ABB i-bus® EIB

Energy-optimised buildings.

For authorised electricians only

ABB

Preface

Flexibility, utilisation value and energy saving are the three main requirements for utility buildings (administration, office and public buildings, schools, hospitals, etc.). Apart from recouping investment costs, so-called life-cycle costs are also becoming increasingly important. These are made up of the investment costs (construction costs and planning) and all operating costs arising during the life of a building.

During the planning and construction phase of a new building, keeping to the planned building costs often becomes an issue. Nobody seems, however, to be looking at the future operating costs although, according to a study produced by A.T. Kearney, these can be up to 20% of the construction cost each year. This percentage generally rises as a result of increasing flexible use requirements.

On average, operating costs have exceeded investment costs after seven years.

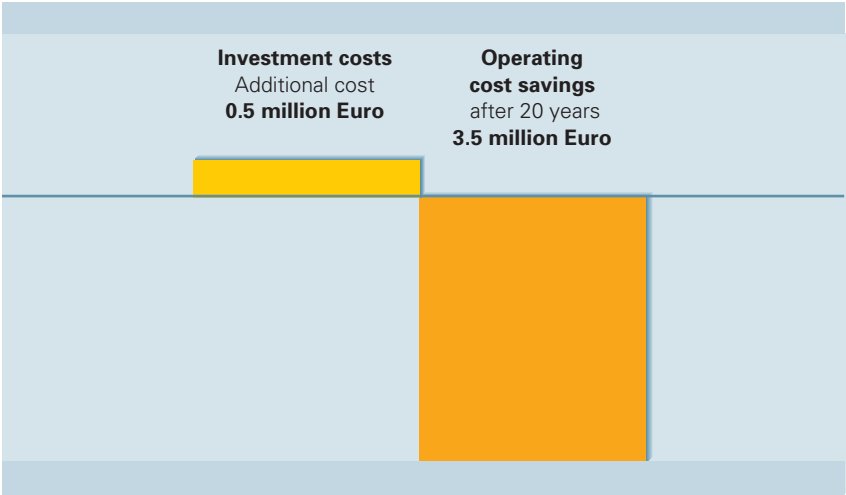**The following example is used to illustrate this point:**

A large administration building requires an investment of 14 million €. The annual operating costs amount to 2 million €. Over a lifetime of 20 years, the following life-cycle costs are generated:

14 million € +20 x 2 million € = **54 million €**

If as a result of an additional investment cost of 500.000 €, operating cost savings of 10% are achieved, the following life-cycle costs are generated:

(14 + 0.5 million € +20x (2 million € - 10%) = 14.5 million € +20 x 1.8 million € = **50.5 million €**

In other words, an additional investment of 0.5 million € reduces life-cycle costs by 3.5 million €.

Investment costs
Additional cost
0.5 million Euro

Operating cost savings
after 20 years
3.5 million Euro

The use of EIBs not only reduces operating costs – as shown in the actual examples below - but also increases the flexibility as well as the utilisation value of a building. Both are important factors that can be quantified, using actual examples. Due to the flexibility of the system, investment costs are recouped with every modification of the facilities. The utilisation value does, on the o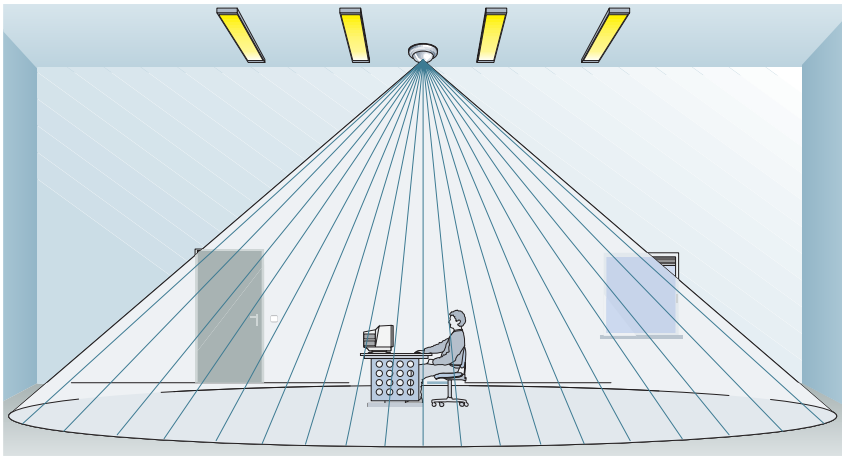ther hand, directly affects the ongoing operation. A comfortable room climate (room temperature and light quality) does, for instance, significantly increase the performance and motivation of employees. The cost of service personnel is also reduced by central monitoring functions.

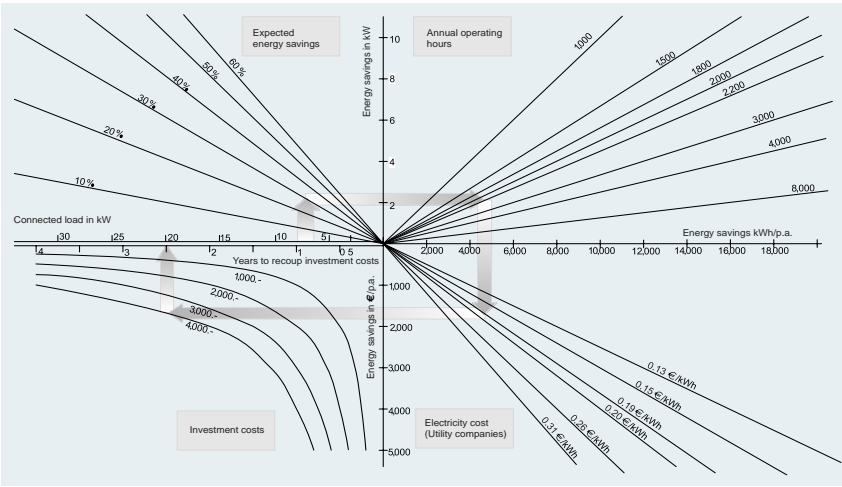# Contents

Potential Savings

The following energy-saving potentials exist in utility buildings and can be easily used with the EIB.

Presence detection
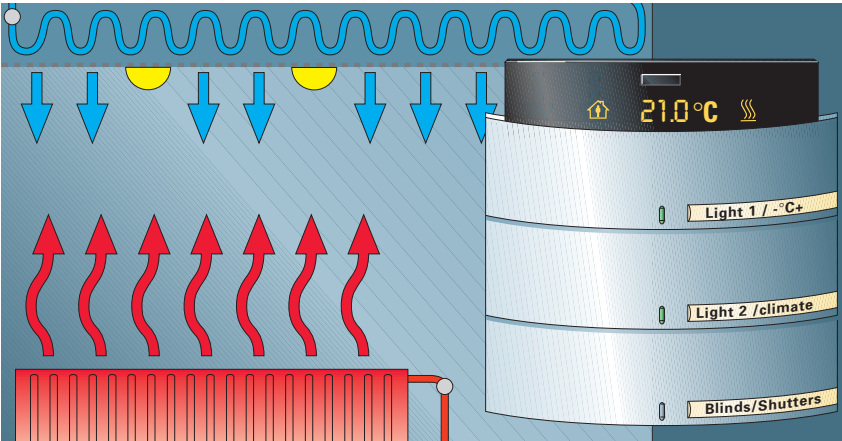Considerable potential savings can be made in regulating lighting and heating in accordance with the requirements. In other words, rooms are only heated if occupied by a person and are only illuminated if also a certain (preset) brightness level is not achieved.

Constant brightness control
Experience has shown that a constant brightness control can save 35 to 50% of energy costs. The life of lamps is also significantly increased whilst the comfort (and thus efficiency) i.e. for office staff is increased.

Individual room temperature control
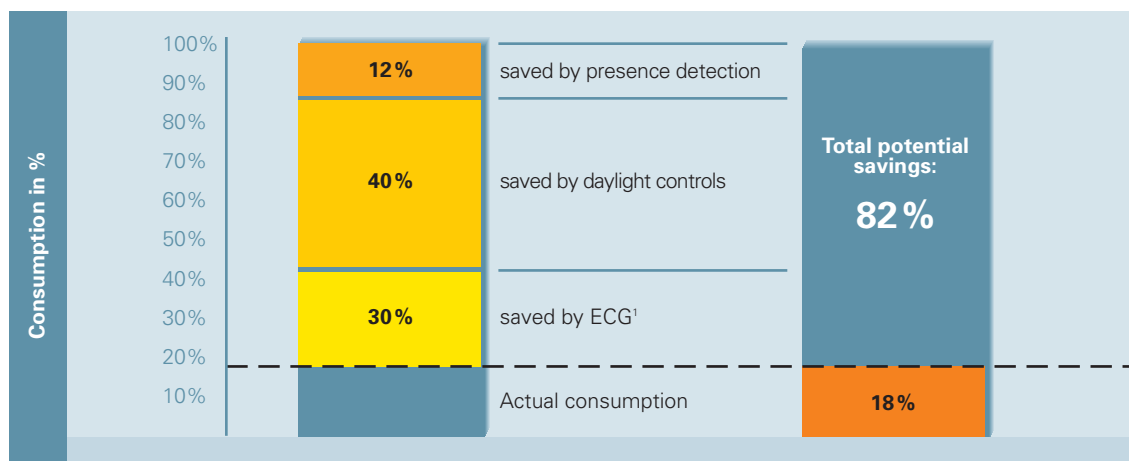The advantages are obvious: In case of the temperature being lowered by 1°C an energy saving of 6% can be achieved. At the same time, the comfort and performance of persons is increased. If the heating control is combined with a presence detector, further potential savings can be made.

The concept described below achieves all described energy saving potentials with only a few components.

This chapter first of all shows the maximum potential savings achievable with lighting and heating controls. Using a cost table, the period for recouping the investment for a controlled office system is shown. The savings are based on the graphic "Fördergemein-schaft Gutes Licht".

	Consumption in %	
100%		
90%	**12 %**	saved by presence detection
80%		
70%		
60%	**40 %**	saved by daylight controls
50%		
40%		
30%	**30 %**	saved by ECG[1]
20%		
10%		Actual consumption

Total potential savings:
82 %

18 %

The potential savings of individual light management components adds up to 82%.

