The SAUTER functional triangle of room automation

Room automation and energy efficiency according to EN 15232
Room automation functions with VDI 3813

Version 1.1

SAUTER Head Office

April 2013

SAUTER
Creating Sustainable Environments.

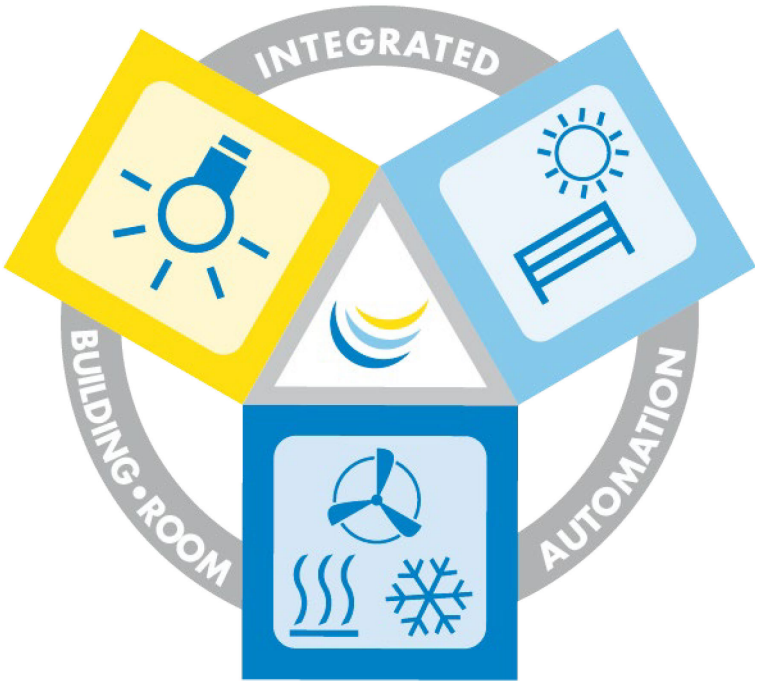
Summary

State-of-the-art SAUTER room automation with the **SAUTER EY-modulo** system covers all the functions necessary to upgrade technical as well as energy-efficient and intelligent building automation in existing buildings and to implement it in new buildings.

In this document, the room automation functions (according to VDI 3813 [2]) are explained using the **SAUTER functional triangle of room automation**, and the functions are assigned to the energy efficiency classes for buildings according to EN 15232 [1].

Introduction

The room automation functions can be divided into three function groups. However, the functions interact closely with each other, so that the idea of a “SAUTER functional triangle of room automation” can visualise this well:



SAUTER functional triangle of integrated building and room automation

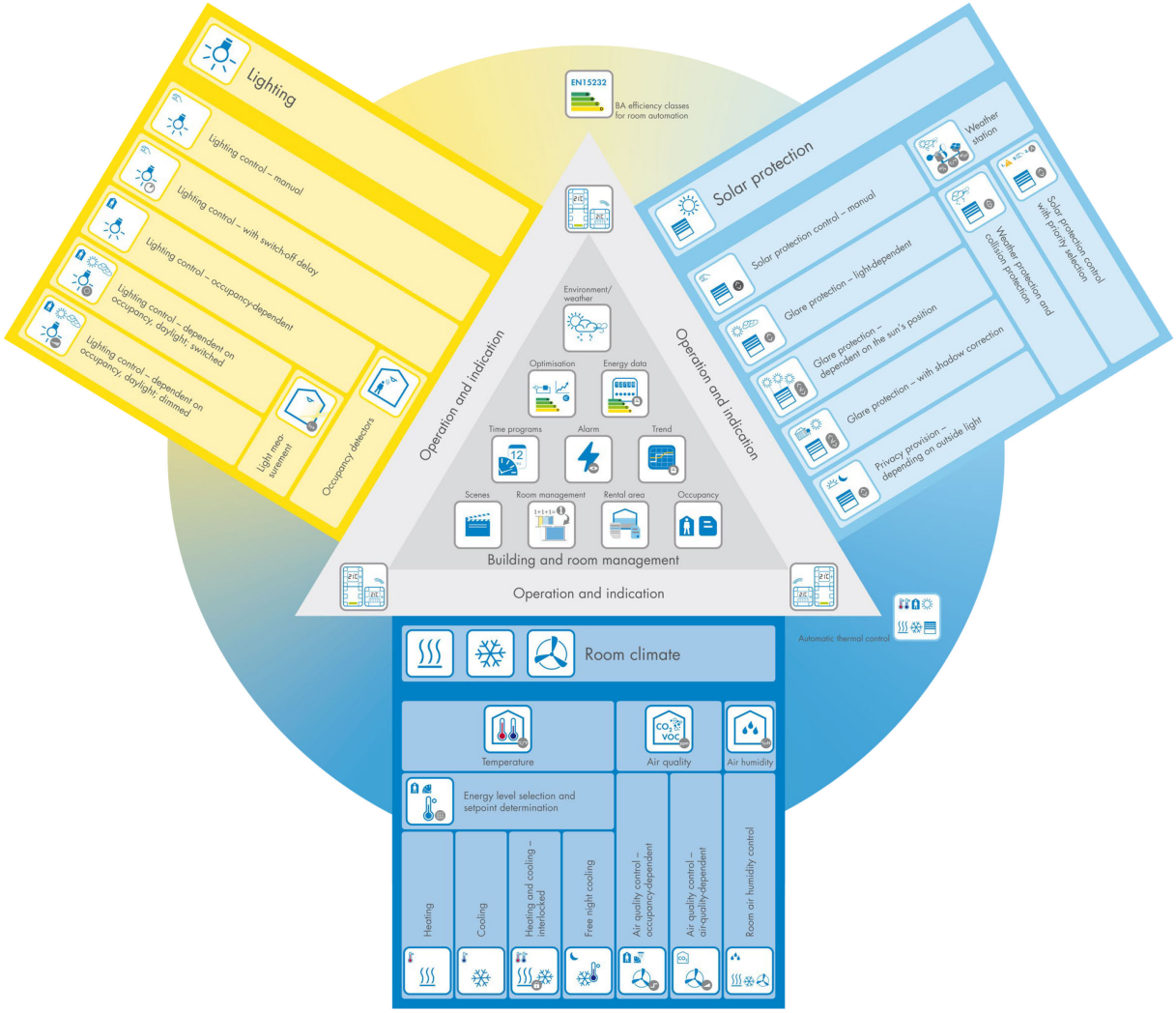
The “automated” interaction of the desired conditions in the room, such as those of the room conditioning with temperature and air quality, and those of the light and solar protection, as well as the local operation and the automated control facility, is known as INTEGRATED ROOM AUTOMATION [3].

With the following functions, SAUTER covers all the requirements for all three interlinked facilities in the room (room conditioning, light, solar protection) and provides functions on the local operating level with the room operating units, and on the management level for optimised, flexible and energy-efficient operation of the rooms.

Integrated room automation functions

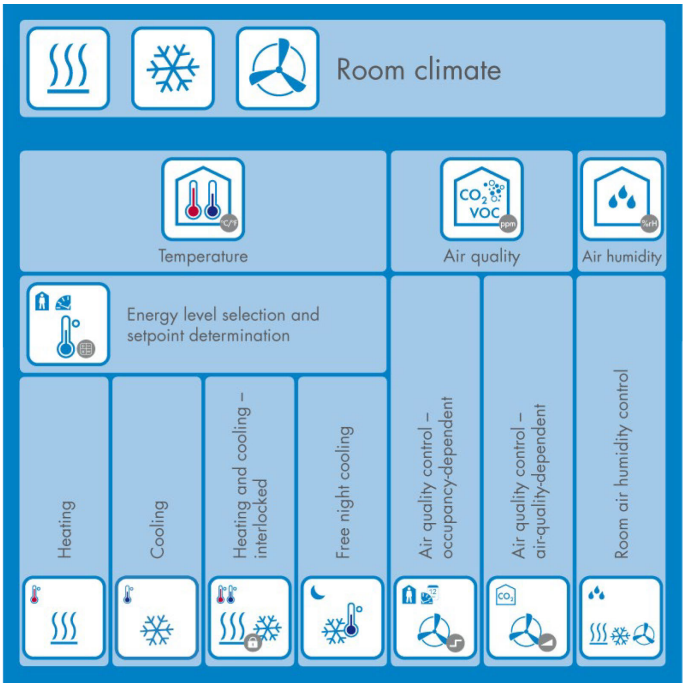
As explained in standard EN 15232, in guideline VDI 3813 and in the SAUTER white paper “Integrated room automation”, the energy-efficient operation of the building and its rooms can only be ensured if the room conditioning, the lighting (lighting control and regulation) and solar protection (blinds, glare protection unit, …) are optimally interlinked.

