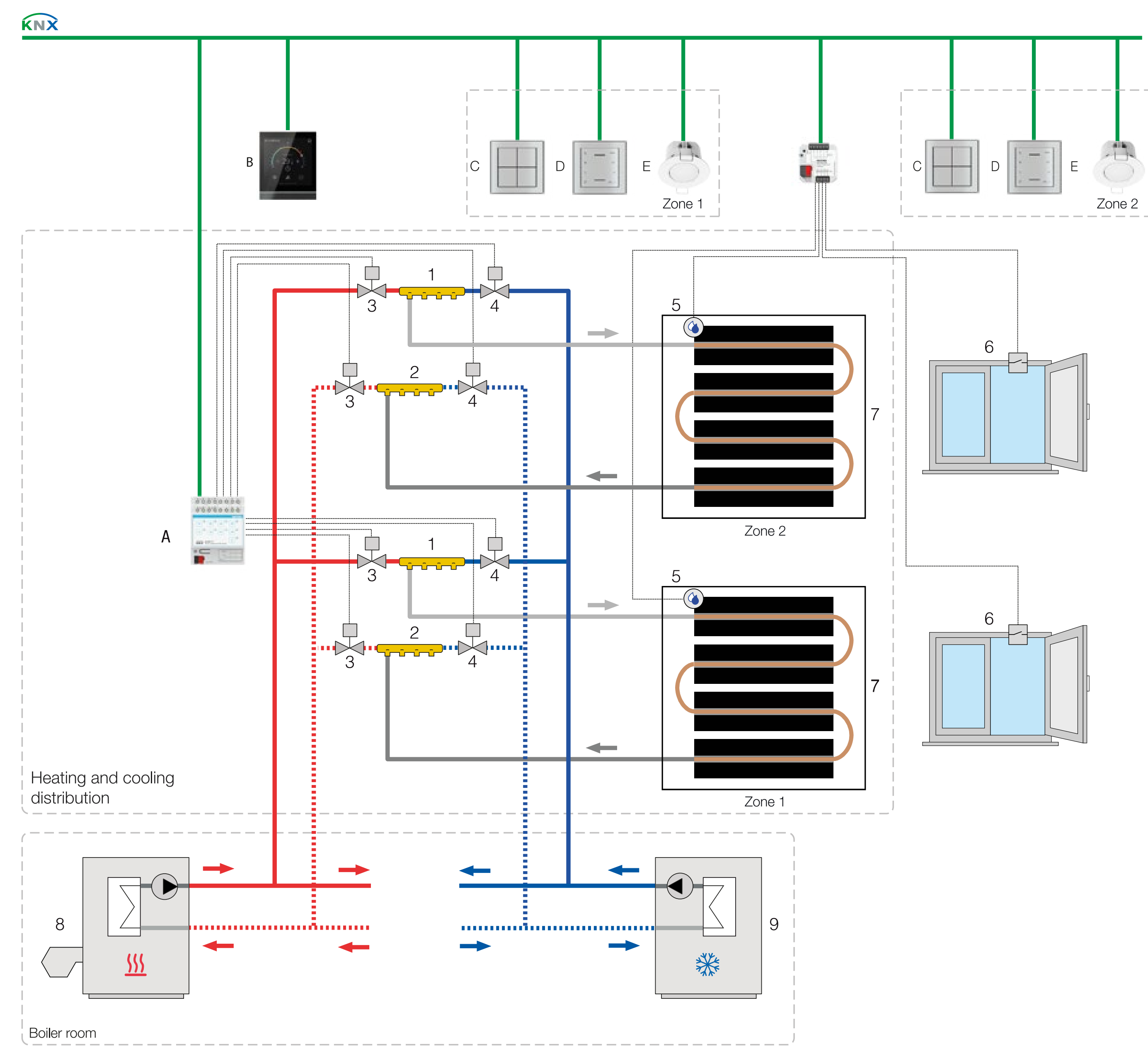
Versions
EK-ET3-TP with temperature, relative humidity and CO_2 eq. measurement
EK-ES3-TP with temperature, relative humidity, TVOC and CO_2 eq. measurement

LEDs
The eight integrated LEDs (with light guide), positioned on the sides of the front cover, can be configured to indicate the active operating mode of the heating system (heating or cooling), the concentration of CO_2 (equivalent) and TVOC (only for EK-ES3-TP version) and the activation of the dehumidification or humidification function.



LED	Colour and meaning (EK-ES3-TP version)
1	white (heating mode) or red (heating ON)
2	white (cooling mode) or blue (cooling ON)
3	blue (dehumidification ON)
4	green (humidification ON)
5	red blinking (CO_2 eq. concentration > threshold 3) orange (CO_2 eq. concentration between thresholds 2 and 3)
6	yellow (CO_2 eq. concentration between thresholds 1 and 2) green (CO_2 eq. concentration < threshold 1)
7	red blinking lampeggiante (TVOC concentration > threshold 3) orange (TVOC concentration between thresholds 2 and 3)
8	yellow (TVOC concentration between thresholds 1 and 2) green (TVOC concentration < threshold 1)

Example



Ekinex devices
A) Actuator-controller for electrothermal drives EK-HE1-TP
B) Touch&Control display EK-EI2-TP-4
C) 4-channel pushbutton (8 functions) EK-E13-TP
D) Multisensor EK-ET3-TP or EK-ES3-TP
E) Real presence sensor EK-SG2-TP-P
F) Universal interface EK-CD2-TP

Other components
1) Distribution manifold for low temperature circuits (supply)
2) Distribution manifold for low temperature circuits (return)
3) Valve with ON / OFF servomotor (hot heat transfer fluid)
4) Valve with ON / OFF servomotor (cold thermovector fluid)
5) Anti-condensation probe (with signaling contact)
6) Window opening contact
7) Radiant ceiling panels (series)
8) Thermal generator (hot heat transfer fluid)
9) Thermal generator (cold heat transfer fluid)

Air renewal with energy recovery ventilation units

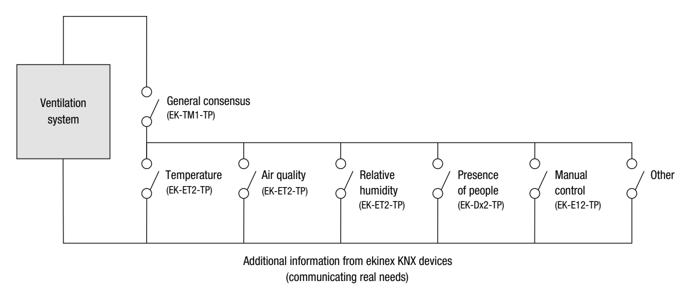
The high level of insulation and the high-performance windows and doors used in new buildings or in buildings that have undergone major renovation to meet the energy efficiency requirements of EPBD directive (91/2002/EC and following releases) have greatly reduced heat losses to the outside and, at the same time, have in many cases made it necessary to use mechanical ventilation units for air renewal with energy recovery. The manual control of these units alone is inadequate to ensure energy efficiency in their operation and even a simple time scheduling is not fully satisfactory. As pointed out by EU Regulations no. 1253 and 1254 of 2014, for these ventilation units it is necessary to use an environmental control by measuring one or more parameters to automatically adjust the flow of fresh air to be introduced into the rooms.