	CCG[2]	ECG[1]	ECG + Presence EIB + Constant Brightness
Operating hours p.a.	1,500	1,500	1,200
On period/making capacity	100 %	100 %	30 %
Power consumed by FLs in W	568	399	399
Price per kWh in Euro	0.10	0.10	0.10
Annual energy costs per room in €	85	60	15
Life of FLs in years	5.3	10.7	13.3
Annual service costs per room in €	15	6	5
Total annual costs	**100**	**66**	**20**
Years to recoup investment		2–3	4–5

Assumptions	CCG:	ECG:
No. of fluorescent lamps per room	8 off	7 off
Output of 58W lamps	71 W	57 W
Power consumed by FLs	568 W/room	399 W/room
Life of lamps	8,000 h	16,000 h

Cost of replacing lamps incl. disposal	10 Euro

The calculated potential savings refer to an office building with a 20 m2 user area with 4 switched or controlled 58 W light units. The life of the light units fluctuates due to the use of the control gear. Lights with conventional control gear have a lower life (8,000 h) compared to lights with electronic control gear (16,000 h).
Due to the low number of operating hours of a controlled lighting system, maintenance costs are also reduced so that the cost of installing ECGs is quickly recouped.

[1] Electronic control gear

[2] Conventional control gear

Overview of Devices

The key components of
the user concept are the
products shown below.

**Busch-Watchdog®
Präsenz EIB including
constant brightness
control**
The presence detector
contains 4 independent
channels, allowing the simple adjustment of the lighting as required, control of
the heating/air-conditioning
according to occupancy,
signal function as well as a
constant brightness
control.

**FM switching/dimming
actuator**
The FM
switching/dimming
actuator allows infinitely
variable dimming of the
ECGs (0-10V). When
combined with the
presence detector, a
constant brightness control can be easily
implemented. As the unit
is installed directly below
the presence detector, no
separate line has to be
installed from the ECG distribution. This reduces
both the required
installation and fire load.

**Commercial-type FM
room thermostat incl.
5gang binary input**
Particularly for utility
buildings, a room
thermostat not allowing
any manual in-room adjustment is available. Via the
5gang FM binary inputs,
conventional switches can
be easily connected. All
switch ranges provide cover plates for the room thermostat.

Busch-triton® 3gang and 5gang room thermostat
In addition to the commercial-type FM room thermostat, the 3gang and 5gang Busch-triton® including room temperature controls is also available. These units also offer the combination of room thermostat and pushbutton sensor in the same unit. The 5gang model offers additional light scenes and infrared functions.

Heating and thermoelectric actuator
The proven combination of heating and thermoelectric actuator effortlessly activates the heating or ceiling cooling system without any noise. In case of installation in e. g. a cable duct, integrated binary inputs are available for scanning window contacts.

Fan coil control
For air-conditioning and/or heating utility buildings, fan coil units (fan convectors) are used increasingly often. When used in conjunction with our 4gang or 6gang switching actuators, these units can be controlled via a special application.
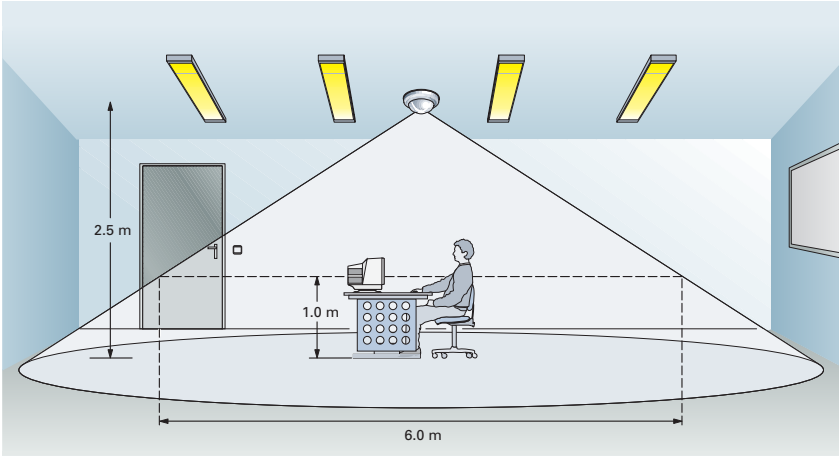
Busch-Watchdog® Präsenz EIB Including Constant Brightness Control

The detection range of the EIB presence detector including constant brightness control depends on the movement of the persons and the installation height inside the room. This also allows the detection of the smallest movements, e. g. at PC stations, 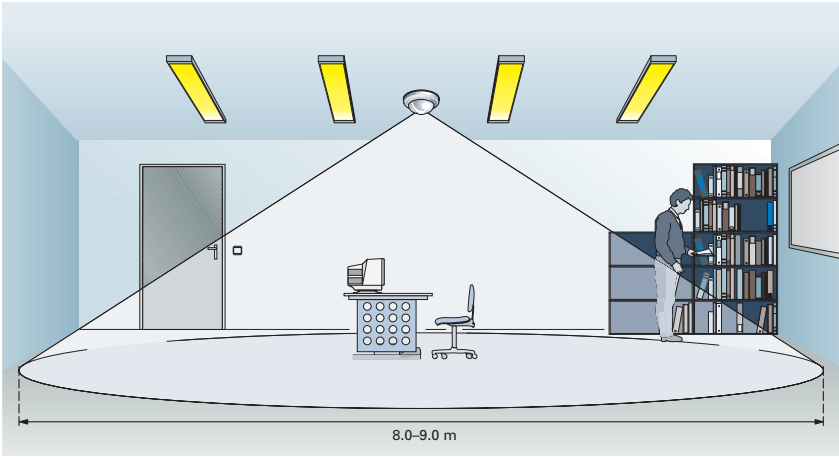desks, etc. A differentiation must be made between the inner and outer detection range and the installation height of the presence detector.

Inner detection range (seated persons)

Seated persons must be fully inside the detection range. The smaller the distance between the person to be detected and the presence detector 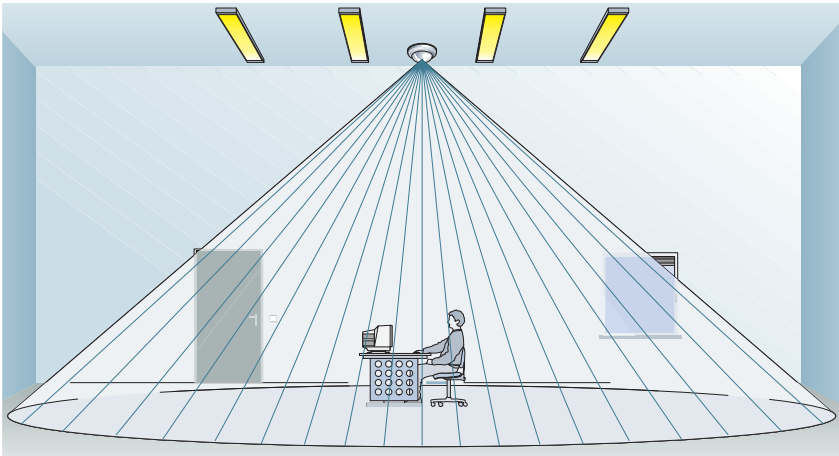the smaller the detectable movement. The reference level for the detection of seated activities is approx. 1 m. At this height, the detection range is 6 m in diameter (installation height of presence detector = 2.5 m). A higher installation increases the detection range but reduces the detection density.

Outer detection range (walking persons)

A larger detection range is available for detecting walking persons. The reference plane for detection is the floor, resulting in a diameter of 10 m for the detection range, based on an installation height of 2.5 m.

Installation heights

Depending on the installation height, the detection characteristics change. As the installation height increases, the sensitivity and detection density decreases.

Depending on the application, a high resolution may not be required and a high installation height may be possible (e. g. in storage rooms, hallways, corridors, etc.)

Installation height	Seated persons*	Walking persons
2.0 m	4 m	8 m
2.5 m	6 m	10 m
3.0 m	8 m	12 m
3.5 m	10 m	14 m
4.0 m	12 m **	16 m
5.0 m	16 m**	20 m

*Seating height: 1 m. **Not suited for pure "desk work" or switch-off delay of > 15 min.

Interference Sources

The switching is activated by movement. If a separate heating source is located near-by, this could lead to accidental activation.
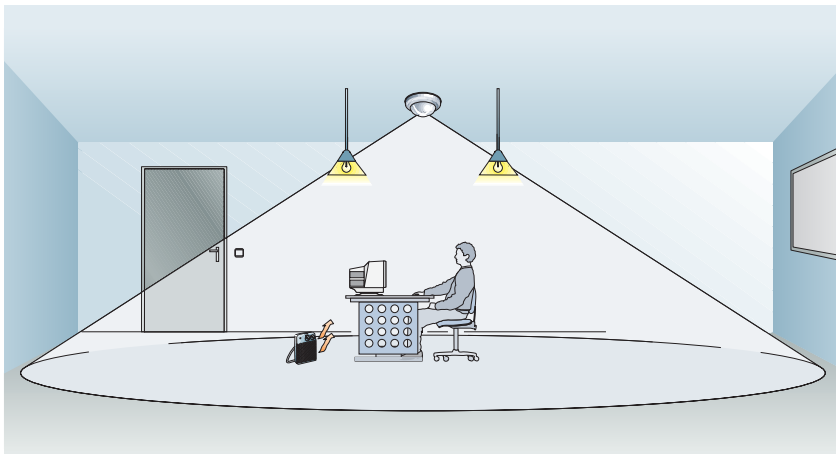
A differentiation must be made between interference caused by a separate heating source and by limited visibility conditions.