This interlinking is usually achieved either when all the functions are present in a single device, or when multiple devices can exchange the functions and their information with each other by means of a suitable procedure (communication protocol, such as BACnet).

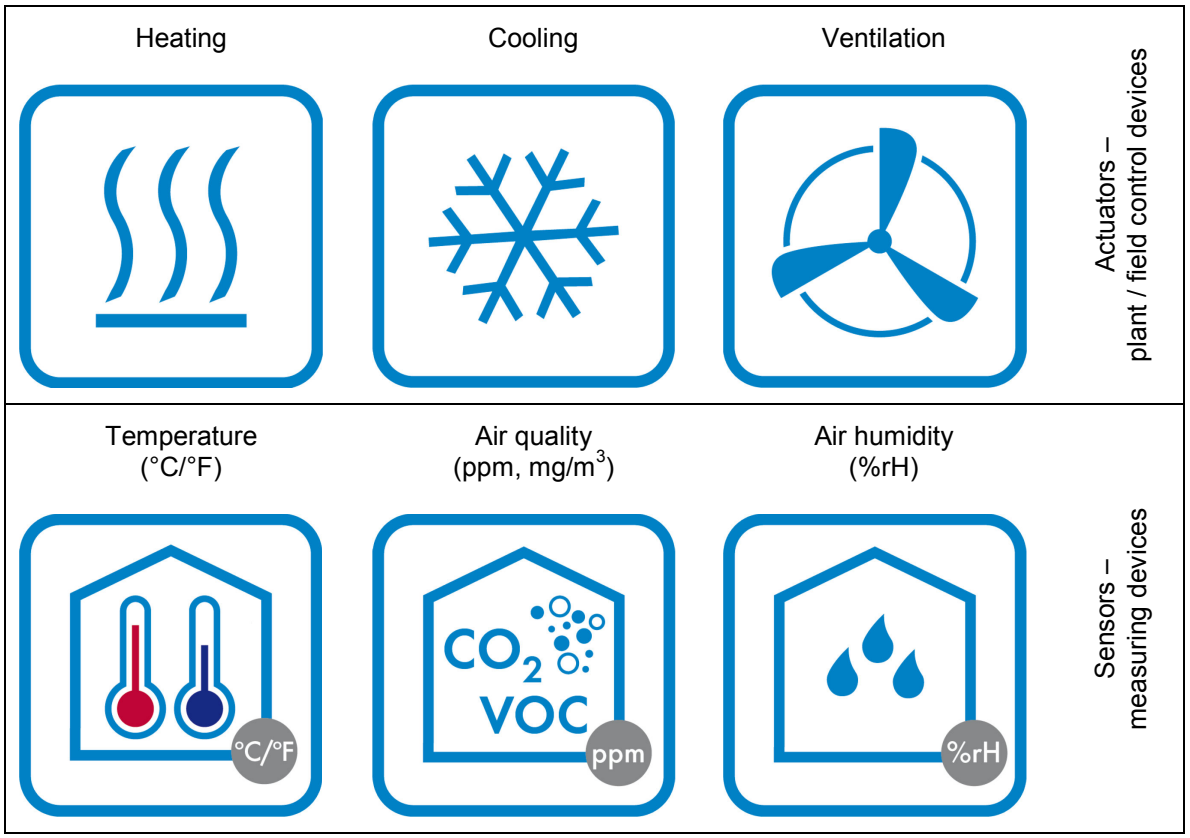


SAUTER functional triangle of integrated room automation according to EN 15232 and VDI 3813

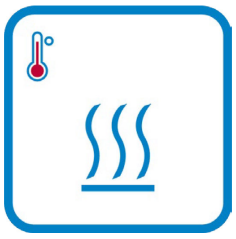
Functions for the room conditioning



Functions for controlling the room conditioning (temperature, air quality, air humidity) with the room automation unit (heating, cooling, ventilation)



Heating



For the **heating**, the controller is installed on the room level (individual room, room segment or multiple rooms as an area).
For energy-optimised controlling of the room temperature, the room controllers must be in communication with the building management system (1.1.3). Occupancy-dependent, demand-led controlling increases the efficiency (1.1.4).
A controller with a time program enables intermittent operation for fixed occupancy patterns, flexible switching (optimised switching) or demand-led usage (Comfort, Precomfort, Economy, Protection) (1.5).

EN 15232:	1	Heating Control
		1.1 Emission control
		1.5 Intermittent control of emission and/or distribution
VDI 3813:	6.5.23	Temperature control (heating/cooling)

Cooling

For the **cooling**, the controller is installed on the room level (individual room, room segment or multiple rooms as an area).
For energy-optimised controlling of the room temperature, the room controllers should be in communication with the building management system (3.1.3). Occupancy-dependent, demand-led controlling increases the efficiency (3.1.4).
A controller with a time program enables intermittent operation for fixed occupancy patterns, flexible switching (optimised switching) or demand-led usage (Comfort, Precomfort, Economy, Protection) (3.5).

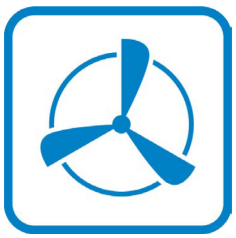
EN 15232:	3	Cooling Control
		3.1 Emission control
		3.5 Intermittent control of emission and/or distribution
VDI 3813:	6.5.23	Temperature control (heating/cooling)

Heating and cooling – interlocked

Heating and cooling never occur simultaneously in the room, therefore this is automatically interlocked. Complete interlocking also guarantees the highest level of energy efficiency.
(Note: Should dehumidification be required, it can technically involve “simultaneous” heating and cooling, and is therefore not to be seen as a function of interlocking heating and cooling)

EN 15232:	3.6	Interlock between heating and cooling control of emission and/or distribution (3.6.1 Partial interlock, 3.6.2 Total interlock)
VDI 3813:	6.5.22	Function selection (enables interlocking of heating/cooling modes)

Ventilation and air-conditioning



The **air-conditioning** and/or **air quality** on the room level can be controlled by **controlling the ventilation** or air volume respectively on the room level (4.1) or by means of free, automatic cooling. (4.5).
Energy-optimised controlling in the room is by means of a time program for occupancy (4.1.1) or with an occupancy detector (4.1.2). The most optimal installation is demand-led controlling based on the room air quality (CO_2, VOC…) (4.1.3).
Both free, automatic cooling (night cooling, free cooling) and H,x-led controlling enable energy-saving potential for refrigeration energy preparation.

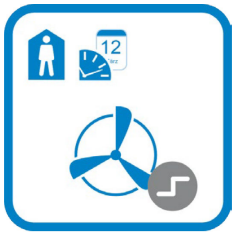
EN 15232:	4	Ventilation and Air Conditioning Control
		4.1 Air flow control at the room level
		4.5 Free mechanical cooling
VDI 3813:	6.5.24	Room supply air temperature cascade control
	6.5.25	Fan control

Free night cooling

During periods in which the room is unoccupied, the cool outside air is used for **free night-time cooling**, e.g. via automatically opening windows (4.5.1).
The most cooling energy can be saved when the cool outside air is used to adjust the automatic cooling during the entire period (4.5.2).

EN 15232:	4.5	Free mechanical cooling
		4.5.1 Night cooling
		4.5.2 Free cooling
VDI 3813:	6.5.29	Night-time cooling

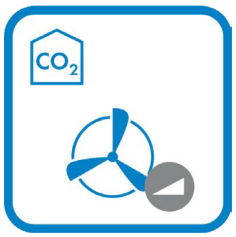
Air quality control – occupancy-dependent



Occupancy-dependent air quality control enables optimised room conditioning for occupied and used rooms. Depending on whether the room is occupied, increasing the fan speed can help raise the proportion of fresh air. Occupancy switches, occupancy detectors and/or time programs for the room occupancy can define the occupancy. The ventilation then usually reacts on different fan levels.

