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MAINTENANCE-FREE WIRELESS SWITCHES & SENSORS

02

INTERNATIONAL EDITION

REVOLUTIONARY
Energy from the environment – the holy grail of wireless sensor networks?

INNOVATIVE
Universal switch insert – EnOcean easyfit

INQUISITIVE
EnOcean goes USA

CONTENT

+++ NEWS +++ On March 9th EnOcean's equity capital was boosted by a further 10 million euro. The new investor is the Swiss SAM Private Equity (http://www.sam-group.com). The SAM group invests in sustainable technologies, and sees batteryless wireless as an ideal contribution to this strategy.
The former investors 3i, Wellington Partners, Siemens VC and Baytech Venture have also participated in the financing. +++

+++ 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 reader,

Munich, April 2005

We've been hearing the catch phrase wireless factory more and more in recent years. But things didn't seem to be moving far beyond the phrase, maybe breaking out into a demonstration at one show with the promise "available soon". A walk around this year's Hanover Fair in Germany, however, showed solutions with integrated EnOcean wireless technology on at least five of the booths. These are in part already obtainable and incorporated in first systems, while the others will soon be generally available.

EnOcean technology set out on its triumphal advance into building automation in 2003 with sensor solutions like wall-mounted switches and air-conditioning controls. In the meantime tens of thousands of these wireless sensor solutions are working successfully in buildings of every kind and size.

The steute company really started to get interested in batteryless radio back in 2002. Some people may think a switch is a switch, whether in a building or in an explosion-proof industrial casing. In principle it is still a switch, but there are much tougher demands for reliability (e.g. realtime conditions), endurance and resistance to adverse environments. And these are the major differences to building systems engineering. Only cabled systems can currently guarantee realtime constraints of the order of milliseconds. But on the other hand there's a demand for flexibility, less cabling and fewer, potentially dangerous, electrical circuits.

Safety requirements can be implemented wirelessly too. All it takes is the right system architecture.

To support our global growth and expansion in selected industrial segments, EnOcean has just closed a Series C round of financing. With SAM Private Equity as a new lead investor and existing investors 3i, Siemens VC, Wellington Partners and Baytech Ventures joining in, we received 13 million USD of funding.

Immediately afterwards, EnOcean staffed its US operations with seasoned manager Jim O'Callaghan as VP Sales & Marketing for North America.

Markus Brehler,
Chief Executive Officer, EnOcean GmbH

REVOLUTIONARY

ENERGY FROM THE ENVIRONMENT – THE HOLY GRAIL OF WIRELESS SENSOR NETWORKS?

A familiar problem in wireless sensor networks is the relatively high power consumption of bidirectional sensor nodes, and the consequent need for frequent battery changes. EnOcean has a solution to this, a combination of energy-autonomous wireless sensors and ZigBee networks. Here the extremely low energy needs of EnOcean wireless transmitter modules are utilized for energy-autonomous operation of sensors. An externally powered EnOcean/ZigBee gateway converts EnOcean wireless signals to ZigBee, and in this way allows use of the network functionality plus networking with other ZigBee components. The gateway for the purpose is currently being prototyped by EnOcean partners.

By Armin Anders, Vice President Product Marketing, EnOcean GmbH

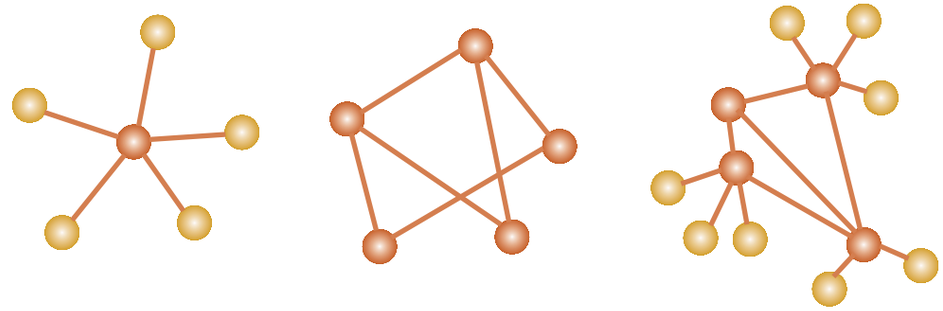
WHAT IS A MESHNET?

Meshnets are a collection of autonomous wireless nodes, decentrally linked to one another, and forming a self-organizing, self-healing, dynamic ad hoc network. Network control is split up among the nodes, enabling multiply redundant communication routes through the network. That makes data exchange possible between nodes that temporarily have no direct link to one another, because of shadowing or adverse reflection for instance. This method also allows large distances to be covered, despite limited transmitting power, by what is called handover from one node to the next.

ENOCEAN IN THE MESHNET

Handover functionality and redundancy for failsafety in mobile ad hoc networks are produced by routing. Each user knows the network infrastructure of the environment, and saves this in routing tables, where it can be constantly updated. In this way the data of a particular user can be forwarded to a communicating partner by the most direct route. If a station drops out, the data are sent to their destination by alternative nodes. Practical implementation is by appropriate software. The hardware platform of the wireless node requires a bidirectional wireless module with a powerful microprocessor and sufficiently large program and data memory. The TCM 120 module from EnOcean is an excellent solution here, because all the hardware components needed are ready integrated. Programming is possible by the TCM 130. Hamburg University is presently developing prototype routing software based on TinyOS.

REVOLUTIONARY



STAR
- Most cost-attractive solution (simplest design)
- Lowest energy requirement (sensor is only woken up in certain conditions)

MESH
- Scalable for wide-area coverage (wireless node handover)
- Highly rugged and reliable (flexible routing)
- Sensor nodes are powered (constantly on standby)

HYBRID
- Lowest energy requirement of sensors
- Highly rugged and reliable
- Scalable for wide-area coverage

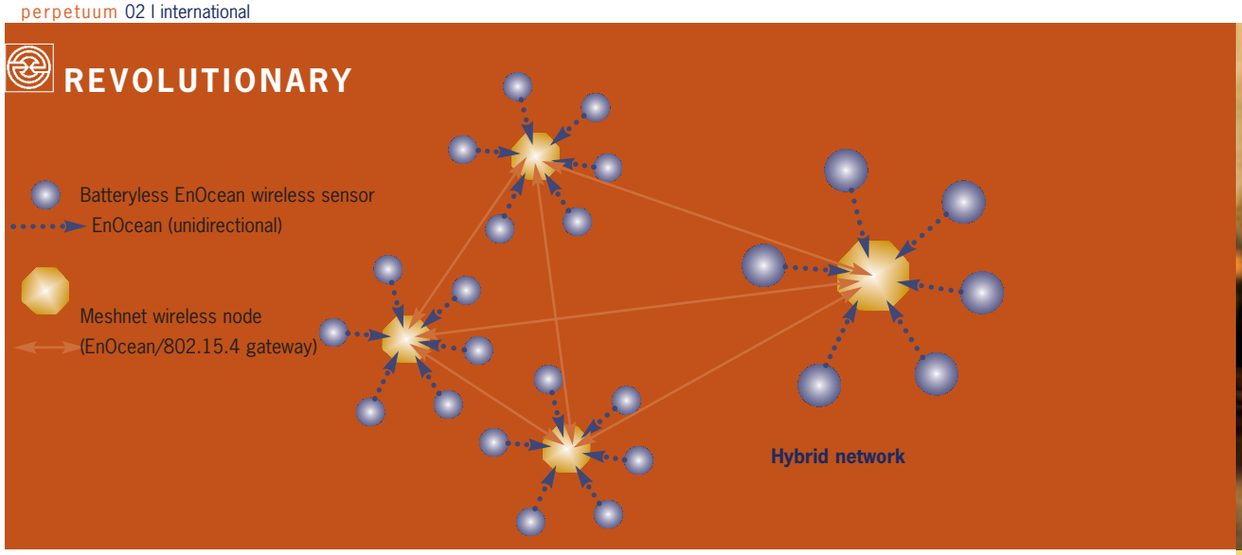
Typical topologies in wireless sensor networks are the star, the mesh and a mixture of the two, i.e. hybrid (source: AMA)

MESHNETS ARE IDEAL FOR DATA ACQUISITION IN A TERRAIN LACKING COMMUNICATION INFRASTRUCTURE

By ad hoc we understand simple, flexible communication independent of infrastructure and locality. Participants in communication are not tied to an infrastructure because this is produced by the meshnet nodes. That enables use in a terrain where access and movement are exceedingly difficult if at all possible, e.g. areas of conflict or struck by disasters, and military missions. Meshnet technology allows recording of seismic activity in an earthquake-endangered region through airdropped sensors. Wireless sensor networks can register soil humidity for agricultural purposes, collect climatic data in primeval forests, monitor oil pipelines or containers onboard ships.

