Room Automation

What is room automation?

- It coordinates the lighting, sun-screening, heating, cooling and ventilation as a holistic room automation system
- It replaces the traditional system-oriented partial solutions and, due to its high integration, optimally attains the objectives of energy performance, flexibility of utilization and productivity.
- It ideally supports the user while he is present in the room by automatically ensuring a glare-free environment, high-contrast illumination of the workspace, a pleasant room temperature and sufficient amount of fresh air
- In rooms that are not used, room automation focuses entirely on energy performance by switching off the lighting, reducing the air change rate, adjusting the room temperature and using the sunlight and sunblinds to support the heating and cooling systems.

Why room automation?

- Energy efficiency that cannot be achieved by a building automation system
- Enhanced comfort for room occupants
- Flexibility of installation and implementation by using modular approach
- Further optimization of the building automation system performance
- Easy interface with DDC technology

Only the room automation system is in the position to significantly reduce the energy requirement of a building in a relation to the room occupancy and user behaviour by consistently avoiding the wastage of energy. With room automation, lights switched on in unoccupied rooms or radiators glowing while the windows are open are definitely a thing of the past. The energy requirement and, consequently the costs can thus be reduced by up to 50%.

Thanks to this contribution, room automation has become the most important part of modern-day building automation and has the leading edge among the automation stations for systems control.

The primary task of room automation is to prevent unnecessary energy consumption. This is achieved by using factors and parameters that can only be known on the room level itself, such as:

- optimum use of daylight by combining sun tracking and constant light control
- time program-controlled switching of mode change-over for heating or cooling
- blocking the energy supply when opening windows
- cooling through windows during the night
- occupancy sensors...
Buildings energy consumption constitutes more than 40% of overall energy consumption in industrialized countries. It also has a tremendous influence on the profitability of building operation due to continuously rising energy costs. The saving of energy therefore is becoming a major challenge.

Efficiency-improving room automation is not just beneficial to the environment but is also a high-return investment: for example, the comparative cost accounts for office or school building show that the monthly operating cost savings exceed the costs of financing room automation dramatically and assures 40% return!

To avoid wastage in your building, an integrated room automation solution needs to be used. It measures the necessary conditions in every room, such as occupancy, temperature, brightness, window position etc. and then adapts the heating or cooling system, ventilation, lighting and the sunblinds to optimally suit one another. In this manner, the desired level of comfort in the occupied rooms as well as the readiness for operation of the unoccupied rooms is maintained with maximum economic efficiency.

The LonMark study from the University of Biberach from 2007 proves that a room automation system can lower the energy consumption of your office or school building by more than 40% with the help of the integrated energy-efficient automation functions.

### Energy performance functions to save lighting energy

<table>
<thead>
<tr>
<th>Function*</th>
<th>Energy saved**</th>
<th>Positive influencing factors**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant light control (with occupancy sensor)</td>
<td>35 - 50%</td>
<td>Good supply of daylight, High-illumination (of 300 lumen), Optimally with sun tracking control</td>
</tr>
<tr>
<td>Daylight switching (with occupancy sensor)</td>
<td>25 - 45%</td>
<td>Good supply of daylight, High-illumination (of 300 lumen), Optimally with sun tracking control</td>
</tr>
<tr>
<td>Sunlight control</td>
<td>5 - 8%</td>
<td>Good supply of daylight</td>
</tr>
<tr>
<td>Sun tracking control</td>
<td>10 - 13%</td>
<td>Good supply of daylight, Optimally with constant light control, Good supply of daylight, Self-induced or externally induced shading</td>
</tr>
<tr>
<td>Calculation of shading factors</td>
<td>Precise related</td>
<td>Precise related</td>
</tr>
<tr>
<td>Automatic light</td>
<td>Precise related</td>
<td>Precise related</td>
</tr>
</tbody>
</table>

* Room automation function according to LonMark definition,
** Saving potential and influencing factors according to LonMark study from the University of Biberach.