Limited visibility of the presence detector
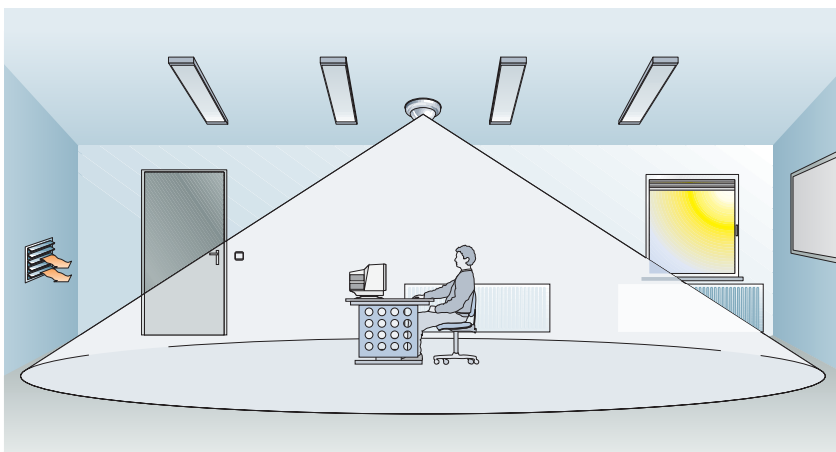The detection range can be covered by various objects, such as:

- Light strips installed lower than the presence detector
- Large plants
- Partitions
- Glass screens

Separate heating sources
Rapid temperature changes in the vicinity of the presence detector can also activate accidental switching, i.e.

- Additional fans
- Switch on/off of lamps in the immediate vicinity (< 1.5 m) of the presence detector, in particular, incandescent and halogen lamps
- Moving machines, swaying posters, etc.

Heat sources without interfering influence
Where the temperature changes only slowly, this does not influence the switching behaviour of the presence detector, e.g. in case of:

- Radiators (distance > 0.5 m)
- Areas heated up by the sun
- EDP systems (computers, printers, monitors)
- Ventilation systems, where the warm air does not flow directly into the detection range
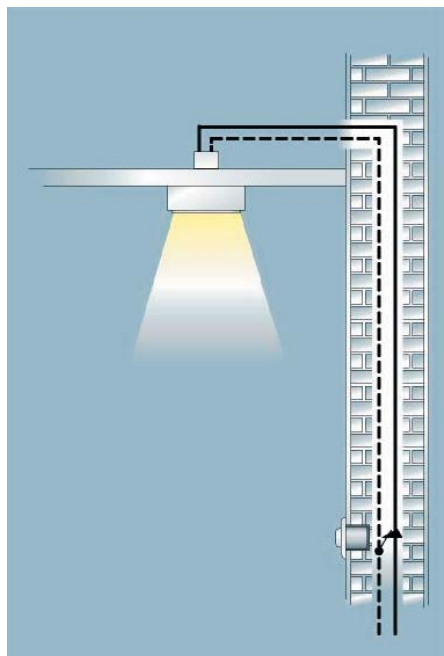
Installation Options

The presence detector including constant brightness control can be operated directly with a FM switching/dimming actuator (6114U). The

switching/dimming actuator can also be operated as a built-in actuator or FM actuator without sensor. The advantage of such a system is, first of

all, the decentralisation of the units and the minimisation of the fire load due to shorter wiring. Another advantage is that the FM

switching/dimming actuator contains a bus coupler and a 10-pin branch interface through which a sensor can be directly operated. The
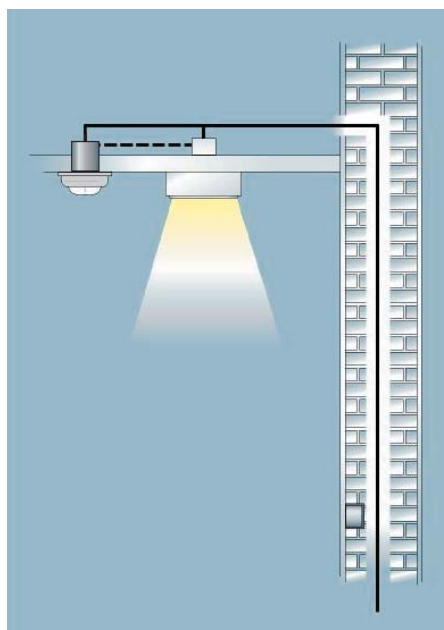
below illustrations explain some installation examples of an FM actuator.

FM wall installation
The bus line and the mains line must be present in the FM box. The switched phase and the 0-10V

control line lead from the actuator to the dimmable ECG.
Advantage: short length of 0-10 V control lines.

FM ceiling installation
As the FM actuator contains a bus coupler, the presence detector can be operated directly on the actuator. Consequently, one less bus connector

and station is required. Another advantage is the lower fire load of a decentralised system compared to DIN rail-mounted components. Where several additional

actuators are required (parallel operation), these can also be installed as FM units in the ceiling or as built-in actuators in a suspended ceiling.

Light Conditions

When using a constant brightness control, a distinction must be made between natural daylight and artificial light. Daylight plays a considerable role for saving energy during a constant brightness operation and for extending the life of lights.

The nominal brightness levels shown in the table should be complied with at all times.

Brightness for different application areas E_n

Application: Rooms, activities	Nominal brightness level E_n in lux (lx)	Comments
Schools	500	
Hospitals / care homes	100 200 300	General lighting Reading lights Examination lights
Offices with daylight-based workplaces, only close to the window	300	
Offices	500	
Meeting rooms	300	
Changing rooms	100	
Toilets	100	
Washrooms	100	
Canteens	200	
Reception areas	100	
Assembly rough/medium/fine	200/300/500	
Sales rooms	300	Wholesaler/retailer
Check-outs	500	Wholesaler/retailer

Channel Functions

The presence detector can be operated on the FM bus coupler and the FM switching/dimming actuator.

FM bus coupler
a) 2 x switching and 1 x signal
b) 2 x switching and 1 x HVAC

c) 1 x switching, 1 x HVAC and 1 x signal
d) 1 x switching, 1 x HVAC, 1 x signal and constant brightness control

FM switching/dimming actuator
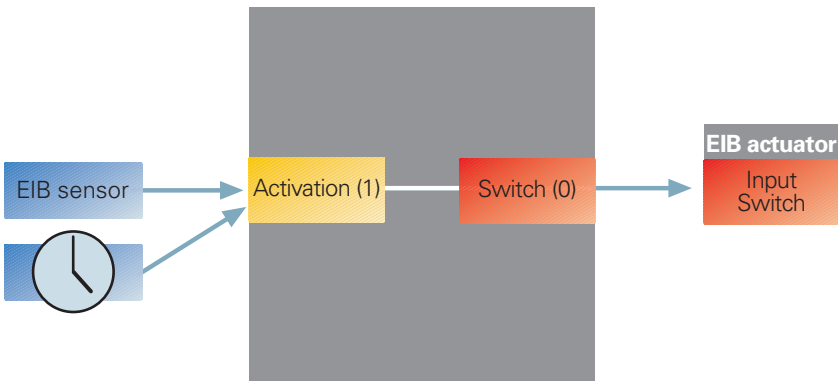a) 1 x switching, 1 x HVAC, 1 x signal and 1 x constant brightness control

The presence detector including the constant brightness control is described in detail below.

Presence detector incl. constant brightness control
The presence detector incl. constant brightness control consists of 4 independent channels.

The numbers in brackets show the allocation of the individual communication objects in the ETS application. This also applies to the below diagrams.

All channels are described in detail below.

Illumination Channel
This channel can be used to switch one perimeter lighting in the room where movement is detected. This channel is switched on by movement irrespective of the brightness. When no more movement is detected, the channel is switched off after a preset period (Poti/ETS). The switching object (0) can be activated separately (via an EIB sensor/timer). The switching object offers the choice of switching (EIS1) or a value (EIS6). For the switching object (EIS1) it is defined whether an ON/OFF or cyclic telegrams are sent in case of any movement. The same also applies to sending the telegram after the preset time (switch-off delay).

HVAC channel
HVAC systems are efficiently controlled via this object. The advantage of such an HVAC object is the time delay (switch-on delay) compared to the movement object. The parameter window settings are very similar to those of the movement object. In addition, a switch-on delay can also be set.

HVAC function

Movement

HVAC ON

Internal switching threshold

10 min.   e.g. 6 min.   e.g. 3 min.

Dynamic adaptation of switch-on delay
If the switch-on delay is set to "automatic", the delay is adapted to the user pattern. Where people frequently leave rooms, the switch-on delay will be reduced upon the next entry to the room. This increases the comfort level and reduces the switching frequency of the thermostats.

Channel Functions

"Light time" overtravel time channel 1 illumination

"HVAC time" overtravel time channel 2 HVAC

Lux 2 Inactive in this case

Pot "Lux 1" threshold value channel 1 Brightness value of constant brightness control

Poti/ETS application

The presence detector offers two setting options: a) Via the potentiometer at the rear of the device. Using the "Light time" potentiometer, the overtravel time (switch-off delay) of the 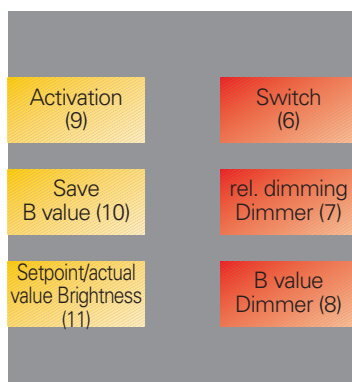movement object is set, i.e. the lights would in this example switch off after 20 min., unless further movement is detected during the overtravel time, resetting the start of the overtravel time. The switch-off delay is set on the "HVAC time" potentiometer. If this potentiometer is set to below 10 min., it can be used to control a toilet fan. The switch-on delay is automatically set to 0.5 s. For offices, a setting above 10 min. should be selected, as the switch-on delay does, in this case, depend on the frequency of the movement. The brightness threshold for switching the movement object is set via the lux potentiometers. It should be observed that the brightness values are determined at the installation point of the presence detector and not at the desired measuring point.
b) Via the EIB applications.

Constant brightness control channel

The same objects are available for both combinations (with bus coupler and switching/dimming actuator). In combination with the FM switching / dimming actuator this is always rigidly connected with the "switching", "rel. dimming" and "brightness value" object. Similar to the illumination and HVAC channels, the constant brightness control also has an activation object.

Setting the brightness value
There are two options:

a) • Using a "rel. dimming" object (4-bit object), "dim down" to the desired brightness value
• Then send a "1" to the "Save brightness value" object
• The controls are then active.

b) • Set the brightness value directly via the 1-byte object "Setpoint/actual brightness value"
• 0 = 0 lux 255 = 8*255 lux = 2040*
• The controls are then active.

Caution:
The set lux value is the brightness at the sensor of the presence detector and not the brightness of the work area!