POWER CONSUMPTION IN A MESHNET IS PROBLEMATIC, INVOLVING FREQUENT BATTERY CHANGES OR WIRED POWERING OF NETWORK NODES

Every wireless node in a meshnet must be equipped with sufficient intelligence and a transceiver (a combination of a transmitter and a receiver that is always ready to listen). Meshnets consequently offer rugged and reliable data communication, but the intelligent wireless nodes have a large energy requirement. Numerous experts are currently discussing the applications for wireless sensor networks where the sensors themselves are part of the meshnet. The power needs of such sensor nodes are an obstacle in many an application, however, for example commercial building automation, where changing batteries is unacceptable: "Energy management remains a worry" (Paul Ehrlich, Trane).



EnOcean technology is the ideal addition to wireless networks to create batteryless and maintenance-free, wireless sensor networks

THE SOLUTION – THE HYBRID NETWORK

EnOcean enables the wireless connection of batteryless sensors to form a meshnet-based infrastructure. The batteryless wireless sensors are configured in a star-shaped topology, the powered actuators take the form of a meshed wireless network, resulting in a hybrid network.

WHAT IS ZIGBEE?

The availability of a product range that is independent of just one producer is a major requirement for broad-based market penetration of a new technology. ZigBee is a wireless standard specially developed for data transmission in sensor networks (www.zigbee.org). A number of wireless sensor networks based on ZigBee are currently being designed in the USA. EnOcean has been a member of the ZigBee Alliance since the beginning of the year, contributing aspects of batteryless sensor technology.

ENOCEAN – IDEAL ADDITION TO ZIGBEE-BASED SENSOR NETWORKS

All it takes to combine energy-autonomous wireless sensors and ZigBee networks is an EnOcean/ZigBee gateway, as is currently being developed at Hamburg University. EnOcean technology is thus the ideal addition to wireless networks to create batteryless and maintenance-free, wireless sensor networks: "Energy from the environment, a holy grail for wireless sensors?" (Harry Forbes, senior analyst at ARC).

ZigBee™ Alliance
Wireless Control That Simply Works

EnOcean is a member of the ZigBee Alliance, an association of companies working together to create a global standard for wireless sensor networks

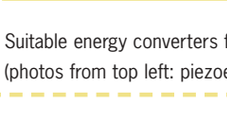
INNOVATIVE

ENERGY HARVESTING – ENERGY FROM THE ENVIRONMENT

Dear reader,

In this issue we should like to present you the latest trends in so called energy harvesting, the gleaning of minimal amounts of energy from the environment. Following that you will find an overview of all current EnOcean wireless products for general applications.

By Armin Anders and Dr Wolfgang Heller, Product Marketing, EnOcean GmbH

	Type of energy used	Converter	Dimensions of converter element	Energy source	Energy produced
	Mechanical energy	Piezoelectrical element	20 x 6 x 1 mm	e.g. button pressure 7 N x 3 mm	200 µWS per actuation
	Thermal energy	Thermocouple	5 x 5 x 2 mm	Temperature difference 5 K	20 µW permanent
	Light	Photovoltaic cell	10 x 20 x 2 mm	Light 400 lux	20 µW permanent

Suitable energy converters for EnOcean Smart Energy wireless sensors
(photos from top left: piezoelement, thermocoupler, miniature solar cell)

The principle of energy harvesting, i.e. gleaning extremely small amounts of energy from the environment, has been around for a long time (e.g. generation of energy for quartz watches from motion or light). For technical reasons, the idea of operating a wireless link, commercially, with energy from the environment was to date only possible with solar cells, and outdoors where there is sufficient light (e.g. traffic counting sensors, wind meters). EnOcean is the first company worldwide, and the only one, to offer commercial solutions for operating wireless links in low-light indoor surroundings, or by energy sources that are an alternative to light.

Among the products presently on the market are energy-autonomous, piezo-based wireless switch modules (PTM 100 button actuation generator, 7 N x 3 mm), batteryless wireless sensor modules (STM 100 miniature solar cell, 1 x 2 cm), and matching wireless receiver and transceiver modules. An electrodynamically powered wireless module (PTM 200, 5 N x 1.5 mm) is now also available, and other high-efficiency, micro energy converters are currently being developed at EnOcean. These include generators to produce energy from vibration on automobile tire rims or moving machinery, electrodynamic generators for energy from rotating shafts, and thermo generators that deliver energy through temperature differences by the Seebeck effect. Efforts are also focused on concepts for generating energy from electromagnetic radiation (through a noise converter), and from muscle contraction (through implanted MEMS generators).

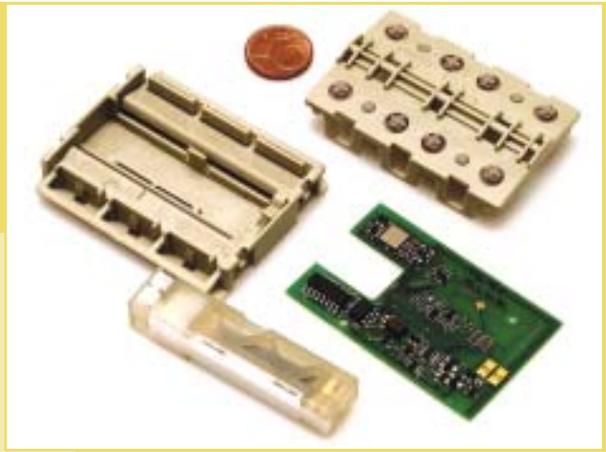
Autonomous wireless sensors show the way to very diverse applications, with enormous future potential. EnOcean is currently investing primarily in the development of new and improved energy generators for further applications, with emphasis on cost reduction and miniaturization.

INNOVATIVE

OVERVIEW OF ENOCEAN MODULES FOR GENERAL APPLICATIONS

PTM 100 – SWITCH MODULE

- Autonomous wireless transmitter, powered by finger pressure (piezo)
- Low headroom
- Mechanical interface for
  - up to four rocker switches
  - up to eight buttons
- Ecological – radiates less than a conventional switch
- Unique 32-bit identification



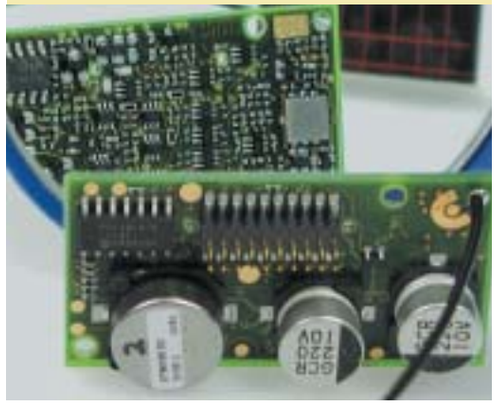
Above: PTM 100 switch module with piezo technology

PTM 200 – ULTRAFLAT MINIATURE SWITCH MODULE

- Maintenance-free energy by finger pressure
- Optionally one or two rocker switches, or up to four buttons
- Dimensions: 40 x 40 x 11.2 mm
- Actuation path 1.5 mm
- Actuation force approx. 5 N

STM 100 – SENSOR MODULE

- Maintenance-free
- Powered by miniature solar cell 1 x 2 cm
- Capable of operating several days in complete darkness
- Periodic presence signaling
- Three ADC inputs
- Four digital inputs

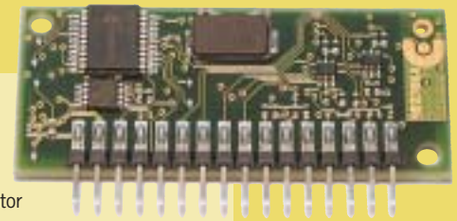


ENOCEAN EASYFIT – UNIVERSAL SWITCH INSERT

- Surface mounting without case
- Switch program frame flat on 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
- Colors: white, aluminum, anthracite

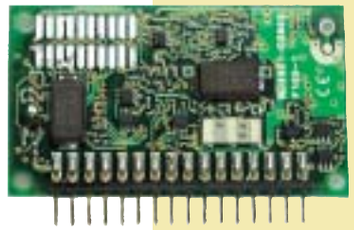
Left: EnOcean easyfit – universal switch insert

RCM 110/120 – RECEIVER MODULES



- Wireless receiver and actuator control module for receiving and preprocessing EnOcean wireless transmitter signals
- Basic functions include switching, blinds control, dimming, plus serial RS-232 interface for bus systems
- Power section scaled and integrated by user to match requirement
- Simple teach-in procedure for up to 30 wireless transmitters
- Memory function (for light and blinds combinations)