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### Energy performance functions to save thermal and cold energy

<table>
<thead>
<tr>
<th>Function*</th>
<th>Energy saved**</th>
<th>Positive influencing factors**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode changeover (per time program)</td>
<td>5 - 10%</td>
<td>Long operating time of heating system, Longer absence times, Low building mass</td>
</tr>
<tr>
<td>Occupancy sensor</td>
<td>5 - 10%</td>
<td>Longer absence times, Low building mass</td>
</tr>
<tr>
<td>Window monitoring</td>
<td>5 - 10%</td>
<td>Low building mass</td>
</tr>
<tr>
<td>Sunblind thermo control</td>
<td>5%</td>
<td>Low building mass, Good supply of daylight</td>
</tr>
<tr>
<td>Summer compensation</td>
<td>Precise related</td>
<td>Only saving of cooling energy</td>
</tr>
<tr>
<td>Free night cooling</td>
<td>Precise related</td>
<td>Depending on air circulation, Reduction of cooling down depends on value of the sunblinds</td>
</tr>
<tr>
<td>Twilight detectors for sunblinds</td>
<td>Precise related</td>
<td>Precise related</td>
</tr>
</tbody>
</table>

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* Calculated with the help of the German electronics' guild,
** EU average prices 2013: Electricity € 0.15/kWh and oil and gas € 0.68/kWh,
*** Financing via anually loan: 10-year duration, interest rate 5%,
Another purpose of room automation is to focus on the users and their well-being. A user personally decides, for example, how high the room temperature should be. Working in the background, the automation system ensures a glare-free and sufficiently lit environment - with as much natural sunlight as possible. Users have full control themselves for the time they are in the room: they can override any function manually. Once the user leaves the room, the room automation can once again concentrate on the automatic functions for saving energy.

Room automation manages the sunblinds, the lighting and HVAC simultaneously and thus guarantees optimum comfort through correct tuning. For this purpose, even opposing requirements such as antiglare protection and daylight maximization have to be solved depending on the room and weather conditions. This is something which only and integrated system can handle with success, a system which moreover also has functions that are perfectly tuned to one another.

Room Automation enhances comfort

Due to its modular structure, e.control supports variable room divisions, from an individual office to an open-plan office, without having to alter the wiring. This proves particularly useful in open-plan areas, removing unnecessary rewiring each time space re-partitioning is required.

Using just the software, logical binding between devices can easily be rearranged based on new partition layout, while physical wiring remains the same.

In addition, the system is open for changes or expansions. The modular structure of system components makes it possible to easily replace actuators and sensors. For example, a switchable lighting can be upgraded to a constant light controller by replacing the switchable modules by dimmable ones and adding multisensors (for light level measurement) to the rooms. What's more, at the same time new functions will be included in the software.

Room Automation increases flexibility

Room automation system uses open LON technology and can therefore be easily and seamlessly integrated into a BMS / DDC system (be it native LON, BACnet or other systems using OPC technology).

Once integrated with the BMS/DDC system, further potential for energy saving can be developed, since room automation can pass on the information on actual energy demand to the production side, thus avoiding unnecessary energy production and losses during its distribution.
Constant light control

Constant light control is the most efficient way of saving electrical energy! In rooms which are supplied with daylight, it adds only as much artificial light as is needed to maintain the required brightness level. In the room automation, the built-in light and occupancy sensor and the integrated constant light controller combined with all dimmable actuators, ensures that this huge energy saving is guaranteed.

Daylight switch

The multisensor can also be used in conjunction with switchable light actuators. In this case the installed controller only activates the artificial light when there is insufficient daylight. An automatic learn function ensures that the lighting is switched off again when there is sufficient daylight.

Automatic lights

Switching on a light only when there is someone in the room is one of the easiest ways of increasing energy performance. Reductions by up to 20% can thus be achieved. The adjustable time delay prevents a light from being switched off unintentionally, in cases where persons present in the room stop moving for a moment.

Twilight detector

Whether indoors or outdoors, in circulation spaces or for illuminating a building at night: light is only required when it gets dark. Since the time at which the sun sets varies from day to day, a twilight detector independently ensures that light is activated at the best possible time.

Time program

The time programs only switch on the lighting when it is required. In this way, it is possible to choose which lights should be switched on or off and at which time using a time program. The user can manage these times, such as public holidays, vacations or other exceptions independently.

Scene control

Wherever rooms are used for different purposes, for example conference rooms, different lighting moods can be called up by a simple push of a button using the scene control system, regardless of whether this is done by pushbutton, via room control devices or via IR remote control.