Deactivate control:
• Set "0" to "Switch" or
• dim using the "rel. dimming" object (4-bit object)

Activate control:
• See "Setting the brightness value"
• using "1", switch to "output"

Activation object constant brightness control			available ▼		
- enabling constant brightness control at			ON telegram ▼		

	01.01.002	6131-74-101 Present detector, FM	Switch Value Cyclic HVAC Monitoring bright.control	
▣←	0	Telegr. switch	Movement channel 1	1 Bit
▣←	1	Activation	Movement channel 1	1 Bit
▣←	2	Telegr. switch	Movement HVAC	1 Bit
▣←	3	Activation	Movement HVAC	1 Bit
▣←	6	Switching	Output	1 Bit
▣←	7	rel. dimming	Dimmer	4 Bit
▣←	8	Brightness value	Dimmer	1 Byte
▣←	9	Activation	Constant brightness controller	1 Bit
▣←	10	save act. Brightness value	Constant brightness controller	1 Bit
▣⇄	11	Brightness setpoint/act.value	Constant brightness controller	1 Byte

Activation object
Via this object, the constant brightness control is e.g. activated with the aid of an ON telegram. Activation can only be carried out via an EIB time switch, a pushbutton sensor or via the movement object of the presence detector (see left screen shot).

Switch ON brightness	50% brightness ▼

Switch-on brightness:
Here, the brightness during switch-on is set via the "Switch" object (6),

i.e. in this example, the dimming actuator would always switch on at 50% brightness (value: 127).

Speed of control	normal (130ms*7) ▼
Setpoint adjustable with	ETS ▼

Speed of control:
The control behaviour of the constant brightness control is influenced via the four parameter

settings. The controls should be set in such a way that its regulating operation is not perceived as irritating.

Type of dimming actuator	internal and external dimmer ▼
Activation object constant brightness control	internal dimmer
	internal and external dimmer

Type of dimming actuator
Where the presence detector is used together with a FM switching/dimming actuator 6114U, the type of dimming actuator can be freely selected.
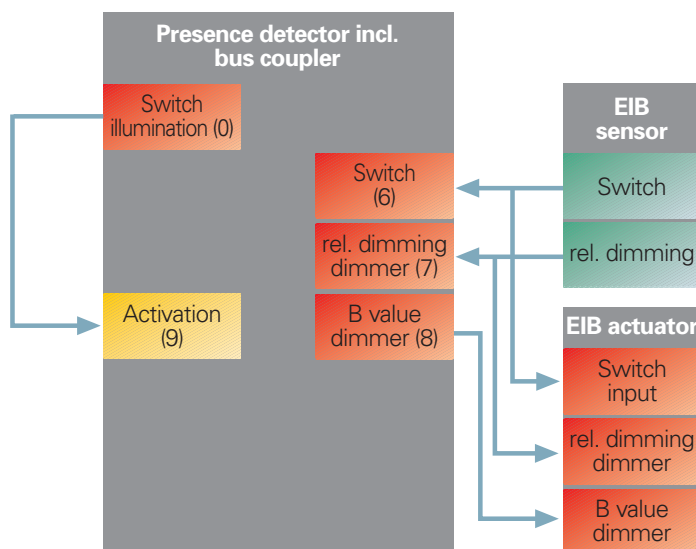
Internal dimmer
For activating the FM switching/dimming actuator 6114U directly connected to the branch interface, for operating dimmable electronic control gears with 0-10 V interface. The advantage is

a reduction of the bus load, as no group addresses are required for regulating.
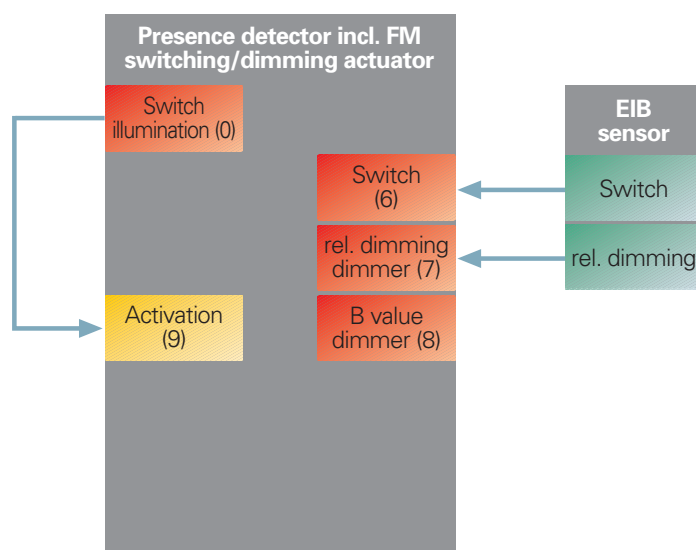
Internal and external dimmer
With this parameter selection, other commercially available dimming actuators can be activated via the brightness object, such as control module 6197/11-101 in connection with the 500 W universal dimmer 6593-10x. In this case, the slave operation must be activated on the additional dimming actuator.

Presence detector incl. bus coupler

Switch illumination (0)

Switch (6)

rel. dimming dimmer (7)

Activation (9)

B value dimmer (8)

EIB sensor

Switch

rel. dimming

EIB actuator

Switch input

rel. dimming dimmer

B value dimmer

Presence detector, external sensor

Where an external dimming actuator is triggered via a combination of presence detector and bus coupler, the communication objects 6-8 of the presence detector are linked to the associated communication objects of the dimming actuator. A pushbutton sensor allows intervention in the controls. The communication objects 6 and 7 of the presence detector receive the same group address as the sensor and the external dimming actuator. The controls are activated by briefly pushing down the pushbutton. Prolonged pushing of the pushbutton deactivates the controls.

Presence detector incl. FM switching/dimming actuator

Switch illumination (0)

Switch (6)

rel. dimming dimmer (7)

Activation (9)

B value dimmer (8)

EIB sensor

Switch

rel. dimming

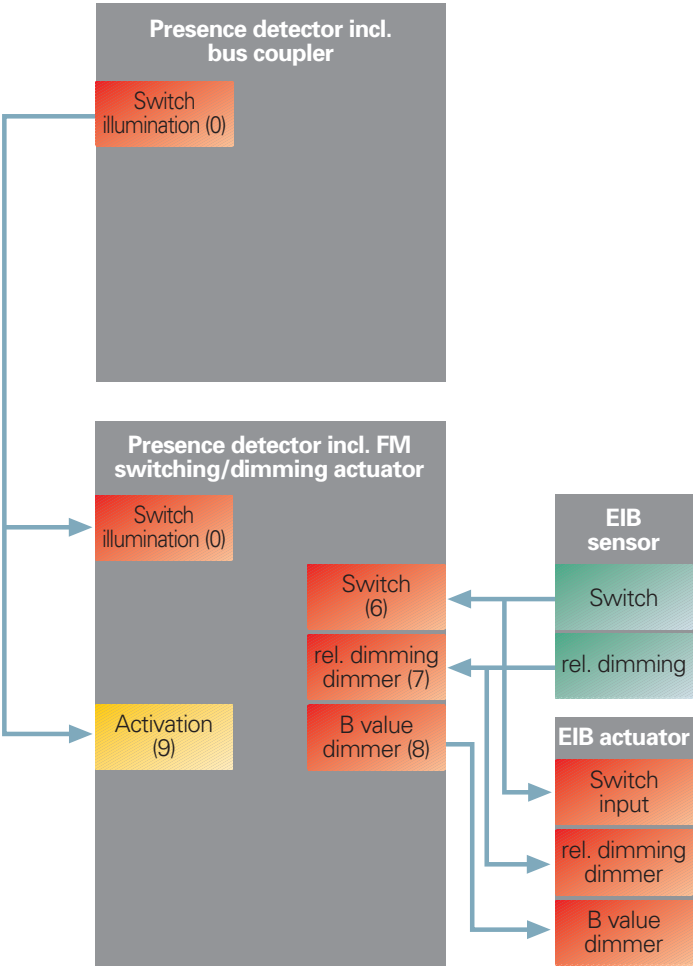**Presence detector incl. FM switching/dimming actuator, external sensor**

With this option, the presence detector directly activates the FM switching/dimming actuator. The presence detector sends an ON or OFF command to the activation object of the constant brightness control via its movement object. The FM switching/dimming actuator is directly triggered by an activation of the constant brightness function. Consequently, no further bus telegrams are required, reducing the number of telegrams. Intervention in the controls is possible via an additional external pushbutton sensor.

Master/Slave Method

This method is always required if a room contains more than one presence detector. It must be ensured that one detector is set to master and the other one to slave.

Presence detector incl. bus coupler

Switch illumination (0)

Presence detector incl. FM switching/dimming actuator

Switch illumination (0)

Switch (6)

rel. dimming dimmer (7)

Activation (9)

B value dimmer (8)

EIB sensor

Switch

rel. dimming

EIB actuator

Switch input

rel. dimming dimmer

B value dimmer

In case of a parallel operation of several constant-brightness presence detectors, the light in an office should not only be activated but also regulated via several presence detectors. In this set-up, the main unit must be linked to the dimming actuators. Communication objects 6 to 8 of the slave units remain unassigned.

The group address of the communications object 0 of the slave unit is linked to the switching object 0 and the activation object 9 of the main unit (see left diagram).

The two screen shots below show what has to be observed when setting the parameters of the master and slave unit.

Note:
The overtravel time of the master must be greater than the cyclic transmission of the slave unit.

Master/Slave Method

General	**Illumination channel 1**	Adjustments channel 1	HVAC channel 2

Sending at detection   `ON telegram`

Telegram after recovery time   `OFF telegram`

For the master unit, the parameter settings shown on the left must be used.

General	**Illumination channel 1**	Adjustments channel 1	HVAC channel 2

Sending at detection   `ON telegram`

Telegram after recovery time   `no telegram`

For the slave unit, the parameters must be set as for "Illumination channel 1" as shown on the left.

