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MAINTENANCE-FREE WIRELESS SWITCHES & SENSORS

04

INTERNATIONAL EDITION

REVOLUTIONARY
Energy for free – wireless technology without batteries

ENABLED BY ENOCEAN
Bavarian tradition meets modern technology - four-star hotel features EnOcean technology

NETWORKED
PEHA innovations in the batteryless and wireless Easyclick system

VISIONARY
Energy autonomous wireless sensors – from crazy ideas to mass market products

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+++ NEWS +++ SAP co-founder and chairman of the supervisory board Professor Hasso Plattner awarded EnOcean the price as “Start-Up of the Year 2006” +++ NEWS +++ Waste management of batteries will be expensive – EU parliament obliges trade industry to collect used rechargeable and normal batteries – implementation until 2008 in all EU member states.

These symbols will help you to match the content of the articles in the magazine with the various applications of EnOcean technology:

Automotive | Building Automation | Manufacturing | Medical | Logistics | Refers to all applications

The power of unused energy
enocean®

EDITORIAL

Dear readers,

Munich, November 2006

Since their release four years ago, over 150,000 batteryless wireless sensors ‘Enabled by EnOcean’ have been installed in commercial buildings worldwide. In recent months there has been a marked increase in requests for proposals calling for this solution.

What are the reasons for this success? I think it's the enthusiastic users passing on their positive experience. Facility managers tell us they can relocate interior walls in hours without rewiring, saving time, cost and minimising intrusion. Specifying engineers report they can design safer, easier installations because of simplified cable routing and reduced fire loads. They can combine products from a variety of EnOcean providers – compatibility guaranteed – for optimal solutions to each specification job. System integrators easily satisfy frequent requests for alterations during construction without scheduling delay. Architects find it easier to realise their creative ambitions such as glass walls, decorative concrete or other stone facades because down-wall cabling is eliminated.
The users of the buildings also benefit because they can locate controls where needed, and not where low-cost wiring dictates.

The actual decision on using a technology is still very much influenced by the initial investment and follow-up costs. Enabled by EnOcean lowers the investment in automation by at least 10%, in most cases savings are substantially more, e.g. by eliminating conduits in concrete walls. Another major saving factor is the absolute freedom from maintenance – not to be neglected when added up over the lifetime of a building.

One of this year's highlights was the light+building show in Frankfurt, Germany where more than 50 companies presented products and solutions Enabled by EnOcean. These were both product providers – you'll find an overview in our new booklet on page 19 – and system integrators such as HGI, Imtech, Johnson Controls, Messner, Neuberger and TAC. These building automation professionals tell us they consider EnOcean "the standard for wireless sensors".

Markus Brehler
CEO and Founder, EnOcean GmbH

REVOLUTIONARY

ENERGY FOR FREE – wireless technology without batteries

Wireless sensors will soon be appearing by the thousands. Not only in our homes where they will control lighting and temperature or supervise domestic appliances, but also in industry to control manufacturing processes, in automobiles to check tyre pressure, or outdoors monitoring the environment. To ensure the required system reliability, maintenance-free solutions are in many cases absolutely essential.

By Armin Anders, co-founder and head of product marketing, EnOcean GmbH

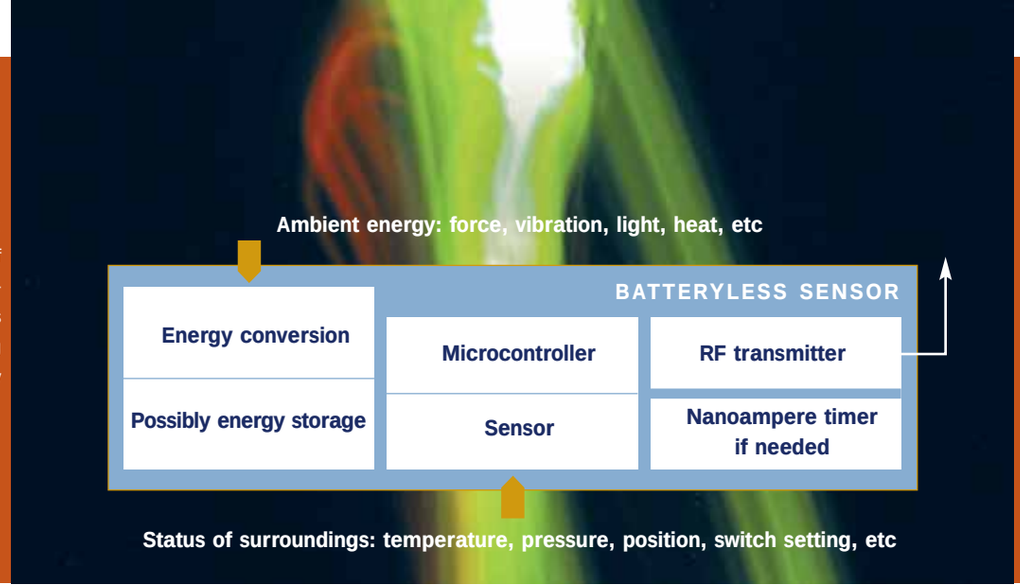


Fig. right: Schematic of maintenance-free wireless sensors using ambient energy

EnOcean wireless transmitters generate their energy from the environment. This energy harvesting enables wireless and batteryless switches and sensors for building, home and industrial automation. In addition to transmission reliability and long wireless range, applications of this kind require sensors that are miniaturised and cost-effective.

BATTERYLESS WIRELESS TRANSMITTER MODULES – 300 METERS RANGE AND ABSOLUTELY MAINTENANCE-FREE

EnOcean has developed a wireless sensor technology that detects control commands or measurement data without any external power source or batteries in the sensor unit. Embedded EnOcean radios transmit some 300 meters in a free field, the length of three soccer fields. A wireless sensor is operated by the smallest amount of ambient energy. About 50 microjoules per action are sufficient, comparable to lifting 1 gram by 5 mm. Pressing the button of a TV remote control takes a multiple of this. A tiny magnet and coil system produces an electric voltage from finger pressure, for example, similar to the way power is generated by a dynamo for a bicycle light. Vibration can be converted into electric energy by using piezoelectric crystals. When the crystal is flexed, energy is generated. Small solar cells, like those in calculators, can also power a wireless sensor from EnOcean. A small energy accumulator (Goldcap), recharged during just one or two hours of light, sustains the operation overnight. A thermal converter, currently under development, makes use of temperature differences to generate voltage. Three to four degrees are sufficient for transmission, less than the difference in temperature between the air in a room and the surface of warm radiators or machine parts. These are just a few examples of highly efficient, micro energy converters already marketed by EnOcean or in the process of development.

ENOCEAN WIRELESS TECHNOLOGY

- Batteryless and maintenance-free
- Interoperable end-products
- Ecologically attractive
- 300 metres free field range, typically 30 metres in buildings (depending on surroundings)
- Reliable functioning of hundreds of transmitters operated in a single radio cell
- Resistant to interference
- 32 bit transmitter identification

SECURE DATA TRANSMISSION – EVEN IN SYSTEMS WITH HUNDREDS OF TRANSMITTERS

EnOcean radios are low energy but not low power. Energy is the product of power multiplied by time. The transmitting power determines the wireless range, so there must be no savings here. EnOcean technology must consequently be extremely fast. The duration of a typical EnOcean radio telegram is less than one thousandth of a second. The microcontroller, the measurement circuitry and the RF transmitter of the wireless sensor are driven for just a few thousandths of a second per action.

Sensor elements connected to the controller A/D converter deliver data that, provided with an identification number and a checksum, are sent by the RF transmitter as a digital data telegram. Energy store and sleep timer are parts of the wireless sensor that need continuous supply. These circuitry parts are effectively optimised for power consumption of some nanoamperes only, making it possible to operate them on tiny amounts of harvested ambient energy.

LOW COLLISION RISK THROUGH EXTREMELY SHORT RADIO TELEGRAMS

The transmission medium of wireless is of course the air, which has to be used by all wireless transmitters alike. When a number of transmitters is operating on the same frequency, there is always the risk that two data telegrams are transferred simultaneously, and that the information they carry is destroyed through collision.

The collision probability of EnOcean radio telegrams is extremely slight because the signals are so short. In addition, the telegrams are sent repeatedly within a few milliseconds and randomly offset from one another in time. So hundreds of wireless sensors successfully coexist. Each sensor is programmed with a unique 32 bit address that is transferred with each radio telegram. More than four billion transmitters can be distinguished from one another.

ECOLOGICAL – NO BATTERY DISPOSAL AND LESS RADIATION ENERGY THAN CONVENTIONAL LIGHT SWITCHES

In addition to the ecological impacts of battery use, i.e. disposal, a frequent argument used against wireless technologies is the radiation they produce. This is where the extremely short transmission times of EnOcean radio present a further substantial advantage. The prestigious ECOLOG Institute examined low-power wireless light switches using EnOcean technology. The result is surprising – the radiation given off by an EnOcean wireless switch is much less than that of a conventional wired switch. And why?