Control with Ekinex

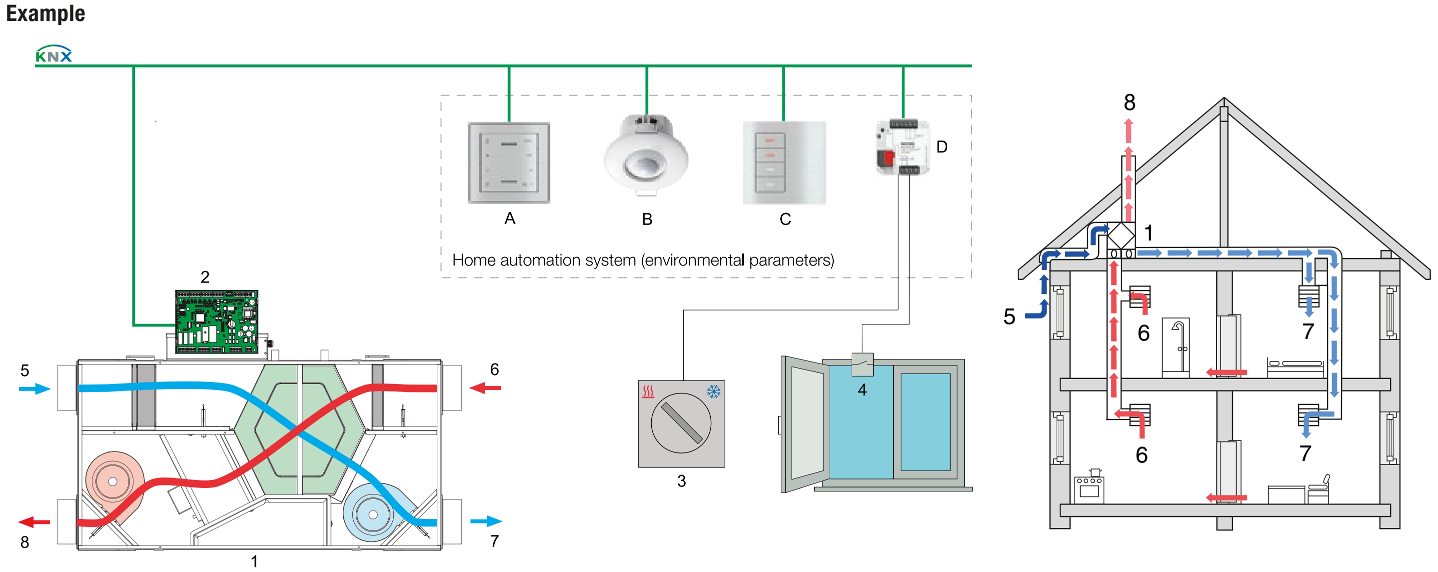
The EK-ET3-TP multisensor **(A)** measures environmental parameters representative of ventilation requirements: the main one is air quality (CO2 concentration) to which relative humidity (in %) and temperature (in °C) are added; the EK-ES3-TP version adds TVOC concentration. Other useful environmental parameters are the detection of presence or movement of people within rooms by means of the EK-SG2-TP-P sensor **(B)** or signals due to the operation of other home automation functions, such as lighting by means of the 20vent Series button **(C)**.
RDZ's VMC units can be equipped with a KNX gateway and thus easily integrated into the system. The EK-CC2-TP universal interface **(D)** acquires signals from conventional components, such as a seasonal switch **(3)** or a window contact **(4)**.

Demand controlled ventilation

Thanks to the many environmental parameters made available by the Ekinex® home automation system, it is possible to carry out ventilation control according to the actual need for air renewal (a strategy known as DCV or Demand Controlled Ventilation). This allows to constantly adjust the air flow rate to be introduced into the rooms to the real needs with the aim of maintaining a constantly high air quality, while minimizing the energy consumption. Air quality can typically be controlled by measuring the CO_2 concentration. With this kind of control, energy savings are twofold: the operating time of the fan units is reduced and the flow rate of fresh air to be handled, before release into the rooms, through heating, cooling, humidification and dehumidification processes.



Example



Ekinex devices
A) Modbus / KNX interface for RDZ air renewal units
B Time / astronomical digital switch EK-TM1-TP
C) GPS module EK-GPS-1
D) Multisensor EK-ET3-TP or EK-ES3-TP
E) Presence sensor EK-DF2-TP
F) Pushbutton Series 20venti
G) Universal interface EK-CC2-TP

Other components
1) Mechanical ventilation unit with energy recovery
2) Control board of RDZ ventilation unit
3) Two-position switch
4) Window contact
5) Fresh air (from outside)
6) Stale air (from inside)
7) Pre-heated air (to inside)
8) Exhaust air (to outside)