EN 15232:	4.1.2	Air flow control at the room level
		- Presence control
VDI 3813:	6.5.28	Air quality control

Air quality control – air-quality-dependent



Air-quality-dependent room control optimises the room conditioning depending on the actually measured room air quality (CO_2, VOC…) and creates fresh air by means of room fans, or controls air dampers for the supply air with a fresh air portion. The room fans are usually controlled with continuous control signals.

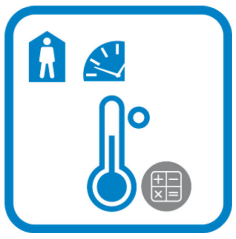
EN 15232:	4.1.3	Air flow control at the room level
		- Demand control
VDI 3813:	6.5.28	Air quality control
	6.5.30	Volume flow control

Room air humidity control

The **humidity control in the room** (4.7.2) and the monitoring of the humidity in the supply air are implemented with humidifying and dehumidifying devices (or reheating of the supply air, dew point control 4.7.1).
For optimal room conditioning, the controlling is structured within a comfort zone (temperature, humidity = enthalpy).

EN 15232:	4.7	Controlling air humidity
		4.7.1 Dew point control
		4.7.2 Direct humidity control
VDI 3813:	6.5.22	Function selection with 6.1.4 Dewpoint monitoring

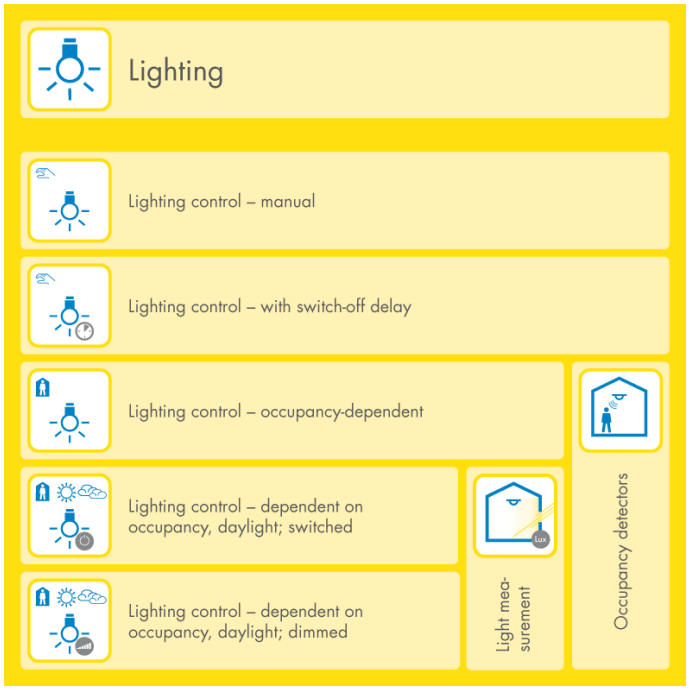
Energy level selection and setpoint determination



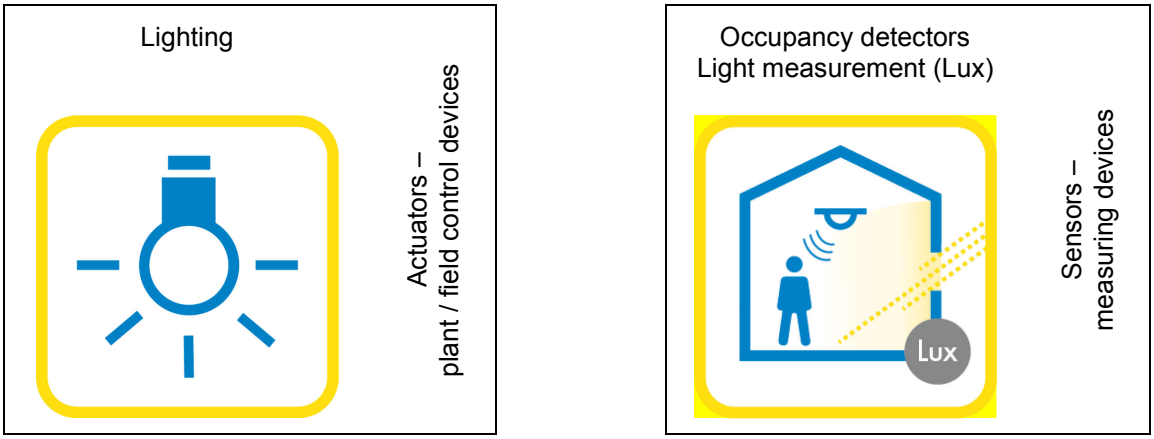
With **energy level selection** or a time program for occupancy, the demand- or occupancy-based controlling determines the suitable setpoints for the integrated room automation and where applicable, pre-conditions the air-conditioning suitably (precomfort, start optimisation)

EN 15232:	1.1.4	Individual room control with communication and presence control
	3.1.4	Individual room control with communication and presence control
VDI 3813:	6.5.19	Energy mode selection
	6.5.20	Energy mode selection with start optimisation
	6.5.21	Setpoint calculation

Functions for the lighting



Functions for controlling and regulating to obtain the optimal lighting conditions in the room



EN 15232:	5	Lighting Control
VDI 3813:	6.5.6…	
	6.5.11	(Functions for controlling and regulating the lighting)

Lighting control – manual

Manual lighting control is based on manual switching on/off. In this case, the energy optimisation fully depends on the room users present and their knowledge of energy saving.
Additionally, the switching off can also occur automatically, e.g. using a timer.

EN 15232:	5.1	Occupancy control
		5.1.0 – Manual on/off switch
VDI 3813:	6.5.6	Light control (for class C: with additional automatic switching-off signal)

Lighting control – with switch-off delay

Lighting control with switch-off delay is switched on and off manually by means of a switch. In addition, the light is switched off automatically at least once a day.

EN 15232:	5.1	Occupancy control
		5.1.1 – Manual on/off switch + additional sweeping extinction signal
VDI 3813:	6.5.6	Light control (for class C: with additional automatic switching-off signal)
	6.5.7	Stairwell light control

Lighting control – occupancy-dependent

Occupancy-dependent lighting control can be performed in different ways and to meet different requirements.
- Automatic switching on / automatic dimming
- Automatic switching on / automatic switching off
- Manual switching on / manual dimming
- Manual switching on / automatic switching off

EN 15232:	5.1	Occupancy control
		5.1.2 – Automatic detection
VDI 3813:	6.5.7	Stairwell light control
	6.5.8	Automatic lights

Lighting control – dependent on occupancy, daylight; switched

Occupancy- and daylight-dependent lighting control *switches on* the lights automatically depending on the proportion of daylight.
A light sensor in the room captures the daylight, and if the brightness is below a predefined setpoint, the light switches on automatically if the room is occupied.

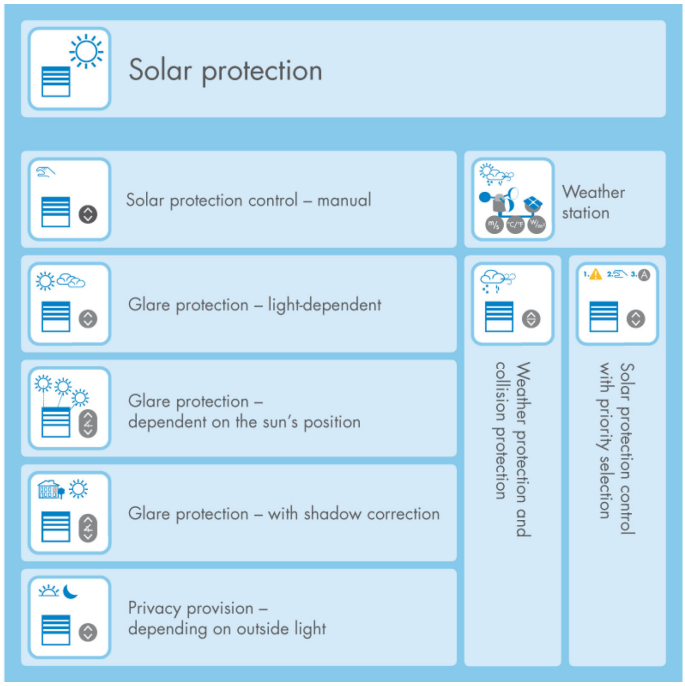
EN 15232:	5.2	Daylight control
		5.2.1 - Automatic
VDI 3813:	6.5.9	Daylight-dependent lighting (room light sensor)
	6.5.11	Twilight control (outside light sensor)

Lighting control – dependent on occupancy, daylight; dimmed

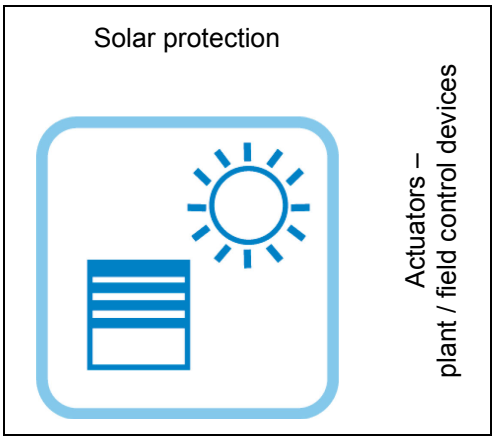
Occupancy- and daylight-dependent lighting control *dims* the lights automatically depending on the proportion of daylight.