The operation of a conventional switch produces a breakaway spark, in other words, a broadband radiation pulse directly on the switch. This disintegrates after traveling a short distance. However, it nearly always hits the person at the switch.

When a wireless switch with low-power electronic circuitry is operated, no breakaway spark is produced. Instead a relatively low-powered wireless signal is sent to a receiver for a thousandth of a second. The current is switched on at the receiver, which is nearly always a few metres away from the person, and the broadband radiation pulse (electrosmog) thus dissolves in the air.
There is much less cabling in the wall, so low-frequency 50/60 Hz radiation is also reduced. EnOcean wireless modules are all manufactured in line with the new European RoHS directive, forbidding the use of hazardous substances in electrical and electronic devices.

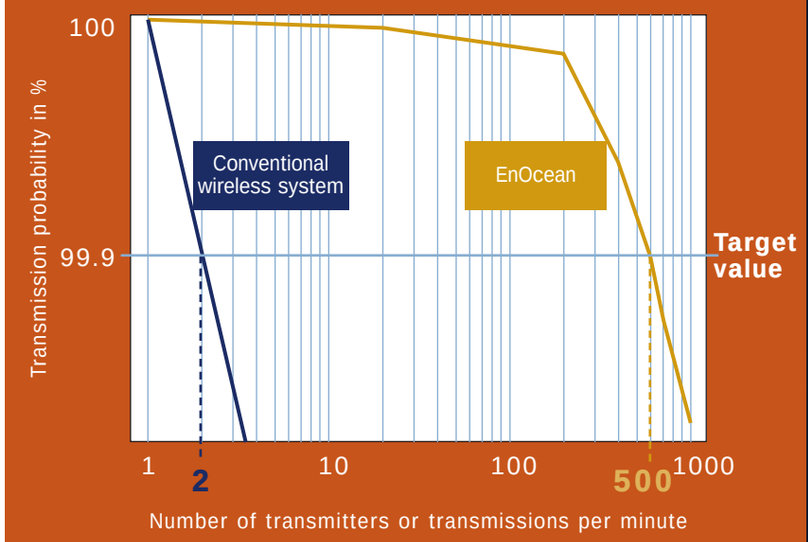
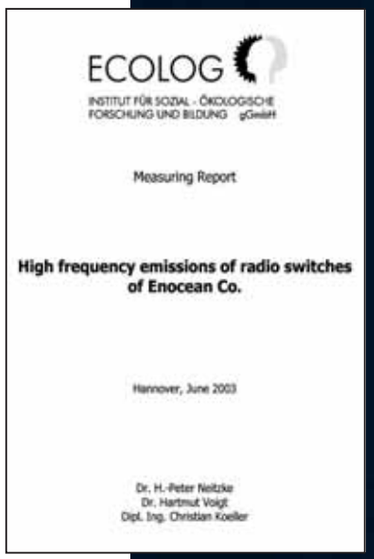


Fig. top: Low collision risk through extremely short telegrams allows hundreds of transmitters in a single radio cell

ENOCEAN WIRELESS IS PROVEN ON A LARGE SCALE

With more than 150,000 wireless modules already sold, and primarily installed in buildings, the practical benefits of batteryless wireless EnOcean technology in building engineering are clearly demonstrated. Currently more than 50 industrial customers offer hundreds of end-products on the market with integrated EnOcean wireless modules. They are serving key applications like lighting, blinds and HVAC control. Numerous gateways allow integration into all common bus systems thus linking to automation engineering. Universal switch inserts are available to match the ranges of nearly all established producers of installation material, with more to follow soon for both European and US designs.

Fig. below: EnOcean radiation energy is 100 times smaller than in conventional, cabled light switches, according to the ECOLOG Institute (download at www.enocean.com, chapter technology/environmental)


ECOLOG
INSTITUT FÜR SOZIAL - ÖKOLOGISCHE FORSCHUNG UND BILDUNG gGmbH

Measuring Report

High frequency emissions of radio switches of Enocean Co.

Hannover, June 2003

Dr. H.-Peter Neitzke
Dr. Hartmut Voigt
Dipl. Ing. Christian Koeller

GOOD PLANNING COUNTS

If you want to plan economically attractive office buildings, you should think of the following:

- *How were office buildings planned before?*
- *What are the shortfalls?*
- *Where is potential for improvement?*

By Oliver Knab, managing partner, Ingenieurbüro Knab GmbH, Munich

Modern administrative buildings must be capable of assuming all common room and office organisation forms. Rigid concepts that cannot respond flexibly to more contemporary layout requirements are a hindrance to a new organisation and thus to the development of an enterprise. In most cases the result is excessive conversion costs.

Electrical installations should be planned so that they are suitable for the usual arrangements like single or team offices, combined offices and open-plan offices. Offices for the future will be planned, technically, for a variety of different uses.

SUCCESSFUL PLANNING FOR MARKETABLE BUILDINGS IS BASED ON A THREE-COLUMN CONCEPT

- Hollow and false floors for flexible cabling of workstations through ground tanks for electrical and data networks.
- Lighting systems, independent of dividing walls and matched to VDU activity, with addressable control gear for linking to building automation (e.g. standard lamps, suspended lamps).
- Cross-sectional building automation with control of all room functions on an IP basis. Wireless units should be used for the signal transmission of the peripheral control units to ensure independence from the office organisation form.

Batteryless wireless technology from EnOcean is particularly suitable because of the lack of maintenance. In investor buildings and those used by the builder, the room and function programmes are in many cases not created until shortly before a building is moved into, i.e. when walls, corridors, etc are defined.

With the previously mentioned three-column concept the electrical planning can be implemented independently of the later room and function programme. Economical and properly scheduled planning is possible while maintaining maximum flexibility in the use of office areas.

www.knab.net

OVERVIEW OF ENOCEAN MODULES FOR GENERAL APPLICATIONS

RoHS COMPLIANT 2002/95/EC

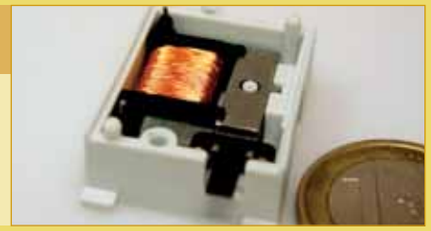
RoHS COMPLIANT 2002/95/EC

PTM 200 – THE ULTRAFLAT MINIATURIZED SWITCH MODULE

- Maintenance-free powering by finger pressure
- Optionally one or two rockers or up to four pushbuttons
- Dimensions 40 x 40 x 11.2 mm
- Actuating travel 1.8 mm
- Actuating force approx. 7 N

ECO 100 – ENERGY CONVERTER FOR LINEAR MOVEMENT

- Qualified for powering PTM 230
- Voltage approx. 5 V at 19 µF
- Dimensions 33 x 22 x 11 mm
- Actuating travel approx. 2 mm
- Actuating force approx. 2 N



PTM 230 – RADIO TRANSMITTER MODULE

- 2 digital inputs
- Dimensions: 20 x 25 x 6 mm
- Operation with ECO 100 or external energy source

STM 100 – THE SENSOR MODULE

- Maintenance-free sensor module
- Powered by mini-solar cell, 13 x 28 mm
- Dimensions 21 x 40 x 9 mm
- Operates for several days in total darkness
- Periodic presence signals
- 3 A/D converter inputs
- 4 digital inputs

RCM 110/120 – THE RECEIVER MODULES

- Wireless receiver module and actuator control module for receiving and predecoding EnOcean wireless transmitter signals
- Dimensions 18 x 42 x 5.5 mm
- 5 Vdc voltage supply
- 25 mA current consumption
- Basic functions: switch, blinds control, dimming and serial interface for bus systems (RS232)
- Power section dimensioned and integrated by user to match requirement
- Simple teaching of up to 30 wireless transmitters
- Memory function (for light and blinds scenes)

TCM 110/120/130 – ENOCEAN BIDIRECTIONAL

- 5 Vdc voltage supply • 33 mA current consumption
- Dimensions 24 x 42 x 5 mm

TCM 110: • Single-level repeater for EnOcean wireless telegrams

TCM 120: • Bidirectional wireless • Serial interface
• Modem functionality

TCM 130: • Software API for TCM 120 module • Programmable in C

- Supports bidirectional serial interface
- Four D/A inputs, four digital outputs

PTM 250 ENOCEAN EASYFIT – UNIVERSAL SWITCH INSERT

- Surface mounting without casing
- Switch program frame flat on the wall
- Compatible with following designs with 55 x 55 mm rocker:
  - BERKER S1, B1, B3, B7 glass
  - GIRA Standard 55, E2, Event, Esprit
  - JUNG A500, Aplus
  - MERTEN M-Smart, M-Arc, M-Plan
- Single or serial rocker
- Colours: white, aluminium, anthracite

STM 250 – WINDOW/DOOR CONTACT

- Maintenance-free powering by daylight
- Operates for several days in total darkness
- Immediate signal transmission as soon as window closes or opens, triggered by window magnet
- Periodic life signal
- Contact monitor (110 x 19 mm, height 15 mm) attachable to all frame profiles

RCM 250/255 – UNIVERSAL SINGLE-CHANNEL SWITCH ACTUATOR

EnOcean easyfit switch actuator for wireless switching of very different 230 V (RCM 250)/110 V (RCM 255) loads, e.g. incandescent lamps, high-volt halogen lamps or low-power motors. Up to 30 EnOcean PTM wireless switches or up to two EnOcean STM 250 wireless window contacts can be teached. Simple connection of the line voltage and load by screw terminals.