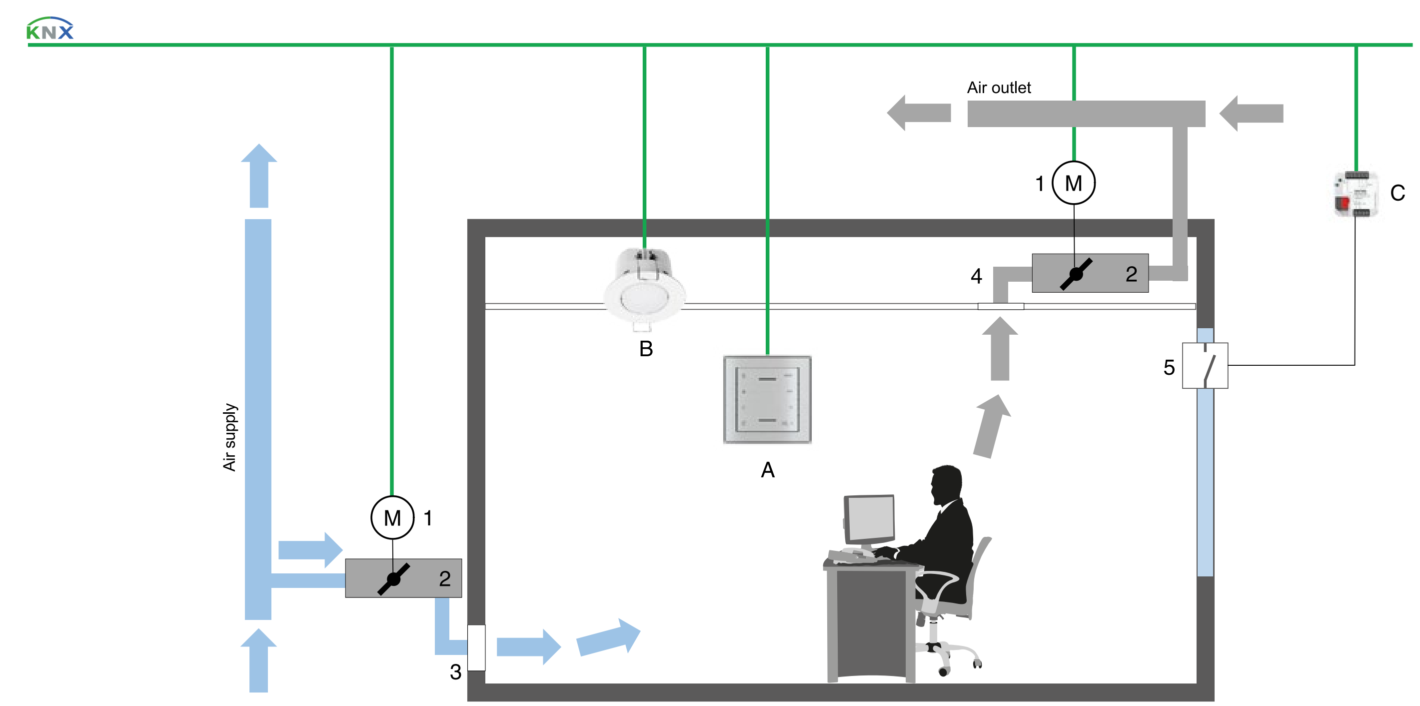
Air renewal with VAV boxes

VAV (Variable Air Volume) systems are designed to ventilate rooms according to actual needs, by arranging motorized dampers **(2)** inside the special boxes **(1)** that act as a regulator of fresh air flow rate. In combination with home automation sensors arranged in the room, the system ensures high energy efficiency, as the room can be ventilated according to one or more parameters measured in the room.
The use of a real presence sensor EK-SG2-TP-P **(B)** is suitable when an automatic control of a simplified type is desired with opening of the VAV box damper under occupied room conditions and setting the minimum flow rate to save energy when the room is unoccupied instead.
Greater efficiency is achieved by the use of a multisensor **(A)** that can adjust the flow rate of air input according to the measured value of air quality and preset thresholds.
The signal of a window opening contact **(5)**, detected by means of an EK-CC2-TP input **(C)**, allows ventilation to be temporarily deactivated so as not to waste energy unnecessarily; reactivation occurs automatically when the window is closed.

Control based on CO_2 or TVOC values

The choice of the control parameter depends mainly on the intended use of the rooms. Where the variability in the occupancy rate is very high or unpredictable (such as in meeting rooms, classrooms or small commercial environments) CO_2 is the most used indicator because its concentration is directly related to human activity and, in particular, to breathing. Although CO_2 is not harmful to human health (except in very high concentrations, which are difficult to achieve), it has a direct impact on the concentration capacity and productivity of the occupants. When the number of people in the room is predictable and limited, the detection of volatile organic compounds (or TVOC), a set of organic chemicals continuously emitted from furniture, paints, cleaning solvents, adhesives or other synthetic materials due to their high volatility, may be more significant.

Example



Ekinex devices
A) Multisensor EK-ET3-TP o EK-ES3-TP
B) Real presence sensor EK-SG2-TP-P
C) Universal interface EK-CC2-TP

Other components
1) KNX servo motor for damper operation (not Ekinex supply).
2) VAV (Variable Air Volume) Cassette.
3) Room air supply grille
4) Intake air grille from room
5) Window opening contact

Interfacing VRF systems

Variable Refrigerant Flow (VRF) systems are used in the summer and winter air conditioning of buildings and in the production of domestic hot water. They are based on the expansion of the refrigerant fluid that passes through the heat exchange terminals (indoor units); in this way the transformations of the fluid (evaporation in cooling and condensation in heating) take place directly in the room through the exchange coils.

Control with Ekinex

In general, VRF systems have their own communication bus system between the various constituent equipment; by means of the VRF control interface with KNX communication EK-AI6-TP-... **(A)** it is possible to interface Ekinex control devices, such as pushbutton panels equipped with EK-EV3-TP-TER thermostat **(B)**, EK-ET3-TP multisensors **(D)**, EK-SG2-TP-M occupancy sensors **(E)** or EK-CD2-TP universal interfaces **(C)** connected to window opening sensors, to the communication bus dedicated to air conditioning performed with VRF and split-type heat exchange terminals.

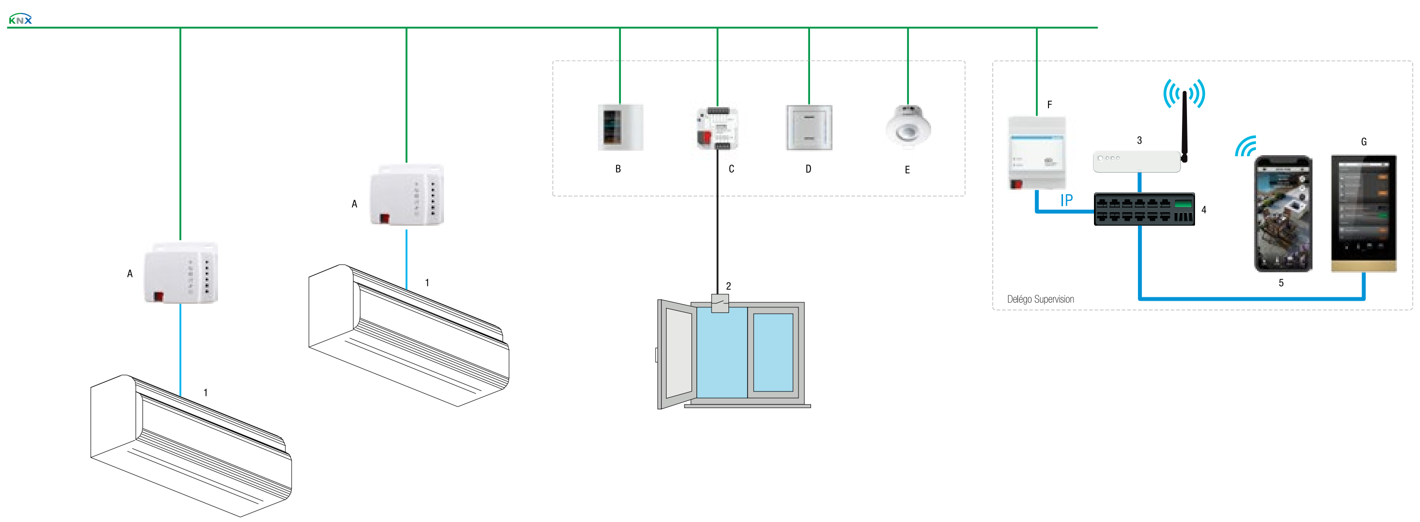
Available controls* include:

- ON/OFF
- mode (Cool, Heat, Auto, Dry, Fan)
- fan speed
- temperature setpoint
- room temperature feedback
- diagnostics
- consumption monitoring

The device is available with communication interface for manufacturers Daikin, Mitsubishi Electric, Toshiba, Panasonic, LG, Samsung and others.