Where also the heating is to be controlled in the room, the same parameters should be set in the "HVAC channel 2" parameter menu.
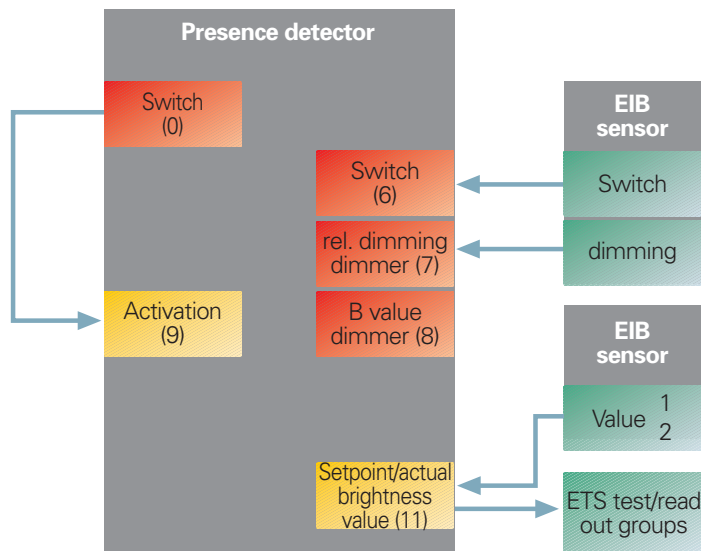
Note:
All activated dimming actuators must be operated as slave units, as otherwise an escalation of bus telegrams is caused. If the presence detector is used together with the FM dimming actuator, the activation of the dimming actuator is set to "internal dimming actuator" under the menu item "Constant brightness control".
This reduces the bus load as telegrams are forwarded internally. Where a parallel operation of several dimming actuators is planned in an object, the dimming actuator and presence detector should be regarded as the master unit and all other dimming actuators, triggered with the same group address, should be set to slave.

Activation of dimming actuators with different brightness values

The presence detector should regulate to two different brightness values. The example applies to a sports hall.
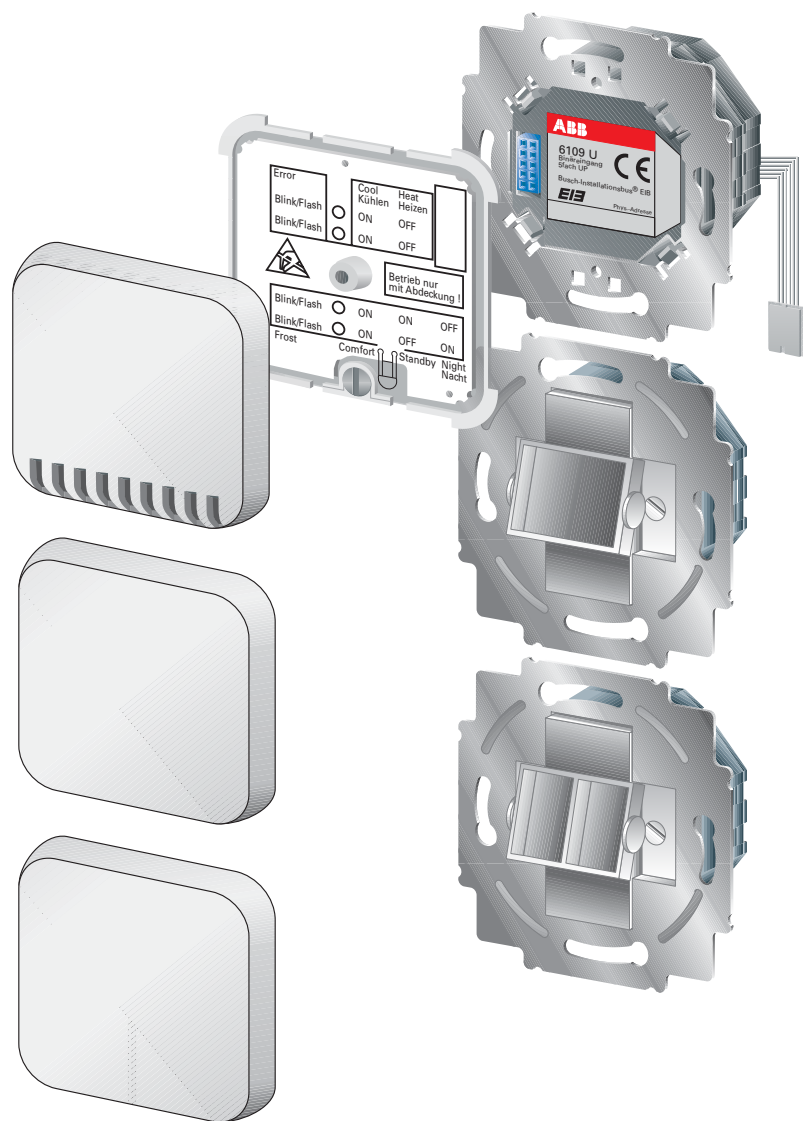
Presence detector

Switch (0)

Switch (6) ← Switch (EIB sensor)

rel. dimming dimmer (7) ← dimming (EIB sensor)

B value dimmer (8)

Activation (9)

EIB sensor
Value 1 2

Setpoint/actual brightness value (11)

ETS test/read out groups

The brightness should be regulated to 200 lux during normal operation and 500 lux during competitions. The lighting should be set to the desired brightness via a pushbutton sensor. The brightness is measured with a lux meter. Once the desired lux value has been reached, the ETS reads out the brightness value via the "Setpoint/actual value" communication object. This value is then entered into the application of the pushbutton sensor. The second value is entered in the same manner. If one of the two brightness values is sent to the presence detector, the previous value is overwritten and the presence detector regulates in accordance with the last brightness value.

Commercial-type FM room thermostat

The principle of a room temperature control system and the functionality of the triton room thermostat has been explained in detail in our manual "Heating, Ventilation and Air-Conditioning Control with EIB".
Below, the additional functions of the commercial-type FM room thermostat are briefly outlined.

Design
The commercial-type FM room thermostat accommodates the cover plates of the dimmer power components. These cover plates cover the commercial-type FM room thermostat and are available for the entire range of switches. The commercial-type FM room thermostat can be mounted on a "conventional" bus coupler or on the new 5gang FM binary input. With the aid of the FM binary input, up to 5 further conventional pushbuttons/switches can be connected.

Range for external setting of the setpoint	±5K ▼
Behaviour when receiving a base setpoint value :	disabled ±1K ±3K ±5K

External setting of set-points

As these room temperature controls do not contain an in-room control, the setpoints can be changed via an external object (e.g. via a display). Where further information is required, please see the Technical Manual.

Inputs general	Enabling of inputs	**Inputs 1/2 / brown/red**	Input 3 / orange	Input 4 / white

Operation mode of input 1	Shutter ▼
Operation mode	Edge (switching) Edge (value) Dimming Shutter
Input 1 = down / Input 2 = up	
Automatic shading (see also at setpoints)	inactive ▼

Binary inputs

The parameters of every input can be set to Switching, Value Transmission, Dimming or Shutter. If the shutter function is selected, the shutter function is also assigned to the next input.

Inputs general	**Enabling of inputs**	Inputs 1/2 / brown/red	Input 3 / orange	Input 4 / white

Activation object for inputs 1-5	available ▼
- enabling inputs 1-5 at	not available available
- behaviour at mains recovery	enabled ▼
Activation object of Input 3 (only active if inputs 1-5 are enabled)	no ▼
Activation object of Input 4 (only active if inputs 1-5 are enabled)	no ▼
Activation object of Input 5 (only active if inputs 1-5 are enabled)	no ▼

Activation objects for binary inputs

A separate object can be activated for enabling or blocking all 5 binary inputs. Where Switching or Value Transmission is entered, a separate activation object can be selected for each individual binary input.

These objects are effective when the central activation object for all binary inputs has been enabled. Upon return of the bus voltage, the individual activation objects are always enabled (if activated). Inputs are enabled with "1" and blocked with "0".
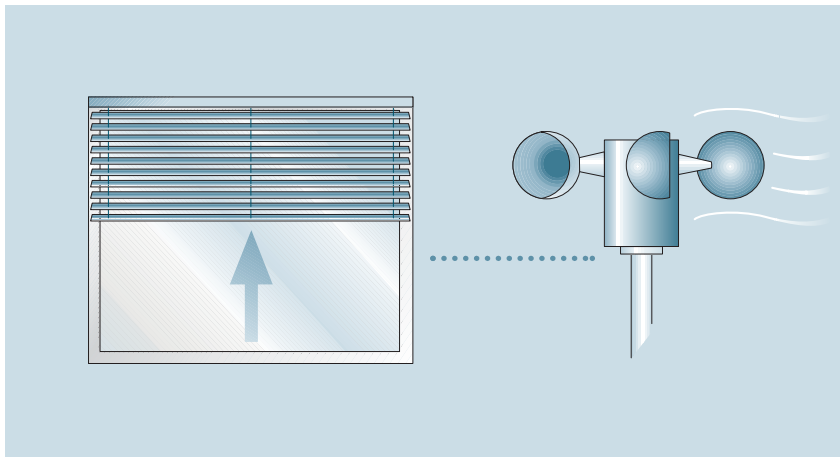
Blind/Shutter controls

The blind/shutter controls contribute significantly to the well-being (and thus to the performance) of the users and to energy saving. The shutters are also protected against damage caused by wind or rain. The central element of the blind/shutter controls is the weather station detecting rain, wind, brightness and outside temperature and operating the shutters accordingly. Users can also adjust their office shutters to their requirements at all times (except during a wind alarm).

Shutter controls have become an integral component of modern utility buildings. They offer numerous benefits, such as
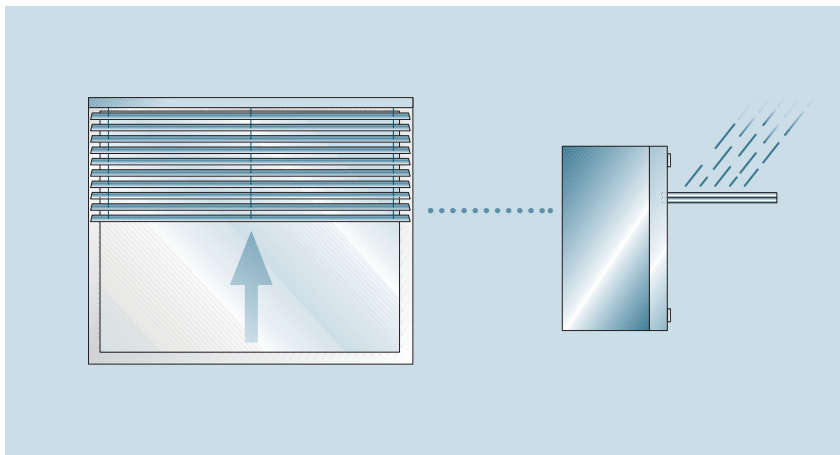- providing shade
- protection against rain or wind
- antiglare protection
- energy savings
  - during summer by offering shade (slightly reducing brightness)
  - during winter by offering antiglare protection (use of solar energy)

Wind monitoring
As soon as a specified wind speed is exceeded, the shutters can be moved into a defined position (e.g. completely raised). The shutters cannot be moved until the wind speed has dropped below a certain level again.