EPM 100 LEVEL METER / EPM 200 RADIO TEST SET

The electrician's installation tool for EnOcean wireless components – for range analysis and simple detection of signal quality and sources of interference.
EPM 200 radio test set contains EPM 100 and PTM 250 EnOcean easyfit switch

ANT ANTENNA PACKAGES

Ready wired antennas for fast and simple installation in locations with restricted reception quality.

EVA 100 EVALUATION KIT

Test board for simple startup of EnOcean wireless modules.

INNOVATIVE

RELIABLE COVERAGE PLANNING

Compared to installing wired systems, wireless systems provide much simpler installation as well as the flexibility to relocate or add to a system. Based on the physical principle of the propagation of radio waves, certain basic conditions should be observed. The following simple recommendations are provided to ensure successful installation and reliable operation of a robust radio network.

By Armin Anders, co-founder and head of product marketing, EnOcean GmbH

BASIC PRINCIPLES OF RADIO SIGNALS IN BUILDINGS

An EnOcean radio transmitter sends wireless transmissions to an EnOcean radio receiver. The receiver checks the incoming telegrams for accuracy and uses the data to control outputs. Radio signals are electromagnetic waves, hence the signal becomes weaker the further it travels.
Remember that coverage is decreased by specific materials found in the direction of the propagation. While radio waves can penetrate a wall, they are dampened more than on a direct line-of-sight path. Examples of different types of wall:

MATERIAL	ATTENUATION
Wood, plaster, glass uncoated, without metal	0 to 10%
Brick, press board	5 to 35%
Ferroconcrete	10 to 90%
Metal, aluminium lining	90 to 100%

In practice, this means that the materials used in buildings play an important role in assessing the radio coverage.
Here are some typical guideline figures:

LINE-OF-SIGHT CONNECTIONS:
typ. 30 m range in corridors, up to 100 m in halls

PLASTERBOARD WALLS / DRY WOOD:
typ. 30 m range, through 5 walls

BRICK WALLS / AERATED CONCRETE:
typ. 20 m range, through 3 walls

FERROCONCRETE WALLS / CEILINGS:
typ. 10 m range, through 1 ceiling

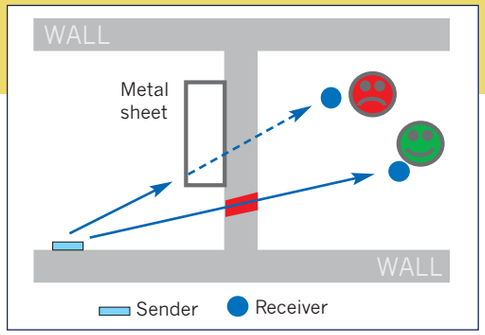
SCREENING

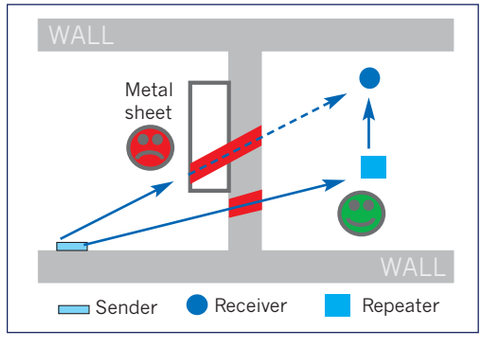
Objects made of metal, such as wall reinforcements, the metal foil of heat insulations or metallised heat protection glass, reflect electromagnetic waves and thus create what is known as radio shadow.

The main factors decreasing coverage include:

- **Switch mounted on metal surfaces** (typically 30% loss of range)
- **Use of metallic switch frames** (typically 30% loss of range)
- **Hollow lightweight walls filled with insulating wool on metal foil**
- **Inserted ceilings with panels made of metal or carbon fibre**
- **Lead glass or glass with metal coating, steel furniture**

TIP 1
Fire-safety walls, elevator shafts, staircases and supply areas should be considered as screening.



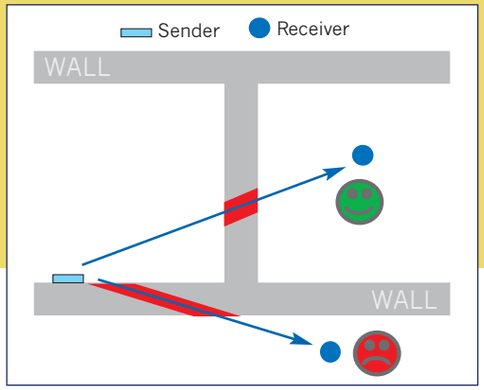


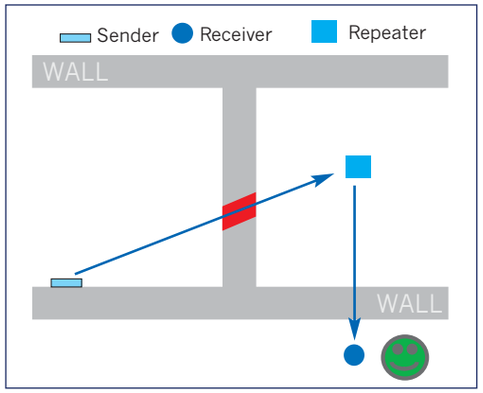
TIP 2
Avoid screening by repositioning the transmitting and/or receiving antenna away from the radio shadow, or by using a repeater.

PENETRATION ANGLE

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided.

INNOVATIVE

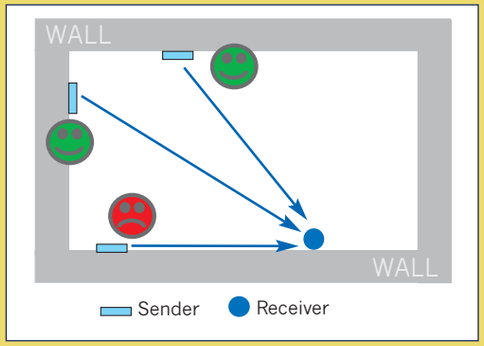




TIP 3
Avoid an unfavourable penetration angle by repositioning the transmitting and/or receiving antenna, or by using a repeater.

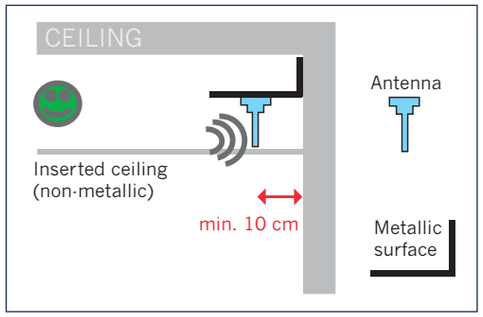
ANTENNA INSTALLATION

When using devices with an internal receiving antenna, the device should not be installed on the same side of the wall as the transmitter. Near a wall, the radio waves are likely to be subject to interfering dispersions or reflections. Consequently, position the antenna on the opposite or connecting wall.



TIP 4
Avoid radio propagation along a wall.

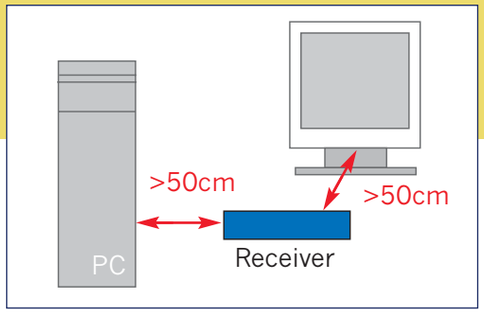
When using devices with an external antenna, the antenna should be mounted in a central location in the room. Where possible, the antenna should be at least 10 cm away from the wall or concrete ceiling .
A magnetic antenna needs to be placed on a large metallic surface to create an adequate antipole. Due to the polarisation of the radio waves, a magnetic base antenna should be placed vertically. Flexing the antenna cable during installation can result in irreparable damage (performance reduction through change of impedance level).