*) Some control and monitoring features may not be present or may be limited based on individual manufacturers' VRF/VRV unit models.

Example



Ekinex devices
A) Controller VRF EK-AI6-TP-...
B) Pushbutton Signum EK-EV3-TP-TER
C) Universal interface EK-CD2-TP
D) Multisensor EK-ET3-TP
E) Presence sensor EK-SG2-TP-M
F) Server Delégo EK-DEL-SRV01
G) Touch-panel Delégo EK-DEL-xPAN...

Other components
1) VRF unit
2) Window opening sensor
3) IP Router
4) IP Switch
5) Delégo APP

Delégo supervision system

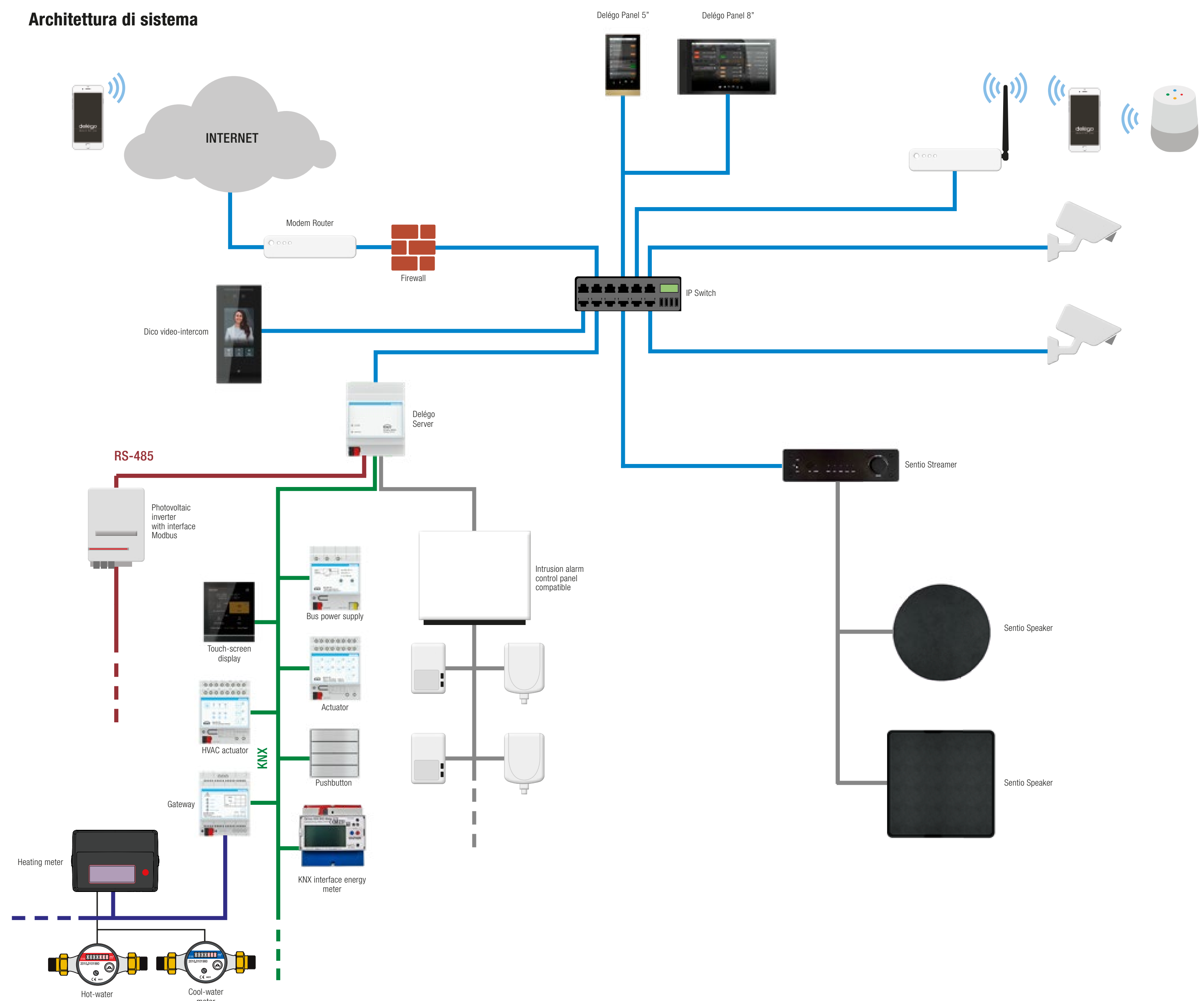
Delégo is a complete system for supervision and control of a KNX-standard system. Developed with web-oriented technologies, it features a uniform interface with high graphical impact on each platform with local and remote connection. The system consists of the Server EK-SRV01-... to be installed in an electrical cabinet that connects directly to the KNX bus; connection to the router is made via the Ethernet port on its local area network (LAN). Delégo offers multiple possibilities for use:

- via desktop PC;
- from mobile smartphone and tablet devices (Apple iOS and Android);
- With one or more fixed Delégo panel stations
- Through a voice assistant (Amazon Alexa, Google Home)

The system features simple yet extremely comprehensive configuration, thanks to the direct import of the ETS project file.

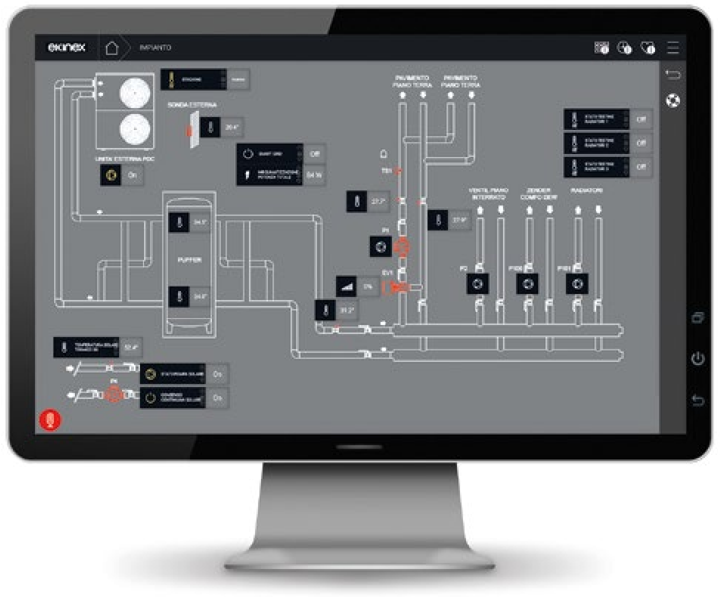
The functional definition of the various imported objects and matching with a rich and customizable set of user controls (widgets) is also very easy. The interface is simple and intuitive and allows the user interaction with the building automation system through the use of different devices, with absolute uniformity of use. The app allows for one-touch control of all functions from a single device and from anywhere in the building reached by the Wi-Fi network, or remotely via web connection.

