



Energy efficiency with room automation

spelsberg gebäudeautomation gmbh + co. kg
www.spega.com

Room automation with e.control™

Agenda

- Why e.control room automation?
- [Saving energy and money with e.control](#)
- [Optimising energy efficiency](#)
- [Selecting e.control devices](#)
- [e.control Example](#)

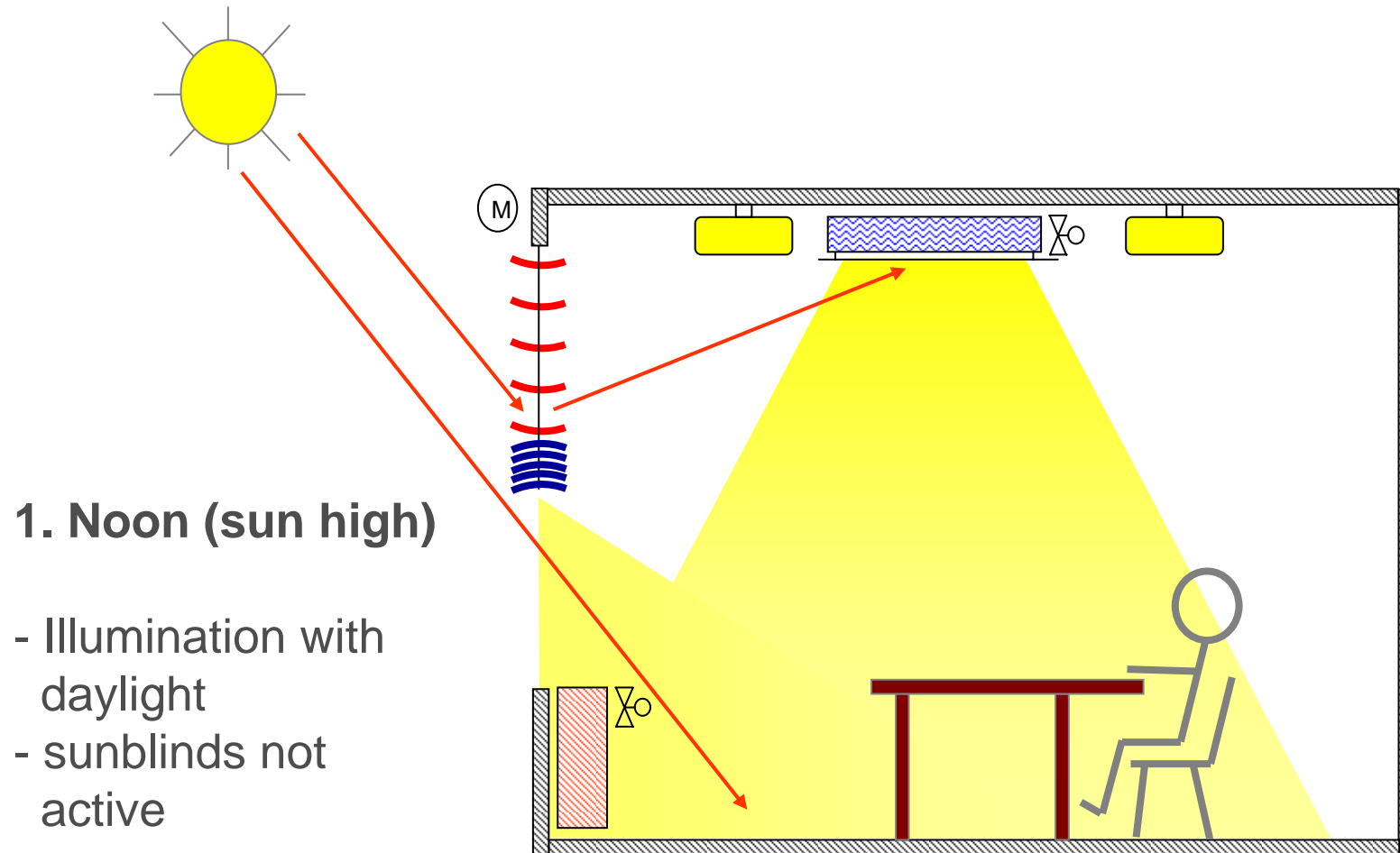
Why e.control™?

Benefits of room automation with e.control

- **Comfort / productivity**
 - ✓ comfortable room temperature and ventilation
 - ✓ sufficient illumination of workplaces
- **Flexibility of utilisation**
 - ✓ for changing work contents / labour organisation
 - ✓ for changing tenants
- **Energy efficiency**
 - ✓ saving electrical energy for lighting
 - ✓ saving energy for heating and cooling

Why e.control™?

1. e.control ensures productivity!

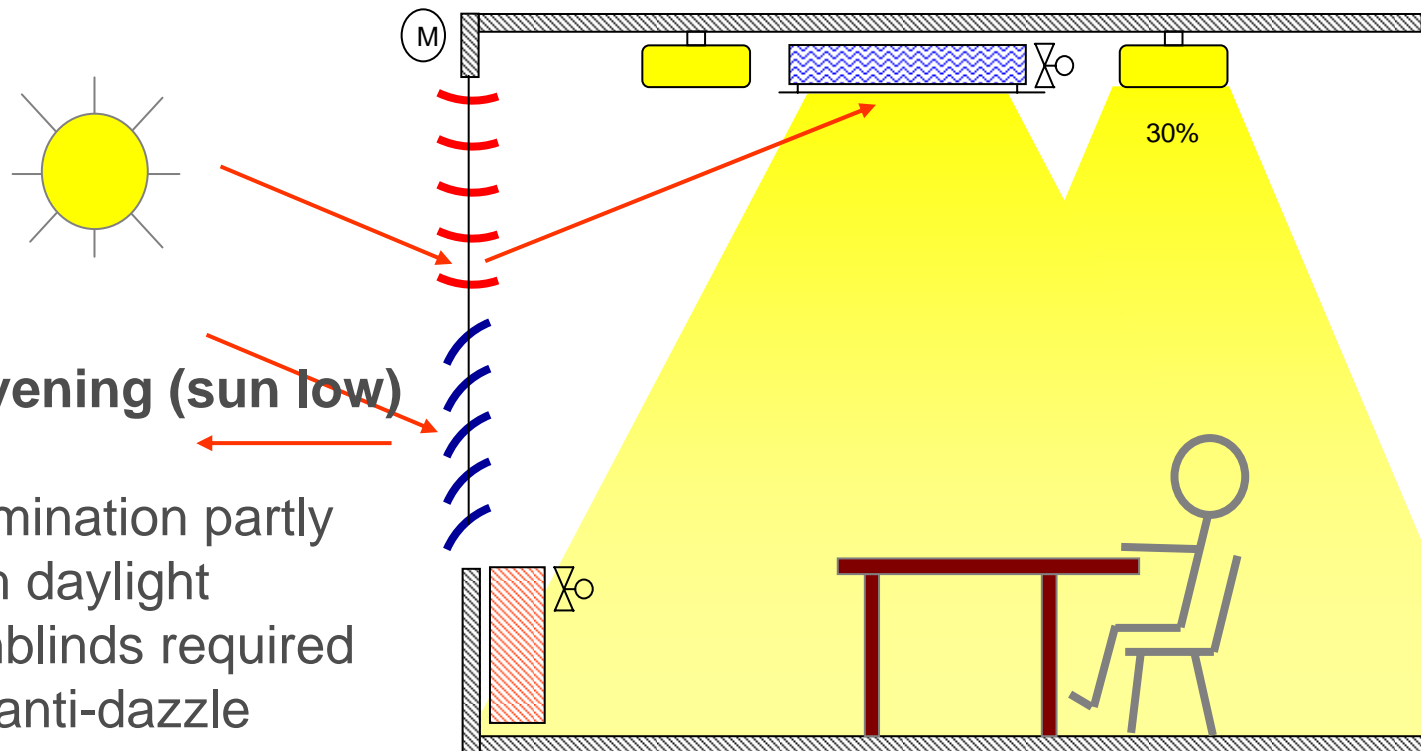


Why e.control™?

1. e.control ensures productivity!

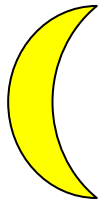
2. Evening (sun low)

- Illumination partly with daylight
- sunblinds required for anti-dazzle



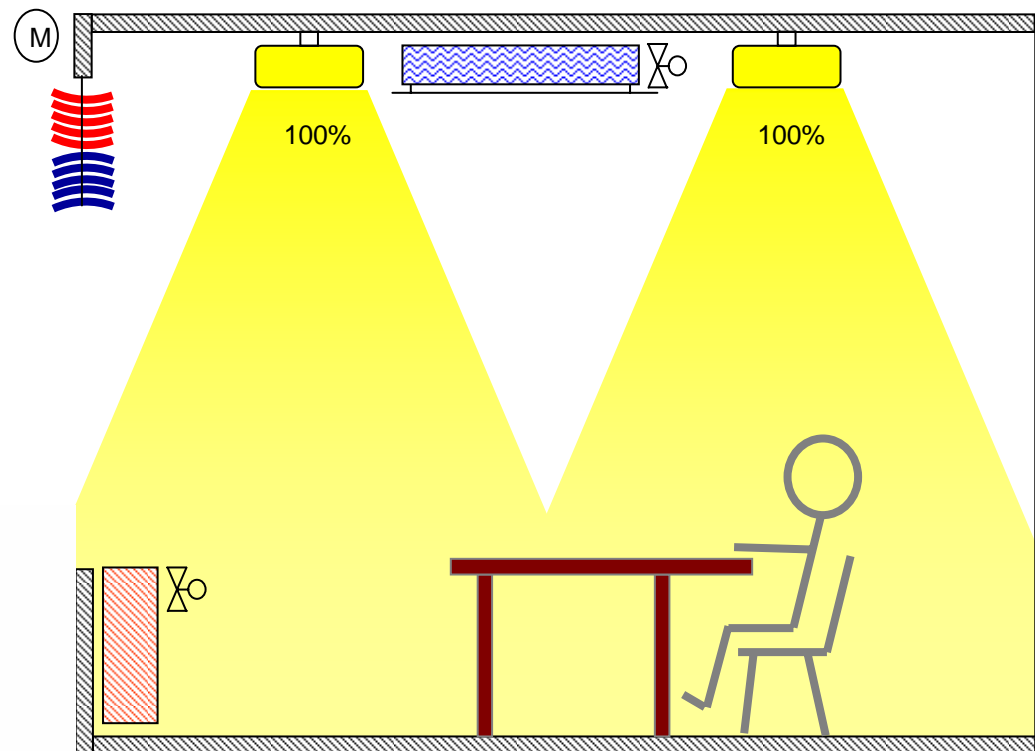
Why e.control™?

1. e.control ensures productivity!