TIP 5
A so-called “active antenna” is a radio receiver with integrated antenna. It communicates with the actuator unit via a RS485 cable for example (“RS485 gateway”). Thus the antenna cable, which would loose performance with increasing length and could be folded during installation, can be avoided.

DISTANCE BETWEEN RECEIVER AND SOURCES OF INTERFERENCE

The distance between EnOcean receivers and other transmitters (e.g. GSM / DECT / wireless LAN) or high-frequency sources of interference (computers, audio and video equipment) should be at least 50 cm. However, EnOcean transmitters can be installed next to any other high-frequency transmitter without any problem.



TIP 6
The distance of the EnOcean receiver to different high-frequency transmitters should be at least 50cm, the transmitter position is not critical.

USE OF REPEATERS

In case of poor reception it may be helpful to use a repeater. EnOcean repeaters do not require any configuration (e.g. programming) and are put into operation simply by connecting them to the supply voltage. The various possibilities of use are shown by the illustrations in the chapters “Screening” and “Penetration”.

TIP 7
While planning, it may be worth considering retrofitting the system with a repeater.

In their basic function, EnOcean repeaters cannot be cascaded, telegrams already repeated are not repeated again (“1-level” repeater). Repeaters which can be switched to 2-level function are currently in preparation. This extended function will allow two repeaters to be cascaded which is required only in rare cases in the building industry.

TIP 8
Do not use too many repeaters as this is counterproductive (higher costs, telegram collisions).

FIELD INTENSITY METER

The EPM 100 is a mobile field intensity meter enabling the installer to determine the ideal mounting positions for sensors and receivers. Furthermore, faulty connections of devices already installed can be checked. The meter shows the field intensities of radio telegrams received and any interfering radio signals in the 868MHz range:

TIP 9
The EPM 100 field intensity meter can be used for on-site determination of the ideal mounting position and for identification of an interfering transmitter.

TIP 10
Even after careful planning, the EPM 100 should be used to verify proper reception at the receiver position during installation.

The flashing of one of the two GREEN light emitting diodes signals that the receiving field strength possesses sufficient power reserve for a reliable installation. There will be generous provision for subsequently changing conditions of the surroundings (i.e. additional screening caused by lightweight walls, shadowing by people etc.). For differentiation from a jammer the YELLOW light emitting diode simultaneously signals a valid EnOcean telegram. For further information, refer to the operating instructions provided with the EPM 100.

How to use the field intensity meter:
Person 1 operates the radio sensor and generates radio telegrams by pressing the button. Person 2 checks the field intensity received on the display of the device and thus determines the ideal position.

PLANNING INFORMATION FOR COMMERCIAL BUILDINGS

The radio coverage in commercial buildings is usually restricted by fire safety walls, which must be considered as screening. Inside the fire protected sections lightweight or glass partition walls are used with excellent radio wave propagation properties (except for metal reinforcements or metallised walls). Here are two common installation architectures:

Automation system (e.g. TCP/IP, LON, EIB):
For complete coverage, each fire safety section usually requires 1 or 2 central radio gateways to the automation bus.

Direct activation of the actuators:
Usually, the radio paths to be covered are not very long (“cubicle installation”) .

Unfavourable conditions can be improved by appropriately repositioning the devices (antennae) or by using a repeater.

Field intensity test set EPM 200

Download:
Further information regarding commercial and residential buildings as well as troubleshooting can be downloaded from our website:
www.enocean.com
(see products/kits and accessories)

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ENOCEAN TECHNOLOGY FOR ANY CONTROL APPLICATION IN BUILDINGS

In buildings, whether residential or commercial, sensors play a growing role. The simple function of switching on a light is already linked to the actuation of a sensor, the light switch. More complex control systems need very different kinds of sensor information, like temperature and humidity to regulate the climate in a room, to minimise the energy consumed in a building, or to operate access systems and report their status to building services management.

By Andreas Schneider, Executive VP, EnOcean GmbH

In specifying a building the different functions are seen as part of what can be called sections: lighting control belongs to the electrotechnical section for example, heating control to the HVAC (heating, ventilation and air-conditioning) section, or to the I&C (instrumentation and control) section. Above all these in the hierarchy is building services management, which accesses all information in and about a building. Often a building incorporates solar shading systems with reflecting louvres, which can be integrated into both lighting control and optimisation of room climate.

EnOcean technology is suitable for all sensor applications in a building. Based on wireless, it does away with all the wiring, which means cost savings in planning, installation and any later conversion of a building. What is more, wireless sensors can be fitted at the precise points where values are to be detected. The compatibility of the different wireless products allows simple creation of discrete bus solutions and the implementation of cross-sectional automation. Finally, EnOcean technology is batteryless, so wireless sensors can be installed in a building in large numbers. This absence of batteries and their replacement results in freedom from maintenance, enhancing the flexibility and quality of an overall system.

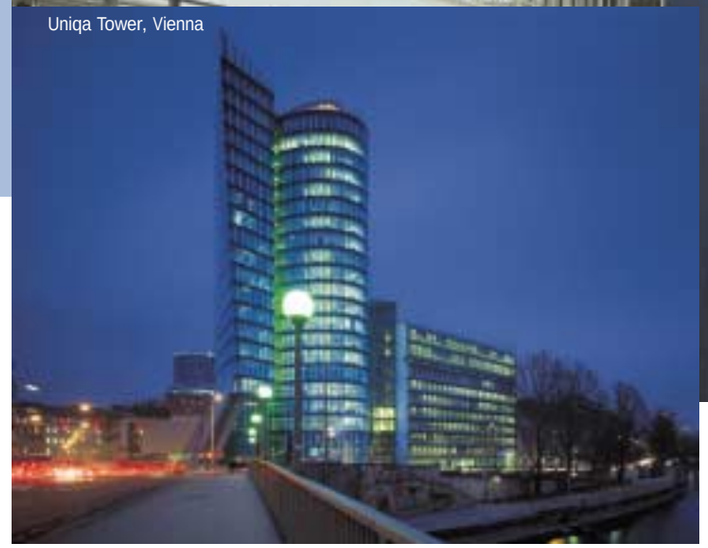
The following reference projects are examples of the enormous variety of applications:

1. LIGHTING CONTROL UPGRADE

This scenario will be familiar in many a home. You want to operate a new standard lamp from the usual light switch, or there is no light switch by the bed to turn off the lights when you go to sleep. These are typical cases that can easily be solved by affixing flat, surface-type light switches with piezo or electrodynamic energy converters and using a socket adapter or flush receiver. The technology is also used for lighting control in the building of new homes and business premises.

In the ecologically designed ‘Arche Noah’, a kindergarten in Tutzing, Germany, the entire lighting control was implemented by the PHC automation system from PEHA with Easyclick DIALOG wireless switches to minimise electrosmog in the building.

aviva Munich



Uniqa Tower, Vienna

Photo: UNIQA/Gerald Zugmann

2. CLIMATE CONTROL

The new Uniqa Tower in Vienna is an office building that incorporates the very latest design principles. Both the outer façade and the walls dividing the open-plan offices are of glass for maximum light penetration. The climate is controlled by complex ventilation systems and cooling ceilings driven segment by segment. The project uses Thermokon's EasySens building sensors, with integrated EnOcean technology, attached at the relevant locations for temperature detection. Wireless receiving gateways to the LON automation system produce the sensor information for the different control purposes.

3. FULL CROSS-SECTIONAL INTEGRATION

Bosch Siemens Hausgeräte fitted its new company headquarters ‘aviva Munich’ with EnOcean technology in 2003. The building, based on Feng Shui principles, was to offer sufficient flexibility so that configuration of the rooms can be altered at any time, speedily and with minimum effort, for differences in organisation necessitated by the market. This was implemented with wireless switches based on EnOcean technology, EasySens room control units from Thermokon and room controllers from Beckhoff with an EnOcean gateway. Networked by TCP/IP, these control lighting and blinds, and drive heating circuits and cooling ceilings. Alterations in the partitioning of the rooms are possible in next to no time by repositioning the wireless switches and sensors and suitably adapting the software in the room controllers.