TCM 110/120/130 – ENOCEAN BIDIRECTIONAL



- 5 V power supply
- 30 mA power consumption
- Dimensions: 42 x 24 x 5 mm

TCM 110

- Single-stage repeater for EnOcean wireless messages

TCM 120

- Bidirectional serial interface
- Serial interface
- Modem functionality

TCM 130

- Software API for TCM 120 module
- Programmable in C language
- Supports bidirectional serial interface
- Four D/A inputs, four digital outputs
- Supports bidirectional radio interface

STM 250 – WINDOW/DOOR CONTACT, WIRELESS AND MAINTENANCE-FREE

- Maintenance-free powering by daylight
- Capable of operating several days in complete darkness
- Immediate signal transmission as soon as window closes or opens, triggered by window magnet
- Periodic presence signaling
- Contact indicator (110 x 19 mm, height 15 mm), attachable to all frames

EPM 100 – LEVEL METER

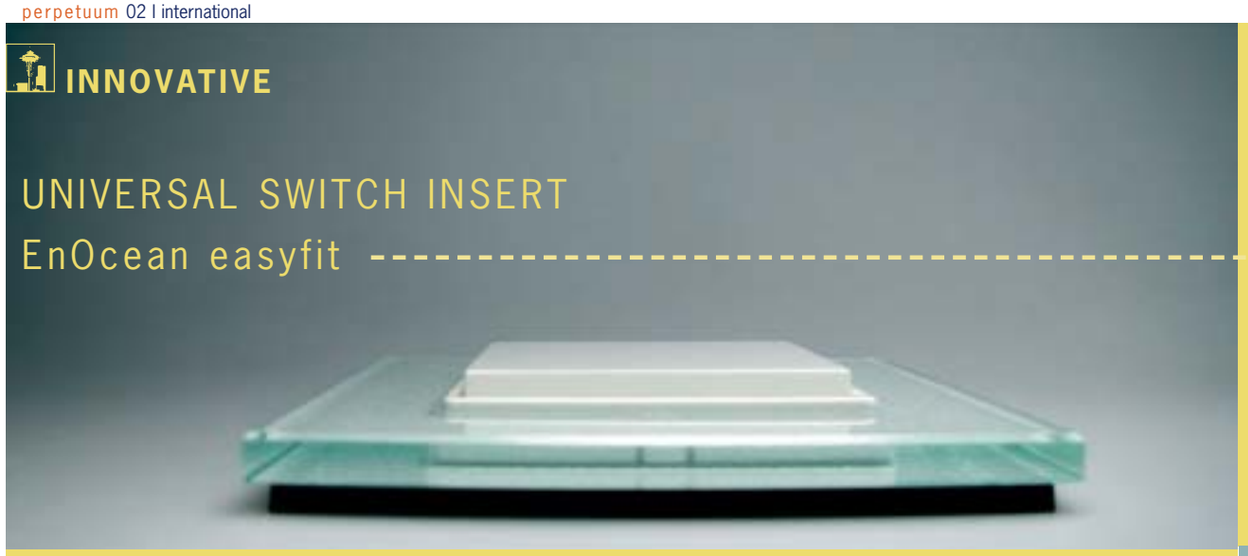
Electrician's aid for installing EnOcean wireless components, enabling range analysis and simple assessment of signal quality and/or detection of interference sources.

ANT – ANTENNA PACKAGES

Ready assembled antenna packages for fast and simple installation at points with poor reception quality.

EVA 100 – EVALUATION BOARD

Aid for simple evaluation of EnOcean wireless modules.



INNOVATIVE

UNIVERSAL SWITCH INSERT

EnOcean easyfit

EnOcean technology is gaining a firm foothold in building automation. The batteryless radio concept is frequently implemented in the construction of flexible office buildings. Further applications include the subsequent creation of conference zones with glass dividing walls, or the retrofitting of switches where no automation or switching point was originally intended. In many cases however, a switch design will have been used that, at least until now, was not available with integrated EnOcean technology.

By Andreas Schneider, Executive Vice President, EnOcean GmbH

To solve the problem, EnOcean has now developed a universal switch insert that is compatible with very different frame systems of many European switch producers. In its system approach the insert is comparable to other established special solutions, for example antenna sockets.

MULTIPLE COMBINATION

The EnOcean easyfit switch insert is as smart as it is simple: a universal plate of standard “Schuko”-71 mm format is adhered or screwed straight to the wall. This size allows any multiple combination in “Schuko” systems, even with flush units like switches and sockets. The frame of the chosen switch range is set upon this plate (see box). The design frame is held by an intermediate frame with outer dimensions of 55 x 55 mm, which comes with a sophisticated spring construction to compensate different frame heights and cutouts, and securely fixes the EnOcean radio module in place. The core of this is the batteryless PTM 200, which converts the energy from finger pressure into short radio signals. Finally, on top of this, sits the single or dual rocker with a side length of approx. 50 mm. The EnOcean easyfit thus combines EnOcean functionality with any switch design. Integrated energy generation makes the units absolutely maintenance-free, and good for more than 50,000 actuations. The transmitters send an actuation and a let-go message, so it is also possible to control blinds and dimmers. The range is up to 300 m in a free field or about 30 m in a building. But that is not the end of EnOcean easyfit innovation. The much reduced actuating force of approx. 5 N for 2 mm travel produces a feeling like with wired switches. Unlike with other electronic switches, the user notices very clearly that the switch has been actuated.

THE ADVANTAGES OF EnOcean easyfit

- Surface mounting without case
- Switch program frame flat on wall
- Compatible with following German 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
- Colors: white, aluminum, anthracite
- Variants for lights and blinds

EnOcean easyfit matches a whole number of switch designs

REDUCED SWITCHING SOUND

The switching sound produced by energy generation is within the range of conventional switches. High-grade design frames, of glass or stone for example, can further damp the click of the generator. In serial switches it is possible to press both rockers at the same time. If each rocker is taught a different blinds actuator, for instance, pressing both of them will control both the blinds.

This universal switch insert is the ideal maintenance-free, wireless addition in building automation. Various receiver solutions to EnOcean standard are available for direct control of loads or as gateway-to-bus systems (see p 21 f).

www.enocean.com

INNOVATIVE

ENOCEAN WIRELESS IN INDUSTRIAL APPLICATIONS

Optimizing processes – something that plays a growing, major role in the definition and implementation of every kind of industrial plant and machinery. Wireless technology presents a whole variety of approaches – focusing on more mobility, faster startup, greater operating ease, rapid service, early fault diagnosis and quality enhancement – that ultimately result in cost-savings for the operator.

By Dr Wolfgang Heller, Product Line Manager Automotive & Industry, EnOcean GmbH

It is not usually just the direct replacement of cabling that is involved. A wireless solution offers other possibilities through appropriate design of the process. Unlike a cable that joins two points, the medium for wireless is the air, and all information can be available anywhere in a process. Additional sensors are very simply integrated, and at points that were previously inaccessible.

MOBILE HUMAN/MACHINE INTERFACES

Process times can be cut by linking mobile human/machine interfaces for example. A maintenance-free wireless switch allows the operator of a forklift truck to open and close electrically powered doors, roller shutters or barriers. That means more flexibility and saves time. A portable display allows critical operating parameters to be monitored at any time, and processes can then be controlled accordingly. The number of firmly installed terminals can consequently be reduced.

INTEGRATION OF MOVING PARTS

Energy-autonomous wireless technology enables the installation of sensors at points of a plant that used to be difficult to access and monitor, like the moving grippers of a robot. Sliding-action contacts on fast rotating machinery tend to be a weak spot because it is not particularly easy for them to transmit data. A wireless solution helps to save elaborate or interference-prone means of transmission like drag chains or collector rings.