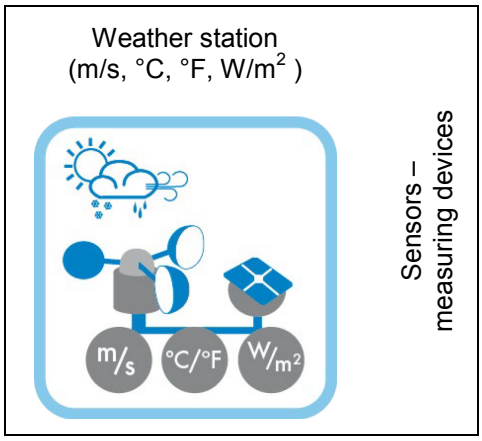
EN 15232:	5.2	Daylight control
		5.2.1 - Automatic
VDI 3813:	6.5.9	Daylight-dependent lighting (room light sensor)

Functions for the solar protection



Functions for optimal solar protection in the room





EN 15232: 6 Blind Control
VDI 3813: 6.5.12…
6.5.18 (Functions for controlling and regulating the solar protection devices)

Solar protection control – manual

Manual controlling of the solar protection devices can prevent overheating or avoid glare. In this case, the energy optimisation fully depends on the room users present and their knowledge of the energy-saving effects of solar protection devices.

EN 15232: 6.1 Motorized operation with manual control
VDI 3813: Not in guideline

Glare protection – light-dependent

Light-dependent glare protection - that is, automatically controlled reduction of the incoming light - also reduces the cooling energy in the summer, aside from protecting from glare.

EN 15232:	6.2	Motorized operation with automatic control
VDI 3813:	6.5.14	Automatic solar control (simple sunshading)

Glare protection – dependent on the sun's position

Glare protection dependent on the sun's position ensures optimal slat adjustment depending on the date/time and the current position of the sun, and on the location and direction of the window blinds.

EN 15232:	6.2	Motorized operation with automatic control
VDI 3813:	6.5.15	Slat tracking (complex sunshading)

Glare protection – with shadow correction

The **glare protection with shadow correction** function can be combined with simple or advanced solar protection. This additional function ensures that windows or a group of windows temporarily shaded by surrounding objects do not receive any positioning commands from the automatic functions during this period, but remain in a defined home position. This guarantees improved daylight supply and conserves the mechanical parts of the solar protection devices.
(Note: The calculation of the shadow corrections requires a precise structural description of the facades, windows, building and its surroundings)

EN 15232:		Not in standard
VDI 3813:	6.5.16	Shadow correction

Privacy provision – depending on outside light

The provision of privacy dependent on the outside light – also known as twilight control – positions the device depending on the external lighting conditions. Closing the solar protection during the night reduces the cooling through the windows and lowers the light emission from the building.

EN 15232:		Not in standard
VDI 3813:	6.5.13	Automatic twilight control

Weather protection and collision protection

Weather protection and collision protection (e.g. interior window blinds when window is open) prevent the solar protection from being damaged. A weather station can detect wind, rain or icing and move the solar protection device into the suitable position using the priority control.

EN 15232:		Not in standard
VDI 3813:	6.5.18	Weather protection with
	6.5.12	Priority control

Solar protection control with priority selection

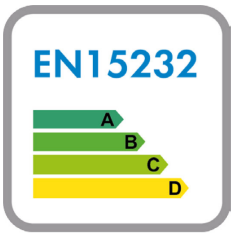
Solar protection control with priority selection calculates different positioning commands with a prioritised sequence in order to avoid damage to the solar protection device (wind, mechanical collision) but still enable manual user intervention.

EN 15232:		Not in standard
VDI 3813:	6.5.12	Priority control

Functions of integrated room automation

Integrated room automation is defined as the optimised interaction of the controlling of the room air conditioning, the lighting and the solar protection. When the optimal room automation functions are selected, the building can be operated optimally in accordance with the BA efficiency classes.

BA efficiency classes for room automation



The functions of the integrated room automation are defined by **BA efficiency classes** and are selected in such a way that the most energy-efficient building automation possible can be achieved.

EN 15232:	Tab.2	Function list and assignment to the classes of BA energy efficiency (heating, cooling, ventilation for the handover (1, 3, 4), lighting (5), solar protection (6))
VDI 3813:	Tab.2	Assignment of the application functions according to BA efficiency classes (basic, lighting, solar protection and air-conditioning functions)

Automatic thermal control

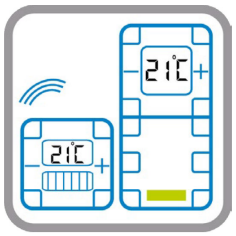
Automatic thermal control uses the solar protection to support the heating and cooling processes in unoccupied rooms. In winter when the solar protection is open, the incoming solar radiation lessens the heating required, and in summer when it is closed it prevents overheating (reduction in the cooling energy used).

EN 15232:	6.3	Combined (light)/blind/HVAC control (= integrated room automation)
VDI 3813:	6.5.17	Automatic thermal control

Operation and indication

Local, standardised operation of all the functions for the user in the room is user-friendly, but it affects the energy balance for the room automation depending on the user.

Local room operating unit with integrated sensor technology



Master **room operating unit** for all the functions (HVAC, lighting, solar protection) in the room; conventionally wired (1:1), communicative, bus-compatible or via wireless (e.g. EnOcean)

Functions: setting light, solar protection, ventilation and temperature setpoint; selecting room usage type; detecting occupancy; integrated sensor technology (temperature, CO_2, VOC, Lux, …)

Systematic resetting of user interventions to the automatic mode
Indication of current energy efficiency for all room functions

EN 15232:		Not in standard
VDI 3813:	6.4	Operator and display functions (local)