In the meantime a very large variety of end-products is available with EnOcean technology. Buildings featuring the batteryless wireless solutions are to be found all over Europe. And in an increasing number of new buildings and renovation projects you find EnOcean as a discrete wireless solution or in conjunction with EIB, LON or TCP/IP-based automation. EnOcean can consequently and justifiably claim to be – the new standard in building automation.

www.enocean.com

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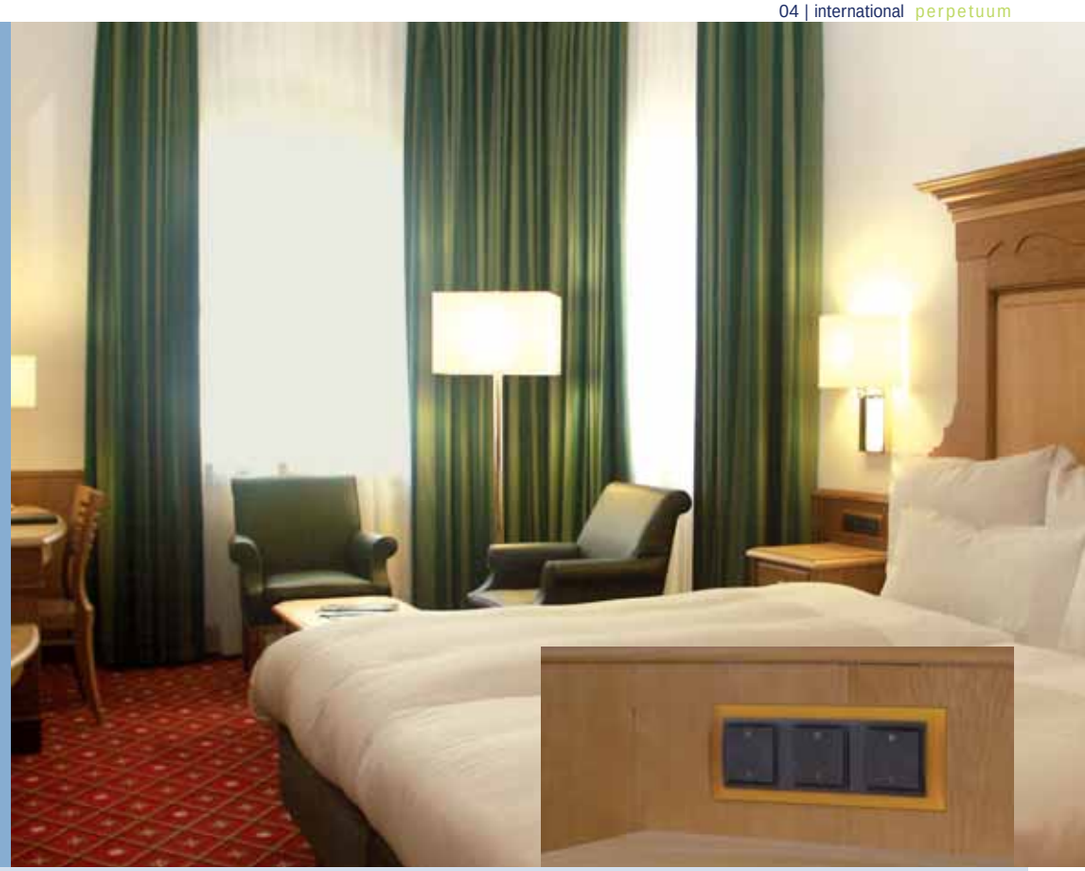
BAVARIAN TRADITION MEETS MODERN TECHNOLOGY

Four-star hotel features EnOcean wireless technology

The renovation of a hotel can present a special challenge. You have the substance of the existing building to match to the modern needs of its guests, which calls for planning skills and smart technology. And the four-star Platzl Hotel in Munich decided to tackle large-scale reconstruction while still operating.

By Robert Gerhäußer, regional sales manager and project coordinator for building systems technology, Wieland Electric GmbH, Bamberg



Lighting control by batteryless wireless switches in the comfortable, renovated hotel rooms

First class in a traditional style and excellently sited in the old quarter of the city – that is the Platzl Hotel. This traditional Munich hotel, between the central Marienplatz, the world-famous Hofbräuhaus and the shops of the exclusive Maximilianstrasse, offers typical Bavarian hospitality. Currently the four-star house is being modernised in two stages. 82 of its 166 rooms are already available, freshly renovated, to guests.

MODERN TECHNOLOGY AND BAVARIAN FLAIR

The link between Bavarian tradition and modern technology is fully reflected in the hotel's rooms. Wooden panelling on the walls, wine-red carpeting and ceilings with stucco edging now characterise the rooms – plus flat-screen TVs, air-conditioning, Internet links and automatic fire alarms. Famous cosmetic products stand ready for the guest in charmingly decorated bathrooms. The function rooms and toilets have also been renovated. The Platzl now has seven conference and banqueting rooms for up to 140 persons, with full daylight and all modern fittings. In addition to the Bavarian Suite, the hotel will soon also boast a Junior Suite. "What's special about our hotel is the link between a consistent Bavarian style, thought out in every detail, and the modern conveniences of an international house", says Folker Müller, director of the Platzl.

WIRELESSLY CONTROLLED LIGHT

Renovation was initiated to mark 50 years of ownership by the Inselkammer family. The first phase was completed earlier than expected in spring 2006. The second phase of rebuilding is planned for January through April 2007.

Work was (and will be) made more difficult by the fact that operation of the hotel continued in the background.

Noisy jobs like drilling had to be kept to a minimum or were only possible at certain times so that guests were not unnecessarily disturbed. Overall the time schedule set for renovation was very tight.

In terms of the electrical installation, these requirements were met by the gesis® RC wireless system from Wieland Electric. This sets up on batteryless wireless technology from EnOcean. The guest operates room lighting solely by two- and four-channel gesis RC buttons, matched in colour to the switch/socket range. The switch inserts are simply screwed onto walls and fitted furniture. This did away with any elaborate advance installation as would have been necessary in a conventional wired arrangement.

A four channel gesis® RC V actuator was fitted in each room and linked to the various lamps by prefabricated gesis® CON lines. Assignment of the individual wireless switches to the light circuits was performed upon startup by a simple teach-in routine. Here the light circuit to be configured is set to teach mode by pressing a button and then all wireless buttons are actuated that are intended to switch the particular lamp. A card switch at a room entrance is defined as the central on/off to switch all circuits with the exception of those for the safe, refrigerator and air-conditioning.

EFFORTLESS ELECTRICAL INSTALLATION

Use of the wireless gesis® RC system from Wieland Electric produced advantages for everyone involved in the project. Electrical planning was easily harmonised between engineers and interior designers, installation was carried out speedily and much of the usual accompanying noise was avoided. The wireless batteryless solution

ENABLED BY ENOCEAN

consequently meant cost savings all-around in the electrical installation.

The worldwide innovation batteryless wireless technology from EnOcean and implemented by Wieland Electric fits excellently into the overall concept of the Platzl Hotel. Compared to conventional wireless solutions there are no batteries to replace at a later date. Guests operate lights as they are used to, by simply pressing a button. That the pressure of their finger is generating the minimal amount of energy needed to power ultramodern wireless technology is something that goes on unnoticed in the background.

www.wieland-electric.com
www.gesis.com
www.platzl.de

NEW APPROACHES IN ELECTRICAL INSTALLATION

The components of the gesis® RC system from Wieland Electric make ducting and drilling, the laying of cables and wiring of switches things of the past. Buttons for lighting and sunshade control can be simply screwed or adhered at normal locations – and without any cabling.

They work wirelessly and need no external power supply, no battery. The necessary energy is generated in the switch itself just by pressing it.

Signals are transmitted by an EnOcean wireless telegram to the receiving devices, which are simply plugged into the installation by prefabricated gesis CON cables. Telegrams contain no instructions, the signals are converted into a switching command in the receiver. No software is needed to start up gesis® RC components. The user programs the operation of sunshades or lights by actuating a teach-in button on the module and the button to be assigned a function.

Gateways are available for integration into LON and EIB/KNX building bus systems.

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NEW HANDY BOOKLET AS USER OVERVIEW OF ALL PRODUCTS WITH ENOCEAN TECHNOLOGY

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EnOcean Munich: +49-89-6734689-30 or info@enocean.com.