EARLY FAULT DIAGNOSIS

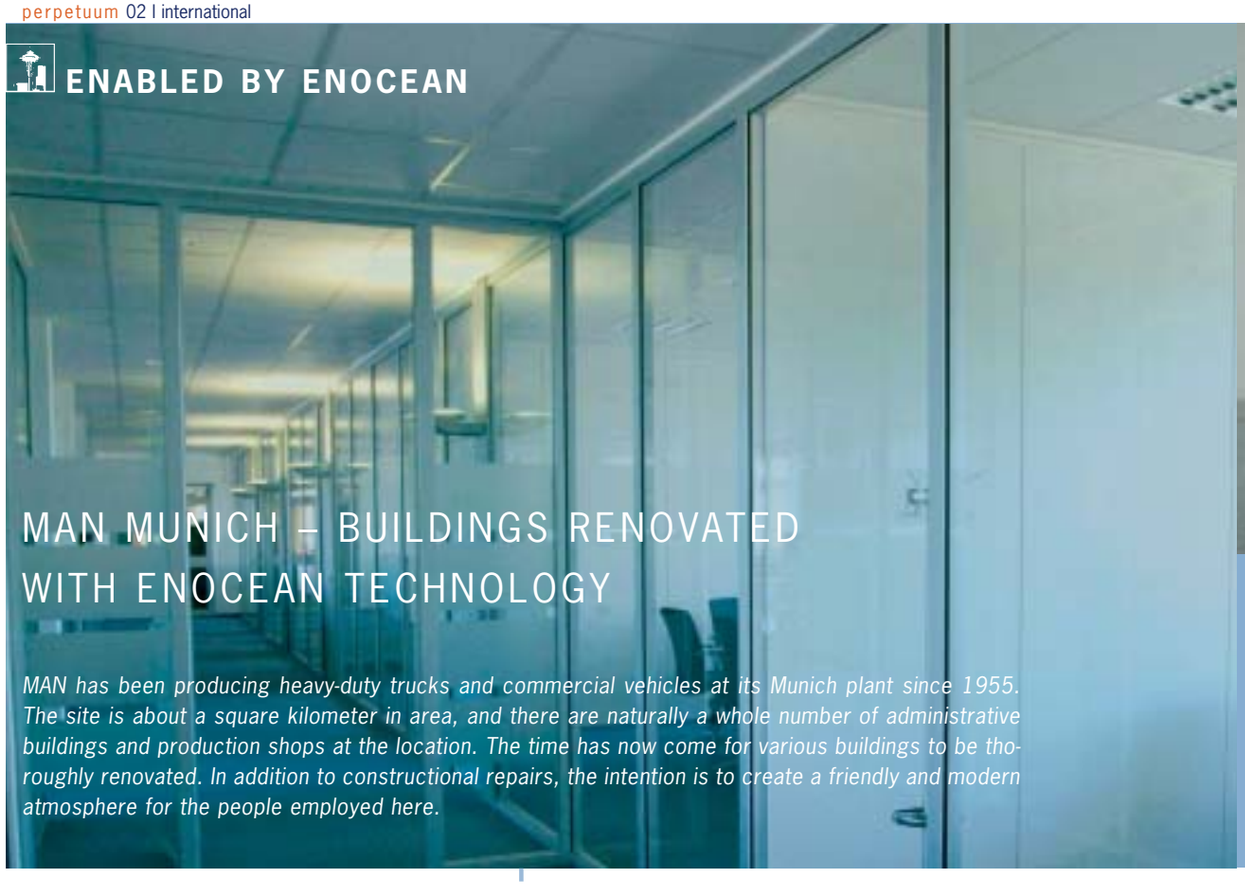
The monitoring of wearing parts, subjected to high temperature or vibration in a bearing or gearing for example, helps to avoid costly secondary damage. Until now it might only have been possible for personnel to randomly check many parts of a plant. But wireless sensors allow systematic supervision. The risk of a shutdown is very much reduced, maintenance intervals can be extended.
What is important is that the wireless sensor itself works maintenance-free. The energy it needs can be obtained from the plant itself, e.g. through rotation, vibration or temperature differences.

CABLE REPLACEMENT

Where access is no problem, the use of cables is bound to remain an optimal solution. But with items of plant that are variable or only temporary, it often makes sense to do away with the cabling and opt for a wireless solution. Installation is speeded up, there are fewer standstills. What is more, plant is very easily expanded, and there is greater flexibility in adapting to requirements.

REDUCED RISK BY ELIMINATING LIVE WIRING

Cabled sensors need wiring that transports voltage to power them and retrieve data from them. Measures to counter the risk of spark discharge can be quite elaborate and costly. Because of the principle by which they work, energy-autonomous wireless sensors do not produce the kind of voltages that cause sparking, so they are an elegant solution for hazardous applications.



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MAN MUNICH – BUILDINGS RENOVATED WITH ENOCEAN TECHNOLOGY

MAN has been producing heavy-duty trucks and commercial vehicles at its Munich plant since 1955. The site is about a square kilometer in area, and there are naturally a whole number of administrative buildings and production shops at the location. The time has now come for various buildings to be thoroughly renovated. In addition to constructional repairs, the intention is to create a friendly and modern atmosphere for the people employed here.

Top: the MAN offices during renovation

Left: the MAN offices after finishing renovation

Modern lighting with a batteryless radio switch

Michael Gartz of EnOcean International Sales spoke to Josef Mair, who is responsible for the planning and maintenance of electrical installations at MAN.

This is one of the biggest industrial sites in southern Germany. Could you give us a few details of your ongoing renovation project?
We're in the first phase at the moment. Three open-plan offices with an area of about 400 sqm each are presently being renovated. We've already completed one and a half floors. The overall renovation project affects five floors.

What are your special requirements and aims in carrying out this renovation?
The corporation wants to create a pleasant and modern atmosphere for the people who work here. You'll see that we're using very high-grade materials. We also want to produce maximum flexibility in how the space is divided up, which is the reason for the variable wall construction.

What was the situation like in this building when you started?
We had lots of little offices, which are now being turned into bright, open-plan offices. And at the same time we're making space for conference rooms.

What kind of electrical fittings are being installed?
As you can see, we're using lights from well-known producers. They're controlled by batteryless radio switches from PEHA, operating with EnOcean modules. At the receiving end we have the WAGO 750 I/O system.

And how many switches have you put in?
About 30 for each office. They're located right close to the workplaces for convenience. We don't have to lay any cables for the switches, so we can even attach them to office cabinets.

Apart from this installation flexibility, are there any other benefits from using wireless technology?
The EnOcean technology is a big advantage because the radio switches don't need batteries, making them absolutely maintenance-free, and saving costs of course. There's also less risk of fire load in the ceilings because there are no cables routed up there.

Flexibility in perfection – simple attachment of batteryless radio switches to office furniture

What's installation and operation of this wireless technology been like up to now?
Quite straightforward. A side-effect worth mentioning is that we saved three workdays and four technicians. That's a big economy compared to conventional cabling. And the system works very reliably. The transmitters and receivers are uniquely assigned, and we've had no disturbances..

And how are your people responding to these innovative wireless switches?
Well, I hope you won't be disappointed – they hardly noticed anything. It wasn't until I went round and started pointing out the advantages that they realized they were using radio switches. Then, when I got into explaining how energy was generated by piezo technology, even the non-technical people became quite fascinated.

EXPANDING FAMILY – EIB/KNX GATEWAY AND ALARM TRANSMITTER

Wieland Electric is set to present two major additions to its range enabled by EnOcean technology. For one thing, sending EnOcean messages to the EIB bus will be simpler and more effective. And Wieland fills the gap with wind and weather alarms for blinds controls with EnOcean.

By Andreas Fenn, Product Manager, gesis Electronic, Wieland Electric GmbH

wieland

Wieland RC R 16/0 alarm transmitter

THE WIELAND ALARM TRANSMITTER WHEN THE WIND BLOWS STRONG

Protection against the sun is usually attached to the outside of a building where it is exposed to all the effects of the weather. So if you want to safeguard it against damage, especially if a strong wind gets up, it needs to be retracted, and any local control has to be disabled.

To prevent a defective weather station from destroying this sun protection, its signals are monitored to see if they reach the control units. This functionality not only comes from building bus systems, wind alarms are also a function familiar from conventional installations with relay boxes. But previous units enabled by EnOcean could not implement this.

The Wieland alarm transmitter reads the floating contacts of commercial weather stations and sends appropriate alarm messages, as many as four different ones. Depending on whether the weather station is connected to the "down" or "up" input of the alarm channel, the wirelessly connected blinds are driven accordingly. Cyclic presence signals are sent every 2 min for each channel. If the contact of the weather station is made, no alarm is sent, and alarm if it breaks. If the input status changes, the appropriate message is immediately triggered.

RECEIVING AND EVALUATING ALARMS

The plug-in, dual Wieland blinds actuator, likewise new, is programmed to the matching alarm, and then evaluates the appropriate alarm messages. If no cyclic message is received, the blinds actuator assumes that there is a disturbance in transmission or the weather station, and automatically adopts the programmed safety status. If no alarm function is entered at startup, there is no evaluation of the alarm, and the blinds output functions quite normally.

INTEGRATING "NORMAL" CONTACTS

The eight binary inputs query connected contacts like window contacts, conventional switches or other floating contacts. They are paired in four groups, and each group can wirelessly drive a switching, switching/dimming or blinds group. The transmitted messages correspond to the EnOcean Org 5 messages used by switches for example.