For this function, a so-called wind alarm actuator is provided on the blind/shutter actuators.
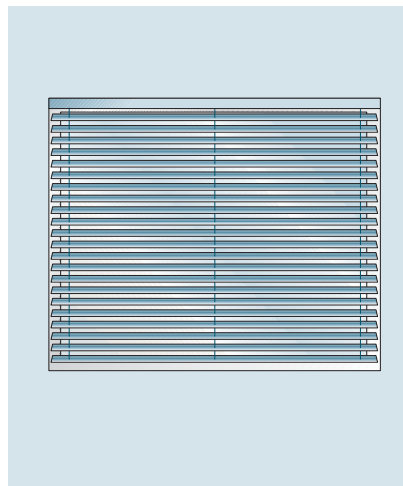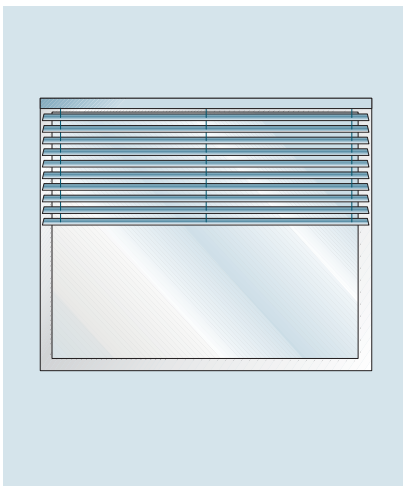

Rain monitoring
Some shutters may not be exposed to rain. A rain sensor monitors the weather and protects the shutters in a similar way as the wind controls.

Brightness monitoring
If the external brightness exceeds a certain lux value, the shutters should be lowered. The brightness should be monitored on every side of the building as the sun is not equally bright on all sides.
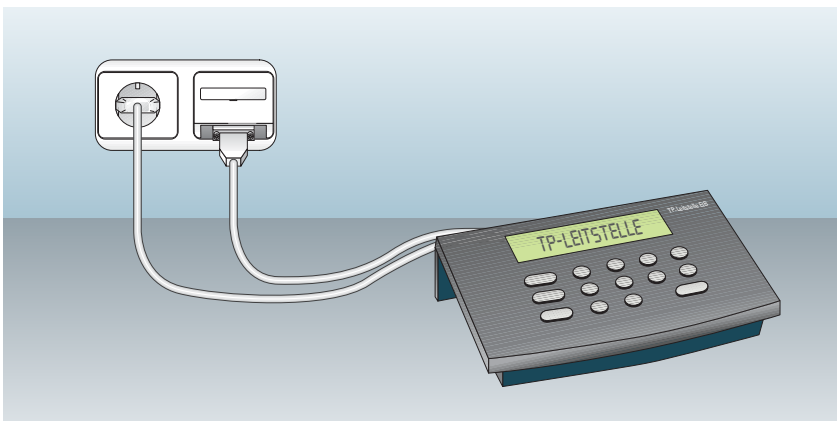
The shutters should not be fully lowered as otherwise the lights would be switched on (automatically in case of constant brightness controls or manually by users).

Combined brightness and external temperature monitoring
During **winter time** (i.e. external temperature <0°C), it makes sense to use the sun radiation to provide additional heat for the room. In this way, valuable heating energy can be saved. Where the external brightness exceeds a certain lux value at low external temperatures, the shutters can be set to partial shading. After partial lowering of the shutters, the shutter lamellas can be slightly tilted. In this way, adequate antiglare protection is provided, the room is still bright enough (no additional lighting is required) and the sun radiation provides additional heat for the room. During summer time it makes sense to produce as much shade as possible for the room, preventing nearly all direct sun energy from entering the room but at the same time, leaving the room as bright as possible. To achieve this, the shutter lamellas can be slightly tilted after partial lowering of the shutters.
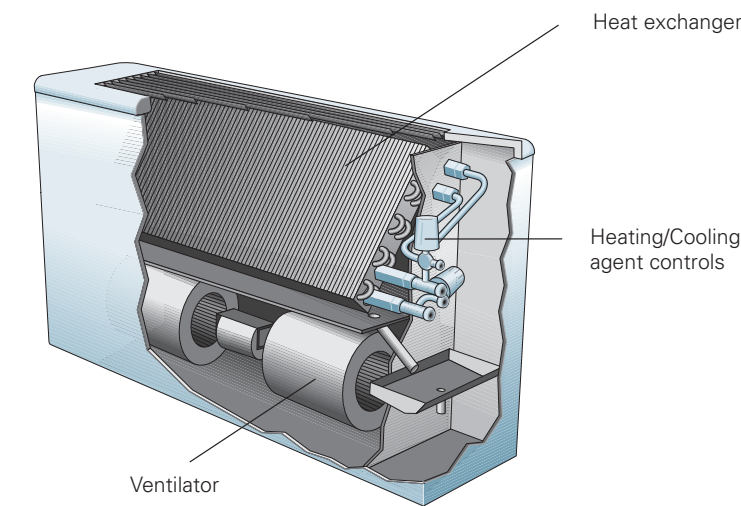
Stand?

Timer controls
Apart from the aforementioned functions, shutters can also be operated by central timer controls. All shutters can, for instance, be moved up in the evening, irrespective of the shutter position chosen by the individual user.
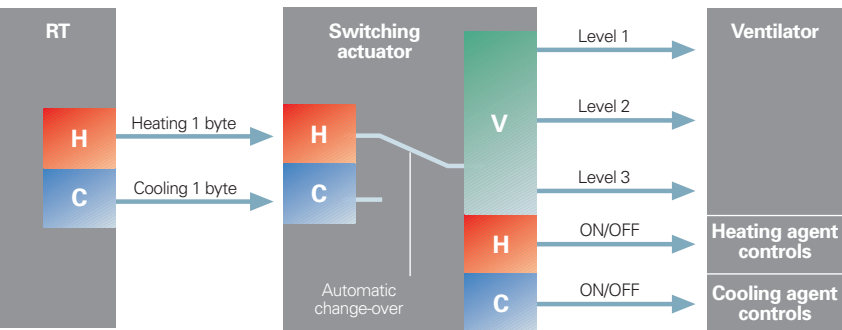
Fan Coil Control

A fan coil unit generally consists of the following components.

Heat exchanger

Heating/Cooling agent controls

Ventilator

2- and 4-pipe systems are available. The 4-pipe systems contain two heat exchangers, one for heating and one for cooling. Hot water for heating or cold water for cooling is passed through the heat exchangers. The ventilator takes in the air from the room (or from outside or from a central air-conditioning system) and blows it out again through the heat exchanger(s). In this way, the air is cooled or heated as required.
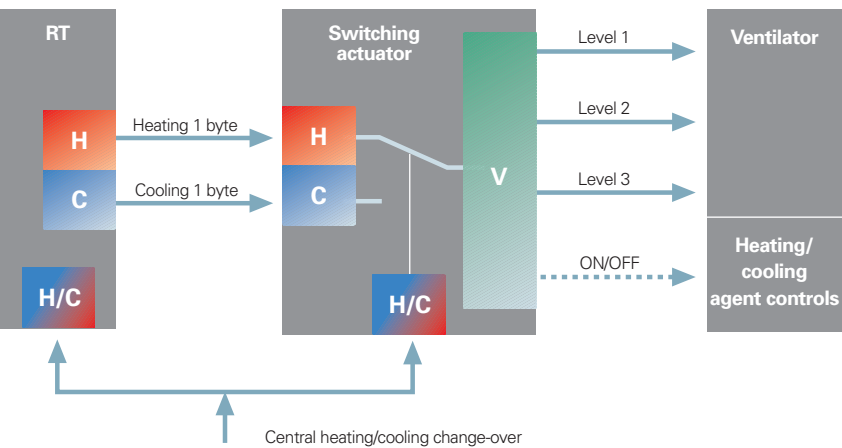

Generally, three different types of controls are available:

4-pipe system
This system has two heat exchangers (one for heating, one for cooling). The system centrally provides hot and cold water in two separate pipe systems (two pipes each). The local 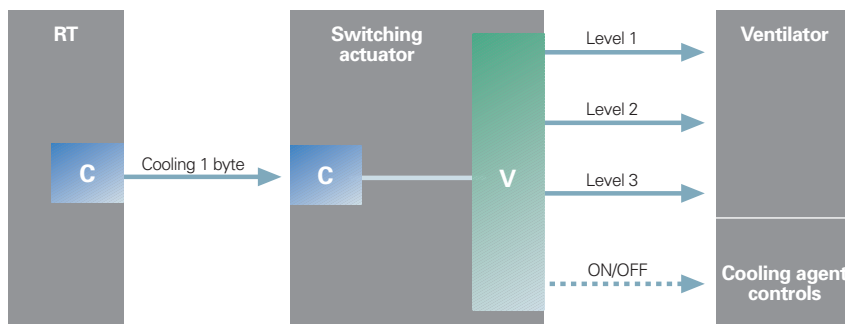room thermostat determines whether the room will be cooled or heated by opening the respective circuit of the heat exchanger and switching on the ventilator.