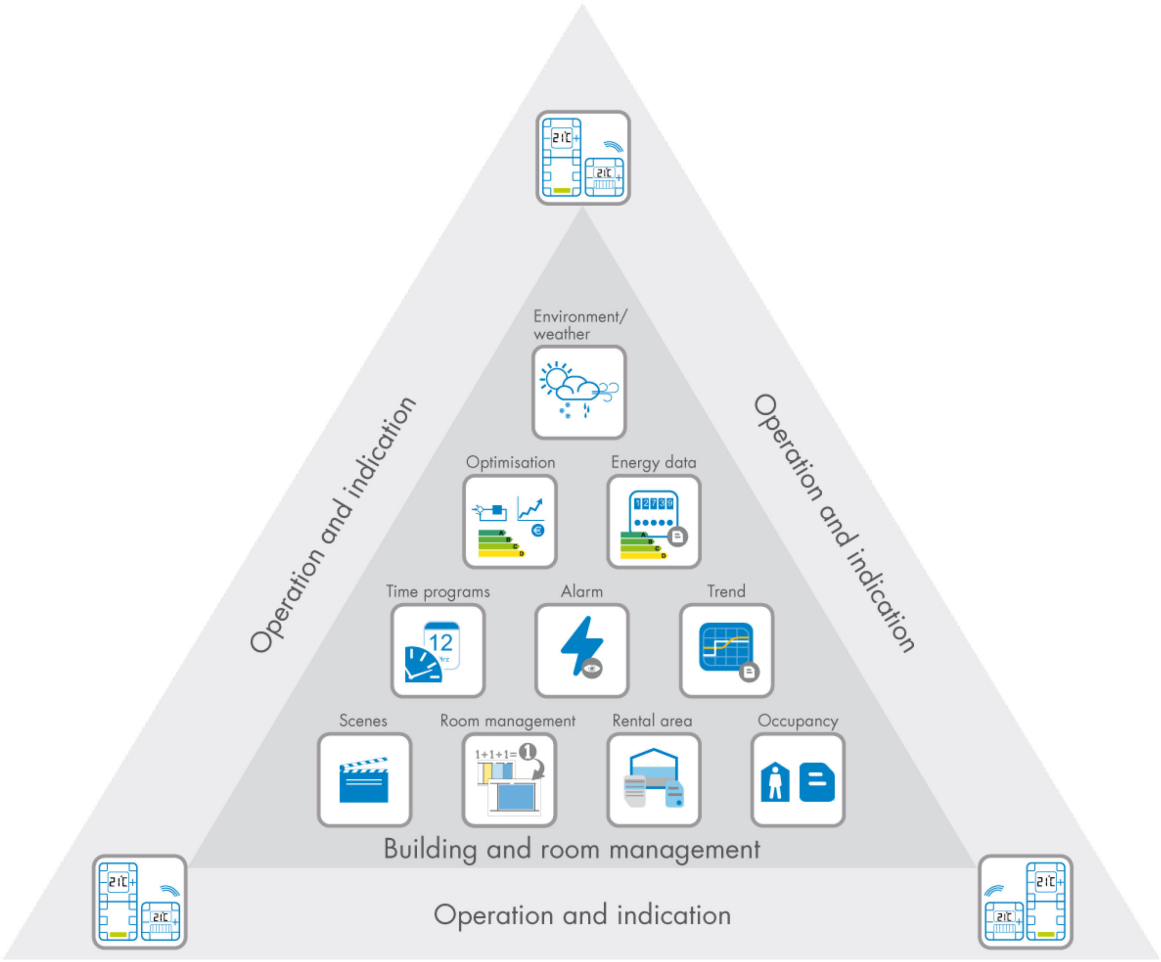
Local scene control

A room operating unit can be used to select room usage types and use them for the integrated room automation.

With **local scene control**, special rooms (e.g. lecture theatre, media / conference room) can be equipped with room operating units (e.g. media touch displays) that specify special room usage types (scenes such as darkening during a lecture, automatic window ventilation during a break) and influence the room automation.

EN 15232:		Not in standard
VDI 3813:	6.4.6	Select room utilisation type
	6.5.3	Control via room utilisation types

Central room management tasks



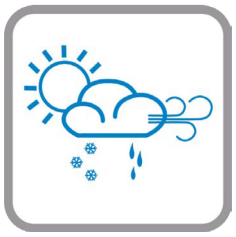
Along with the local operating and display functions with the standard room operating units (outer, light-grey triangle), the central functions on the management level of the building automation are summarised for the various requirements of the room automation and for the room management (inner, dark-grey triangle).

General room automation functions

Central room automation functions co-ordinate with the management level of the building management system

EN 15232:	7	Technical Home and Building Management
VDI 3813:	6.7	Management functions
	6.8	Operator functions

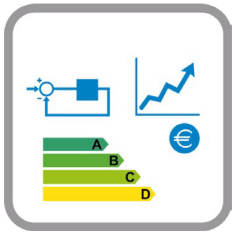
Environment/weather



Environmental factors affect the integrated room automation to the extent that weather conditions particularly affect, according to priority, the regulation and controlling of the solar protection device. A **central weather station** on the building performs this task. For slow heating/cooling reservoirs (TABS: thermoactive building elements), **weather forecast data** can also be used to predictively influence the room automation.

EN 15232:	7	Technical Home and Building Management
VDI 3813:	6.5.18	Weather protection

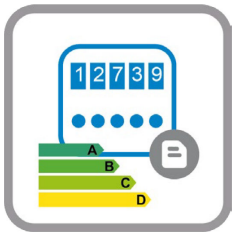
Optimisation



Technical house and building management and communicative control facilities enable continuous, central monitoring and optimisation of the setpoints and control parameters (coefficients for PI-controllers). Central, automatic correction and optimisation of setpoints, as well as the set control parameters, affect the energy-efficient and therefore the cost-optimised operation of the building. This central **optimisation** fulfils the specified BA efficiency class.

EN 15232:	7	Technical Home and Building Management
VDI 3813:	6.7.2	Management communication functions

Energy data



The central acquisition of energy consumption data, separately for every building section or even every room, and the displaying and logging of this **energy data**, can contribute to better, more energy-efficient operation of the building.
An energy management system with energy monitoring (energy data acquisition and monitoring), energy data logging, energy billing or benchmark, can be used by the operator to minimise the energy costs.
With virtual acquisitions of consumption data in each room (virtual counters), the costs for metering devices is minimised while the room users are still informed of their energy consumption.

EN 15232:	7.2	Reporting information regarding energy consumption, indoor conditions and possibilities for improvement
VDI 3813:	6.7.3	Operating data storage

Time programs

The building management system also centrally manages the **time programs** and (operating) calendars for the overall operation of the room and building automation. As the time profiles and calendars are stored locally in the respective automation stations, the building management system only has to manage and synchronise the time programs and calendars.

EN 15232:		Not in standard
VDI 3813:	6.7.2	Management communication functions
	6.8.1	Operator functions - General

Alarm

Notification is important for the safe operation of the room and building automation. Alarm monitoring and forwarding, but also alarm confirmation by the user, with or without an audit trail, and alarm logs, are the tasks of a notification system integrated into the building management system.
The various prioritised events and alarms are displayed clearly in alarm and event lists. Important alarms can also be forwarded to defined persons (alarm dispatching).

EN 15232:	7.1	Detecting faults of home and building systems and providing support to the diagnosis of these faults
VDI 3813:	6.7.2	Management communication functions
	6.8.4	Event statement text
	6.8.5	Message to external recipient

Trend

To ensure the continuous, high-quality operation of the building and rooms, the states, events and measurement and positioning values of the MCR devices are logged. This **trend** and **event data logging** is performed using current and historical databases and, optimised visually, supports the data monitoring, both for current values (live data) and for long-term historical values (data archiving).

EN 15232: Not in standard
VDI 3813: 6.7.3 Operating data storage
6.7.3.1 Long-term event logging
6.7.3.2 Archiving in database

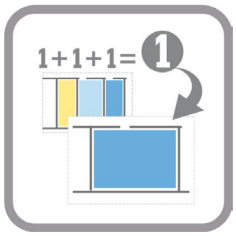
Rental area functions

Scenes

With **central scene control**, various rooms can be stored with different types of scenes. When required (time program, calendar, occupancy, central command), these rooms are activated centrally with a specified scene (scenes such as dimmed corridor lights at night, comfort temperature when lecture theatre is occupied).

EN 15232: Not in standard
VDI 3813: Not in guideline

Room management



The **room management** can be used to optimally adjust flexible room divisions in an office building to the needs of the users. With this central partition wall control, adjacent rooms can be combined to make up a single room. The room automation devices automatically configure themselves into a single unit. This can be performed automatically with a partition contact or manually with the building management system. (Flexible room division, smart wall)

EN 15232: Not in standard
VDI 3813: 6.5.5 Partition wall control

Rental area

With the support of functions for operating building areas for various or changing tenants - the **additional rental area functions**, such as energy billing, rental contract management, rights of use, responsibilities - buildings can be used and let optimally by the investors and owners. These rental area functions are usually provided in additional modules, or management systems of the technical facility management.