IMPLEMENTING CENTRAL COMMANDS

Use of the alarm transmitter ("alarm" and "normal" messages) makes it possible for the first time to generate central commands direct in the EnOcean system. Alarm transmitters are placed in a building so that all installed outputs can be reached wirelessly. All the inputs of the alarm transmitters are then simply connected in parallel, and the required outputs allocated to the particular alarm or central command.

EIB/KNX – ENOCEAN GATEWAY

System-conformant connection to EIB/KNX

Among other things, system-conformant means being able to work the EIB/KNX with the ETS on the one hand, and with simple assignments and without software at the EnOcean end.

EIB/KNX – EnOcean gateway

Putting 56 wireless channels on the EIB/KNX

The gateway can handle a total of 56 wireless inputs, and map these on 56 EIB objects. There are also four inputs for 230 V/16 A. The standard functions – switch, blinds, dim and set value – as well as the EnOcean window contact (EnOcean Org 6 message with the 1-bit information "open/close") are supported direct. The EnOcean Org 7 message can also be put on the EIB/KNX.

Parameterize and program

The channels are paired, and the functionality is specified in the ETS by parameters – without extra programs. Programming of EnOcean transmitters to the gateway is independent of the EIB end and is performed similarly to the Wieland outputs. Several transmitters can be assigned to one channel, or one transmitter to several channels. Changes at the EnOcean end are possible at any time by specific clearing or adding of wireless transmitters.

Extra switching outputs integrated

The switching outputs already integrated are addressed through EIB/KNX objects. If internal connections of EnOcean inputs are made to the outputs, they will also work if the bus voltage drops out. These internal connections are already in place as delivered.

If wireless switches are programmed to the first channels, they will automatically control the outputs after application of the bus voltage. The connections are automatically cleared after the first download by the ETS.
The gateway creates a simple means of linking the two systems.

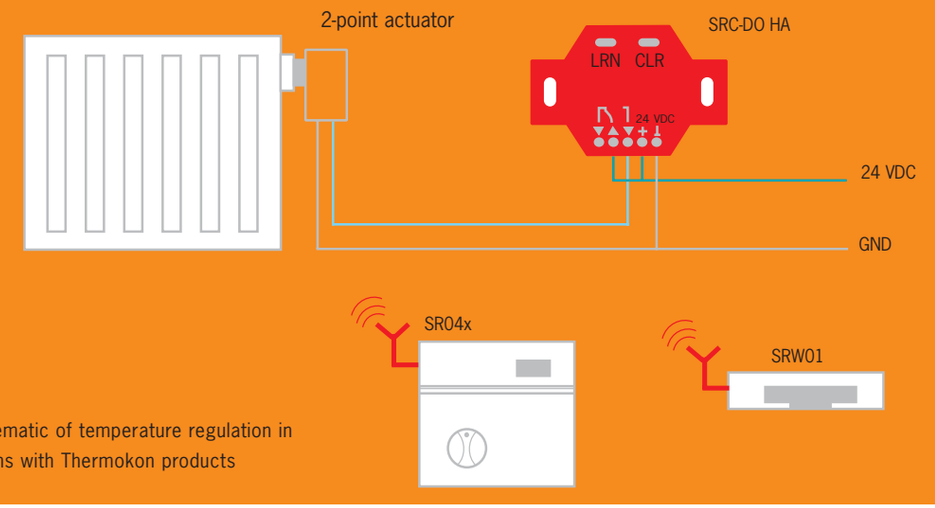
www.wieland-electric.com, www.gesis.com

NETWORKED

PRODUCT PRESENTATION – THERMOSTAT ACTUATOR SRC-DO HA

The SRC-DO HA type 1 wireless receiver used in the Rolandsbrücke office block project in Hamburg is designed for temperature control. The energy stop function allows teaching in of up to ten wireless window contacts.

By Dirk Debus, Head of Development, Thermokon Sensortechnik GmbH



Schematic of temperature regulation in rooms with Thermokon products

The wireless thermostat receiver compares the room temperature sent by a sensor to the set-point on the sensor. If it is above or below this set-point, a relay is switched on or off. The floating relay output can be used for direct control of thermal two-point valves.
It is also possible to teach in window contacts of the type SRW01 to use the so called energy stop function, i.e. when a window is open, the receiver will deenergize the relay contact for the valves.

TEMPERATURE REGULATION

The thermostat receiver compares the measured room temperature to the calculated setpoint. If the room temperature is less than the setpoint, a relay is energized and the PROG LED illuminates. If the room temperature exceeds the setpoint, the relay is deenergized and the PROG LED extinguishes. The receiver calculates the room temperature set-point from the basic setpoint (default 20°C) and the setpoint offset (default –5 to +5 K) set on the wireless sensor. This wireless sensor sends a message with the measured values to the receiver about every 1.6 min (if the room temperature changes more than 0.8 K since the last message) or at the latest about every 16 min. In normal mode brief illumination of the LRN LED on the receiver indicates reception from a teached-in sensor.

ENERGY STOP

Using teached-in window contacts, the thermostat receiver can only energize the relay if
- the window contact signals "Window closed",
- there has been no signal from the window contact in the last 45 min (defective window contact),
- the window contact signals "Window open" but the room temperature drops below 8°C (frost protection).

Parameter table of SRC-DO HA wireless receiver

		Factory setting
1	Ignore local setpoint offset	Deactivated
2	Local setpoint offset +/-5 K	Activated
3	Local setpoint offset +/-2.5 K	Deactivated
4	Basic setpoint 17°C	Deactivated
5	Basic setpoint 18°C	Deactivated
6	Basic setpoint 19°C	Deactivated
7	Basic setpoint 20°C	Activated
8	Basic setpoint 21°C	Deactivated
9	Basic setpoint 22°C	Deactivated
10	Basic setpoint 23°C	Deactivated
11	Basic setpoint 24°C	Deactivated

DETAILS OF RECEIVER

Monitoring of communication between the receiver and sensor works as follows. If the receiver has received no valid message from the room sensor for > 90 min, it energizes and deenergizes (defective sensor) the relay output in a 10 min cycle. The fault is indicated on the receiver by rapid flashing of the LRN LED. As soon as a valid message is received again from the failed sensor, the receiver continues to operate in its normal regulating function. A fault message is cleared manually by changing into teach mode.

EASYSENS – ON THE SAME WAVELENGTH

Again the Rolandsbrücke office block project in Hamburg – convenience and comfort by room controllers and thermostat actuators from Thermokon.

By Harald Zygan, Chief Executive Officer,
Thermokon Sensortechnik GmbH

In November 2003 in the heart of Hamburg, a stone's throw from City Hall and the Stock Exchange, the foundation was laid for the new Rolandsbrücke office complex. This project was implemented together with our Hamburg-based partner OPTIMATIC. A total of 42 wireless room controllers SRO4P and 42 thermostat actuators SRC-DO HA type 1 were installed in the building. The advantages of our batteryless wireless system, such as no complicated and time-consuming cabling and direct installation of room sensors at representative measuring points, were of paramount importance for the project.

A TEN-FLOOR OFFICE BLOCK WITH IMPACT

The gross floor area of the Rolandsbrücke office block is 3700 sqm, with about 3000 sqm for offices and 150 sqm for storage, plus 18 parking bays in the second and third basements. The façade is a conservative mix of metal and glass, but a pleasant contrast to many sterile-looking glass structures of recent years. Inside, the new office building is an attractive solution with some 300 sqm of floor space on each of its ten floors. Its fittings are first-class and of the very latest. All office space has optimum lighting. A generously scaled foyer, distributed over two floors, makes an inviting impression on the visitor to the building.