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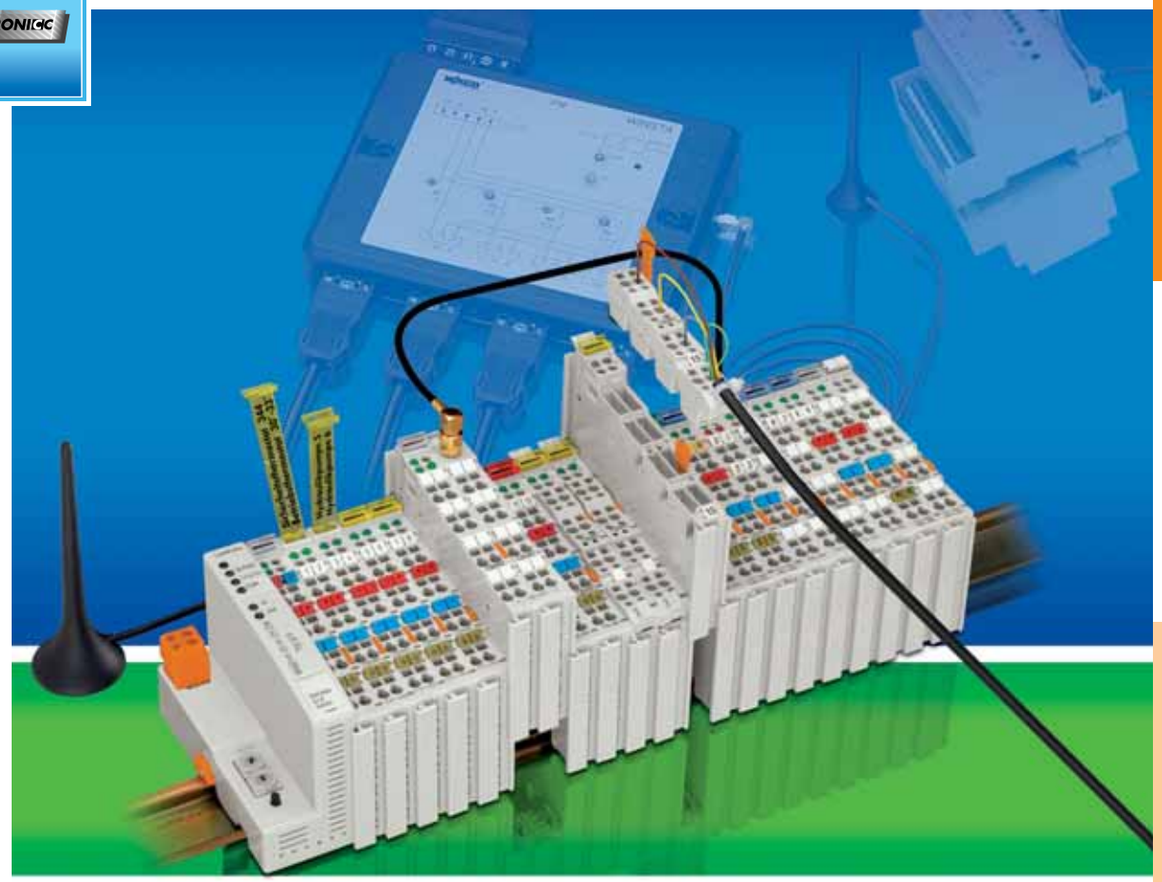
ELECTRONIC



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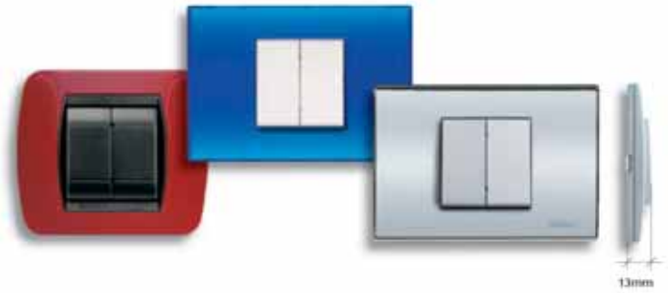
BTICINO PRESENTS NEW WIRELESS SWITCH CATALOGUE IN ITALY

Comandi radio is the title of a new catalogue from BTicino especially for design-oriented wireless products. BTicino is the market leader in Italy for building services engineering and well-known as the inventor of the modular switch design. Its series Living International, Light and Light Tech now also present batteryless wireless technology from EnOcean, a flexible addition to the MY HOME house automation system.

Download:
www.enocean.de / Partner / BTicino
More informations:
www.bticino.com



FLEXTRON – NEW BATTERYLESS WIRELESS SWITCHES FOR SWITZERLAND

The newly expanded ALADIN Easyclick range from Flextron offers building installation companies in Switzerland a broad selection of switches and receivers.

At the request of many customers, Flextron is presenting new wireless switches that are compatible with the Edizio Due series from Feller, these being delivered together with the matching Edizio Due frame. Additional mounting plates mean that the switches can also be used in multiple combinations.

The enlarged range of ALADIN Easyclick receivers and actuators includes switching, blinds and dimmer receivers, some in a variant for incorporation in a canopy, with much expanded programming possibilities for greater variety of use.

ALADIN Easyclick products from Flextron have proven their worth in very many applications, with special benefits in the renovation of conserved property, villas, offices, hospitals and schools. The ALADIN Easyclick range is obtainable in Switzerland from electrical wholesalers or Flextron.

www.flextron.ch

ALADIN EASYCLICK

FLEXtron

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SecuSignal FROM HOPPE –
– THE WIRELESS WINDOW HANDLE THAT SHOWS YOU WHAT YOU SHOULD KNOW ABOUT YOUR WINDOWS

By Thomas Lödel, PR manager, HOPPE AG

DOES THE FOLLOWING SITUATION SOUND FAMILIAR?

It is Monday morning and you leave home in a hurry. After closing the door you begin to think: Did I close all the windows in case it rains? To be sure, the only thing is to open the door, go back inside and check each window upstairs and downstairs.

How convenient it would be if you could see at a glance, before leaving the house, whether all windows are closed or not. SecuSignal, the new window handle generation from HOPPE with integrated batteryless wireless technology, allows you to do just that.

SecuSignal

WHAT SECUSIGNAL GIVES YOU

The system consists of one or more SecuSignal window handles with a batteryless wireless transmitter and the SecuSignal receiver.

The current selection of window handles comprises the attractive Atlanta in aluminium and brass, and Amsterdam in stainless steel. The colour of the SecuSignal wireless transmitter matches the handle.

As for all door and window handles from HOPPE, this brand name product also comes with a ten-year operational warranty. Once the receiver is connected to line voltage and the window handle is programmed, the transmitter reports the position of the handle directly by a wireless signal to the receiver. Here the status of the handle is indicated by coloured lamps: red for window open, yellow for window tilted, green for window closed. The particular window handle and thus the room is identified by a two-digit display on the receiver. In this way you can check at a glance, anytime and centrally, whether a window is open or closed.

SecuSignal reports the position of the window handle by a batteryless wireless transmitter

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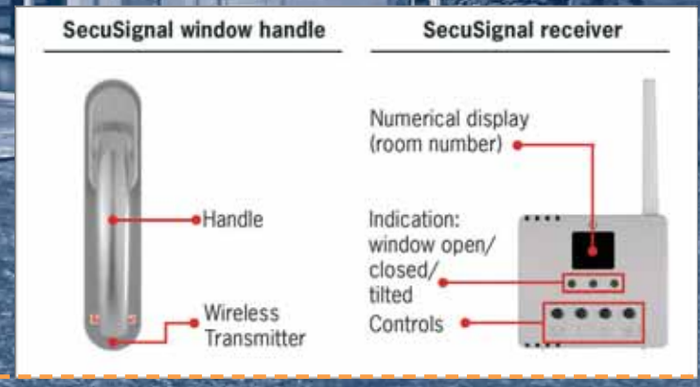

NO BOTHERSOME CHECKING AND REPLACEMENT OF BATTERIES

The SecuSignal transmitter works wirelessly and without the usual batteries. Energy is produced by a patented system when you turn the SecuSignal window handle. Obvious advantages are that there are no bothersome checking and replacement of batteries and no environmentally harmful batteries to be disposed of. The SecuSignal transmitter is entirely maintenance-free.

For high transmission security, the wireless signal is sent multiply and in short succession when a window handle is turned. The range inside a building, depending on what type, is about 30 metres. The advanced technology means that SecuSignal operates on very little transmitting energy, making the system quite harmless in terms of electrosmog, and it is of course CE certified.

All it takes to equip a house with SecuSignal is a SecuSignal receiver and a SecuSignal handle for each window in the house

UP TO 128 WINDOW HANDLES AT A GLANCE

Because of its wireless batteryless technology, SecuSignal is simply and speedily installed, and suitable for all standard windows, also TBT (tilt before turn) windows. As many as 128 SecuSignal window handles can be managed from one receiver, composing a maximum of 99 user-programmable groups (e.g. all living room windows, all child's room windows), and centrally shown on the receiver's two-digit display.

www.hoppe.com

HOPPE

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Oventrop thermostat Uni LHZ+DynaTemp
THE INTELLIGENT, EASY TO OPERATE ROOM TEMPERATURE CONTROLLER

The thermostat with an electrical cutback function allows individual room temperature control to match needs within the framework of intelligent building engineering, controlled by a wireless window handle.

ADVANTAGES

- Low-cost installation
- Set up on existing infrastructure
- Clear, flexible operation through browser interface
- Supported by system administrator
- More convenience and safety through central status monitoring of windows through the window handle / high transmission security
- No software installation necessary
- Global access on the Internet
- Updates for installation of new functions

Many different demands are made of intelligent building engineering. When it comes to room heating this means that the supply of heat to a radiator should be automatically reduced when rooms are not used or "wildly" ventilated.