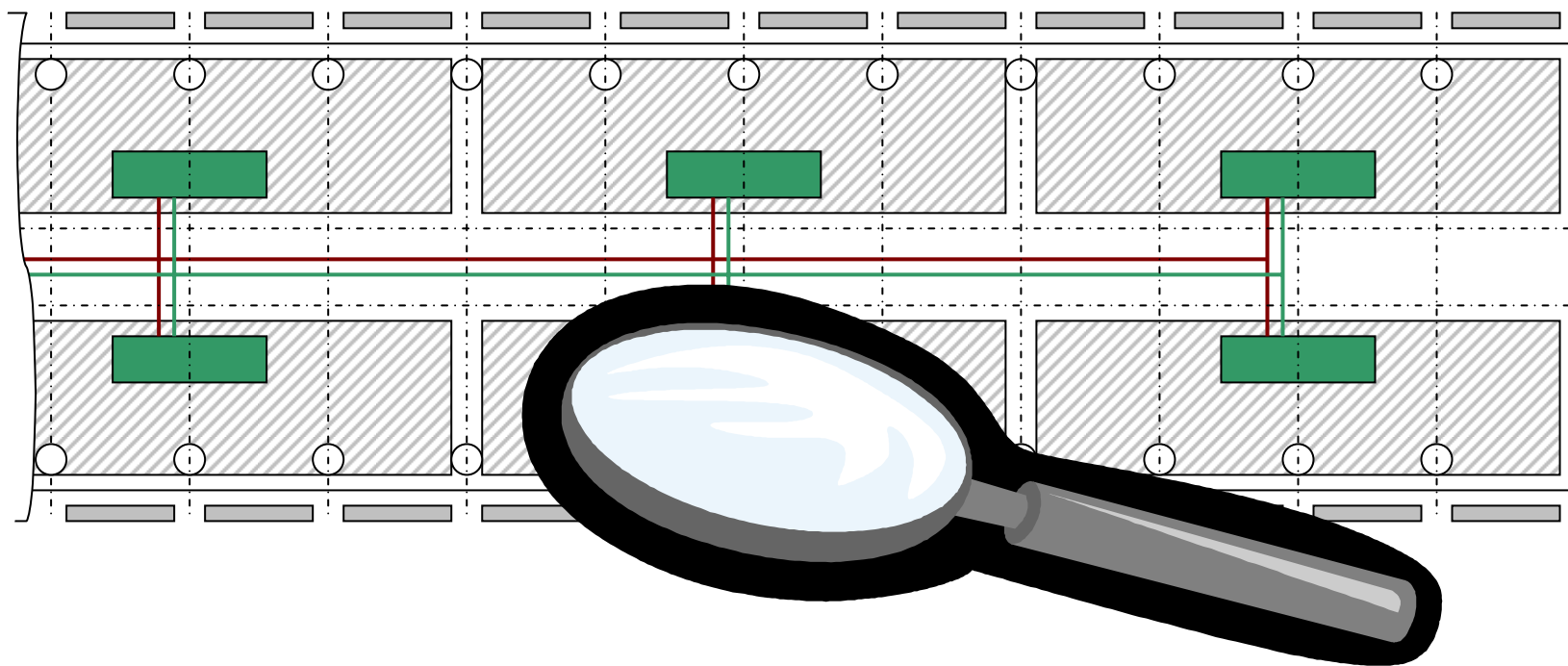
3. Night

- Illumination with artificial light



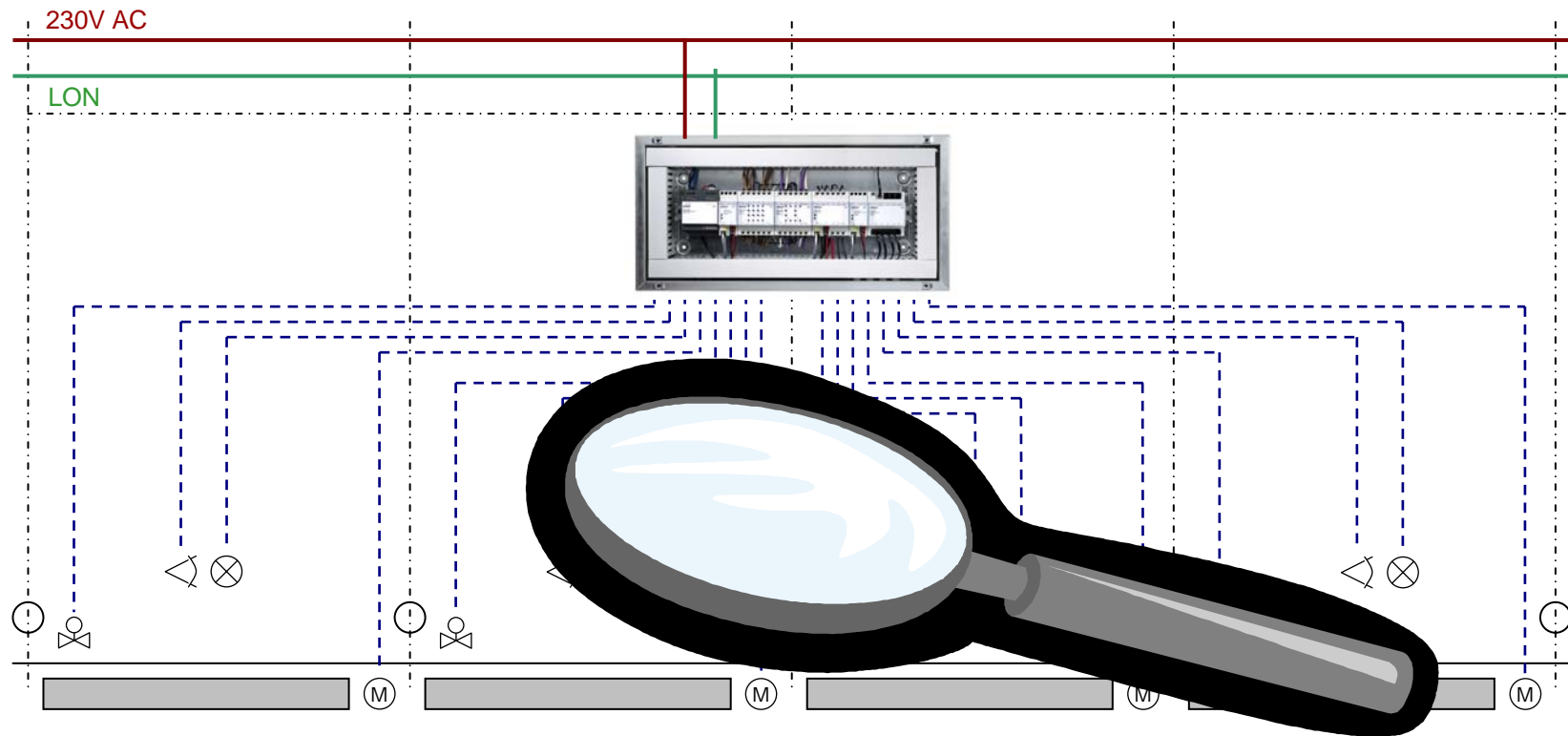
Why e.control™?

2. e.control creates full flexibility!



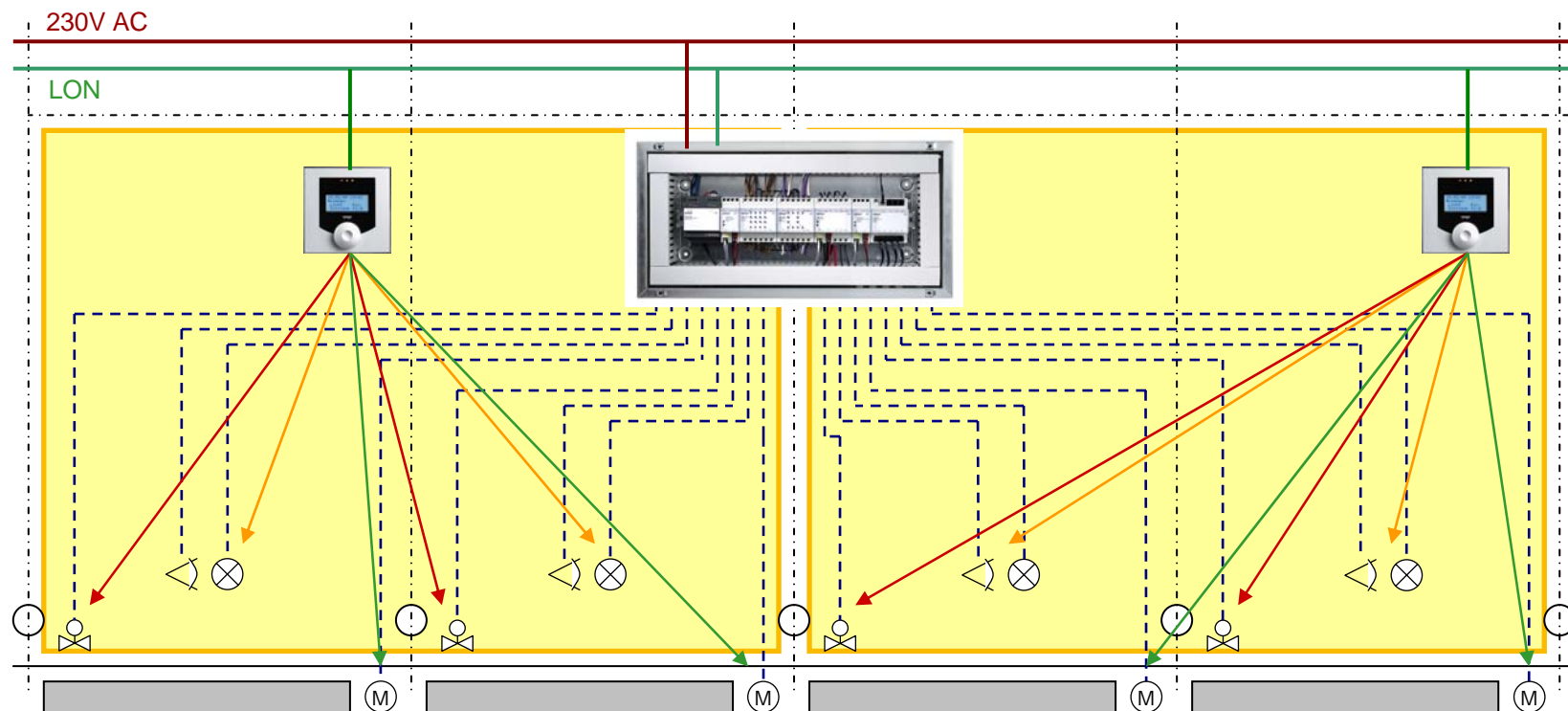
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2. e.control creates full flexibility!



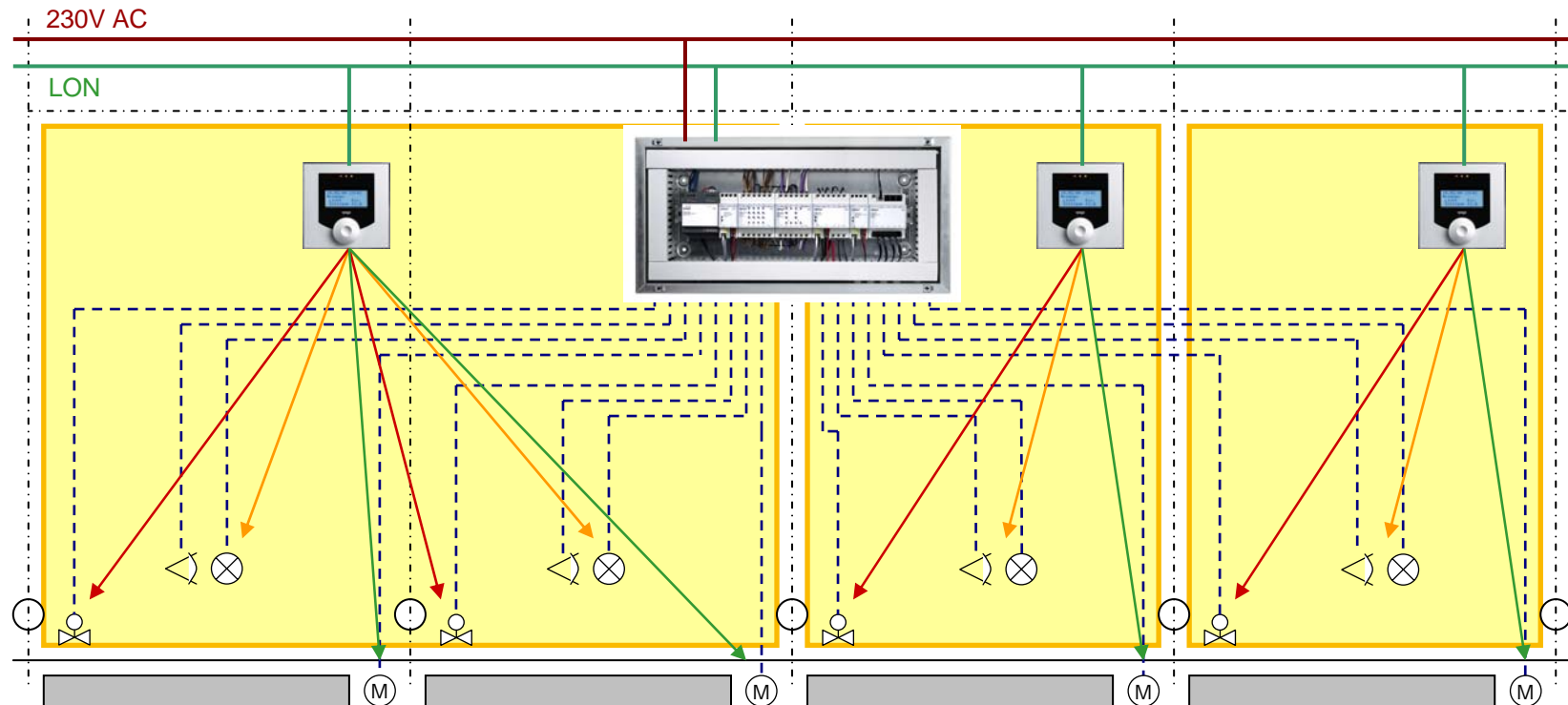
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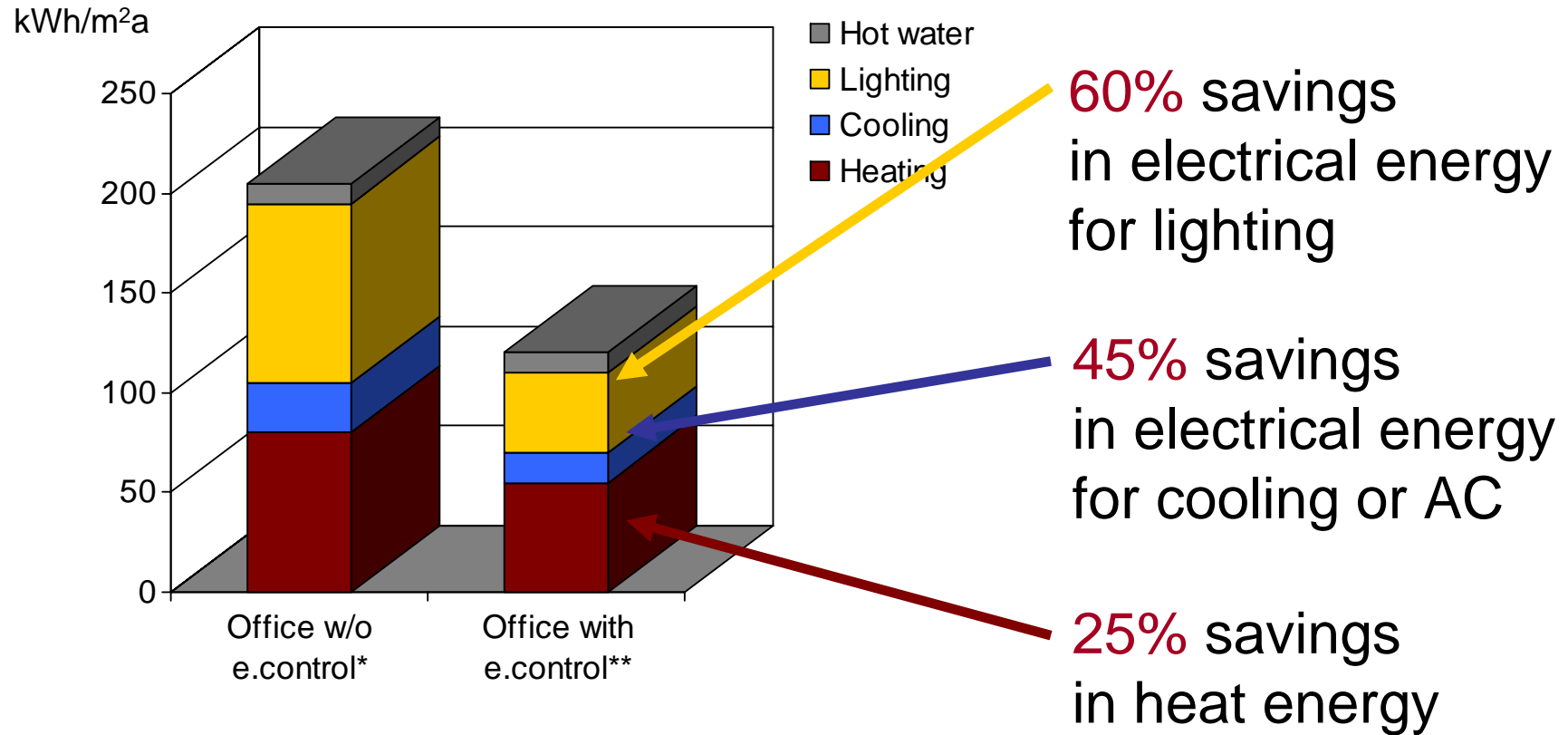
Why e.control™?

2. e.control creates full flexibility!



Why e.control™?

3. e.control saves energy and money!