Partition wall control

Partition wall systems allow conference rooms to be used variably. This variability means that the lighting needs to be just as variable: operation whether it be switching on/off, dimming or calling up scenes should always relate to the non-separated part of the room only. The open status of the partition wall can be detected by any e.control device with binary input via a limit switch.

Sunblind protection control

High-precision sensors for temperature, rain, wind speed and direction ensure that the sensor unit always keeps an overview of weather conditions. To ensure that the blinds are not damaged by wind or frost or potentially in the case of fabric awnings, by rain the sensor unit moves them safely into the final position beforehand.

Sunlight control

The sunlight control system evaluates the outside brightness measured on each façade and determines from which threshold value and with which time delay the blinds are moved into a definable antidazzle position, in order to prevent sunlight having an adverse effect on the user. In the event of the subsequent formation of clouds which exceed an adjustable time delay, the blinds are drawn in or turned to produce maximum visibility.

Sun tracking control

By comparison with the sunlight control system, there is further optimising potential to be found in only closing the blinds as far as necessary to avoid glare from direct sunlight coming in. Since the position of the sun differs at each time of the day and at different times of the year, cyclical adjustment of the slats to suit the path of the sun is required.

Calculation of shading factors

The blind of a window only needs to be moved by both aforementioned automatic devices if it is not at that moment in the shadow of neighbouring buildings. In such cases, calculating shading factors is used with the aid of geometric data from the surrounding building which is stored in each actuator.

Sunblind thermo control

During the winter or spring the additional energy is welcome in order to save heating energy. In summer, on the other hand, it can have a counterproductive effect, due to the possibility of overheating.

Occupancy sensors

An ideal compliment to the operating mode switching system using occupancy sensors or multisensors. By using these, it is possible to completely do without time-controlled switching to the Comfort mode, since switching to this mode only takes place on a room-by-room basis and only if the room is actually occupied.

Window monitoring

In addition to transmission heat losses via the external walls which can be minimised using the functions mentioned previously the second means of increasing efficiency is reducing ventilation cooling and heat losses through open windows.

Free night cooling

During the summer months, rooms heat up during the day due to the high air temperature and heat radiation. The free night cooling function on e.control controllers opens the windows or shutters in every room during the night, as soon as the cooler outside air can be circulated through the room to reduce the room temperature.
Spega - Spelsberg Gebäudeautomation GmbH + Co. KG is a leading German room automation systems provider

Intelligent buildings are what we do best. As one of the pioneers in room automation and one of the leading manufacturers of open LON automation solutions in Germany, we focus on realising efficient and comfortable buildings. By combining a full-fledged and flexible automation concept with a software functionality which goes well beyond your expectations, we are able to always produce optimum solutions regardless of the requirements.

Selected references

**Head office Tubingen Savings Bank**
- Floor space: 23,000 sqm
- Scope of supply: Individual room control for heating and cooling in all offices and conference rooms
- System integrator: Honeywell GmbH, Offenbach

**New State Exhibition Center Stuttgart**
- Floor space: over 100,000 sqm in 8 exhibition halls, 1 congress center and 1 multi-purpose hall
- Scope of supply: Lighting and sunblind control, infrastructure components
- System integrator: Imtech, Siemens, Speidel, Schlagenauf (Consortium)

**University Hospital Hamburg - Scientific Campus East**
- Floor space: 10,000 sqm
- Scope of supply: Individual room control in laboratories, infrastructure components
- System integrator: Siemens Building Technologies, Hamburg

**Westend-Duo, Frankfurt**
- Floor space: 32,700 sqm
- Scope of supply: Lighting and sunblind control system
- System integrator: Siemens Building Technologies, Frankfurt

**Head office of public services Bochum**
- Floor space: 21,300 sqm
- Scope of supply: Room climate control (heating, cooling ventilation), lighting and sunblind control, room control panels dialog 1
- System integrator: Siemens Building Technologies GmbH, Essen

**Grammar schools Dusseldorf**
- Object: Complete refurbishment of all school buildings for optimised energy efficiency
- Scope of supply: Presence depending room climate control, lighting and sunblind control system with daylight linking, multisensors
- System integrator: Kieback & Peter GmbH, Dusseldorf
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We are taking the lead in transforming the way communities and buildings are designed, built and operated, towards creating Green Building communities, maintaining sustainable built-environment, protecting the ecosystem, and reducing the CO2 emission in our environment.