EN 15232: Not in standard
VDI 3813: Not in guideline

Occupancy

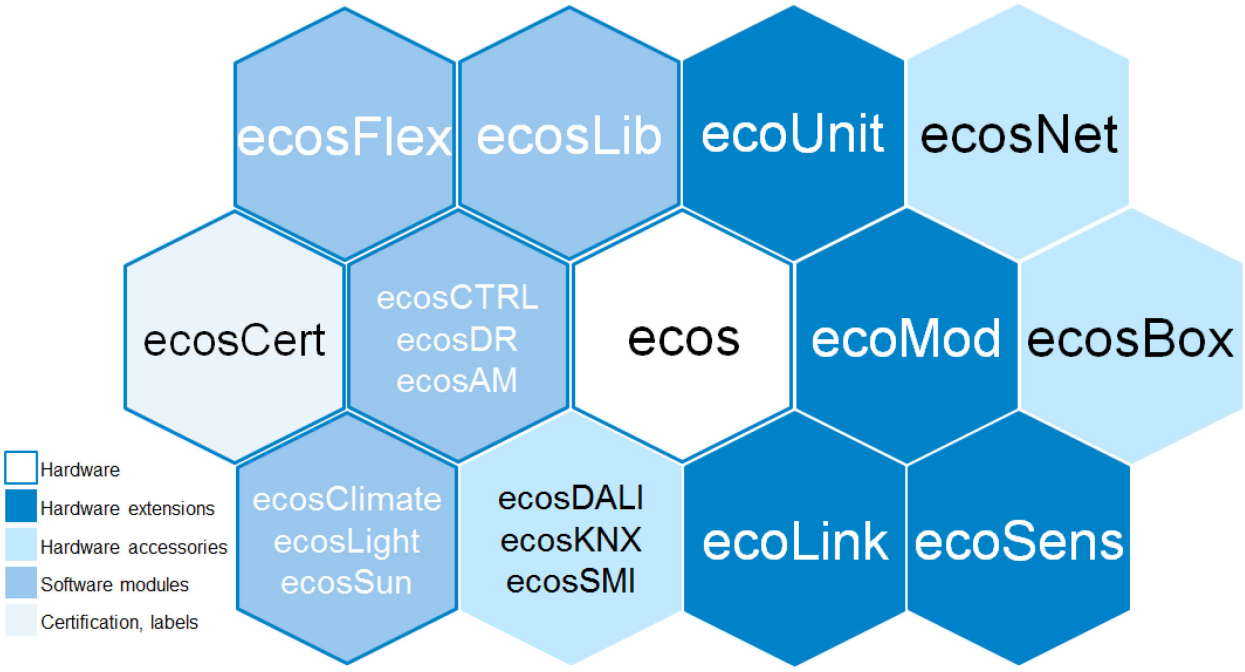
With a system for **room occupancy**, such as the room occupancy system for hotels or a central occupancy evaluation (statistical evaluation of the room occupancy), the room climate conditions can be prepared and operated optimally for the user. The central specification of the room occupancy and a dynamic, local occupancy evaluation (card holders, occupancy sensors) in the room can provide optimal support to the energy-efficient building automation and also be used for operating the rooms in the facility management segment.

EN 15232:		Not in standard
VDI 3813:	6.5.2	Occupancy evaluation

Integrated room automation functions with SAUTER

SAUTER EY-modulo ecos room automation system

The SAUTER EY-modulo ***ecos*** (economic, cost-optimized system) room automation system consists of modular components that enable intelligent operation of the building according to the requirements of the room and building automation system:



ecos – SAUTER room automation system - **e**conomic, **c**ost-**o**ptimized **s**ystem
Room automation stations

ecoUnit – room operating units with integrated room sensor technology

ecoLink – autonomous, communicative I/O modules for room functions such as heating, ventilation, cooling, fan coil units, lighting, solar protection, …

ecoMod – module for ecos for system integration of other devices such as EnOcean devices

ecoSens – SAUTER sensor technology for building automation

ecosLib – the complete room automation library for CASE Suite with all the function groups for BA in accordance with EN 15232 and VDI 3813

The functions are grouped as follows:

ecosClimate	room climate functions (heating, ventilation, cooling/air-conditioning)
ecosLight	BA functions for lighting
ecosSun	BA functions for solar protection and glare protection
ecosCTRL	room automation functions for MCR
ecosDR	demand-led, intelligent room automation in interaction with the primary energy preparation (Demand-Response)
ecosAM	logging of the virtual and physical energy consumption in the room and in the building, accumulated for the entire building (Advanced Metering)

ecosCert – certifications for the SAUTER ecos products (eu.bac, BACnet B-BC, …)

ecosFlex – flexible room division for the building management system

ecosBox – room automation box for easy installation and start-up

ecosNet – the ecos RA system is based on communicative, freely programmable controllers in open, standardised or proprietary networks like for BACnet/IP, LonWorks or SAUTER novaNet

ecosDALI, ecosKNX, ecosSMI… – additional system integration devices for expanding SAUTER ecos DALI, KNX, SMI and many more

The following is a brief overview of the SAUTER family of systems for room automation:

SAUTER EY-modulo 2 ecos

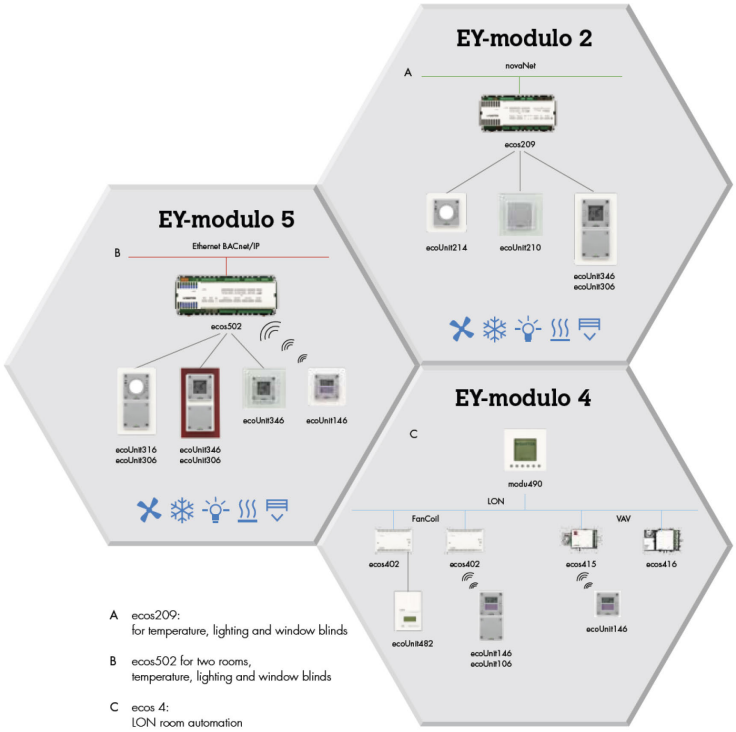
Room automation system with SAUTER novaNet (2-wire system bus)

SAUTER EY-modulo 5 ecos

Room automation system with BACnet/IP

SAUTER EY-modulo 4 ecos

Room automation system with LonWorks protocol



Expertise in room automation

The SAUTER ecos room automation system, incorporating many years of know-how and the implemented room automation functions, completes the comprehensive solutions of the SAUTER EY-modulo building management system. [4]

Independently of the technology (BACnet, LonWorks, EnOcean…), SAUTER can fulfil all of your requirements for integrated room automation. [5]

Conclusion

The descriptions of room and building automation functions from EN 15232 and VDI 3813 enable the planner of a building and room automation system (BACS, RACS) to select the correct functions so that the energy for operating the building is used efficiently.

Suitable building and energy management systems (BEMS) enable the monitoring of such “intelligent” buildings (smart buildings, green buildings, integrated and intelligent buildings).

In the future, these requirements for intelligent room automation functions will also be found in international standards, as in ISO 16484 (ISO 16484-3: BACS functions / ISO 16484-4: BACS / RACS applications), and therefore in the standards of all countries.

Literature and references

Recommended literature:

[1] EN 15232-2012: Energy performance of buildings - Impact of Building Automation, Controls and Building Management

[2] VDI 3813-2011: Building automation and control systems (BACS)
Part 1: – Fundamentals for room control (May 2011)
Part 2: – Room control functions (RA functions) (May 2011)
Part 3: – Function macros (in preparation)

[3] SAUTER white paper: Integrated room automation and energy efficiency (V1.1, 2013)

[4] SAUTER brochures: EY-modulo, EY-modulo 5, EY-modulo 2, EY-modulo 4

[5] SAUTER brochures: Room Management, Room Automation, Wireless Communication

Authors

Roland Hofstetter, SAUTER Head Office: Market Manager, SAUTER Systems; worked on the marketing strategy within the framework of the “Room Automation Competence Centre”; defined the requirements for improved intelligent building management systems with SAUTER products. Member of CEN TC 247 – Working Group 3.

Ulrich Howorka and **Markus Strittmatter**, SAUTER Germany: Product Manager, Room Automation; worked on setting up the SAUTER RA libraries according to the functions in VDI 3813; worked on VDI 3813 expert group and on CEN TC 247 WG6; provided support for room automation projects for SAUTER Germany and led seminars for planners and training courses for customers.