In public buildings in particular (administrations, educational institutions, etc) rooms are often heated longer than necessary or a thermostat is not cut back when they are ventilated. But a room temperature lower by just 1°C can produce energy savings of about 5 to 6%. Given such substantial energy saving potential, the use of intelligent but easy to operate room temperature controllers is thus especially recommendable in public buildings. And controlled window ventilation should also be allowed for.

This radiator control and controlled ventilation can be implemented by the Oventrop Uni LHZ thermostat combined with the DynaTemp 100/16 room temperature controller plus SecuSignal wireless window handles from HOPPE.

oventrop

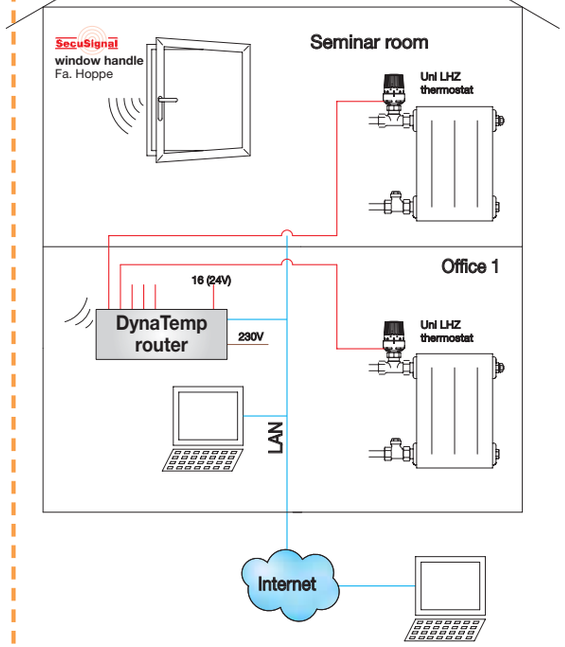
The Uni LHZ thermostat (M30 x 1.5) allows timed temperature control by means of an integrated, electrically heated liquid sensor without reset. DynaTemp 100/16 is a system that is connected to a building's internal data network by a simply installed application router – comparable to the installation of DSL routers. The system makes use of the existing infrastructure (cable ducts, computer network).

Room temperature is cut back by driving a resistor in the Uni LHZ thermostat. The cutback phases can be freely programmed. In normal operation of the heating the Uni LHZ will work without any auxiliary energy and regulates the set temperature.

Use of programmable Uni LHZ thermostats, connected by the application router to the data network, makes it possible to check the setting of individual thermostats and to operate them from any PC integrated in the network or by Internet access. Additionally, the degree of opening of windows can be sent to the router by SecuSignal wireless window handles from HOPPE. These window handles are enabled by EnOcean technology and consequently need no wiring and no batteries. The incoming signals are processed by the router with its integrated receiver, and appropriate pulses are sent to a thermostat, which will switch to cutback or normal mode depending on window position.

The result is individual room temperature control to match the situation plus a substantial energy saving.

www.oventrop.de
www.hoppe.com



PEHA INNOVATIONS IN THE BATTERYLESS AND WIRELESS EASYCLICK SYSTEM

At the light+building show 2006, the long established PEHA company, headquartered in Lüdenscheid, presented interesting innovations from its Easyclick wireless system, which has been attracting attention for some time already. A special benefit of the Easyclick system is that it manages entirely without batteries.

By Christian Sturm, PR manager, PEHA Paul Hochköpper GmbH & Co. KG

The Easyclick Plus wireless system at a glance: Easyclick Plus Up 1-channel receiver, Easyclick window contact and Easyclick four-channel remote control.

The pulses that trigger building control functions are produced simply by soft finger pressure – without any current source. Easyclick offers the user a whole new freedom in interior design, because transmitters can be simply adhered to a wall at any point. What is more, the system will work for decades without any maintenance.

EASYCLICK UP RECEIVER PLUS – SIMPLICITY OF USE, MULTIPLE POSSIBILITIES

Easyclick UP (= flush-mounted) receivers Plus are a new generation of receiving devices that considerably expand the functionality of the system. Each can handle as many as eight functions, which are simply selected and stored on the device together with their fine settings by pushbutton. That simplifies the choice of device and its initial operation. Three different receivers are available:

SINGLE- OR DUAL-CHANNEL EASYCLICK UP RECEIVER PLUS

Functions:
on/off, staircase light, automatic off, continuously pulsed, ventilation, save and recall four lighting situations, fan control with window supervision.

SINGLE-CHANNEL EASYCLICK CEILING ROSE DIMMER RECEIVER PLUS

Functions:
dim with and without memory and one- or two-button operation, on/off/dim, staircase light, save and recall four lighting situations.

Another speciality: these receivers can be concealed in a ceiling rose for simple wireless control of suspended lights for example.

EASYCLICK UP RECEIVER PLUS FOR ROLLER BLINDS AND WINDOW SHADES

Functions:
up/stop/down/louver adjustment by two or four buttons, sunshade, automatic, safety function, save and recall four positioning situations.

EASYCLICK WINDOW CONTACT – MORE SAFETY AS A RETROFIT TOO

The Easyclick window and door contact also works without batteries. It draws its voltage from an internal, solar-driven energy storage that can easily manage for several days without sunlight. As soon as a window is open or closed for example, this triggers a window magnet. The device emits a signal that is detected by Easyclick receivers and results in the execution of certain functions. In this way it is possible to block an extractor hood if it is in the same room as an open fireplace and the window is closed. If the hood were switched on, carbon monoxide in the room would be enriched. This possible source of danger can be reliably eliminated by the Easyclick window contact. It fits all frames to maximise safety, and is easily retrofitted too.

EASYCLICK FOUR-CHANNEL REMOTE CONTROL – EXTRA CONVENIENCE IN THE PALM OF YOUR HAND

The Easyclick wireless system is usually operated from stationary, wall-mounted transmitters. Now there is the possibility of adding a four-channel remote control. The attractively styled device fits in every pocket, ready to hand to operate lighting, blinds and shades or open a garage gate. The mobile Easyclick transmitter will activate as many as four lighting situations at the push of a button.

www.peha.de

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SRC-KNX/ENO gateway (32 channel AP) VARIABLE INTERFACE BETWEEN ENOCEAN WIRELESS SENSORS AND EIB/KNX BUS

By Heiko Schnaubelt, head of development, Thermokon Sensortechnik GmbH

The SRC-KNX/ENO device serves as a gateway between EnOcean wireless sensors and the EIB/KNX bus. It comes with 32 channels, each of which can be assigned one of the following functions:

Wireless EnOcean switch
- Switch (on/off/throw/valuator)
- Switch and dim
- Blinds up/down

Temperature sensor with selection of
- Presence button/switch
- Setpoint setter
- Stepping switch
- Humidity sensor
- Window contact
- Binary input
- Light sensor
- Motion detector

The device can be surface-mounted (e.g. on brick or wood surfaces), and an adapter frame is available for attachment to flush-type boxes. When installing the device it is necessary to observe the range of the EnOcean sensors that are to be linked to it. Shielding objects (e.g. metal cabinets) or sources of interference (e.g. computers, electronic transformers, control gears) close to the gateway should be avoided. Further details of planning the range and on the subject of RF penetration can be found in the sensor data sheets.

The device is connected to the EIB/KNX bus by a bus terminal. Correct poling of this terminal is shown by a schematic print inside the device. The voltage supply to the device is through the bus.

More information on the new website: www.thermokon.de

thermokon Sensortechnik GmbH

VISIONARY

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ENERGY AUTONOMOUS WIRELESS SENSORS – FROM CRAZY IDEAS TO MASS MARKET PRODUCTS

By Frank Schmidt, CTO EnOcean GmbH and Dr. Wolfgang Heller, Product Line Manager EnOcean GmbH

Atmos, a clock operated by differences in temperature

Just ten years ago the idea of reliably operating different kinds of wireless sensors alone on their ambient energy was still considered to be somewhat unreal – something for perpetuum mobile inventors. But if you enter "energy harvesting" on an Internet search machine today, you are likely to get half a million hits. There is no doubt about it, the idea no longer belongs to the fringe. Surprisingly enough though, there are very few products on the market, to date at least, that have the potential for production in large numbers to go into mass market applications. This article illustrates major technical challenges and how they are overcome on the way to creating energy autonomous wireless sensors for a mass market, exemplified by selected products from EnOcean. It is shown how innovative technical concepts often make it necessary to "reinvent" all parts of a system, and to actually further accelerate technical progress.