Architettura di sistema



Monitoring of technical systems

The monitoring and supervision of technical systems plays a fundamental role in functional buildings: in fact, it is absolutely essential for users to ensure a high level of service and maximum continuity of operation of the systems.
Based on the needs of the individual building, the system allows to keep under control a set of values, parameters, states and quantities relevant to the operation of the several systems; the comparison with the values of design and reference standards allows to highlight any anomalies, analyse the deviations and quickly restore the optimal operation. The inclusion in the system of the signaling of technical alarms is decisive for the timely intervention of the service and maintenance personnel. The integration between the monitoring of technical systems and the building automation system offers the possibility to increase the efficiency in the use of resources, reducing waste, to exploit the full potential of technical systems, to limit the need for inspections and to allow a longer life of individual components or complex equipments.
Thanks to centralization and real-time availability of information, it is easier for building maintenance personnel to identify problems on the synoptic diagrams and then report them to the technicians responsible for service. This is especially important for facilities spread across multiple buildings with a multitude of technical rooms and substations.



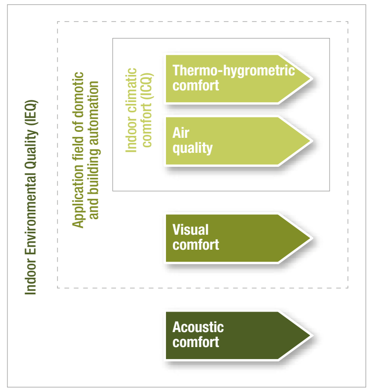
Indoor environmental quality (IEQ)

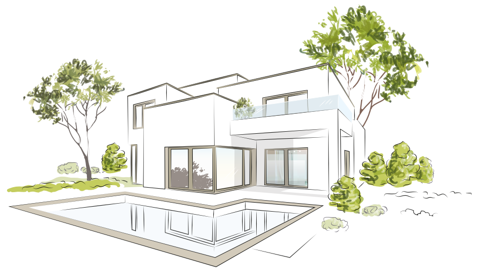
The legislative and standard framework for building design has evolved profoundly since the early 2000s. The European Union has drawn attention to the fact that buildings are responsible for 40% of final energy consumption - and 75% of them are still energy inefficient - requiring Member States to make a major recovery of efficiency through mandatory transposition directives. On the other hand, this action must not decrease the comfort and well-being of the end-users of buildings, also considering the high proportion of time spent indoors. The concept of Indoor Environmental Quality (IEQ) has therefore been affirmed, underlining the importance of ensuring high environmental quality within confined spaces, together with the recovery of energy efficiency.
This is a comprehensive approach in four dimensions:
- thermo-hygrometric comfort;
- air quality;
- visual comfort;
- acoustic comfort.

The first two dimensions are representative of the Indoor Climate Quality (ICQ) and are directly influenced by the heating, cooling, dehumidification, air renewal and ventilation systems and by the functions carried out by the building automation and control system.

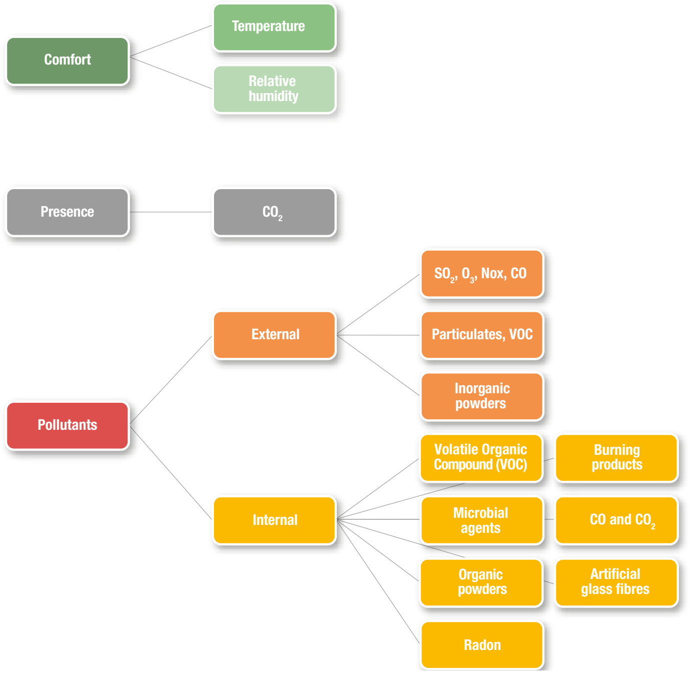
In 2008, the IEQ concepts were recognised with the publication of EN 15251 standard, which was replaced in 2019 by EN 16798-1 standard.

References
EN 16798-1:2019 Energy performance of buildings. Ventilation for buildings. Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics - Module M1-6