* Data source: Reference calculation in LonMark study acc. to DIN V 18599

** Saving potentials according to LonMark study 2007 (University of Biberach)

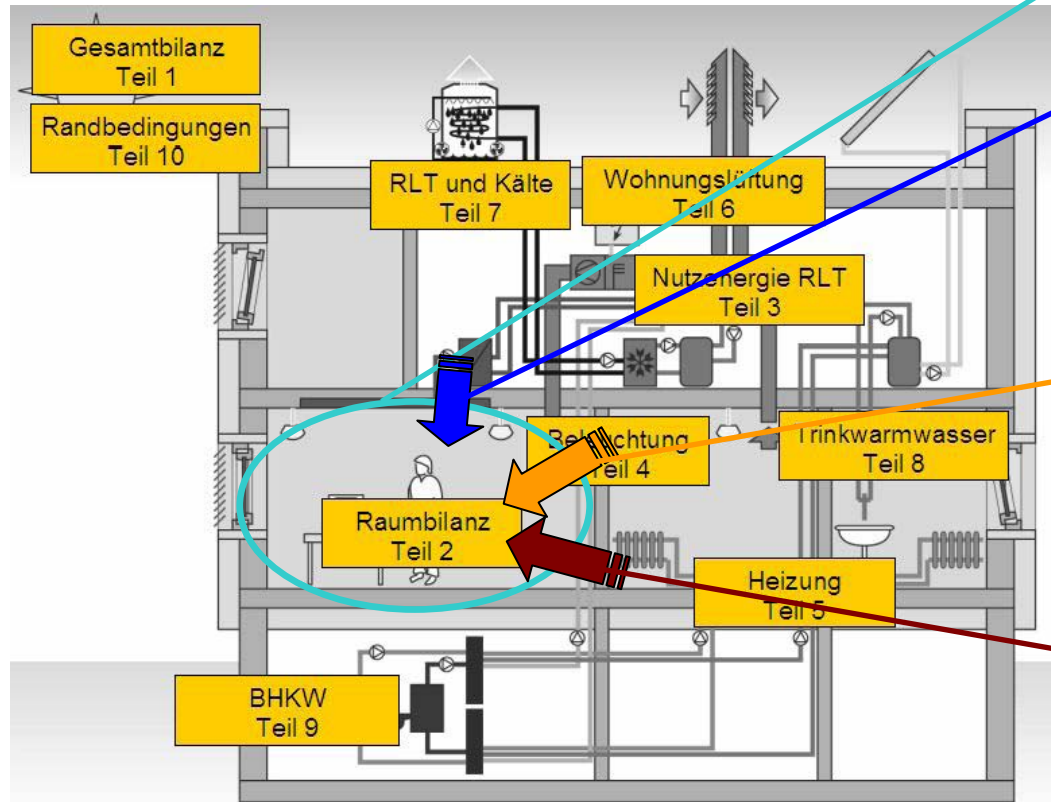
Room automation with e.control™

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Saving energy with e.control™

German EPBD calculation method: DIN V 18599



Part 2:

Rooms are the center of all considerations

Part 3 + 7:

Cooling energy with influence factors:

- control function
- presence detection*
- window monitoring*

Part 4:

Lighting energy with influence factors:

- presence detection
- control strategy
- sun blind control

Part 5:

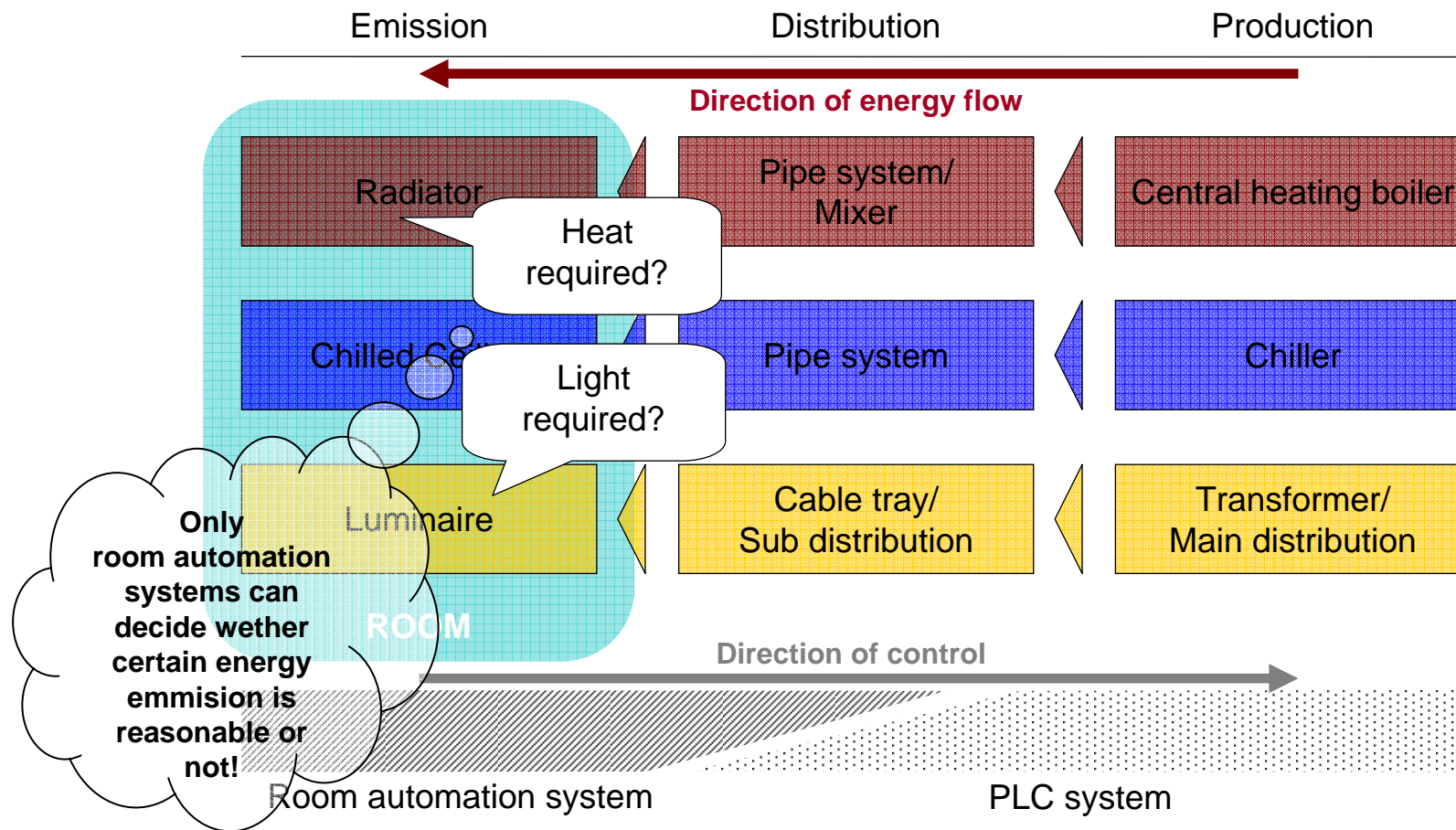
Heating energy with influence factors:

- control strategy
- presence detection*
- window monitoring*

* considered in prEN 15232

Saving energy with e.control™

Room automation is mandatory for efficient buildings!



Saving energy with e.control™

Calculation of profitability

- (1) Basic data of virtual office building
- (2) Standard building (EPBD reference type)
 - Technical equipment
 - Investment costs
 - Energy consumption and costs
- (3) Energy-efficient building with e.control
 - Saving potentials
 - Technical equipment
 - Investment costs
 - Energy consumption and costs
- (4) Profitability

Saving energy with e.control™

(1) Basic data of virtual office building

- Contemporary insulation
- Axis dimensions: Width: 3 m, Depth 5 m
Utilised as double-axis offices with 30 sqm
- Heating: Static radiators
- Cooling: Chilled ceiling
- Ventilation: Via windows
- Operating time: 5:00 – 22:00 on workdays
- Occupancy time: 7:00 – 18:00 on workdays
- Population density: 15 m² per person
- Illumination: 500 lux at workplace

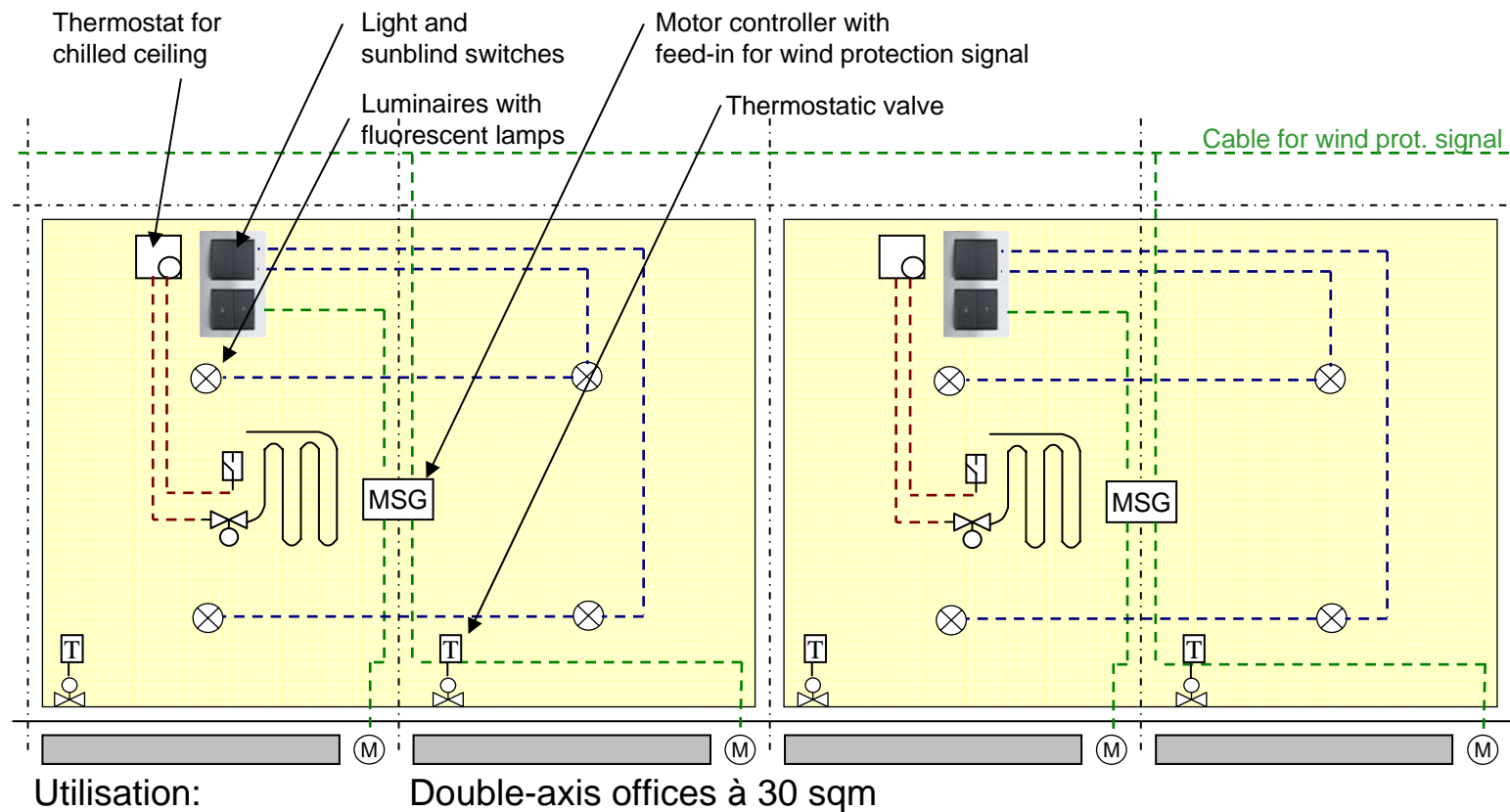
Saving energy with e.control™

(2) Standard building

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Saving energy with e.control™

(2) Standard building – Technical Equipment



Saving energy with e.control™

(2) Standard building – Investment costs

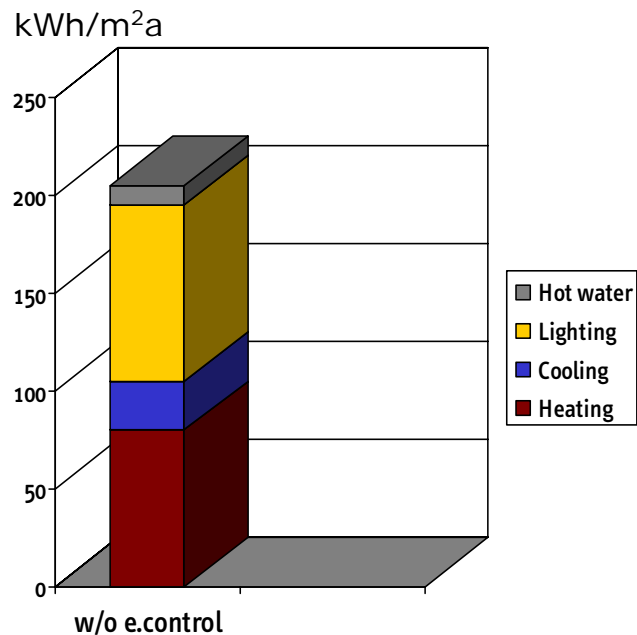
Item		Qty.	Length	List price	Market pr.	Total
Devices						
Thermostat for chilled ceiling		1		89,00 €	71,20 €	71,20 €
Sunblind switch with cover		1		17,65 €	14,12 €	14,12 €
Light switch with cover		2		8,80 €	7,04 €	14,08 €
Switch frame		1		8,50 €	6,80 €	6,80 €
Motor controller for 2 sunblinds		1		65,00 €	52,00 €	52,00 €
Thermostatic valve		2		29,00 €	23,20 €	46,40 €
Actuator for chilled ceiling		2		24,50 €	19,60 €	39,20 €
Dew point sensor		2		20,00 €	16,00 €	32,00 €
TOTAL DEVICES						275,80 €
Cabling and Routing*						
Actuator for chilled ceiling	H05RNF 2x1,0mm ²	2	7	1,20 €	0,96 €	13,44 €
Dew point sensor	H05RNF 2x1,0mm ²	1	7	1,05 €	0,84 €	5,88 €
Sunblind motors	H07RNF 4x0,7mm ²	2	6	1,10 €	0,88 €	10,56 €
Motor controller	H07RNF 4x0,7mm ²	1	10	1,15 €	0,92 €	9,20 €
Cable for wind protection signal	NYM 4x1,5mm ²	1	13	1,65 €	1,32 €	18,16 €
Lighting	NYM 3x1,5mm ²	4	7	1,20 €	0,96 €	26,88 €
TOTAL WORK						84,12 €
TOTAL COSTS PER OFFICE						359,92 €

* Prices based on calculation schemes of the German Electric Trade Organisation

Saving energy with e.control™

(2) Standard building – Energy costs

Primary energy requirement w/o e.control



Data source: LonMark study (reference building)

Energy costs per office (30 sqm) w/o e.control

Prices:		Gas/Oil	0,05 €/kWh
		Electricity	0,16 €/kWh
Heating/Cooling			
	Site energy	Area	Total
	[kWh/m2a]	[m2]	[kWh/a]
Heating	80	30	2400
Hot water	10	30	300
Cooling	9	30	270
Lighting			
2 luminaires with fluorescent lamps per axis			
Type: 4 x T26 / 36W / 6400 lm			
	Power	Hours*	Total
	[W]	[h]	[kWh/a]
	580	1650	957
* Operating hours (2750 h * 0,6)			
TOTAL ENERGY COSTS [€/a]			331,32

Saving energy with e.control™

(3) Energy efficient building

- (1) Basic data of virtual office building
- (2) Standard building (EPBD reference type)
 - Technical equipment
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- (3) Energy-efficient building with e.control
 - Saving potentials
 - Technical equipment
 - Investment costs
 - Energy consumption and costs
- (4) Profitability

Saving energy with e.control™

(3) Energy efficient building – Saving potentials

- Heating:
 - ✓ Time and presence-dependent change of operation modes 25%
 - ✓ Interruption on open windows (window monitoring) 10%
 - ✓ Additional heat load due to constant light control -10%