Kilian Haller and **Mathieu Dehlinger**, SAUTER Head Office: Product Manager, Room Automation; Project Manager and worked on setting up and implementing the SAUTER RA libraries according to EN 15232 and VDI 3813; international product training courses for the room automation system SAUTER ecos.

Abbreviations

BACS BA	Building Automation and Control System Building Automation
RACS RA	Room Automation and Control System Room Automation
BMS BM	Building Management System Building Management
TBM	Technical Building Management
BEMS	Building and Energy Management System
MCR	Measurement, Control and Regulation
EMS	Energy Management System / Solution
ISO	International Standard Organisation
EN	European Norm
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
BACnet	Building and Automation Control Network
B-BC	BACnet Building Controller (BACnet profile type)
DALI	Digital Addressable Lighting Interface
KNX	Standard for Home and Building Control
SMI	Standard Motor Interface

Company portrait

As a leading provider of solutions for building automation technology in 'green buildings', SAUTER provides pleasant conditions and a sense of well-being in sustainable environments. SAUTER develops, produces and markets energy-efficient total solutions and offers a comprehensive range of services to ensure that buildings are operated with optimal energy usage. Our products, solutions and services ensure high energy efficiency throughout the entire life-cycle of a building, from planning and construction through to operation, in office and administrative buildings, research and educational establishments, hospitals, industrial buildings and laboratories, airports, leisure facilities, hotels and data centres. With over a century of experience and a track record of technological know-how, SAUTER is a proven system integrator, with a name that stands for continuous innovation and Swiss quality. The recipient of awards for the best automation system and the best energy service, as well as eu.bac and BTL certifications, SAUTER provides users and operators with an overview of energy flows and consumption, enabling them to track the development of their costs.

Tables in appendix

Room automation from EN 15232-2012 (tab. 1)

AUTOMATIC CONTROL		
1	**HEATING CONTROL**	
1.1	Emission control	
		The control system is installed at the emitter or room level, for case 1 one system can control several rooms
	0	No automatic control of the room temperature
	1	Central automatic control: There is only central automatic control acting either on the distribution or on the generation. This can be achieved for example by an outside temperature controller conforming to EN 12098-1 or EN 12098-3
	2	Individual room control: By thermostatic valves or electronic controller
	3	Individual room control with communication: Between controllers and BACS (e.g. scheduler)
	4	Individual room control with communication and presence control: Between controllers and BACS; Demand / Presence control performed by occupancy

1.5	Intermittent control of emission and/or distribution	
		One controller can control different rooms/zones having same occupancy patterns
	0	No automatic control
	1	Automatic control with fixed time program: To reduce the indoor temperature and the operation time
	2	Automatic control with optimum start/stop: To reduce the indoor temperature and the operation time
	3	Automatic control with demand evaluation: To reduce the indoor temperature and the operation time

3	**COOLING CONTROL**	
3.1	Emission control	
		The control system is installed at the emitter or room level, for case 1 one system can control several rooms
	0	No automatic control: Providing the room temperature
	1	Central automatic control: There is only central automatic control acting either on the distribution or on the generation. This can be achieved for example by an outside temperature controller conforming to EN 12098-1 or EN 12098-3
	2	Individual room control: By thermostatic valves or electronic controller
	3	Individual room control with communication: Between controllers and BACS (e.g. scheduler)
	4	Individual room control with communication and presence control: Between controllers and BACS; Demand / Presence control performed by occupancy

3.5	Intermittent control of emission and/or distribution	
		One controller can control different rooms/zones having same occupancy patterns
	0	No automatic control
	1	Automatic control with fixed time program: To raise the indoor temperature and to lower the operation time
	2	Automatic control with optimum start/stop: To raise the indoor temperature and to lower the operation time
	3	Automatic control with demand evaluation: To raise the indoor temperature and to lower the operation time
3.6	Interlock between heating and cooling control of emission and/or distribution	
		To avoid at the same time heating and cooling in the same room depends on the system principle
	0	No interlock: the two systems are controlled independently and can provide simultaneously heating and cooling
	1	Partial interlock (dependant of the HVAC system): The control function is set up in order to minimize the possibility of simultaneous heating and cooling. This is generally done by defining a sliding set point for the supply

		temperature of the centrally controlled system
	2	Total interlock: The control function enables to warranty that there will be no simultaneous heating and cooling.

4	**VENTILATION AND AIR CONDITIONING CONTROL**	
4.1	Air flow control at the room level	
	0	No automatic control: The system runs constantly (e.g. manual controlled switch)
	1	Time control: The system runs according to a given time schedule
	2	Presence control: The system runs dependent on the presence (light switch, infrared sensors etc.)
	3	Demand control: The system is controlled by sensors measuring the number of people or indoor air parameters or adapted criteria (e.g. CO2, mixed gas or VOC sensors). The used parameters shall be adapted to the kind of activity in the space.

4.5	Free mechanical cooling	
	0	No automatic control
	1	Night cooling: The amount of outdoor air is set to its maximum during the unoccupied period provided: 1) the room temperature is above the set point for the comfort period; 2) the difference between the room temperature and the outdoor temperature is above a given limit; if free night cooling will be realised by automatically opening windows there is no air flow control
	2	Free cooling: The amount of outdoor air and recirculation air are modulated during all periods of time to minimize the amount of mechanical cooling. Calculation is performed on the basis of temperatures
	3	H,x- directed control: The amount of outdoor air and recirculation air are modulated during all periods of time to minimize the amount of mechanical cooling. Calculation is performed on the basis of temperatures and humidity (enthalpy).

4.7	Humidity control	
	The control of the air humidity may include humidification and / or dehumidification. Controllers may be applied as "humidity limitation control" or "constant control"	
	0	No automatic control: No control loop enables to act on the air humidity
	1	Dewpoint control: Supply air or room air humidity expresses the Dewpoint temperature and reheat of the supply air
	2	Direct humidity control: Supply air or room air humidity; a control loop enables the supply air or room air humidity at a constant value

5	**LIGHTING CONTROL**	
5.1	Occupancy control	
	0	Manual on/off switch: The luminary is switched on and off with a manual switch in the room
	1	Manual on/off switch + additional sweeping extinction signal: The luminary is switched on and off with a manual switch in the room. In addition, an automatic signal automatically switches off the luminary at least once a day, typically in the evening to avoid needless operation during the night
	2	Automatic detection **Auto On / Dimmed Off:** The control system switches the luminary (ies) automatically on whenever there is presence in the illuminated area, and automatically switches them to a state with reduced light output (of no more than 20 % of the normal 'on state') no later than 5 min after the last presence in the illuminated area. In addition, no later than 5 min after the last presence in the room as a whole is detected, the luminary(ies) is automatically and fully switched off **Auto On / Auto Off:** The control system switches the luminary(ies) automatically on whenever there is presence in the illuminated area, and automatically switches them entirely off no later than 5 min after the last presence is detected in the illuminated area **Manual On / Dimmed:** The luminary(ies) can only be switched on by means of a manual switch in (or very close to) the area illuminated by the luminary(s), and, if not switched off manually, is/are automatically switched to a state with reduced light output (of no more than 20 % of the normal 'on state') by the automatic control system no later than 5 min after the last presence in the illuminated area. In addition, no later than 5 min after the last presence in the room as a whole is detected, the luminary(s) are automatically and fully switched off **Manual On / Auto Off:** The luminary(ies) can only be switched on by means of a manual switch in (or very close to) the area illuminated by the luminary(ies), and, if not switched off manually, is automatically and entirely

		switched off by the automatic control system no later than 5 min after the last presence is detected in the illuminated area
5.2	Daylight control	
	0	Manual: There is no automatic control to take daylight into account
	1	Automatic: An automatic system takes daylight into account in relation to automatisms described in 5.1.
6	**BLIND CONTROL**	
	There are two different motivations for blind control: solar protection to avoid overheating and to avoid glaring	
	0	Manual operation: Mostly used only for manual shadowing, energy saving depends only on the user behaviour
	1	Motorized operation with manual control: Mostly used only for easiest manual (motor supported) shadowing, energy saving depends only on the user behaviour
	2	Motorized operation with automatic control: Automatic controlled dimming to reduce cooling energy
	3	Combined light/blind/HVAC control: To optimize energy use for HVAC, blind and lighting for occupied and non-occupied rooms
7	**TECHNICAL HOME AND BUILDING MANAGEMENT**	
	The Technical Home and Building Management enables to adapt easily the operation to the user needs. *One shall check at regular intervals that the operation schedules of heating, cooling, ventilation and lighting is well adapted to the actual used schedules and that the set points are also adapted to the needs.* – *Attention shall be paid to the tuning of all controllers this includes set points as well as control parameters such as PI controller coefficients.* – *Heating and cooling set points of the room controllers shall be checked at regular intervals. These set points are often modified by the users. A centralised system enables to detect and correct extreme values of set points due to misunderstanding of users.* – *If the Interlock between heating and cooling control of emission and/or distribution is only a partial interlock. The set point shall be regularly modified to minimise the simultaneous use of heating and cooling.* – *Alarming and monitoring functions will support the adaptation of the operation to user needs and the optimization of the tuning of the different controllers. This will be achieved by providing easy tools to detect abnormal operation (alarming functions) and by providing easy way to log and plot information (monitoring functions).*	
7.1	Detecting faults of home and building systems and providing support to the diagnosis of these faults	
7.2	Reporting information regarding energy consumption, indoor conditions and possibilities for improvement	

Table from EN 15232-2012 (tab. 1)

SAUTER
Creating Sustainable Environments.