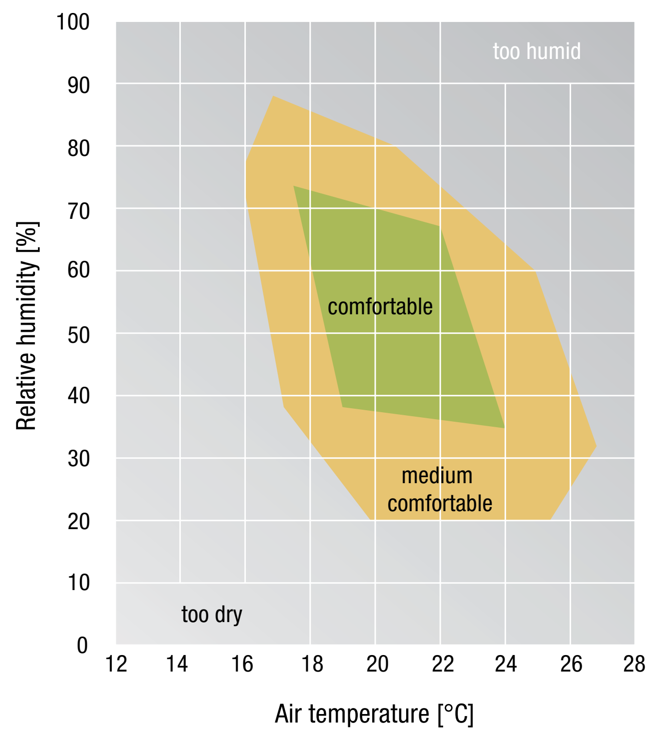


Indoor Climatic Quality (ICQ)
There are many parameters that influence indoor climate quality (ICQ); as a first approximation, they can be grouped into three categories.
- Temperature and relative humidity mainly concern the thermo-hygrometric comfort and the well-being felt by the end-users of a building. In moderate thermal rooms these parameters do not have an impact on human health.
- CO_2 is mostly produced by breathing people and animals, but it is only harmful above very high concentrations that are usually not reached inside buildings. However, a high concentration of CO_2 in confined spaces negatively affects people's productivity and cognitive abilities; this parameter is often used as a reference for evaluating the quality of the room air mass.
- The actual pollutants can instead have consequences on human health; the extent varies and ranges from simple olfactory stress and headaches, through biological effects such as irritation and allergic reactions, to serious diseases in case of very prolonged exposure. Pollutants can be divided into two categories according to their origin: internal or external. Due to the inevitable exchange of air between outside and inside, external pollutants are generally also detectable inside. Indoor pollutants are numerous and heterogeneous, but particular attention should be paid to Volatile Organic Compounds (VOCs) and airborne dust (PM or Particulate Matter). Many synthetic substances introduced on the market in recent decades belong to the VOC class and for most of these there is still not enough information to determine their hazardousness.



Thermo-hygrometric comfort

Climatic comfort is a complex concept, since it depends on a large number of variables, both objective and subjective; moreover, the conditions within confined spaces are subject to transients and the occupants themselves, aware or not, can implement adaptive behaviours.
In terms of thermo-hygrometric comfort, the two main parameters to be controlled are the temperature and relative humidity of the air; during the design of the HVAC system, desired values are defined, which are then taken as a setpoint values by the control and regulation devices.
Actually, there are several combinations of temperature and relative humidity resulting in a comfortable climate defining a "comfort zone" that may be represented in a diagram. Some home automation devices allow this zone to be defined by means of five parameters (minimum and maximum temperature, minimum and maximum relative humidity and absolute humidity), informing system supervision when the combination of measured values is outside the comfort zone.
The EN ISO 7730 standard offers the design tools to assess not only the overall comfort experienced by occupants of moderate thermal environments using the PMV (Predicted Mean Vote) and PPD (Predicted Percentage of Dissatisfied) indexes, but also any local discomfort using four indexes that consider respectively the air currents, the vertical air temperature gradient, the temperature, the floor temperature and the radiant asymmetry.



References
EN ISO 7730:2005 Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria

Air quality

When we talk about air quality, we generally think of the outdoor air, due to polluting and climate-altering emissions caused by production activities, vehicle traffic or winter heating of buildings. But today we are aware that problems of poor air quality can arise even indoors, due to pollutants from both inside and outside the building and by the increase in the concentration of CO_2 produced by human presence.
This is not to be underestimated, since in Europe, on average, more than 90% of one's time is spent indoors: in Italy, for example, 55% in the home, 33% in the workplace, 4% in other environments, while only a residual percentage of time is spent outdoors. In addition, 10 to 20 m³ of air are inhaled every day, depending on age and activity: this corresponds to an air mass that varies between 12 and 24 kg, much greater than that of food and drinking water consumed every day.
In this case we are talking about air quality in confined spaces (IAQ, or Indoor Air Quality), a topic that has come back in recent years when we began to build and renovate buildings in accordance with the provisions of the law following the directive on energy performance in buildings (2002/91/EC). With the aim of minimising heat loss to the outside, buildings are now strongly insulated and fitted with sealed doors and windows; this increases energy efficiency, but still makes them airtight. In these conditions, air renewal by manual opening of windows alone is inadequate and people are exposed to the risks of increased concentration of slowly but constantly emitted pollutants from the synthetic products used in the construction sector and from the consumer products present in all buildings.
If exposure to pollutants becomes very prolonged over time, the problem is no longer just the well-being in confined spaces, but can also seriously affect people's health. It is therefore clear why it is important to take all the necessary precautions to ensure high air quality.
Several studies show that adequate ventilation in the workplace leads to higher productivity and fewer absences for health reasons. In school environments, high air quality helps students to concentrate, while in commercial buildings it makes shopping time more enjoyable. On the other hand, the room ventilation means an energy cost that can become relevant. The control of air renewal by the home automation system makes it possible to reach the best compromise between high air quality and high energy efficiency. Using home automation for this purpose also means reducing the number of sensors to be installed and making multifunctional use of the devices and signal wiring already provided in the building for other functions, such as air conditioning, lighting or shading control.

Building automation and European directives

In recent years, the interest in building control and automation systems has considerably increased: now they are considered by directives and standards as a fundamental element to achieve the ambitious energy efficiency objectives of the European Union, while maintaining a high level of comfort in all situations.
The energy efficiency and performance of buildings has been a focus of attention for designers, builders and end-users since 2002, when Directive 2002/91/EC on the energy performance of buildings was published. The second revision of this Directive (2018/844/EU) aims at spreading intelligent technologies as much as possible inside buildings. This latest version is therefore particularly important for the sector of home automation and building automation, as it actively promotes the widespread use of these systems. The directive requires that non-residential buildings with heating (or heating and ventilation combined) systems with an effective rated output of more than 290 kW must be equipped with automation and control systems by 2025, while for residential buildings there is a requirement for continuous electronic monitoring to measure the efficiency of the systems and inform owners (or administrators) if significant efficiency drops or need for maintenance occur. To these must be added effective control capabilities to optimize power generation, distribution, storage and consumption.
The Directive also introduces the Smart Readiness Indicator (SRI), which provides summary information on the intelligence of the building to all interested parties: end-users, designers, builders, investors, operators and service providers. The indicator summarises the ability of the building to maintain energy efficiency and its functioning by adapting its energy consumption using, for example, available renewable sources. In addition, the building must adapt its operation to the needs of end-users, ensuring ease of use, the thermo-hygrothermal comfort of the interior and the ability to communicate data on energy consumption.
The Directive also recognises that building automation and monitoring is a cost-effective alternative to technical inspections, particularly in large non-residential buildings and condominiums.
The way in which certain articles of Directive 2018/844/EU are implemented has been described in more detail in the recommendations subsequently drawn up by the European Commission, which serve to support Member States in preparing national transposition measures. The recommendations definitively recognise that the use of intelligent systems in buildings is essential to achieve the targets set for energy efficiency by 2030 and decarbonisation of the building stock by 2050.