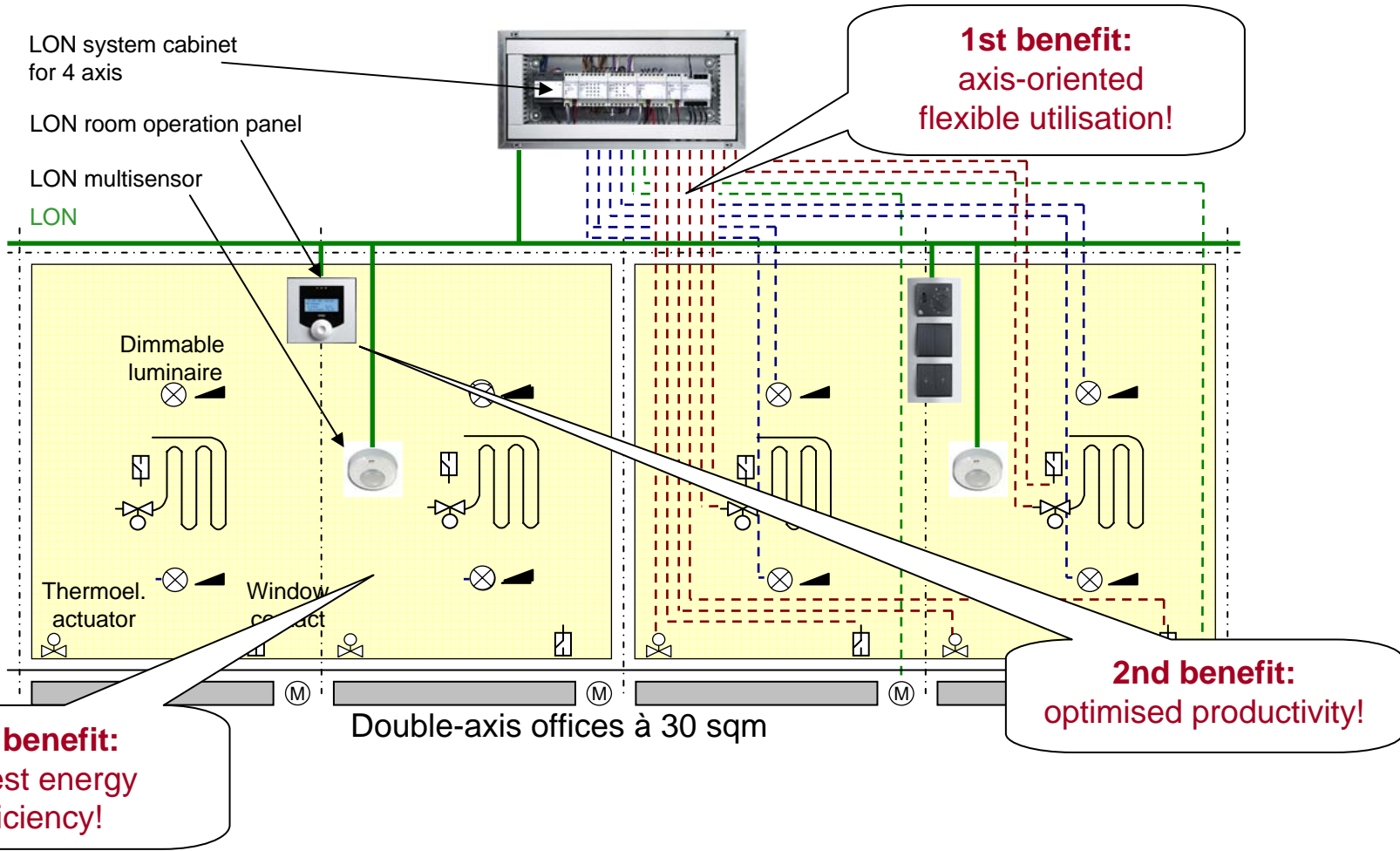
- Cooling:
 - ✓ Presence-dependent change of operation modes 5%
 - ✓ Automatic shading (sunblind thermo control) 5%
 - ✓ Interruption on open windows (window monitoring) 10%
 - ✓ Cool load reduction due to constant light control 25%

- Lighting:
 - ✓ Constant light control with presence detection 50%
 - ✓ Daylight maximising with sun tracking control 10%

Data source: LonMark study, University of Applied Sciences Biberach, Prof. Dr. Becker under reference to DIN V 18599, prEN 15232 and related studies.

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(3) Energy efficient building – Technical equipment



Saving energy with e.control™

(3) Energy efficient building – Investment costs

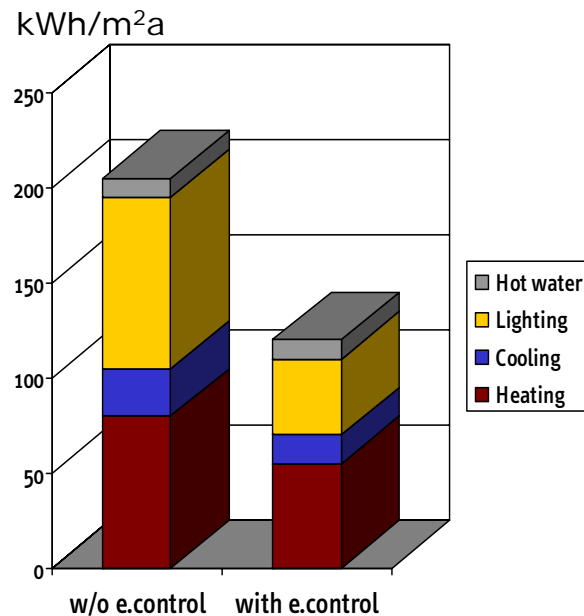
Item		Qty.	Length	List price	Market pr.	Total
Conventional devices						
Serial switch with cover		2		13,70 €	10,96 €	21,92 €
Cover for clima R2		1		5,90 €	4,72 €	4,72 €
Switch frame		1		8,50 €	6,80 €	6,80 €
Thermoelectric actuator for heating/cooling		4		24,50 €	19,60 €	78,40 €
Dew point sensor		2		20,00 €	16,00 €	32,00 €
Window contact		2		10,00 €	8,00 €	16,00 €
LON devices						
lumina T6 - Binary input module		1		100,00 €	80,00 €	80,00 €
clima R2 - room temperature controller		1		142,50 €	114,00 €	114,00 €
lumina MS3 - multi sensor		1		178,00 €	142,40 €	142,40 €
e.control system distribution box		0,5		1.171,00 €	936,80 €	468,40 €
TOTAL DEVICES						964,64 €
Cabling and Routing*						
Window contacts	H05RNF 2x1,0mm ²	2	6	1,30 €	1,04 €	14,48 €
Actuators for heating	H05RNF 2x1,0mm ²	2	8	1,20 €	0,96 €	17,36 €
Actuators for cooling	H05RNF 2x1,0mm ²	2	4	1,20 €	0,96 €	9,68 €
Dew point sensor	H05RNF 2x1,0mm ²	2	4	1,05 €	0,84 €	8,72 €
Sunblind motors	H07RNF 4x1,0mm ²	2	6	1,10 €	0,88 €	12,56 €
Lighting	H07RNF 5x1,5mm ²	4	4	1,20 €	0,96 €	19,36 €
LON cables	FB-2Y(ST)2x2x0,8	1	13	1,45 €	1,16 €	16,08 €
feed cable for multi sensor	FB-2Y(ST)2x2x0,8	1	2	1,45 €	1,16 €	3,32 €
feed cable for operation panel	FB-2Y(ST)2x2x0,8	1	4	1,45 €	1,16 €	5,64 €
System integration						
Parameterisation and commissioning		flat				75,00 €
TOTAL WORK						182,20 €
TOTAL COSTS PER OFFICE						1.146,84 €

* Prices based on calculation schemes of the German Electric Trade Organisation

Saving energy with e.control™

(3) Energy efficient building – Energy costs

Primary energy requirement with e.control



Data source: LonMark study with energy efficient room automation

Energy costs per office (30 sqm) with e.control

Prices:		Gas/Oil	0,05 €/kWh	
		Electricity	0,16 €/kWh	
Heating/Cooling				
	Site energy [kWh/m2a]	Area [m2]	Total [kWh/a]	Price [€/a]
Heating	60	30	1800	90,00
Hot water	10	30	300	15,00
Cooling	5	30	150	24,00
Lighting				
2 luminaires with fluorescent lamps per axis Type: 4 x T26 / 36W / 6400 lm				
	Power [W]	Hours* [h]	Total [kWh/a]	Price [€/a]
	580	660	382,8	61,248
* Operating hours (2750 h * 0,24)				
TOTAL ENERGY COSTS [€/a]			190,25	

Saving energy with e.control™

(4) Profitability

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- (4) Profitability

Saving energy with e.control™

(4) Profitability – e.control pays off!

Financing costs		
Building type	Investment	Annual rate*
Standard	360,00 €	44,50 €
e.control	1.150,00 €	145,00 €
Additional costs (annual)		100,50 €

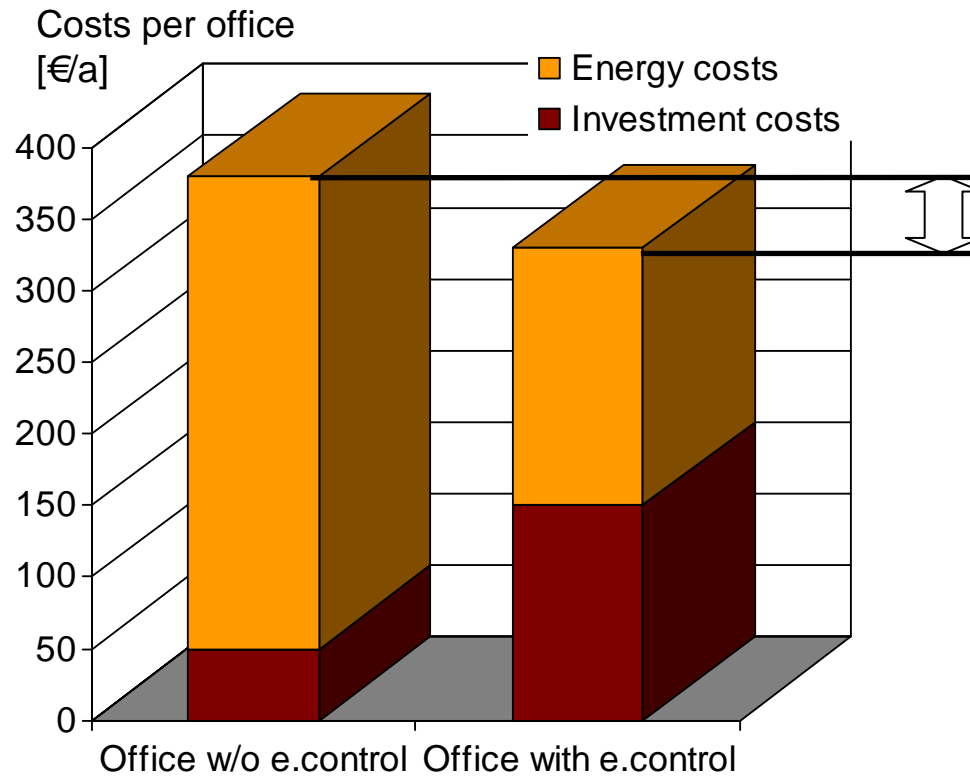
Energy costs		
Building type	Energy costs	
Standard	331,00 €	
e.control	190,00 €	
Savings (annual)		141,00 €



* Financing over 10 years with full redemption, interest 4.5%
calculated by: www.interhyp.de

Saving energy with e.control™

(4) Profitability – e.control pays off!



11% deduction on total costs

or

40% annual return on investment

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- Optimising energy efficiency
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- [e.control Example](#)

Optimising energy efficiency

Room automation functions as a „tool kit“ ...

■ Heating:

- ✓ Time and presence-dependent operation modes
- ✓ Interruption on occupancy
- ✓ Additional heating

■ Cooling:

- ✓ Presence-dependent operation modes
- ✓ Automatic shading
- ✓ Interruption on occupancy
- ✓ Cool load reduction

■ Lighting:

- ✓ Constant light control with presence detection
- ✓ Daylight maximising with sun tracking control

Room climate functions:

- Time switch for operating modes
- Occupancy sensing
- Window monitoring
- Free night cooling
- Load optimisation

Blind functions:

- Blind thermo control
- Light control
- Tracking control
- Manual shading-dependent control

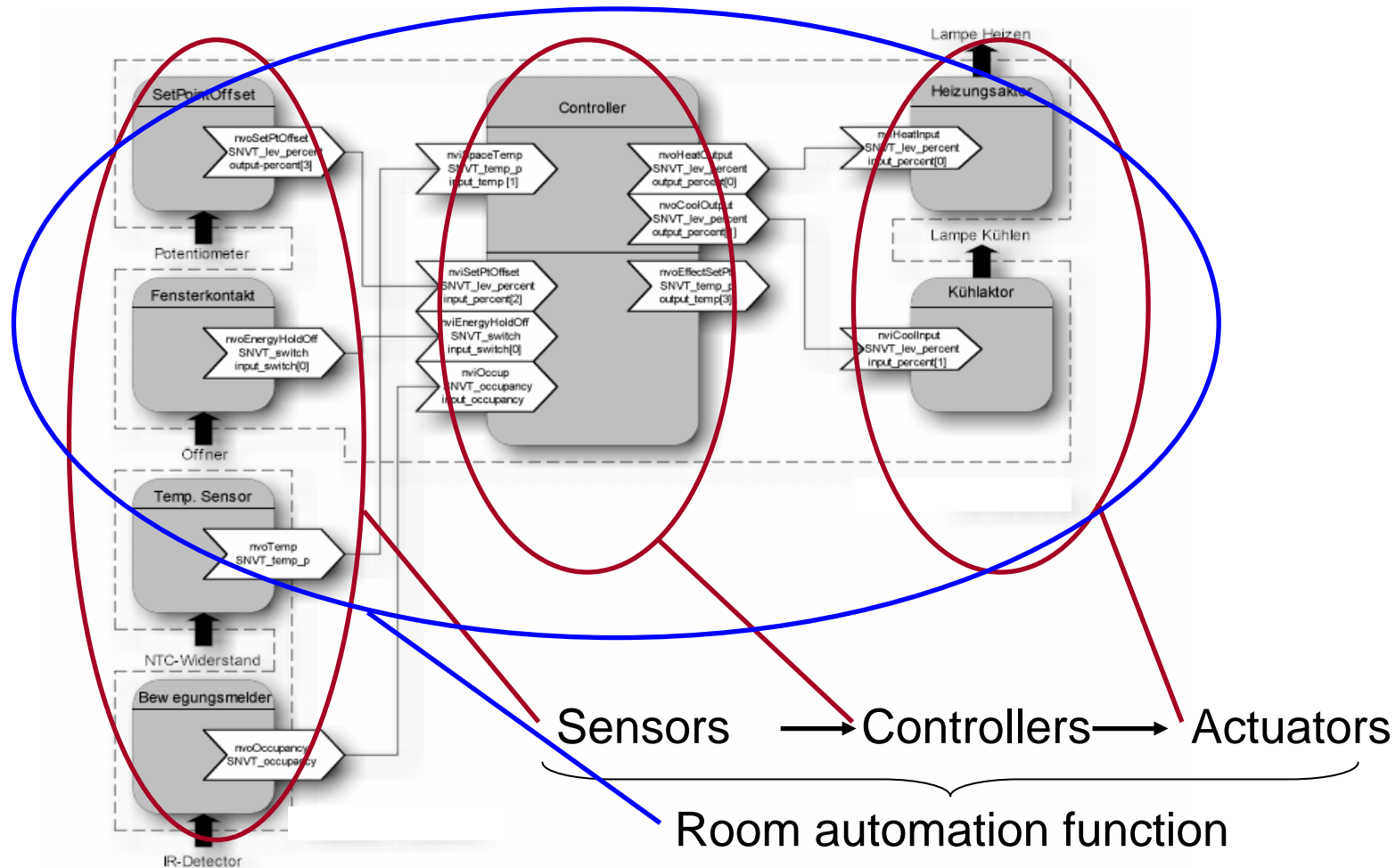
Lighting functions:

- Constant light control
- Occupancy sensing
- Time switch

defined by
LonMark Germany
including
text templates
control schemes
function lists
(see e.control CD)

Optimising energy efficiency

...are fully defined by LonMark functional profiles!