From the technical point of view, the building is admirably equipped with heating, cooling, air-conditioning and concrete core temperature control to satisfy the high standards of the investors and users. The climate in the offices is additionally regulated by underfloor convectors and cooling ceiling panels, whereby corner and middle offices as well as flexible room configurations make high demands of the control technology. The points of installation for room sensors, dispensation with batteries and actuator response were decisive factors. The concept presented by OPTIMATIC and adopted for the building, with wireless room sensors and actuators to drive the valves, is an optimal solution to the demands.

www.thermokon.de

thermokon
Sensortechnik GmbH

SUPPLIER	FINAL PRODUCTS											DESCRIPTION / DESIGN
in alphabetic order	Light	Shading	HVAC	Switches	Window contacts	Building sensors	Industrial sensors	Receivers/ actuators	Gateways/ bus systems	Repeaters	Acces-sories	
BALLUFF							■		■			Industrial sensors
BECKHOFF	■	■	■						■			RS-485 wireless adapter KL6023 for bus clamp controller TCP/IP
ENOCEAN				■								Universal switch module EnOcean easyfit, 2-channel, white, anthracite and alu
				■								Universal switch module EnOcean easyfit, 4-channel, white, anthracite and alu
											■	Field-strength measurement tool EPM 100
HELIOS			■	■				■				Fans
MSR			■			■	■	■				Wireless gas sensors
NIKO	■	■		■				■				Radio system Easyclick
OMNIO	■	■	■							■		Flush-mounted RF repeater 24V UPR24/01
	■	■	■							■		Flush-mounted RF repeater 230V UPR230/01
	■	■	■			■						Security sensor SS101 white, grey, black
	■	■	■									Universal transceiver US 101 white, grey, black
	■	■	■						■			EIB receiver 29Vdc REG-EIB/01
	■	■	■						■			EIB receiver 29Vdc REG-EIB/02
	■	■		■								2-channel / Omnium white, grey, alu grey, black, red, blue, green, gold
	■	■		■								4-channel / Omnium white, grey, alu white, alu grey, black, red, blue, green, gold
	■	■		■								6-channel / Omnium white, grey, alu white, alu grey, black, red, blue, green, gold
	■	■		■								8-channel / Omnium white, grey, alu white, alu grey, black, red, blue, green, gold
	■	■		■								2-channel / Universal cartridge Switzerland
	■	■		■								4-channel / Universal cartridge Switzerland
	■											Flush-mounted receiver 1-channel
	■							■				Flush-mounted receiver 2-channel
	■							■				Flush-mounted dimmer switch
		■						■				Flush-mounted receiver 1-channel
		■						■				Flush-mounted receiver 2-channel
			■			■						Indoor temperature sensor Omnium white, grey, alu white, alu grey, black, red, blue, green, gold
			■									Heating valve controller, 4-channel 230Vac 6A REGH230/01
			■									Heating valve controller, 4-channel 24V 6A REGH24/01
			■	■				■				Doorbell
			■		■							Window contact with solar cell
OSRAM	■							■				Electronic ballast "TOUCH-DIM"
PEHA	■	■	■							■		Easyclick flush-mounted repeater
	■	■	■						■			Easyclick PHC interface
	■	■		■								Easyclick wall transmitter, 2-channel / neutral design
	■	■		■								Easyclick wall transmitter, 4-channel / neutral design
	■	■		■								Easyclick wall transmitter, 2-channel / "Dialog" white or aluminium design
	■	■		■								Easyclick wall transmitter, 4-channel / "Dialog" white or aluminium design
	■	■		■								Easyclick wall transmitter, 2-channel / "Aura" white, anthracite and aluminium design
	■	■		■								Easyclick wall transmitter, 4-channel / "Aura" white, anthracite and aluminium design
	■							■				Easyclick flush-mounted receiver, 1-channel
	■							■				Easyclick flush-mounted receiver, 2-channel
	■							■				Easyclick in-ceiling receiver
	■							■				Easyclick socket receiver (Schuko)
	■							■				Easyclick socket receiver with grounding bolt
	■							■				Easyclick socket receiver (SEV)
	■							■				Easyclick DIN-rail receiver
		■						■				Easyclick flush-mounted receiver blinds control
											■	Antenna for DIN-rail receiver

SCHLAPS & PARTNER	■	■	■						■			EIB gateway
SERVODAN A/S						■						Movement sensor PIR TYP 41-301
	■					■						Light sensor (outdoor) TYP 43-160
STEUTE							■					Door handle switch TGF
							■					Position EF 41
							■					Pull-wire EF 41 Z
STUHL REGELTECHNIK			■			■						Indoor sensor SF10
			■			■						Room controller SF10
			■					■				Adapter module SAM
THERMOKON	■	■	■							■		SRE repeater
	■	■	■						■			Ethernet TCP/IP receiver 230Vac SRC-Ethernet
	■	■	■						■			LON receiver 24V SRC-FTT
	■	■	■						■			RS-485 receiver SRC RS-485 Modbus
	■	■	■						■			RS-485 receiver SAIA controller SRC RS-485 EVC
	■	■	■						■			RS-485 receiver standard serial RS-485 gateway
			■		■							Door contact with solar cell SRW01
			■			■						Room controller/sensor SR04
			■			■						Room controller/sensor with set point command SR04P
			■			■						Room controller/sensor with set point command and presence device SR04PT
			■			■						Room controller/sensor with set point command and presence device and gear ratio level SR04PT
			■			■						Room controller/sensor with rel. humidity SR04rH
			■			■						Outdoor temperature sensor SR65
			■			■						Contact temperature sensor SR65 VFG
			■			■						Duct temperature sensor SR65 VFG
			■			■						Cable temperature sensor SR65 TF
			■					■				RF thermostat actuator SRC-DO HA Typ 1
			■					■				Indicator relais, 1-channel SRC-DO HA Typ 2
			■					■				Hygrostat actuator, 1-channel SRC-DO HA Typ 3
			■					■				RF receiver actuator with analog output SRC-ADO BCS
WAGO	■	■	■						■			I/O System 750 (EIB/LON/TCP-IP/Modbus) radio clamp 750-642
	■	■						■				DIN-rail receiver, 4 shutters 789-601
	■	■						■				DIN-rail receiver, 4 changeover contacts 789-602
	■							■				Winsta light control 770-629/101-000
		■						■				Winsta blinds control 770-629/102-000
WAREMA						■		■				Blinds control / shading
WIELAND	■	■	■						■			EIB gateway
	■	■	■					■	■			"gesis" connector system
	■							■				Light control actuator, 4-channel, flush-mounted
		■						■				Blinds control actuator, 2-channel
		■							■			Pluggable blinds control actuator, 2-channel
			■					■	■			ETS
WIESEMANN & THEIS	■	■	■						■			Com server, 10/100BT, 24V

Balluff GmbH
www.balluff.de

Beckhoff Industrie Elektronik
www.beckhoff.de

EnOcean GmbH
www.enocean.com

Helios Ventilatoren GmbH + Co
www.heliosventilatoren.de

MSR Electronic GmbH
www.msr–electronic.de

Niko N.V.
www.niko.be

Omnio AG
www.omnio.ch

Osram GmbH
www.osram.de

Peha Paul Hochköpper GmbH & Co KG
www.peha.de

Schlaps & Partner Nachrichtentechnik – Systemsteuerungen GmbH
www.schlaps-automation.de

Servodan A/S
www.servodan.dk

steute Schaltgeräte GmbH & Co. KG
www.steute.de

Stuhl Regelsysteme GmbH
www.stuhl.com

Thermokon Sensortechnik GmbH
www.thermokon.de

WAGO Kontakttechnik GmbH
www.wago.com

WAREMA Renkhoff GmbH
www.warema.de

Wieland Electric GmbH
www.wieland-electric.com
www.gesis.com

Wiesemann & Theis GmbH
www.WuT.de

NETWORKED

MACHINE TOOLS: BETTER ERGONOMICS THROUGH WIRELESS SWITCHES

The new AXA dual machinery centers use wireless door-handle switches from steute with EnOcean technology, the EnOcean radio signal proving its stability here in a rough industrial environment.

By René Scherer, Product Manager, Control technology, steute Schaltgeräte GmbH & Co. KG

Lathing, milling, drilling – these are the typical operations handled by machine tools from AXA Maschinenbau GmbH. The innovation and performance of the machines produced by the company based in Schöppingen, Germany, stand out straight away. In conventional machine tools just one workpiece is chucked and machined at a time. But the dual machining centers from AXA have two stations between which the tool changer is arranged. This principle improves performance, because while one workpiece is being machined on one station, the next can be chucked on the second station.

IMPORTANT: ERGONOMIC OPERATION

With AXA the innovation cannot not only be found in the machine concept but also in the details. The company's designers look for operation and handling that are as ergonomic as possible. With many machine tools the operator must look at an external control panel to know if he can unlock the guard door or a machinery operation is still in process that must not be interrupted. But with AXA machines this information is presented direct on the door handle, integrating both LEDs to indicate operating status, as well as the unlocking button for the solenoid interlock.

EVERYTHING UNDER CONTROL

These door handle switches developed by steute, and used by AXA now for about four years, simplify operation of machines. The only drawback was the wear-and-tear-prone and not exactly inexpensive trailing cable device that had to be added for energy supply and signal transmission from the guard door to the machine control. This takes time and money, because the energy supply must be implemented by authorized personnel to avoid the mechanical wear of moving components.