Devices powered by energy from the environment are not new. In addition to methods of using energy produced by wind and water, which everyone will have heard of, a lesser known but technically very interesting product deserves mention: the Atmos clock from the Swiss company Jaeger-LeCoultre, which has been produced since 1936.

This clock possesses a capsule filled with ethyl chloride that expands as the temperature rises and contracts as it falls, making the capsule move like a concertina to wind a main spring. A change in temperature of only one degree centigrade is sufficient for two days of operation. For efficient use of the minimal amounts of energy, the engineers had to take a new approach. So the balance only executes two torsional oscillations per minute, and especially low-wearing, oil-free bearings were designed. All parts are permanently in equilibrium, so no effort is wasted working against gravitational force. The new concept of powering the clock from changes in ambient temperature could not be applied directly to existing technology – a feature of innovative ideas that we also encounter in energy autonomous wireless sensors.

Such fascinating and technically sophisticated products, despite all the innovation, are not automatically suited for a mass market. Systematic assessment of the potential of different ambient energy converters, allowing for size, cost and reliability, is an essential first step in judging technical feasibility with a view to a market.

If energy converters like solar cells, vibration converters or those for temperature gradients are to be a marketable replacement for batteries, various factors need to be considered. It takes low cost (size and technology), low response thresholds and an adequate energy surplus to cover periods when ambient energy is lacking. The result is that you have very small amounts of energy available that, as in the case of the above clock, call for a redesign of the entire system from the point of view of energy.

DEMANDS OF WIRELESS TECHNOLOGY AND ENERGY MANAGEMENT

Comparison of the average energy available with the energy requirement of wireless systems with which the range necessary for many products (some tens of meters in buildings, also through several walls) can be achived quickly shows that continuous operation of wireless transmitters or receivers is out of the question. This is seldom a restriction, however, because many sensor systems are intended to transmit only relatively small amounts of data and at relatively large intervals (in relation to the duration of transmission). Performing all operations as fast as possible is the real answer to saving energy. While it takes a lot of effort to increase the efficiency of radio frequency modules, for example, and the result is only slight, a multiple of the energy can be saved by executing all phases of operation very fast and always deactivating the modules not needed.

While some modules can be fully deactivated, others must operate permanently. Special cases are threshold switches, which activate electronic circuitry when a certain voltage or sensor signal appears, and timers, which initiate periodic action

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like reading out a sensor. Such modules can fast dominate the energy requirement and consequently need to be optimised with a hard hand. One result is the timers developed by EnOcean for the STM 100 and STM 250 sensor modules, drawing only about 20 nA of current and completely shutting down all other components during sleep phases. The extreme optimisation produces a reserve of up to one week even in complete darkness – just from the capacitor on the board. The same applies to sensors as to wireless transmission: activating and deactivating them as fast as possible saves energy. This procedure is especially effective in the case of slowly changing measured parameters because it enables very small duty cycles. When you have to analyse fast events like vibrations on parts of machines however, it is best to preprocess the measured values. In a best-case situation no measured data are transmitted but simply the status, decisions or warnings. In the case of the STM 100 sensor module for instance, measured values are only transmitted if there is a difference from those last sent – because it takes more energy to transmit than to measure.

INTEGRATION AND MINIATURISATION

On the basis of integrated devices, fusing all specific requirements of energy autonomous wireless sensor modules in a single chip, it is possible to achieve a substantial reduction of size and cost accompanied by greater performance and flexibility. A building block model is suitable for energy converters and energy storage mechanisms, enabling composition of the optimal modules for an application. The meaningful range of available energy should be made accessible through a minimum number of variants of the individual energy converters and energy storage mechanisms. High transmission security and resistance to tampering and interception are major requirements today of wireless systems. The EnOcean protocol can consequently implement encoding of data against illicit interception or manipulation. Transmission security is becoming increasingly important because of the growing use of wireless systems.

LONGTERM TRENDS

Generally you find a trend towards more complexity (e.g. distributed intelligence) and an increased attempt to see whole systems in their interaction and optimise them. You might say that sensor systems are becoming more similar to living organisms and collectives in that they act increasingly autonomously, exchange information, employ dynamic strategies for more efficiency, and influence one another in a specific manner. The in part absolutely astonishing and technically unsurpassed results of the evolution of living organisms deserve more intensive and systematic study in this context, because as Thomas Edison once said:

"Until man duplicates a blade of grass, nature can laugh at his so called scientific knowledge."

INTERNATIONAL

ALCOM NOW SELLING ENOCEAN IN THE BENELUX

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Alcom offers solutions in the segments semiconductors, embedded modules, passive and electromechanical components, displays, optoelectronics and energy conversion. All product lines are accompanied by the excellent service of a highly qualified team of product managers, application engineers and consultants.

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PRESS ECHO

■ High Tech Magazine – September 2006

PEEL-AND-STICK ELECTRONICS

Someday, installing a thermostat or remote volume knob for a home audio system might be as little effort as putting up a new air freshener. Germany's EnOcean has come up with a series of sensors and switches that can extract energy from the environment and then transmit information via radio signals to a computer, which can then take the requested action. Because the sensors don't need to be linked to the building's electrical wiring, they can be installed without retrofitting. A dimmer switch, in other words, can be plunked on the wall without the need for cutting holes. "One of the hot markets we are seeing is home automation," said Jim O'Callahan, vice president of EnOcean's U.S. operations.

■ High Tech Magazine – September 2006

CASE STUDY: WIRELESS SENSORS OPEN THE DOOR TO ENERGY MANAGEMENT

A convenience store chain solves a complex problem with wireless connectivity and power-harvesting technology. To maximize the efficiency of refrigeration and reduce overall operating costs, XtraMart convenience stores turned to National Resource Management (NRM), a provider of remote energy management solutions. NRM's retrofit of the facilities relied primarily on traditional hard-wired sensing and control, but it's installation of a simple door sensor turned out to be far from simple, leading to the company's adoption of cutting-edge technology. Adding wireless, power-harvesting capabilities to the door sensor … we specifically went for the EnOcean solar-powered door-switch.

■ EE Times – July 2006

LANDSCAPE OF INNOVATION

Poised to launch in print and online, EE Times Europe represents startup culture within tradition of excellence. What do the following companies have in common: EnOcean, Innovative Silicon, PolymerVision, Revolt Technology, Sequans Communications, Siano Mobile Silicon and Teraview? Savvy readers will recognize them as a mix of startup and emerging enterprises that are shaping tomorrow's global technology landscape. These companies have another thing in common: They are all European. And while they are not from Silicon Valley, they are very much of Silicon Valley in temperament, ambition and culture.

■ Industrial Technology – June 2006

WIRELESS SWITCHES ARE SELFPOWERED

Steute has taken wireless switch technology to a new level with a range of “fit and forget” devices that work totally self-sufficiently. Back in 2004, Steute opened up a host of application possibilities with a range of wireless position switches which used low energy EnOcean radio technology to transmit their signals. The energy for the transmission was generated by means of a high-input battery or a miniature solar cell. But now the company has taken the technology to a new level with a new generation of devices that produce their own operational power, and so dispense with the need of cables, batteries or light.

■ L’Usine nouvelle – May 2006

UN INTERRUPTEUR AUTONOME EN ÉNERGIE

Avec Easyfit, EnOcean a développé des modules sans pile ni câbles pour des applications de contrôle et de surveillance á distance.

Qui n’a jamais rêvé d’une télécommande sans pile ou d’un interrupteur que l’on peut déplacer à volonté sans avoir besoin de tirer un câble électrique à chaque fois? EnOcean combine ces deux principes (absence de pile e télécommande par radio fréquence) sous la forme des modules prêt à l’emplois. La «spin off» du géant Siemens, créée en 2001, arrive en France, au travers du distri-buteur Pyrecap, avec la deuxième génération de ses produits Easyfit, qui multiplie les sources.

EVENTS

NOVEMBER 2006

November 14-17 – electronica 2006, Munich, Germany
New Munich Trade Fair Centre, EnOcean exhibits in Hall A4,
Booth A4.266, www.electronica.de

November 15-16 – Wireless Congress, Munich (at electronica)
15.11., 17:30 p.m.: Presentation by Dr. Wolfgang Heller (PM Enocean),
Subject: “Wireless Sensor Networks Powered by Smart Energies“
http://www.wireless-congress.com/

November 28-29 – International Congress for Wireless Sensors & Networks, Paris
Conference & Exhibition – 2nd Edition
28.11., 17:15 p.m.: Presentation by Armin Anders (Vice President PM EnOcean),
Subject: “Energy Harvesting for Power Source for Sensors Networks“
Info: http://www.icwsn.com/home/

JANUARY 2007

January 24-28 – World Economic Forum, Davos, Switzerland
Participation by Marcus Brehler, CEO of EnOcean, www.weforum.org

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