Optimising energy efficiency

1. Saving potentials on lighting energy

RA function*	Savings**	Influencing factors
Constant light control (presence-dep., dimmed)	35 – 50 %	-> sufficient daylight provision -> high illuminance level (300lx +) -> most efficient with sun tracking
Constant light control (presence-dep., switched)	25 – 45%	-> sufficient daylight provision -> high illuminance level (300lx +)
Sunlight control	5 – 8%	-> sufficient daylight provision
Sun tracking control	10 – 13 %	-> sufficient daylight provision -> most efficient with light control
Automatic light (presence-dep., switched)	n.s.	-> intermittent presence (e.g. corridors)

* see explanations and definitions in spega e.control catalogue (pages 10 - 15)

** Saving potentials on lighting energy acc. to DIN V 18599 and prEN 15232 compared to EPBD reference building type

Optimising energy efficiency

2. Saving potentials on heating and cooling energy (I)

RA function*	Savings**	Influencing factors
Time switch for operating modes	5 – 10%	-> long operating time of boiler or chiller -> low building mass
Occupancy sensors	5 – 10%	-> longer periods of absence during operating time of boiler and chiller
Window monitoring	5 – 10%	-> low building mass
Free night cooling	n.s.	-> air circulation must be possible
Summer compensation	n.s.	-> feasible for all cooling systems
Load optimisation	n.s.	-> feasible for all heating and cooling systems

* see explanations and definitions in spega e.control catalogue (pages 10 - 15)

** Saving potentials on lighting energy acc. to DIN V 18599 and prEN 15232 compared to EPBD reference building type

Optimising energy efficiency

2. Saving potentials on heating and cooling energy (II)

RA function*	Savings**	Influencing factors
Sunblind thermo control	5%	-> sufficient daylight provision -> outside sunblind systems
Time switch for sunblinds	n.s.	-> prevents cooling-down during night

* see explanations and definitions in spega e.control catalogue (pages 10 - 15)

** Saving potentials on lighting energy acc. to DIN V 18599 and prEN 15232 compared to EPBD reference building type

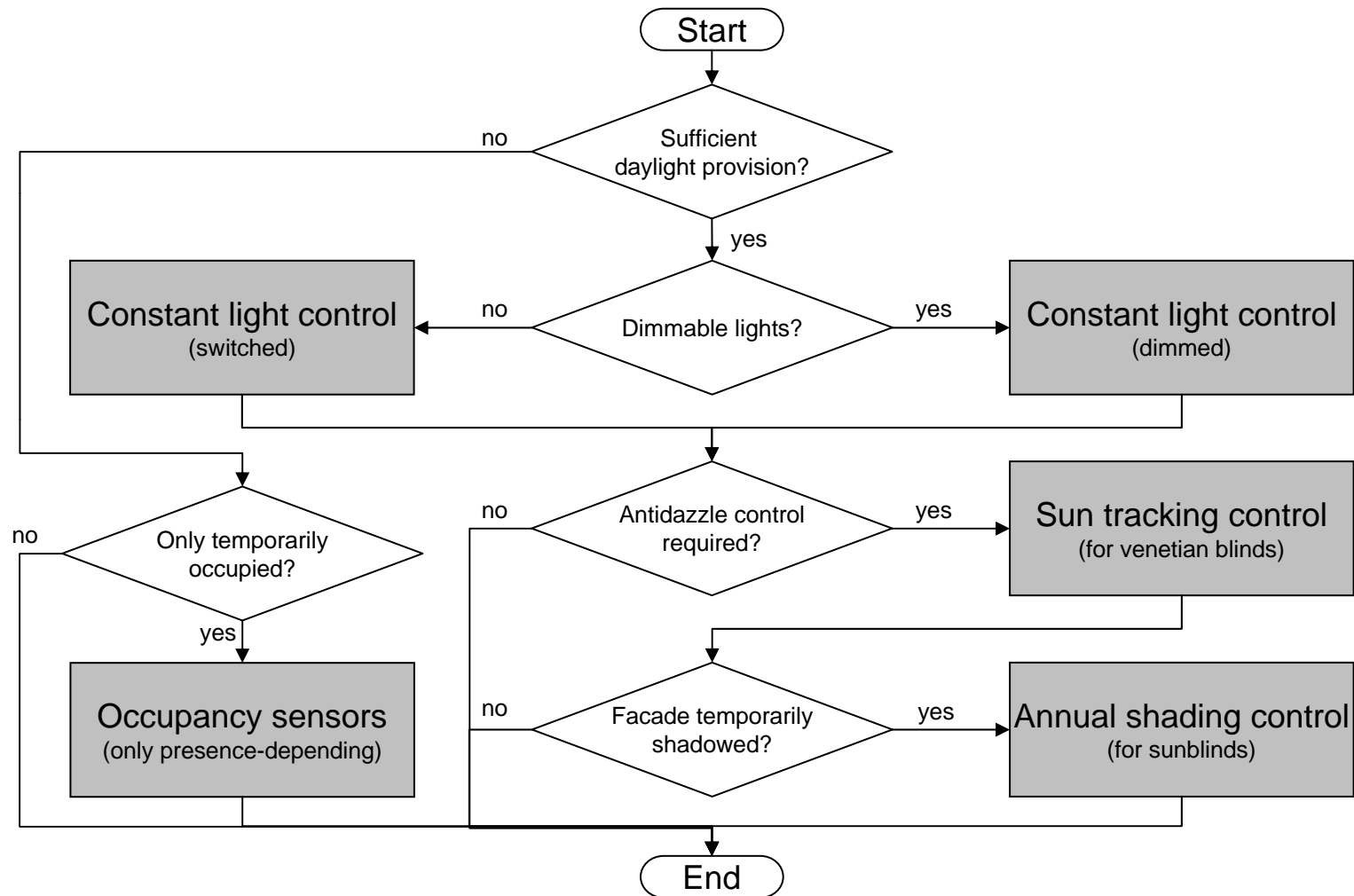
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- [e.control Example](#)

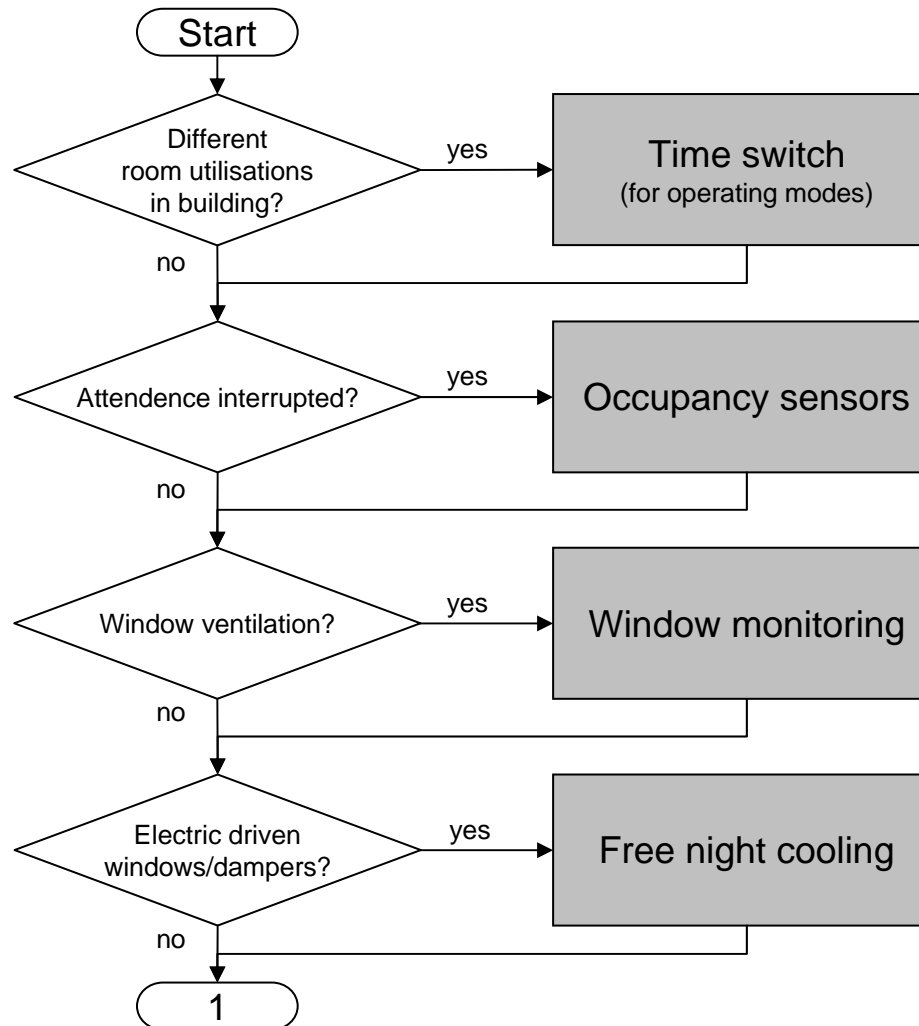
Selecting e.control devices

1. Efficiency check for lighting energy improvements...



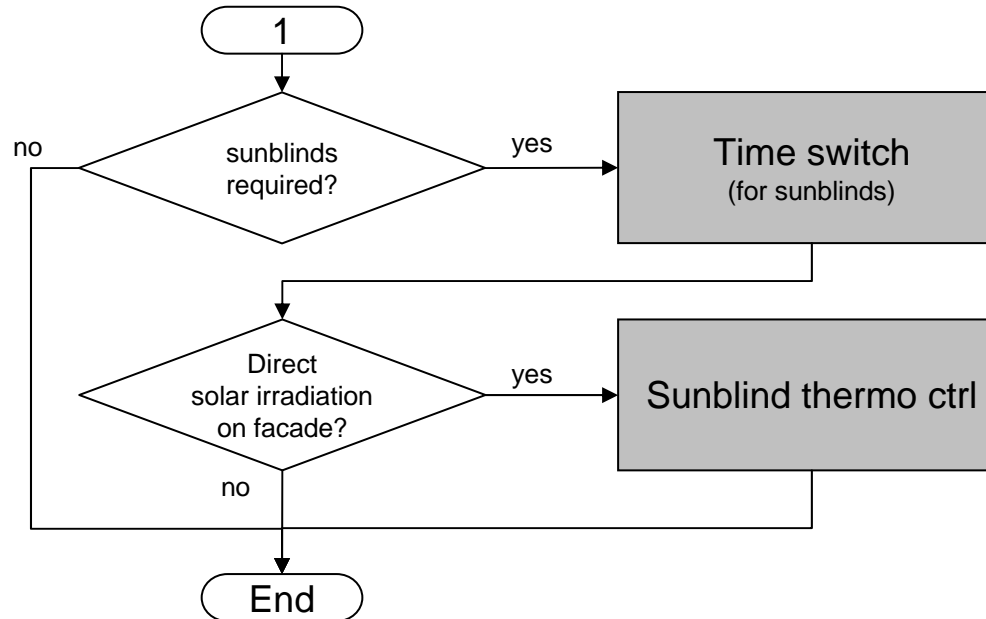
Selecting e.control devices

... and thermal energy improvements (I)










Selecting e.control devices

... and thermal energy improvements (II)



Selecting e.control devices

2. Selecting appropriate devices for each function...

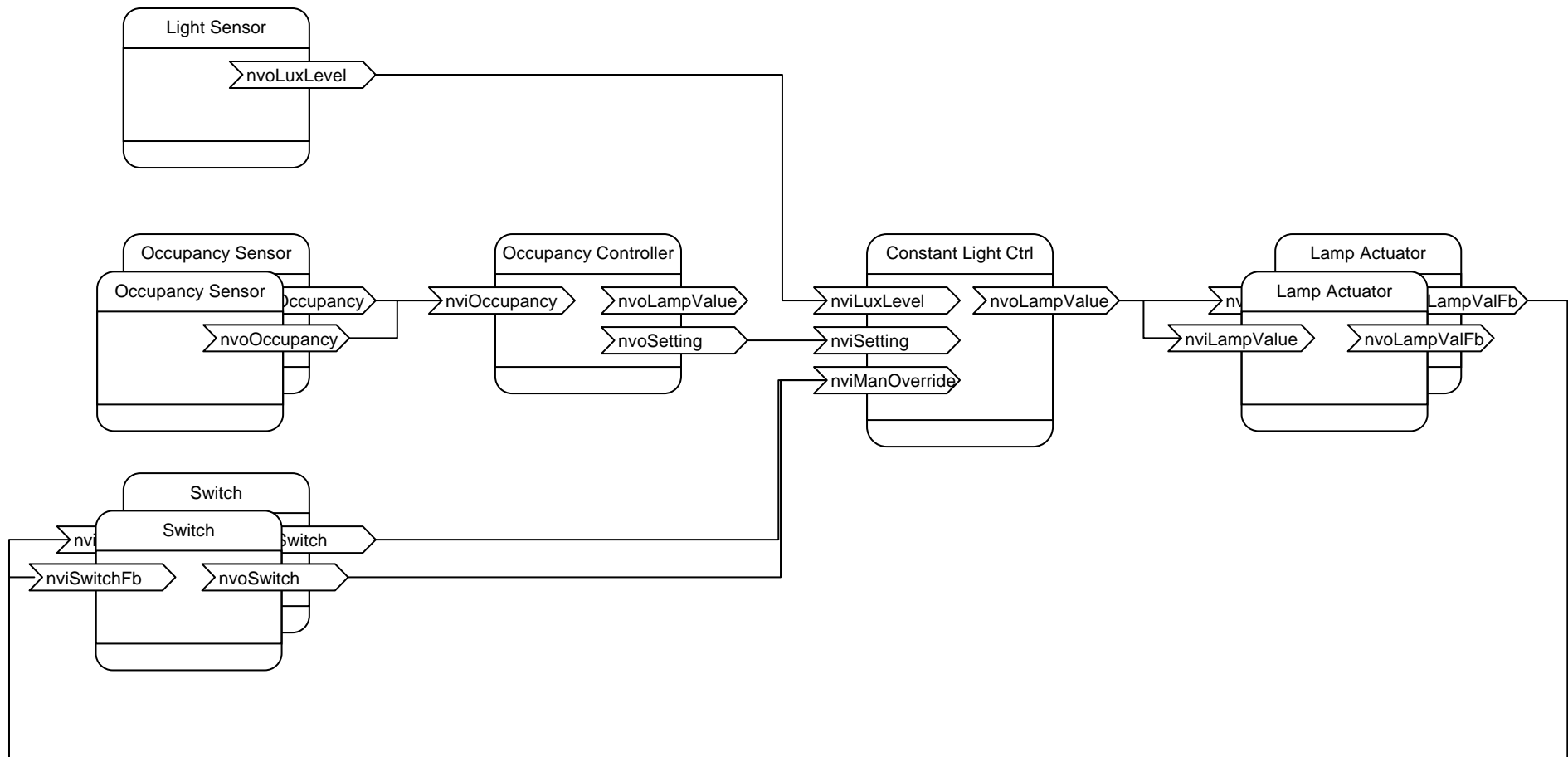
e.control Constant light control (dimmed)						
Functional profile	Occupancy Sensor # 1060	Occupancy Controller # 3071	Light Sensor # 1010	Constant Light Ctrl # 3050	Lamp Acuator # 3040	Switch #3200
Devices						
Usage / quantity	●○	●	●	●	●○	○○
 Multisensor lumina MS3	✓	✓	✓	✓		✓*
 Room panel dialog 1	✓**	✓		✓		✓
 Binary input lumina T6	✓**	✓		✓		✓
 Control output lumina (R)STx					✓	
 Universal dimmer lumina RDAx					✓	
 DALI Controller lumina RDALx					✓	
 FastCon Actuator lumina FSTx					✓	

Legend: * with optional remote control
** as presence button

●/●○ Exactly / leastwise one profile per function required.
○/○○ One / multiple profile(s) can optionally be used per function.