INITIAL SKEPSIS

Last year when steute introduced its first wireless door-handle switch incorporating EnOcean technology, AXA's designers were very interested in the solution. But at the same time they were doubtful whether the low signal strength was a match for the kind of industrial environment in which their machines worked – and whether the signal could at all penetrate the metal enclosure of a machine.

So extensive tests were started. A door-handle switch with a solar module was installed on a guard door to communicate with a four-channel WAGO receiver module in the switchgear cabinet of a machine. The module was simply attached to a C rail. The associated receiving antenna may have been on top of the switchgear cabinet, but the wireless signal still had to pass through the machine, so to speak, and overcome, among other things, the solid wall separating the workspace from the machine. Plus, it had to "survive" in the presence of reflection and radiation from metallic parts of the machine.

RESULT: PROPER SIGNAL TRANSMISSION

Practice proved practicability – the signal transmission functioned perfectly. AXA then decided to start equipping dual machining centers with wireless door-handle switches from steute. The solution convinced not only the designers but also users of the machines, who benefit from much improved work procedures.

Left: industrial automation with door-handle switches from steute

ENERGY FROM MOTION

Position switch with electrodynamic energy generator

At the Hanover Fair steute will present the next generation of wireless position switches, dispensing even with solar cells or high power batteries. This is made possible because the switches generate the energy needed for signal transmission from the switching operation itself. The answer is a miniaturized energy generator that, similar to a dynamo, converts the motion of the plunger into electric energy.

The energy generator is so small that it fits into a normal switch insert. Besides the wireless signal transmission there is a further benefit: the generator achieves substantially more switching cycles than a conventional system using piezo technology. So the user profits from longer lifetime of the switchgear.

CLEAR PLUS FOR WIRELESS

In terms of economy the concept of wireless signal transmission with autonomous energy sourcing is also convincing, because AXA can now do without the trailing cable.

www.axa-maschinenbau.de
www.steute.de

.steute

NETWORKED

INTELLIGENT LIGHTING MAKES FOR MOBILITY

All Osram QTi DALI and QT DALI EVG can now be conveniently remote-controlled by the new Touch DIM system, consisting of a dual-channel wireless receiver module based on the EnOcean RCM 120, and a matching PTM 100 or PTM 200 batteryless, maintenance-free wireless switch. This wireless receiver can be fitted straight into a luminaire or, using the snap-on assembly kit, simply placed in a false ceiling for example.

By Axel Pilz, Light Management Systems, OSRAM GmbH

Combining the wireless receiver with the Touch DIM light and motion sensor shows the way to fascinating new possibilities especially for mobile luminaires. Probably the best example is the SiNILUX II uplight from siTeco. You plug in the power cable, make your setting, and double click to save it. The intelligent luminaire is then ready to go. It turns on automatically in the presence of motion, and illuminates as a function of daylight. If there are no persons around, it dims and then turns off. That means a whole lot more convenience compared to conventional solutions, plus possible energy savings of more than 50%.

OPERATION

Operation could hardly be more straightforward. The wireless switch can be attached next to an entrance like a normal light switch, for example, and allows manual operation of all luminaire functions. Multiple points of operation are no problem – up to 30 wireless switches can be teached. If a room is newly divided, the uplight is simply placed elsewhere and plugged into the next best socket.

These wireless switches need no flush socket, they can be attached to any flat surface and relocated as necessary. The luminaire and its control are thus fully mobile, and can relocate anytime you want to. The Touch DIM remote control system results in a big reduction in installation and maintenance, and genuine luminaire mobility, in other words entirely new flexibility in planning and implementing modern lighting solutions.

www.osram.de

OSRAM

SIMPLE, FLEXIBLE, INNOVATIVE, ECONOMICAL – THE RATIO® WIRELESS BUS SYSTEM

From family to functional – Ratio® is the solution for "intelligent building".

By Christian Genter, Chief Executive Officer, Omnio AG

Rising standards and better information of everyone involved in building, from the planner and architect through to the owner, is creating a requirement for intelligent electrical installation that is flexible and economical. Functions like central turning off of all lights, turning on of specific lights or a panic switch, too mention but a few, should be possible. This is exactly what caused the owner of the building described in what follows to choose the Ratio® wireless bus system.

KÄMPF & CO. FRANKFURT – LOOKING FOR A NEW COMPANY HQ

Kämpf & Co. is one of the leading businesses in the Frankfurt region for electrical, air-conditioning and sanitary fittings. The owners of the company were long unhappy with their headquarters in Seestrasse, so they decided to build a new one in Königsstrasse. The building was to be big enough for Kämpf & Co. itself, but also offer space for rental by other companies. It was not clear how the open-plan offices should be split up, nor was it possible to decide how to configure the two floors for tenants. At least this made the requirements for controlling lighting and shade quite clear. A fully flexible system was needed to allow diversity of room configuration without excessive cost. After thorough consultation Kämpf & Co. opted for the Ratio® wireless bus system. The many advantages of Ratio® compared to a conventional electrical installation and wired bus systems like EIB were quite convincing.

Although the decision on which system to use came relatively late, planning of the electrical installation was simple because implementation of the Ratio® wireless bus system involves no major changes compared to a conventional installation.

The lighting consisted of suspended FL luminaires and floor standard lamps. Our UPS230/01 wireless receiver was directly integrated into each of the 100 FL luminaires. Blinds were fitted in each window to be driven by our UPJ230/01 blinds actuator. These actuators were accommodated in an AP socket in the false floor.

For operation of the lighting and shade, the customer chose wireless switches of the Omnium series. These were teached in with the wireless receivers during startup by the electrician. This is a speedy process and requires no PC or laptop. On the floors for tenants only a wireless switch for central up/down and automatic sunshine response was teached into all blinds receivers. This allows later adaptation to the tenants' requirements.

In functional buildings like this, the Ratio® wireless bus system demonstrates all its capabilities: unmatched flexibility through batteryless and maintenance-free wireless switches, temperature sensors and window contacts, simplicity through an ingenious teaching and programming procedure – without PCs and time-consuming training.

RATIO® WIRELESS BUS SYSTEM – AN ECONOMICAL, INNOVATIVE AND LASTING SOLUTION

The Ratio® wireless bus system has already proven its worth in a whole variety of buildings: new and converted residential buildings, business, industrial and functional buildings, restaurants, schools, kindergartens, hospitals.

Ratio® is an open system, so it is easily integrated into buildings with an EIB bus system, for example, through the REGG01 EIB/EnOcean gateway. Wireless receivers come in different versions for requirements like fitting in flush-type boxes, false floors, suspended ceilings or electricity distributors.

OMNIO AG

The Swiss company Omnio AG concentrates fully on the development, production and sales of equipment incorporating EnOcean technology for applications in industry and building. A wide selection of products and many years of expertise are ready to focus on ensuring the success of your project.

www.omnio.ch

NETWORKED

WIRELESS SENSOR TECHNOLOGY MONITORS GASES IN MULTI-LEVEL CAR PARKS

By Dipl.-Ing. Wolfgang Schmitt,
Sales and Product Management, MSR Electronic GmbH

SYSTEM

The measurement system consists of a receiver unit and up to eight wireless gas sensors. As many as eight receiver units, i.e. 64 gas sensors, can be linked to the central analysis system on a local operating network (LON) bus. Integration of the transmitter unit on the sensor board creates a compact and economical wireless gas sensor. The power comes from a standard battery with a lifetime of three to four years. Use of solar cells was not possible because of the poor light in such car parks. Currently available are wireless gas sensors for CO (carbon monoxide) and NO2 (nitrogen dioxide). These measure the exhaust concentrations of gasoline and diesel vehicles in the ambient air. The system complies with legal directives in more than 90% of all countries. Further wireless gas sensors are being developed and are due to be available by the end of 2005.

APPLICATIONS

The system is primarily aimed at enclosed car parks and satisfies stipulations like VDI 2053 in Germany, ÖNorm in Austria and UL 2075 in the USA. If specified exhaust concentration limits are exceeded, digital relay outputs in the detection system will activate ventilators, warning lights or horns to protect persons against the toxic fumes.

In addition to car parks, there are applications in cooling systems (NH3) or oxygen monitoring in laboratories or on production lines.

BENEFITS

Wireless gas sensor technology reduces the electrical installation investment in car parks by as much as 80%. Considering that a gas sensor is needed for every 400 to 500 sqm of an enclosed car park, the potential for savings is obvious.

MSR ELECTRONIC GMBH

MSR Electronic designs and produces gas sensor technology (toxic, combustible, oxygen, refrigerant) for building automation and semi-industrial applications:

- Analog (AT/4 series, 20 mA)
- Digital (DT/LON bus series)
- Wireless (RT/868 MHz series)

The company's systems are in use worldwide.

www.msr-electronic.de

NETWORKED

Balluff WIRELESS TRANSMISSION SYSTEM BWT

Balluff has added a complete wireless solution based on EnOcean technology in the licence-free 868 MHz ISM band to its range of electromechanical switches. In other words, the system requires no extra approval, and the customer can start it up without any connection charges.