References
Directive 2018/844 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency
Recommendation 2019/786 on the renovation of buildings
Recommendation 2019/1019 on the modernisation of buildings

Sustainability certification

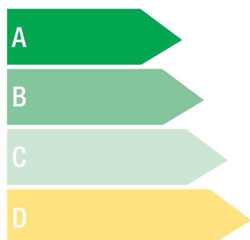
With the passage of time, more and more buildings are undergoing sustainability certification. The concept of "sustainability," now common in many areas, was defined in the "Our Common Future" report (or Brundtland Report) published in 1987 by the World Commission on Environment and Development. "Sustainable development" is defined as a process that can ensure "the satisfaction of the needs of the present generation without compromising the ability of future generations to realize their own." In this sense, sustainability must ensure compatibility between development and environmental protection.
Buildings are major consumers of resources and therefore this principle is also applicable to them; therefore, certification schemes have been developed over the years to attest to their sustainability. Building projects that undergo sustainability certification can receive points in several categories: in the case of LEED* (an acronym for Leadership in Energy and Environmental Design), for example, location and transportation, site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation and more count. Based on the number of credits earned, a project obtains one of the rating levels under the certification scheme.
For the purpose of obtaining sustainability certification, a very important role is played by building automation. The use of the KNX system can contribute up to 54 credits** out of a maximum of 110 provided by LEED certification. Eighty percent of the credits to which KNX contributes relate to three LEED categories: water efficiency, energy and atmosphere, and indoor environmental quality.
*) Developed by U.S. Green Building Council (USGBC).
**) KNX for LEED, 2013, Jesús Arias García, Miguel Ángel Jiménez Ibiricu, KNX Association cvba (Brussels)

To better define the concept of sustainability with reference to the construction sector, the ISO 15392 standard was also published in 2008, which indicates sustainability goals and general principles. The standard defines sustainability as "the condition in which ecosystem components and their functions are maintained for the present and future generations." Complementing ISO 15392, the ISO/TS 12720 technical specification has been published that provides guidelines for its application. In addition, ISO 21931-1 identifies and describes factors to be considered when assessing the environmental performance of new or existing buildings in the design, construction, operation, maintenance, renovation and decommissioning phases.

References
ISO 15392:2008 Sustainability in building construction - General principles
ISO/TS 12720:2014 Sustainability in buildings and civil engineering works - Guidelines on the application of the general principles in ISO 15392
ISO 21931-1:2010 Sustainability in building construction - Framework for methods of assessment of the environmental performance of construction works - Part 1: Buildings.

Energy efficiency rating of the building

Buildings constructed or renovated according to the latest legal requirements offer considerable potential for increasing energy efficiency, but in order to fully capture this potential, the operation of the various technical systems must be optimized. This is provided by building automation systems, and thermal system control functions are a key part of this. According to UNI EN ISO 52120*, at the design stage it is possible to evaluate the energy savings achievable by adopting increasing levels of automation and place the building in one of four defined energy efficiency classes: from A (most efficient) to D (least efficient).



High-efficiency HBA and TBM

Advanced HBA and TBM

Standard HBA or traditional controls (reference)

Inefficient systems

HBA = Home and Building Automation **TBM** = Technical Building System

(*) Which replaced UNI EN 15232 Energy performance of buildings standard.

Seven categories of services contribute to energy efficiency:
- **heating, cooling and domestic hot water;**
- **ventilation and air conditioning;• illuminazione;**
- **solar shading control;**
- **Technical management of housing and buildings.**

While up to Class C there is no energy consumption detection, higher Classes require centralized and coordinated management of functions and individual facilities (Technical Building Management) with respectively:

- **The detection and control of energy consumption (Class B, advanced);**
- **The detection of consumption trend and directions for continuous improvement (Class A, high energy performance).**

Over time, the previous standard (UNI EN 15232) had become the reference for several legal measures such as the June 26, 2015 "Minimum Requirements" interministerial decree that prescribed a minimum level of automation corresponding to Class B for the control, regulation, and management of building and heating system technologies (BACS) for nonresidential buildings.

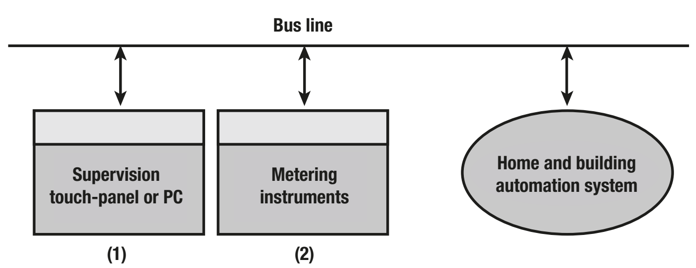
In UNI EN ISO 52120, the functions that characterize each energy efficiency class are listed in a table. Different performance levels are given for each function, identified by a number ranging from 0 to a certain value according to increasing energy performance.

TBM: Technical Building Management
According to IEC Guide 205-18, TBM is that part of a building's management that deals with the operation, maintenance and management of technical systems to verify their energy efficiency. This system includes the functions of measurement, recording and verification of consumption trend, alarm detection and diagnostics with regard to energy use.

			Classes definition							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
7		**TECHNICAL MANAGEMENT OF HOUSING AND BUILDINGS**								
7.1		Detecting faults in housing and building systems and providing support for diagnosis								
	0	No								
	1	Sì								
7.2		Informative reports on energy consumption, indoor conditions, and opportunities for improvement								
	0	No								
	1	Sì								

In the table, nonresidential buildings can be identified separately from residential buildings. In addition, for each class it is possible to identify what is the minimum performance level that must be guaranteed for each automation function.
The Technical Management of Dwellings and Buildings (TBM) table shows that for this function, in both the nonresidential and residential spheres, a minimum of Level 1 is required to achieve Classes B and A.

Relationship between energy consumption, indoor conditions, and opportunities for improvement
Level 1 requires the adoption of a system that ensures the display of energy consumption parameters and various operating conditions. This aims to ensure continuous energy efficiency and the ability to intervene at later times, adapting the system to changing environmental conditions and housing needs.



Schema della funzione 7.1.2-A/A secondo CEI 205-18

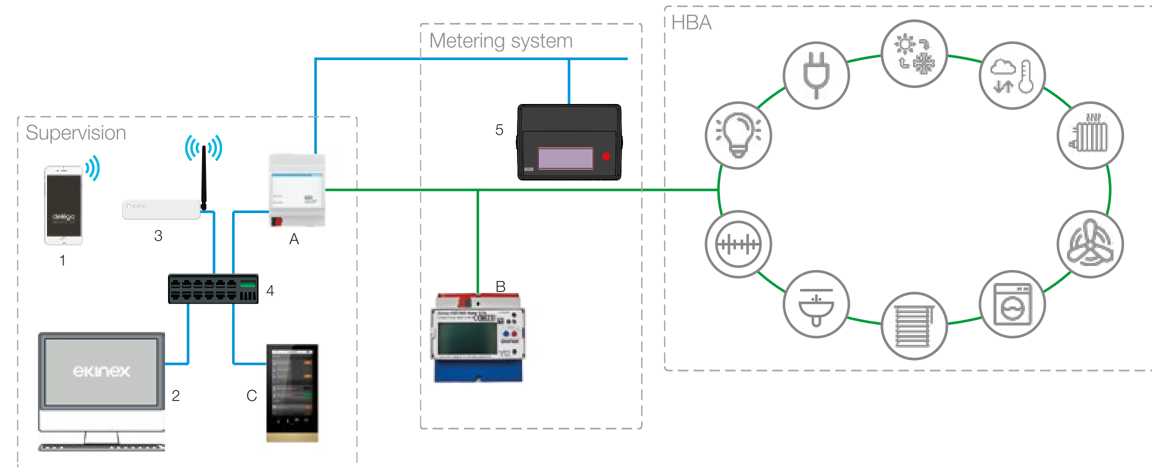
BUILDING TECHNICAL SYSTEMS MANAGEMENT (TBM)
Function data sheet 7.1.2-A/A

Class CODE 7.1.2-A/A	**Report regarding energy consumption, indoor conditions and possibilities for improvement**

Description
Report of energy consumption, indoor conditions and possibilities for improvement

Scheme Ref.	**Realization**
	System supervision: -Equipment equipped with interfacing with the homeand building automation (HBA) system for data logging and control via graphical interface Consumption measurement instruments (hardware or software) equipped with serial bus communication (CS).