Selecting e.control devices

...and understand the functional design



Selecting e.control devices

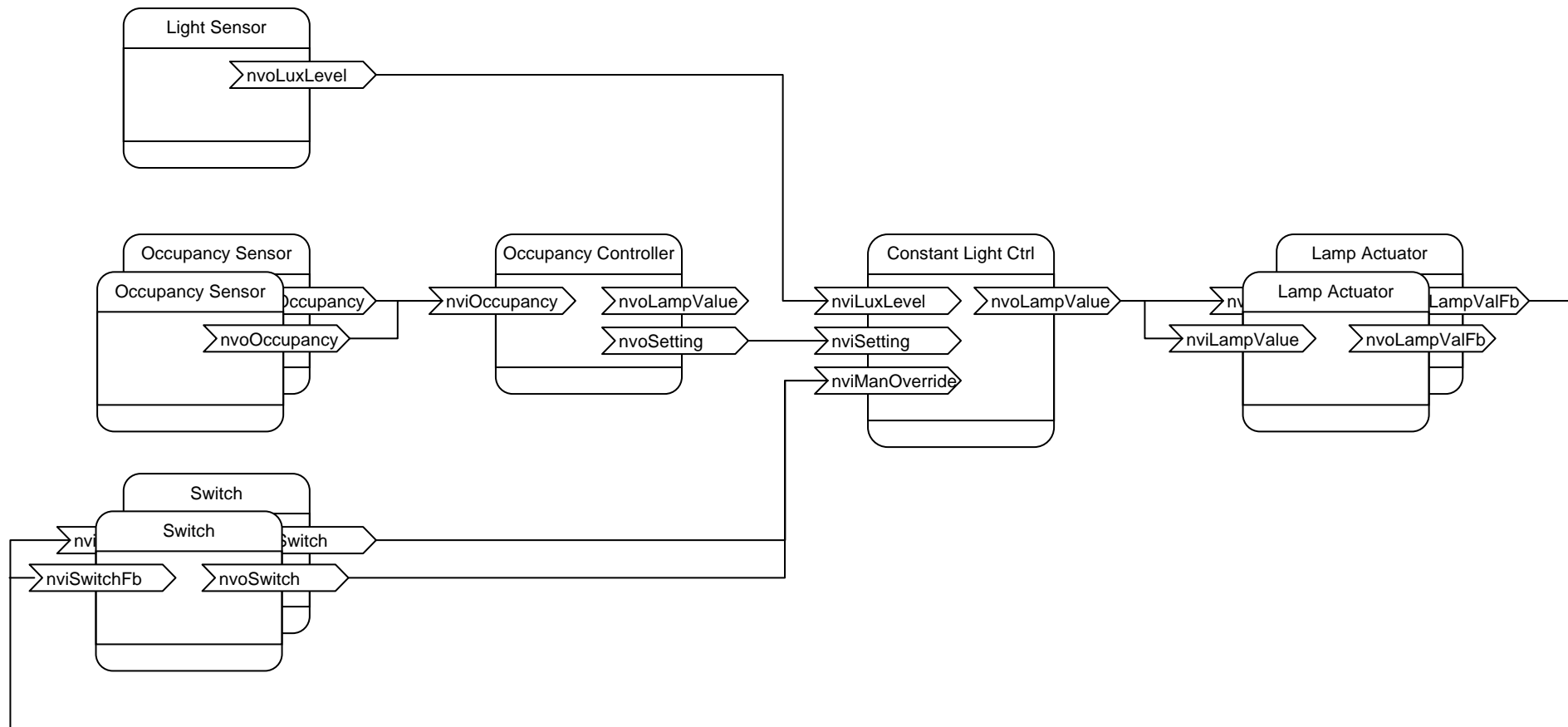
2. Selecting appropriate devices for each function...

e.control Constant light control (switched)							
Functional profile	Occupancy Sensor # 1060	Occupancy Controller # 3071	Light Sensor # 1010	Constant Light Ctrl # 3050	Lamp Acuator # 3040	Switch #3200	Devices
Usage / quantity	●○	●	●	●	●○	○○	
 Multisensor lumina MS3	✓	✓	✓	✓			✓*
 Presence sensor lumina PM	✓**						
 Room panel dialog 1	✓***	✓		✓			✓
 Binary input lumina T6	✓***	✓		✓			✓
 Switch actuator lumina (R)SAX					✓		
 FastCon Actuator lumina FSAX					✓		
 Weather sensor ombra W2/W8			✓****				

Legend: * with optional remote control ●/●○ Exactly / leastwise one profile per function required.
 ** In combination with binary input ○/○○ One / multiple profile(s) can optionally be used per function.
 *** as presence button
 **** works as light control depending on outdoor illuminance (instead of indoor sensing)






Selecting e.control devices

...and understand the functional design



Selecting e.control devices

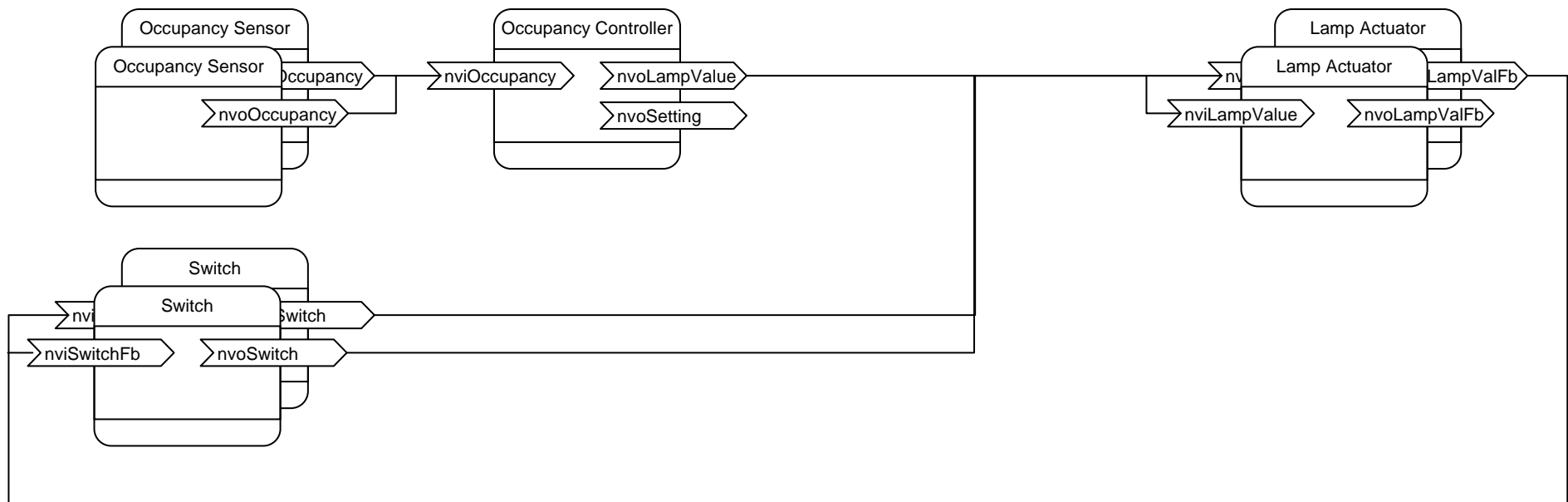
2. Selecting appropriate devices for each function...

e.control Automatic light control (Occupancy sensor)						
Functional profile	Occupancy Sensor # 1060	Occupancy Controller # 3071	Lamp Acuator # 3040	Switch #3200		
Devices						
Usage / quantity	●○	●	●○	○○		
 Multisensor lumina MS3	✓	✓		✓*		
 Presence sensor lumina PM	✓**					
 Binary input lumina T6		✓		✓		
 Switch actuator lumina (R)SAx			✓			
 FastCon actuator lumina FSAx			✓			

Legend: * with optional remote control ●/●○ Exactly / leastwise one profile per function required.
 ** in combination with binary input ○/○○ One / multiple profile(s) can optionally be used per function.
 *** as presence button







Selecting e.control devices

...and understand the functional design



Selecting e.control devices

2. Selecting appropriate devices for each function...

e.control Sun tracking control						
Functional profile	Light Sensor # 1010	Sun position Sensor*** # 22502	Suntracking Controller # 22503	Sunblind Actuator*** # 6040	Switch #3200	
Devices						
Usage / quantity	●○*	●	●○*	●○	○○	
 Weather station ombra W2/W8	✓					
 Sun tracking ctrl. ombra BST		✓	✓			
 Binary input lumina T6					✓	
 Room panel dialog 1					✓	
 Sunblind actuator ombra (R)BAx				✓*		
 FastCon actuator ombra FBAX				✓*		

Legend:

* for each orientation / facade

** also available as DMI or DC type

*** also required for annual shading control

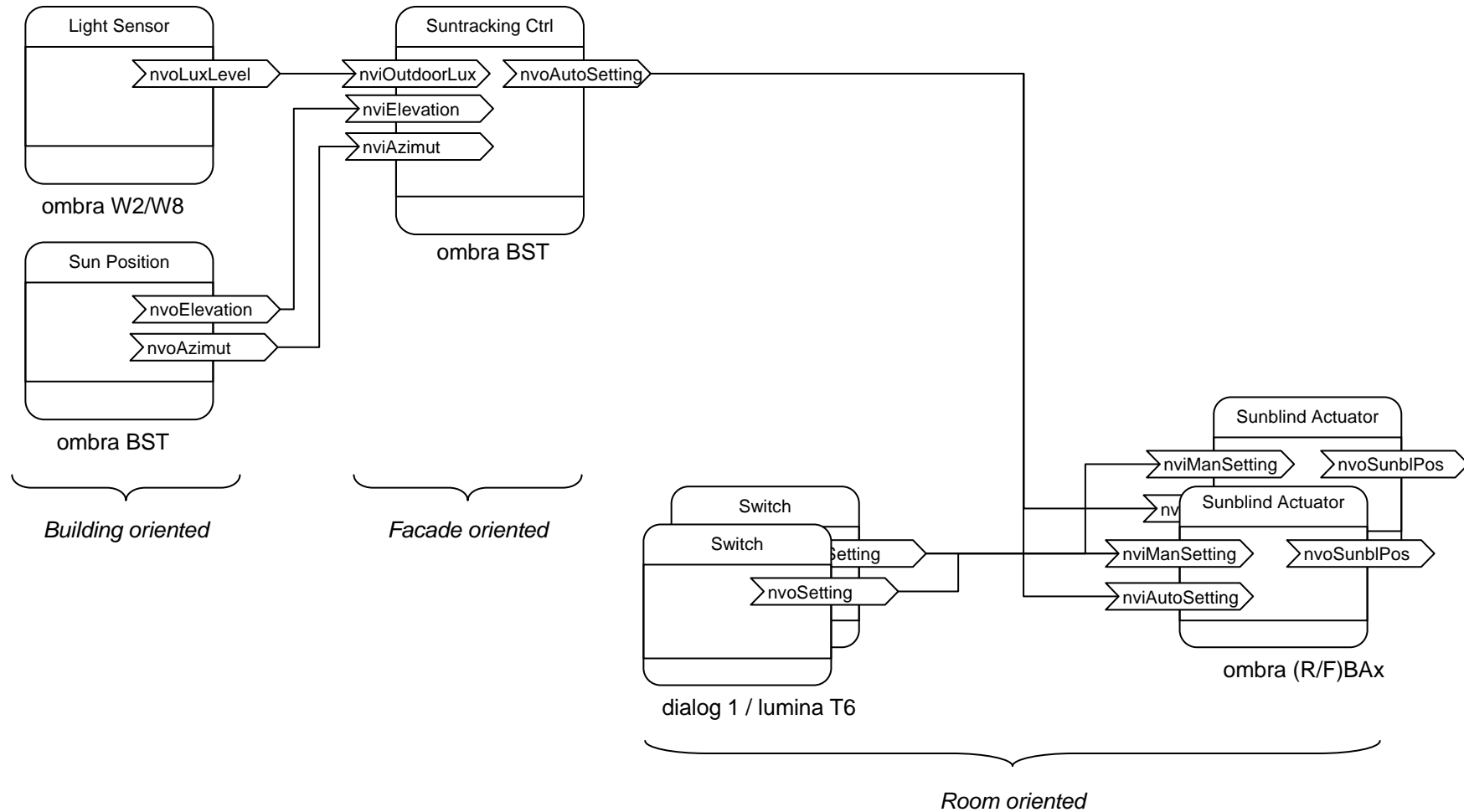


Exactly / leastwise one profile per function required.

One / multiple profile(s) can optionally be used per function.