2-pipe system, heating and cooling
This system has one heat exchanger (for heating and cooling). Depending on the weather, the system centrally provides hot and cold water in the pipe system (two pipes). The room thermostat is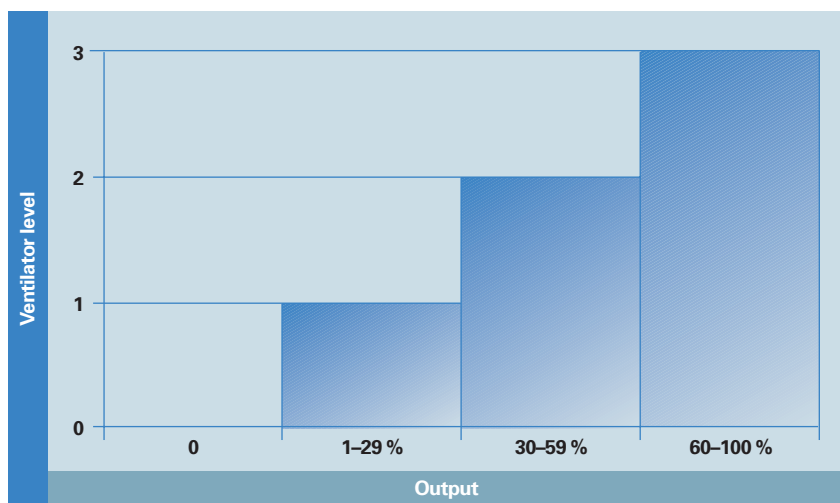 informed of whether the pipe circuit contains hot or cold water. The thermostat then only sends out heating or cooling outputs.

2-pipe system, heating or cooling

This system has one heat exchanger (for heating or cooling). The unit is only used for heating or cooling. Generally, only hot or only cold water is centrally fed into the pipe system (2 pipes).

This system is normally almost exclusively used for cooling.

All 3 systems use the same 3-level ventilator control operated via a change-over switch. Depending on the required cooling capacity (output 1 byte), the ventilator levels are switched on accordingly. 3 levels are available for

which the threshold parameters can be set. Based on the continuous output (1 byte; 0 ... 100%), the threshold value of the respective ventilator level is determined.

Example:
Ventilator level 1: 1 ... 29%; ventilator level 2: 30 ... 59%; ventilator level 3: 60 ... 100%
This results in:
Threshold value Off -> level 1   = 1%
Threshold value level 1 -> 2   = 30%
Threshold value level 2 -> 3   = 60%

The threshold values are set on this screen:

Fan Coil Control

The following additional functions are available for this control.

General	Ventilation	**Step limiting**	Forced position	Fault alarm

Step limiting	yes
maximum step at step limiting	Step 2

"Step limiting" folder
If the Step limiting function is selected with the top parameter, the object "Step limiting" and the parameter "Maximum step at step limiting" appears. The step limiting is activated with a "1" on the "step limiting" object. It is then no longer possible to exceed this step with the preset parameters. This is often used in hotels, where guests are able to reduce the noise at night (reducing the cooling output at the same time).

General	Ventilation	Step limiting	**Forced position**	Fault alarm

Forced position	yes
Behaviour at forced position	Step 2

"Forced position" folder
The parameter "Behaviour at forced position" is used to determine the behaviour at the forced position. With the object "Forced position" set to "1", the switching actuator moves to the position with the preset parameters irrespective of the output value, step limiting and any fault alarms.

In other words, the forced position has the highest priority and precedes:
• Fault alarm
• Step limiting
• Output

General	Ventilation	Step limiting	Forced position	**Fault alarm**

Fault alarm	yes
Monitoring time fault report	24 min
Behaviour at fault signal	OFF

"Fault alarm" folder
If no telegram is received within a certain time (fault alarm monitoring time), the actuator moves into the position determined with the "Step at fault" parameter. In addition, a telegram is sent via a separate object, i.e. to a monitoring person (service technician or caretaker). Upon receipt of an output, a fault is cancelled again.

EIB in Large Utility Buildings

In large utility buildings so-called management or command levels can be used in some cases. This command level controls and displays all processes in the building and interconnects different bus systems, where applicable. In addition to the EIB, also DDC systems, special safety system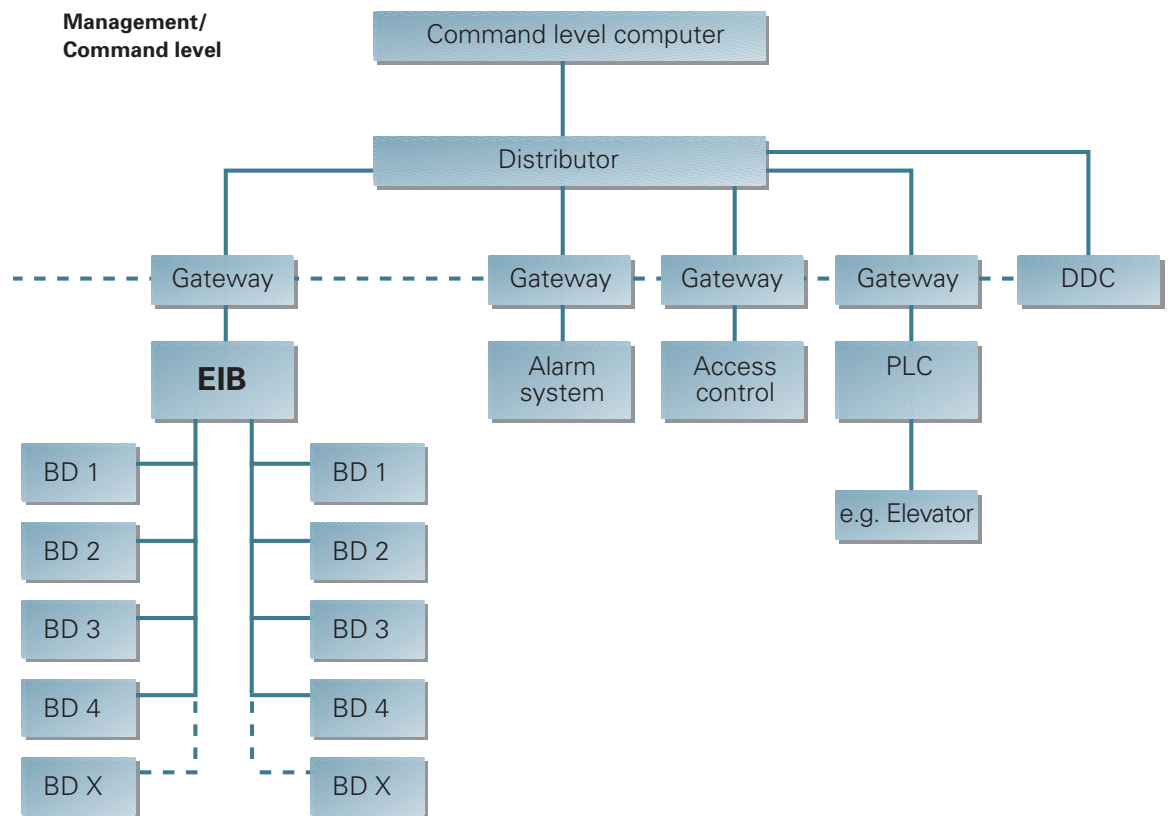s, elevator controls and access systems could be used. These systems are then connected to the management or command level via gateways (connecting elements between the different bus systems).

In this case, the management system determines e.g. the basic set temperature for the room thermostats. This information is then converted by the gateway into an EIB telegram. For the boiler system (i.e. controlled via a DDC) it can, for instance, be important to receive information about the actual and setpoint temperatures or output values from individual rooms. The gateways are generally provided and planned by the installers of the command or management level so that only the information flow via the gateway has to be agreed. The connection of the EIB is not problematic due to the wide popularity of the system.

Management/Command level

Command level computer

Distributor

| Gateway | Gateway | Gateway | Gateway | DDC |

EIB

Alarm system

Access control

PLC

e.g. Elevator

BD 1   BD 1
BD 2   BD 2
BD 3   BD 3
BD 4   BD 4
BD X   BD X

BD = bus device

Manufacturers of Gateways
- ABB Gebäudetechnik
- Siemens (SBT)
- Johnson Controls
- Kieback & Peter
- Honeywell
- etc.

Application Examples

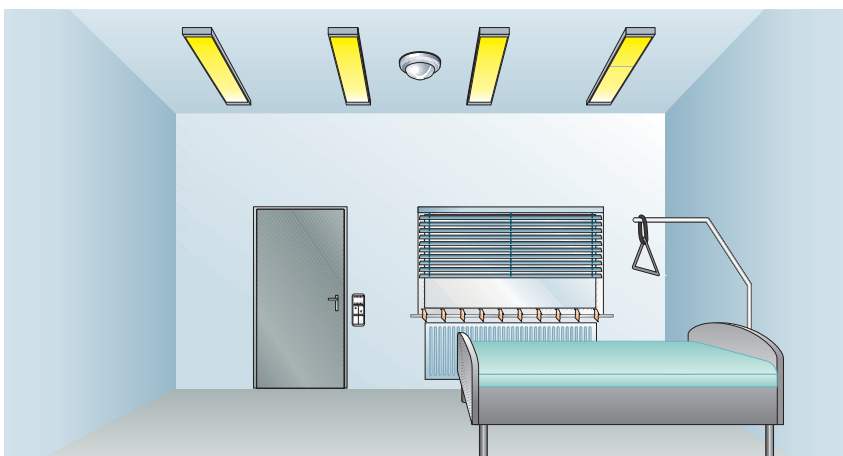Below, examples and recommendations for special applications are provided.