Room automation from EN 15232 (tab. 2)

			Definition of classes							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
AUTOMATIC CONTROL										
1	**HEATING CONTROL**									
1.1	Emission control									
		The control system is installed at the emitter or room level, for case 1 one system can control several rooms								
	0	No automatic control	■				■			
	1	Central automatic control	■				■			
	2	Individual room control	■	■			■	■		
	3	Individual room control with communication	■	■	■		■	■	■	
	4	Individual room control with communication and presence control	■	■	■	■	■	■	■	■
1.2	Emission control for TABS									
…										
1.3	Control of distribution network hot water temperature (supply or return)									
…										
1.4	Control of distribution pumps in networks									
…										
1.5	Intermittent control of emission and/or distribution									
		One controller can control different rooms/zones having same occupancy patterns								
	0	No automatic control	■				■			
	1	Automatic control with fixed time program	■	■			■	■		
	2	Automatic control with optimum start/stop	■	■	■		■	■	■	
	3	Automatic control with demand evaluation	■	■	■	■	■	■	■	■
1.6	Generator control for combustion and district heating									
…										
1.7	Generator control for heat pumps									
…										
1.8	Sequencing of different generators									
…										
2	**DOMESTIC HOT WATER SUPPLY CONTROL**									
…										
3	**COOLING CONTROL**									
3.1	Emission control									
		The control system is installed at the emitter or room level, for case 1 one system can control several rooms								
	0	No automatic control	■				■			
	1	Central automatic control	■				■			
	2	Individual room control	■	■			■	■		
	3	Individual room control with communication	■	■	■		■	■	■	
	4	Individual room control with communication and presence control	■	■	■	■	■	■	■	■
3.2	Emission control for TABS for cooling									
…										
3.3	Control of distribution network cold water temperature (supply or return)									
…										

SAUTER
Creating Sustainable Environments.

			Definition of classes							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
3.4	Control of distribution pumps in networks									
…										
3.5	Intermittent control of emission and/or distribution									
		One controller can control different rooms/zones having same occupancy patterns								
	0	No automatic control	■				■			
	1	Automatic control with fixed time program	■	■			■	■		
	2	Automatic control with optimum start/stop	■	■	■		■	■	■	
	3	Automatic control with demand evaluation	■	■	■	■	■	■	■	■
3.6	Interlock between heating and cooling control of emission and/or distribution									
	0	No interlock	■				■			
	1	Partial interlock (dependant of the HVAC system)	■	■	■		■	■	■	
	2	Total interlock	■	■	■	■	■	■	■	■
3.7	Different generator control for cooling									
…										
3.8	Sequencing of different generators									
…										
4	**VENTILATION AND AIR CONDITIONING CONTROL**									
4.1	Air flow control at the room level									
	0	No automatic control	■				■			
	1	Time control	■	■	■		■	■		
	2	Presence control	■	■	■	■	■	■	■	
	3	Demand control	■	■	■	■	■	■	■	■
4.2	Air flow or pressure control at the air handler level									
…										
4.3	Heat recovery exhaust air side icing protection control									
…										
4.4	Heat recovery control (prevention of overheating)									
…										
4.5	Free mechanical cooling									
	0	No automatic control	■				■			
	1	Night cooling	■	■			■	■		
	2	Free cooling	■	■	■	■	■	■	■	■
	3	H,x- directed control	■	■	■	■	■	■	■	■
4.6	Supply air temperature control									
…										
4.7	Humidity control									
	0	No automatic control	■				■			
	1	Dewpoint control	■	■			■	■		
	2	Direct humidity control	■	■	■	■	■	■	■	■
5	**LIGHTING CONTROL**									
5.1	Occupancy control									

			Definition of classes							
			Residential				Non residential			
			D	C	B	A	D	C	B	A
	0	Manual on/off switch	■	■			■			
	1	Manual on/off switch + additional sweeping extinction signal	■	■	■		■	■		
	2	Automatic detection	■	■	■	■	■	■	■	■
5.2	Daylight control									
	0	Manual	■	■	■		■	■		
	1	Automatic	■	■	■	■	■	■	■	■
6	**BLIND CONTROL**									
	0	Manual operation	■				■			
	1	Motorized operation with manual control	■	■			■			
	2	Motorized operation with automatic control	■	■	■		■	■		
	3	Combined light/blind/HVAC control	■	■	■	■	■	■	■	■
7	**TECHNICAL HOME AND BUILDING MANAGEMENT**									
7.1	Detecting faults of home and building systems and providing support to the diagnosis of these faults									
	0	No	■	■			■			
	1	Yes	■	■	■	■	■	■	■	■
7.2	Reporting information regarding energy consumption, indoor conditions and possibilities for improvement									
	0	No	■	■			■	■		
	1	Yes	■	■	■	■	■	■	■	■

Table: EN 15232 – RA functions (emission = room)

Room automation from VDI 3813 (tab. 2)

Table 2. Allocation of the application functions based on BACS efficiency classes

Application function		BACS efficiency classes as per EN 15232			
		D	C	B	A
Basic functions having an impact on energy performance					
6.5.2	Occupancy evaluation using presence detection			X [a)]	X [b)]
6.5.4	Time program [c)]			X	X
Lighting functions having an impact on energy performance					
6.5.6	Light control		X [d)]		
6.5.8	Automatic lights [e)]			X	X
6.5.9	Daylight-dependent lighting [f)]			X	X
6.5.10	Constant-light control [f)]			X	X
Sunshading functions having an impact on energy performance					
6.5.14	Automatic solar control		X		
6.5.15	Slat tracking			X	X
6.5.16	Shadow correction			X	X
6.5.17	Automatic thermal control			X	X
Room climate functions					
6.5.19	Energy mode selection [g)]			X	X
6.5.20	Energy mode selection with start optimisation			X	X
6.5.21	Setpoint calculation			X	X
6.5.22	Function selection		X	X	X
6.5.23	Temperature control (heating/cooling)		X [h)]	X	X
6.5.24	Room supply air temperature cascade control			O	O
6.5.25	Fan control			X	X
6.5.28	Air quality control				X
6.5.29	Night-time cooling		X	X	X

X function required

O function required/useful depending on the requirements of the mechanical system

a) function required at least for lighting and sunshading functions, integration into room climate functions recommended

b) Function acts equally on lighting, sunshading and room climate functions.

c) for energy mode changeover

d) additional automatic shutoff signal required

e) in rooms insufficiently provided with daylight

f) either *Daylight-dependent lighting* or *Constant-light control* depending on dimmability of the luminaires

g) only if start/stop optimisation is implemented at the generation or distribution level

h) unless thermostatic valve is used

Table: VDI 3813 – RA functions for EN 15232

Note: (not in table; no assignment to BA efficiency classes)

6.4.6 Select room utilisation type
6.5.3 Control via room utilisation types
6.5.5 Partition wall control
6.5.7 Stairwell light control
6.5.11 Twilight control
6.5.12 Priority control
6.5.13 Automatic twilight control
6.5.18 Weather protection
6.5.26 Sequence control
6.5.27 Manipulated value limiting
6.7.2 Management communication functions
6.7.3 Operating data storage