Selecting e.control devices

...and understand the functional design



Selecting e.control devices

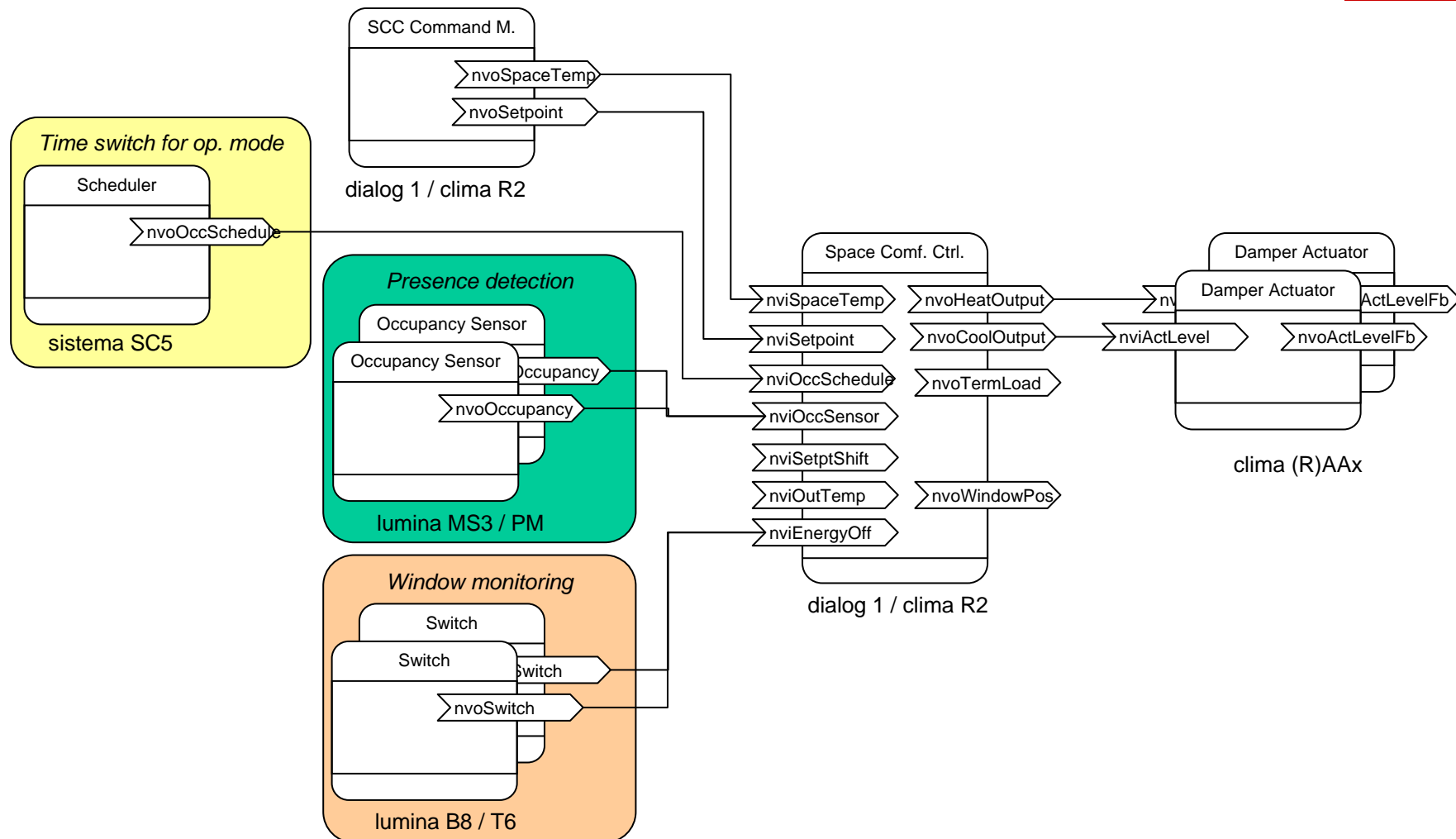
2. Selecting appropriate devices for each function...

Functional profile		Presence detection	Window monitoring				Fan control	
		Occupancy Sensor # 1060	Binary Input bzw. Switch # 3200	SCC Command # 8090	Space Comfort Ctrl # 850x (CC,FC,VAV)	Sunblind thermo ctrl Thermo Controller # 23501	Damper Actuator # 8110	Damper Actuator # 8110****
Devices								
Usage / quantity		●○	●○	○	●	●	●○	○○
	Multisensor lumina MS3	✓						
	Presence sensor lumina PM	✓*						
	Binary input lumina T6 / B8	✓*	✓					
	Room panel dialog 1			✓	✓	✓		
	Room climate ctrl. clima R2(-o)			✓	✓			
	Radiator actuator clima R1	✓*	✓		✓	✓		
	HVAC actuator clima (R)AA(-10V)					✓		
	Multi-stage act. clima LAX-2						✓	

Legend: * Occupancy sensor in combination with lumina T6, lumina B8 or clima R1, binary inputs can also be used as presence button.

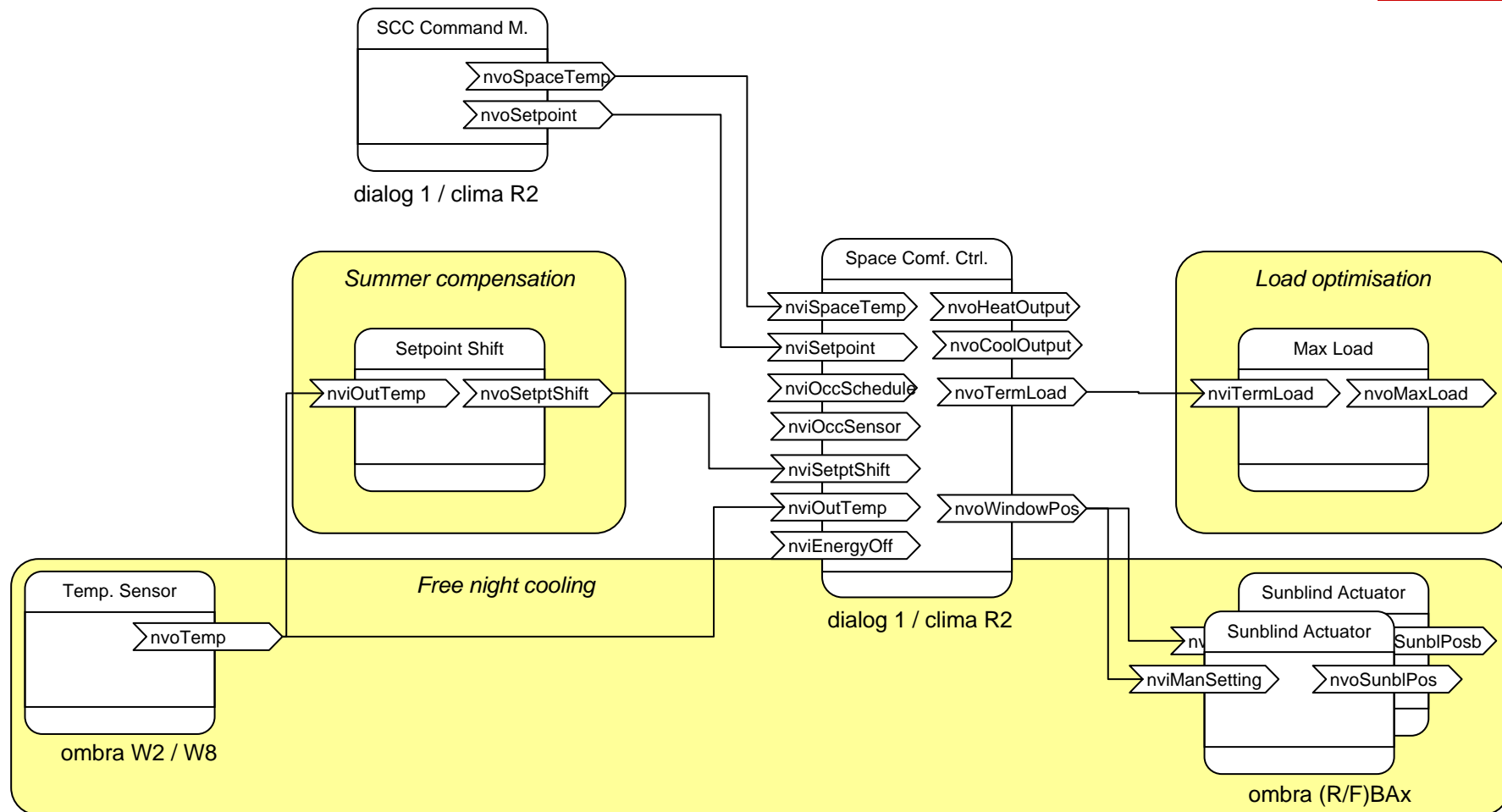
Selecting e.control devices

...and understand the functional design



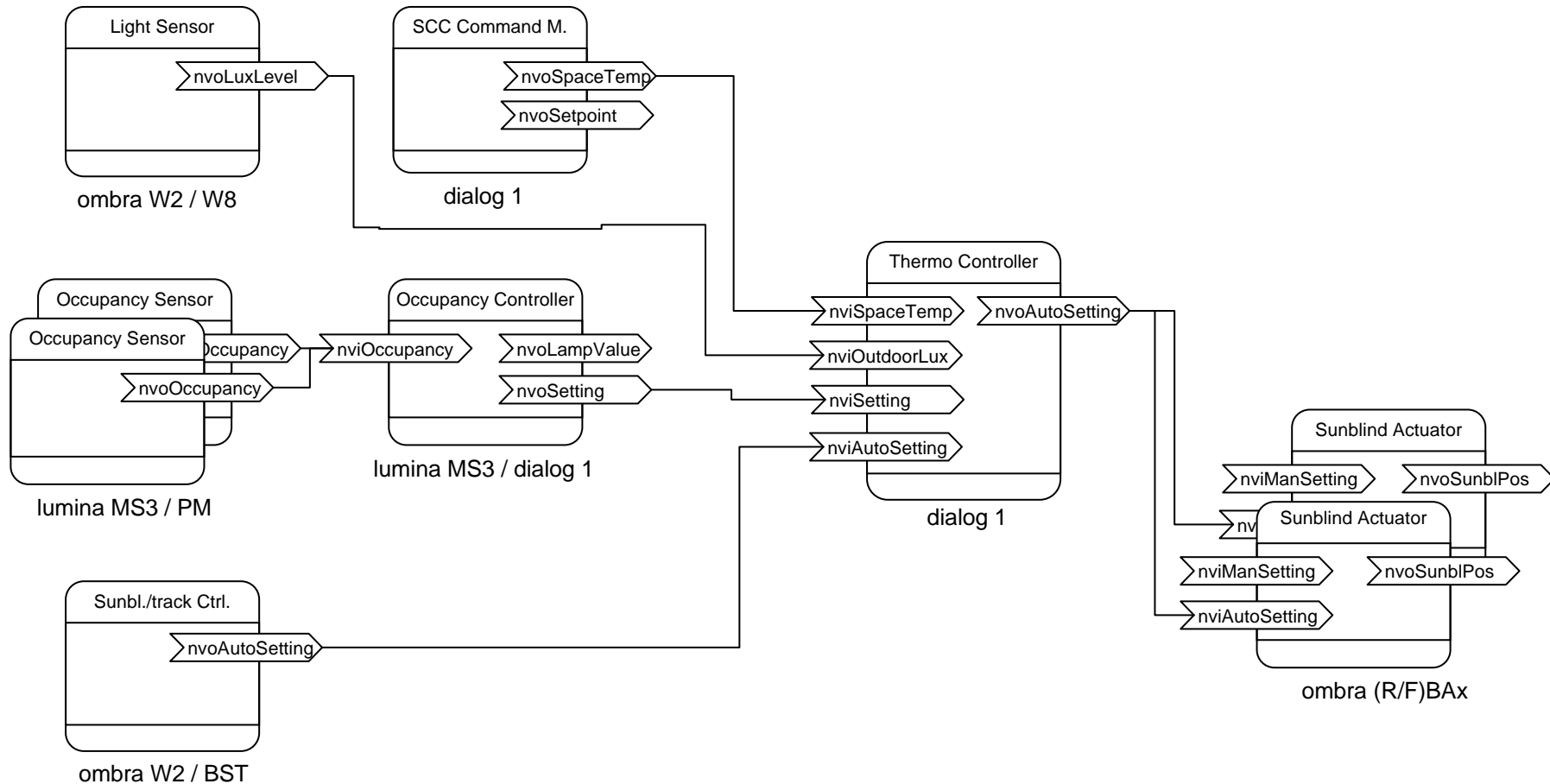
Selecting e.control devices

...and understand the functional design



Selecting e.control devices

...and understand the functional design



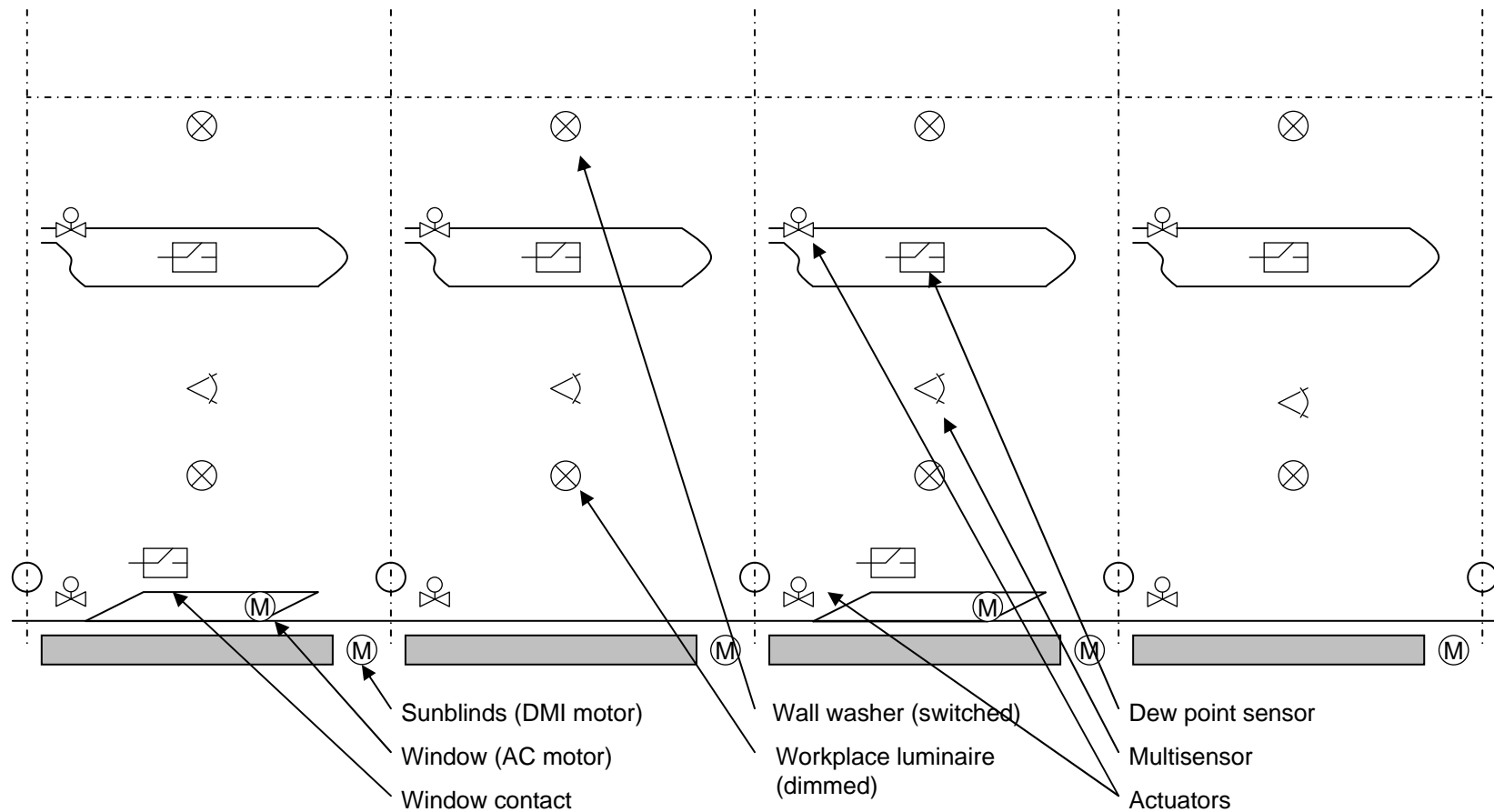
Room automation with e.control™

Agenda

- Why e.control room automation?
- Saving energy and money with e.control
- Optimising energy efficiency
- Selecting e.control devices
- e.control Example