Schools

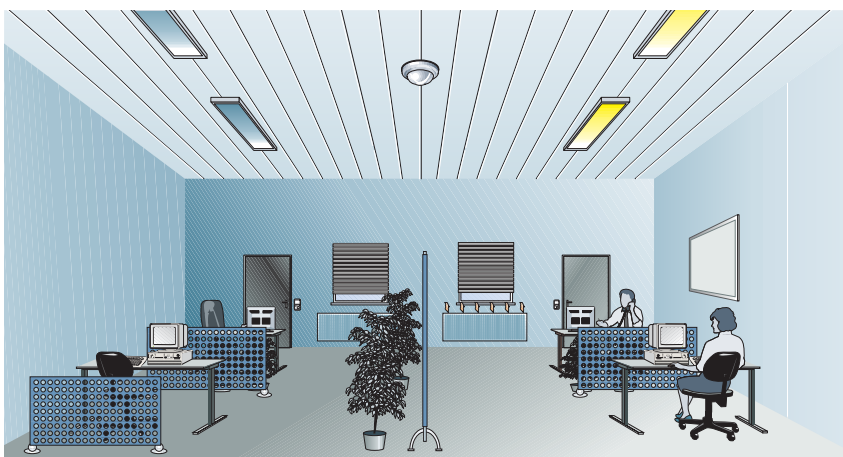|	
Recommended illumination:	500 lux

Used components
1 off commercial-type FM room thermostat	6134/10
1 off FM binary input	6109 U-500
- Input 1: activation light 1	
- Input 2: activation light 2	
- Input 3 and 4: blinds/shutters	
- Input 5: blackboard light	
2 off presence detector	6131-74-101-500
2 off FM switching/dimming actuator	6114 U-500
1 off heating actuator	6164 U-500
1 off actuating drive	6164/10
1 off blind/shutter actuator	6152 EB-101-500

Hospitals

Recommended illumination:	
during examination	300 lux
reading light	200 lux
general illumination	100 lux

1 off commercial-type FM room thermostat	6134/10
1 off FM binary input	6109 U-500
- Input 1 and 2: blinds/shutters	
- Input 3: basic lighting	
- Input 4: lights for examination	
1 off presence detector	6131-74-101-500
1 off FM switching/dimming actuator	6114 U-500
1 off heating actuator	6164 U-500
1 off actuating drive	6164/10
1 off series actuator	6152 EB-101-500

Public (office) buildings

Recommended illumination:	500 lux

Used components
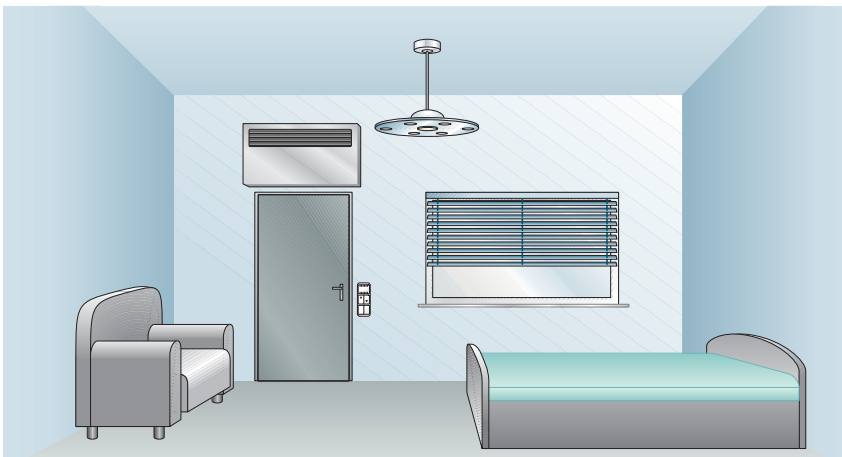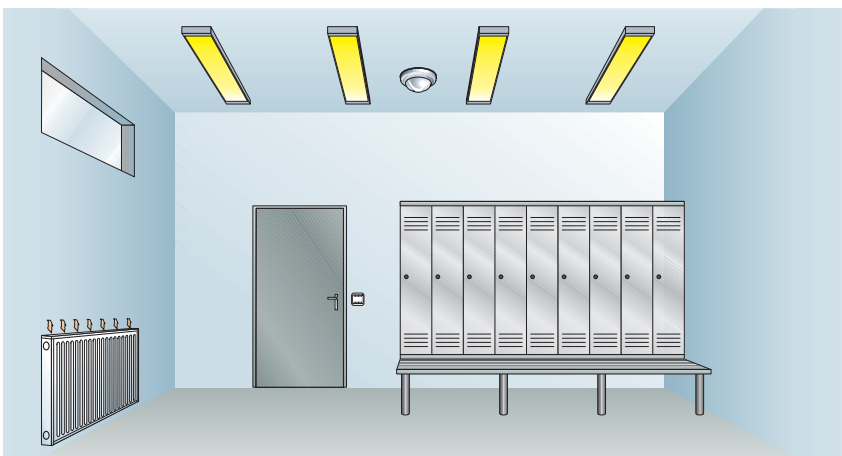|	
1 off commercial-type FM room thermostat	6134/10
1 off FM binary input	6109 U-500
- Input 1 and 2: blinds/shutters	
- Input 3: Basic lighting activation	
1 off presence detector	6131-74-101-500
1 off FM switching/dimming actuator	6114 U-500
1 off heating actuator	6164 U-500
1 off actuating drive	6164/10
1 off series actuator	6152 EB-101-500

Hotels

Used components:
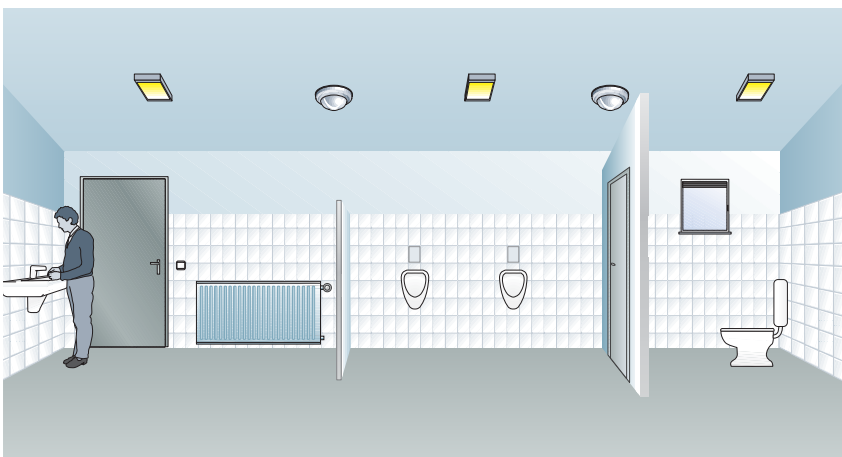
1 off commercial-type FM room thermostat   6134/10
1 off FM binary input   6109 U-500
     - Input 1 and 2: blinds/shutters
     - Input 3 illumination
     - Input 4: toilet lights
     - Input 5: temperature level
1 off 6gang switching actuator   ATS 6.6.1
2 off series actuator   6152 EB-101-500

Sports facilities

Recommended illumination: 100 lux

1 off commercial-type FM room thermostat   6134/10
1 off bus coupler   6120U-10x-500
1 off presence detector   6131-74-101-500
1 off FM switching/dimming actuator   6114 U-500
1 off heating actuator   6164 U-500
1 off actuating drive   6164/10

Toilets

Recommended illumination: 100 lux

1 off commercial-type FM room thermostat   6134/10
2 off bus coupler   6120U-10x-500
2 off presence detector   6131-74-101-500
1 off FM switching/dimming actuator   6114 U-500
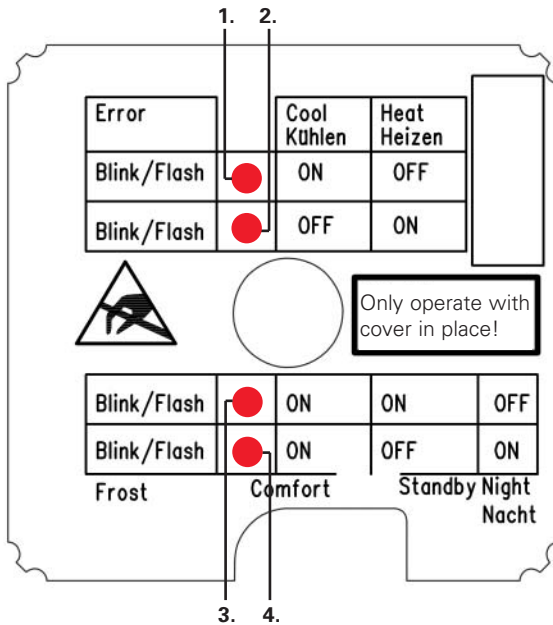1 off heating actuator   6164 U-500
1 off actuating drive   6164/10

Tips and Tricks

- New systems should have run at least 100 operating hours (ageing process).

- In case of used systems, new bulbs/tubes should be used and any dirt should be removed from lamps.

- The measuring level for the horizontal illumination has been determined at, e.g.:
  · for desks, etc. approx. 0.85 m
  · for hallways approx. 0.2 m
  · for sports halls approx. 1 m
  · Where other levels are used, this must be mentioned in the report.

- Further information is provided in DIN 5035, part 6.

- If the controls do not come on, the setpoint value should be checked and changed, where necessary.

- The presence detector and constant brightness control should be placed at a point where they are not exposed to daylight or artificial light.
  - Controls are automatically deactivated as the brightness level has been exceeded.
  - Controls cannot be switched on again as the incoming daylight is above the switch-on threshold of the brightness value.
  - Where several presence detectors are used, one detector must be set to master and the other to slave operation. (see also page 17).
  - The dimming actuators must be operated as slaves.

Error		Cool Kühlen	Heat Heizen
Blink/Flash	●	ON	OFF
Blink/Flash	●	OFF	ON

Only operate with cover in place!

Blink/Flash		ON	ON	OFF
Blink/Flash		ON	OFF	ON
Frost		Comfort	Standby	Night Nacht

Room temperature control
A detailed fault analysis is specified in our manual "Heating, Ventilation and Air-Conditioning Control with EIB".

In case of the commercial-type FM room thermostat, service LEDs are located under the cover plate (red in the drawing), representing the following operating conditions:

Controller cools:	1. LED ON
Controller heats:	2. LED ON
Standby operation:	3. LED ON
Night operation:	4. LEDON
Comfort operation:	3. & 4. LED ON
Frost/heat protection operation:	3. & 4. LED flashing
Fault:	1. & 2. LED flashing

Constant brightness control
A fault analysis requires a systematic approach:
1. Light does not come on.
   a) Illumination in room too bright
   b) Redetermine brightness value and save, using "Save brightness value".
2. Constant brightness control does not regulate light.
   a) Constant brightness control has been deactivated by prolonged pushing of the pushbutton. – Switch on illumination by briefly depressing pushbutton.
   b) Shine a light source (torch, etc.) directly onto sensor. Illumination switches off.
   c) Cover sensor (cloth, cardboard, etc.). Illumination switches on.
   d) Allocate an address to communication object 8 (brightness value) and check via ETS if cyclical telegrams are being sent.
      (for external dimmer only)

   If yes:
   Constant brightness control is ok, check connection and/or programming of actuators and possibly lights.

   If no:
   Check group addresses and parameters of presence detector 6131-74-101-500 and proceed again as specified in items 1 a-b and 2a-d.