Datasheet of Function 7.1.2-A/A according to IEC 205-18



Ekinex devices
A) Server Delégo EK-DEL-SRV01
B) MID energy meter EK-ME1-... with integrated KNX module
C) Touch-panel Delégo EK-DEL-xPAN...

Other components
1) Smartphone with App Delégo (iOS, Android)
2) PC with browserfor acces to the web server
3) LAN Wi-Fi access point
4) Switch IP
5) MID thermal energy meter with integrated Modbus communication module

An information report on the status of energy consumption and indoor conditions (lighting, heating, cooling, air conditioning, etc.) must be prepared.
This report must include:
A) The building's Energy Performance Certificate (APE);

B) The sensing function to be used to obtain the consumption measurement according to prEN15203:
- If an in-line meter is used, there is full compliance with prEN15203
- Measurements with meters can be made for exactly one year in accordance with 7.2
- If a sufficient number of meters are installed, measurements can be made for each type of energy (e.g., electricity, heat) employed
- Energy not used for heating, cooling, ventilation, hot water, or lighting may be metered separately in accordance with 7.3
- Outdoor temperature measurements allow results to be corrected for outdoor climate, in accordance with 7.4
The measurements can be used to prepare an energy performance certificate in accordance with EN 15217 "Energy performance of buildings - Methods for expressing energy performance and for energy certification of buildings."

C) The assessment of building and energy system improvement.
This assessment can be made according to prEN15203 using a validated calculation model as specified in 7.9. Using the monitored values (b) the influence of actual data regarding climate, indoor temperature, free internal gains, hot water use and lighting can be considered according to prEN15203, 9.2 and 9.3.

D) Energy sensing.
The TBM energy sensing function can be used to prepare and display energy consumption graphs defined in prEN15203, Annex H.

E) The monitoring of room temperature and indoor air quality.
This function allows reporting of room or indoor air temperature and quality operational data.
- For buildings that are not permanently occupied, these functions are differentiated between occupied and unoccupied buildings.
- For heated and cooled buildings, the report must consider heating and cooling periods separately.
The report must include both actual temperature values and set-point values.

F) The monitoring of system power consumption.
This function allows reporting of operational consumption data of electrical loads by comparing them with special tariffs and with operating parameters reset for energy-saving purposes
- For buildings that are not permanently occupied, these functions are differentiated between occupied and unoccupied buildings

Energy savings
Measurement of energy consumption is key parameter for user awareness resulting in the possibility of motivating investments for continuous improvement of the system for energy saving purposes.
Detailed calculation
Historical recording and verification of consumption.

References
UNI EN ISO 52120-1:2022 Energy performance of buildings - Contribution of building automation, control and technical management - Part 1: General framework and procedures
UNI CEN/TR 15232-2 Energy performance of buildings - Part 2: Technical report accompanying prEN15232-1:2015 - Modules M10-4,5,6,7,8,9,10.
UNI/TS 11651 asseveration procedure for building automation and control systems in accordance with UNI EN 15232.
IEC 205-18 Guidance for the use of EN 15232. Classification of automation systems of technical systems in buildings, identification of functional schemes, estimation of the contributions of these systems to the reduction of energy consumption.

Energy classification of radiant systems (UNI/TR 11619)

In 2016, the CTI (Comitato Termotecnico Italiano) published the technical report UNI/TR 11619, which defines the normative references and calculation methodology for determining the energy efficiency index of radiant systems for heating and cooling with low temperature difference, in floor, wall and ceiling versions in accordance with UNI EN 1264, combined with regulation, balancing and control strategies for circulation pumps.

The index defined by the technical report considers the efficiency of:
- radiant system emission (η_e)
- room air and heat transfer fluid thermoregulation (η_{rg})
- circuit balancing (η_{bal})
- circulators (η_{circ})

RSEE Index

The energy efficiency index, called RSEE (Radiant System Energy Efficiency), is expressed as the product of the efficiencies of various systems and system components:

$$RSEE = \eta_e \cdot \eta_{rg} \cdot \eta_{bal} \cdot \eta_{circ}$$

The overall efficiency of a system can vary significantly: the most significant factor is the choice of temperature control devices (values range from 0.91 to 0.99). η_{rg} represents control efficiency and is directly influenced by design choices (such as independent control by zones or individual rooms, climate compensation function) and device configuration (on/off or PI Proportional-Integral type control). Based on the index value, the radiant system can be placed in 5 classes, from AAA (>0.98) to D (<0.88).

Simulations (from: UNI/TR 11619)

Regulation	Description	η_{rg}
Zone only on/off	Thermostat in the living room, setpoint temperature: 20°C ± 1°C. Fixed flow temperature equal to the design temperature determined in the most disadvantaged room.	0,848
(situazioni intermedie)	...	from 0,862 to 0,916
For single environment, PID controller	One thermostat in each room (living room, bedrooms, bathroom), setpoint temperature: 20°C. The digital electronic control unit controls the electrothermal actuators located on the manifold heads and the three-way mixing valve. The control unit receives the temperature data from all zones in the room.	0,987
Ideal	Maintaining an indoor temperature of 20°C in all rooms	1,00

References

UNI/TR 11619:2016 Low-temperature radiant systems - Energy classification.

HVAC Applications - September 2024
The technical information in this catalog is for reference only. The company reserves the right to make changes without prior notice.

The diagrams represent some examples of the use of Ekinex devices at KNX standard, are made with simplified symbology and show only the system components relevant to control and automation with Ekinex devices. Refer to qualified professionals for planning, installation and commissioning of Ekinex systems and equipment.

Refer to the relevant technical documentation for installation, connection, and commissioning of Ekinex devices.

For availability of Ekinex products in various markets, contact the sales department (commerciale@ekinex.com).

Credits

Creative Direction	Marketing & Comunicazione Ekinex
Graphic Design	Marketing & Comunicazione Ekinex
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