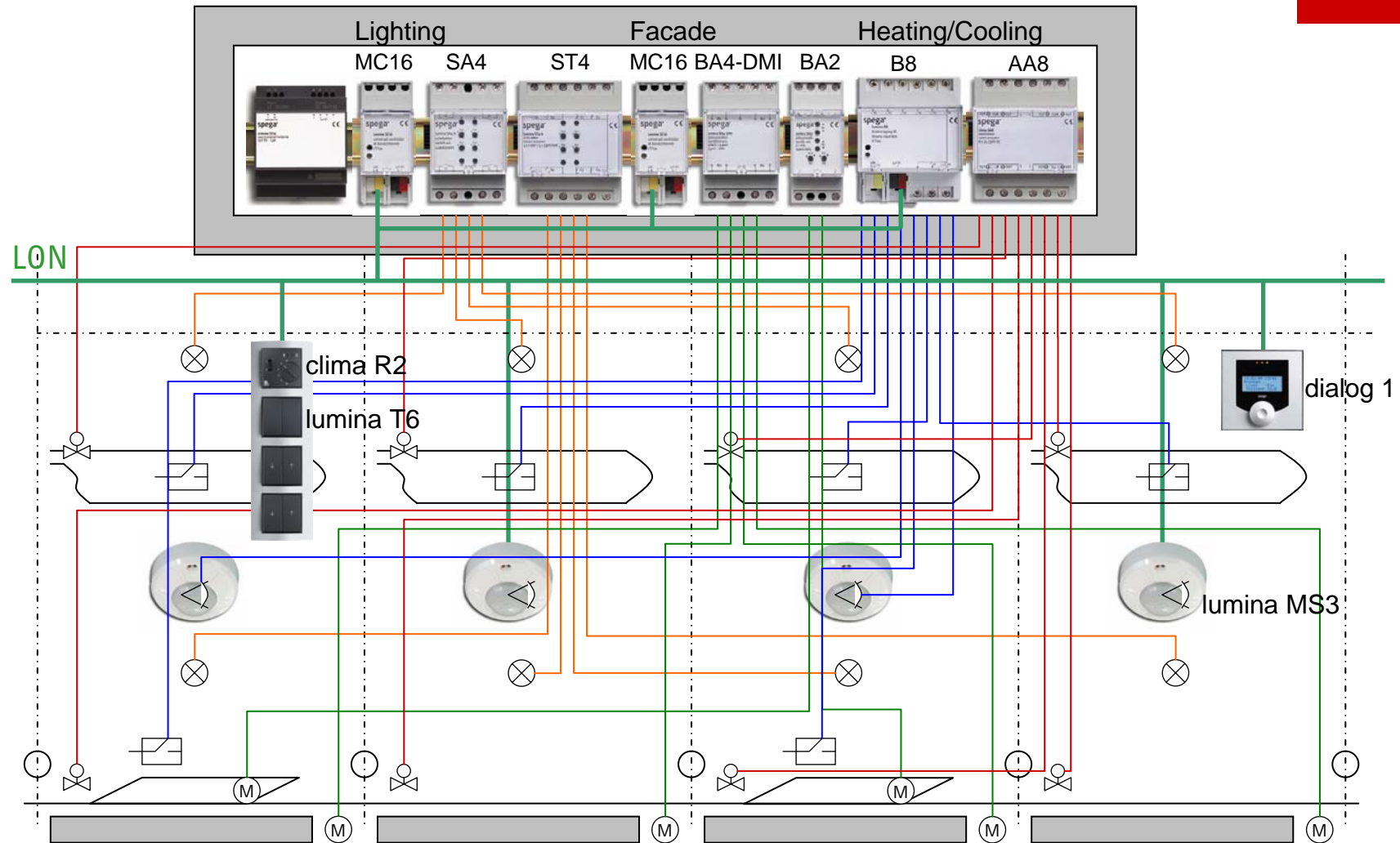
e.control™ example

Low energy office building – Equipment



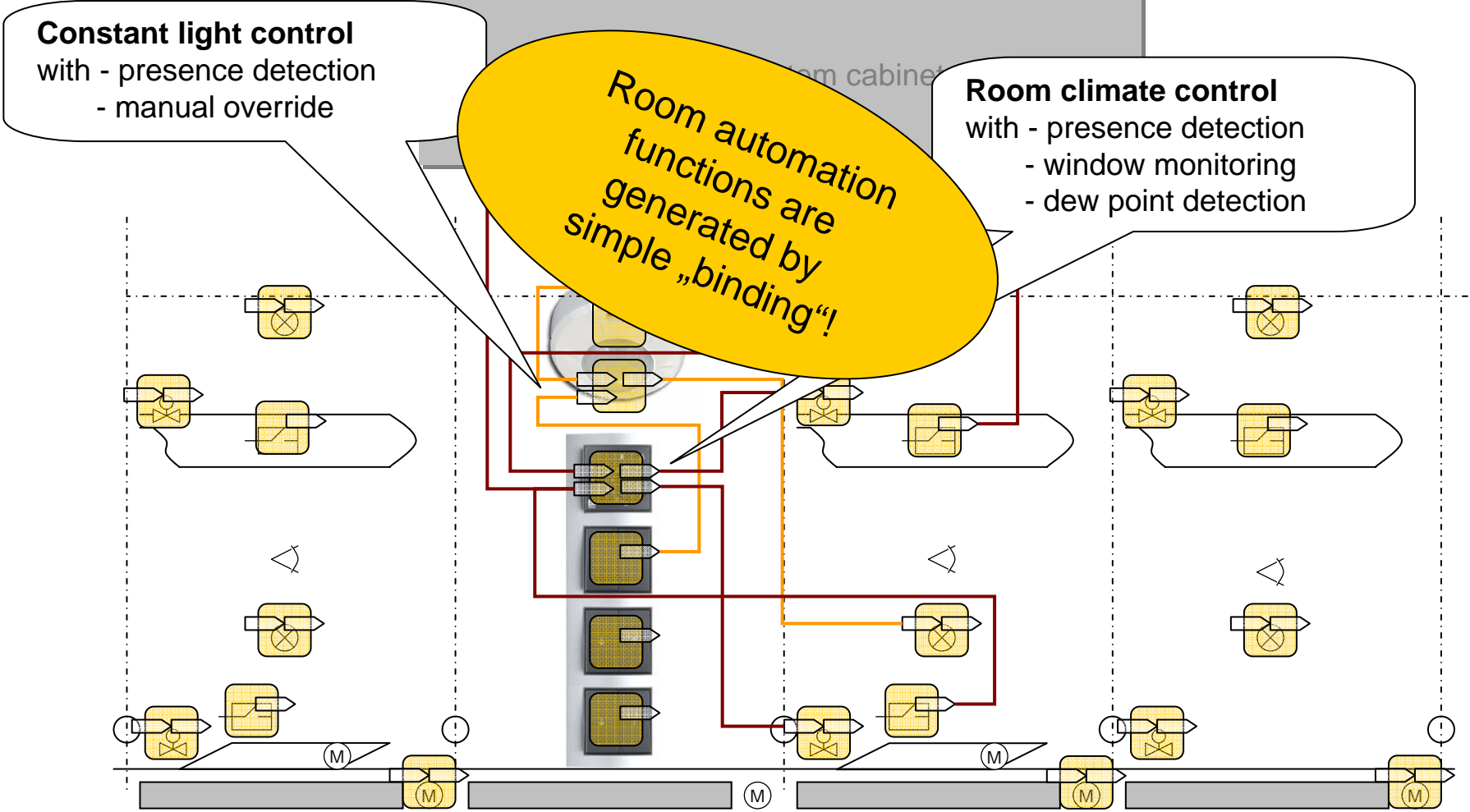
e.control™ example

Low energy office building – e.control hardware



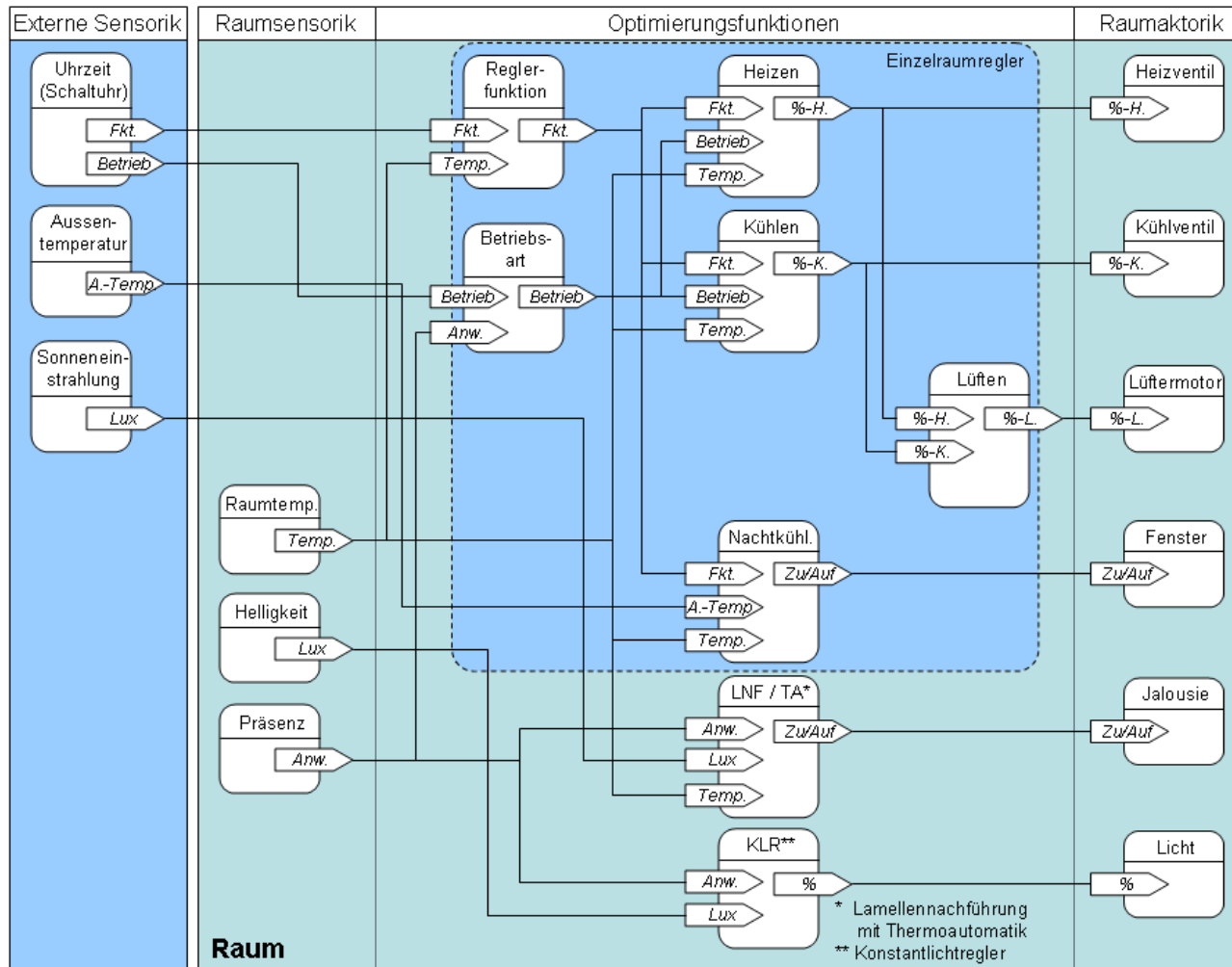
e.control™ example

Low energy office building – e.control functions

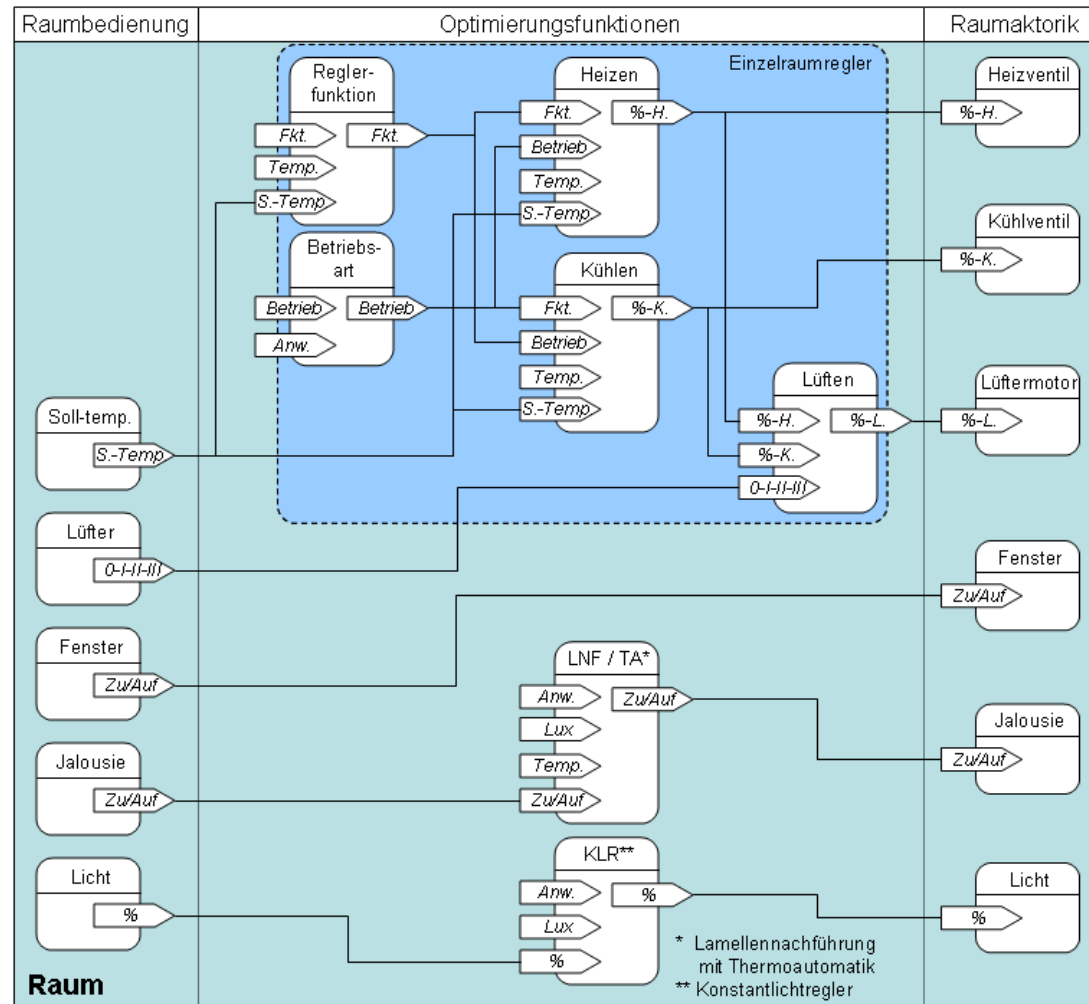


e.control™ example

Low energy office building – control scheme (I)



Low energy office building – control scheme (II)





Thank you for your attention!