BALLUFF

The position and multi-position switches are mechanically actuated, e.g. by a control cam. Signal transmission is wireless, doing away with wiring and cabling on the switches. The maintenance-free, autonomous generation of energy means there is no need for any external energy source or battery.

The Balluff wireless transmission system is speedily adapted to specific applications or reconfiguration of space. It can work simultaneously with a number of receivers, so it has network capability.

Simple installation and programming together with absence of maintenance are further pluses of the new system.

This sums up to features making the system an attractive solution for industry, in applications like drag chains, rotary indexing tables, robot grippers and custom mechanical plant.
Balluff offers a full range of accessories to match its wireless transmission system, including antennas, repeaters and cams.

www.balluff.de

VISIONARY

NEW ENERGY SOURCES FOR WIRELESS SENSORS

The number of wireless sensors implemented in every kind of application has increased rapidly in recent years. They measure the pressure in rotating automobile tires, help to control multiple industrial processes, and regulate climate and light in buildings. High demands are made in terms of how these wireless sensors are powered, i.e. long life, reliability and cost.

By Frank Schmidt, CTO, EnOcean GmbH

Laboratory mockup of the vibration energy converter in a case with the wireless sensor. The latter sends measured values every second, driven solely by the vibration of the plate.

VISIONARY

BATTERIES AS AN ENERGY SOURCE?

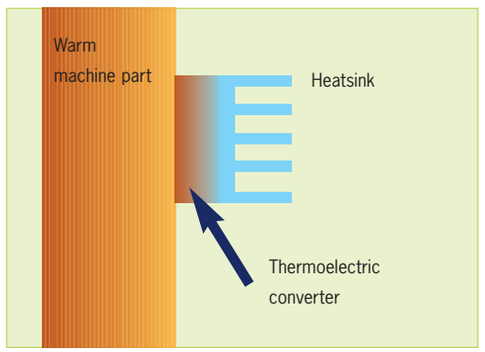
We are well acquainted with the advantages and disadvantages of batteries from our daily use of a remote control or key to unlock a garage or car. They usually work for a number of years before needing replacement. Battery replacement and the spread in battery quality are acceptable because not so many devices are affected. But with the increasing number of sensors and switches the situation changes dramatically. Because the constant need to replace batteries can outweigh the benefits of all the technology. In addition to the burden on the environment of used batteries, there are solid economical reasons for an alternative: the maintenance of multiple wireless sensors in a large building or factory is simply too cost-intensive. Economically and ecologically meaningful wireless sensor technology must be maintenance-free, and that means batteryless.

CAN AMBIENT ENERGY COVER THE NEEDS?

The solution lies in intelligent use of energy. Wireless sensors need not be operated permanently, only very briefly during each measurement and transmission of a signal (EnOcean: about 1000th of a second).

As a rule of thumb in scaling energy converters you can say that the time-averaged energy needed by a sensor must be somewhat less than the time-averaged energy produced by a converter. This simple fact has far-reaching consequences for optimizing energy converters and the overall system. The electrical power that the converter has to deliver can be very much less than the power needed by the sensor. A simple calculation will illustrate this. Our sensor requires 10 mA of current for about 1 ms at 3 V. That corresponds to energy of 30 µWs (energy = voltage x current x time). If this sensor is to measure and transmit every 30 s for example, the energy source only needs to produce mean power of 1 µW (= 30 µWs / 30 s).

Even small, inexpensively produced energy converters already generate a multiple of this power (cf "Innovative" on p 7). The surplus can then be saved to operate the sensor when ambient energy is temporarily unavailable. The simplified example indicates the practical potential of ambient energy. Now for a closer look at two actual converters that turn new and especially promising forms of ambient energy into electrical energy.

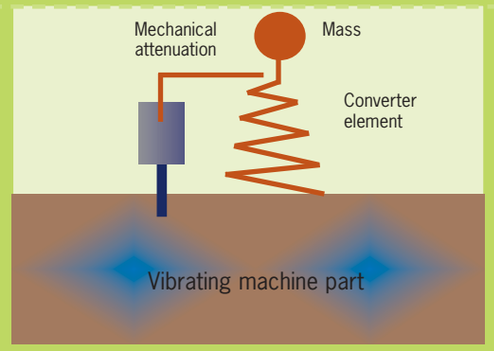


Schematic of thermal energy converter

ENERGY FROM VIBRATION

Many machines, vehicles and units of equipment generate some kind of vibration when working. This can be converted into electrical energy by a suitable converter. Principles that can be chosen for the purpose include the piezoelectric effect, electromagnetic and capacitive converters. The piezoelectric effect, familiar to many of us from cigarette lighters, allows the construction of particularly small converter systems because of the high energy density in the material. All vibration energy converters possess a vibrating mass that, because of its mechanical inertia, acts on the converter element during vibration. Mechanical attenuation must also be optimized so that the converter can work at as many frequencies as possible. The energy delivered is directly proportional to the magnitude of the working mass. So larger converters produce more energy. In the laboratory, prototyped vibration converters from EnOcean for instance achieve 200 µW for 1 cm^3 volume when excited at 100 Hz with 1 m/s^2 acceleration amplitude. These vibrations are produced by the illustrated drill in the plate.

VISIONARY



Schematic of vibration energy converter

With this energy the STM 100 transmitter module can determine measured data every second and send three wireless messages.

Heat, or waste heat, is also found in a lot of machines, plant, and also with humans. Heat gradients are an especially capable energy source. Some 100 mW of useful energy will flow through a surface of 1 cm^2 at just 5° temperature difference (between 20 and 25°). The picture on the previous page illustrates the use of a semiconductor-based thermoelectric converter. Such converters have no moving parts, so there is no wear and tear, making them particularly interesting in application. The thermoelectric converter is attached to a warm surface, and on the opposite side it bears a heatsink. The latter exchanges heat with the ambient air to produce a permanent temperature gradient in the converter. Unfortunately the efficiency of semiconductor converters using the socalled Seebeck effect is very poor. Laboratory models developed at EnOcean manage about 100 µW in the stated conditions. And this figure is excellent compared to the results of other working groups, being enabled by an especially powerful, patented electronic converter circuit.
A further advantage is that commercially available components can be used – showing the way to fast development of products.

WHAT DOES THE FUTURE HOLD?

Many research groups worldwide are working on the development of new energy converters. The demands of miniaturized, low-cost converters are so different from those of their established big brothers like motors and turbines that the development of new concepts and optimized materials is still in its infancy. Examples of especially interesting work are the development of implantable fuel cells for medical applications that work with blood glucose, the use of fluctuations in barometric pressure, or micromechanical thermal power generators, socalled Stirling motors, integrated in silicon. What is very noticeable is the trend towards simulation of biological systems that, being energy-autonomous, have in many cases achieved an extremely high degree of perfection. Not long ago a British research team even presented a demonstrator that attracts insects and digests them to produce current! So it is obviously going to be very interesting to see what research comes up with next.

VISIONARY

HOP, HOP, MULTIHOP

Ad hoc multihop networks can get sensor/actuator information to where it is wanted even if there is no direct link between the transmitter and receiver. At the same time the ruggedness and reliability of data transfer increase. If such a network is to be operated with energy-autonomous sensors, the available energy must be used as efficiently as possible, and the entire network designed for minimal energy consumption. Here too, multihop networks offer suitable solutions.

By Prof. Dr.-Ing. Gerd Scholl, Chair of Electrical Measurement Engineering, Helmut Schmidt University, Hamburg

In addition to the now familiar Bluetooth and the new ZigBee standard based on IEEE 802.15.4 for wireless networking of low-power modules, of late the open-source TinyOS operating system (http://www.tinyos.net/) developed at the University of California, and aimed specially at radio-frequency networking of wireless low-power modules, has been gaining a foothold. The worldwide TinyOS community is constantly growing with the appearance of new software modules, so the network functionalities are increasing. This, of course, also means the possibility of optimally matching a sensor/actuator network to the specific application. The focus is not only on energy-efficient communication between sensors and actuators, but also on suitable evaluation and presentation of the available information. In TinyDB, for example, there is a tool for directing queries to a network and conditioning and displaying the responses.

To exploit these possibilities for users of EnOcean products, a gateway to the TinyOS world was created on the basis of EnOcean's TCM 120 transceiver module. First the microcontroller/RF interface was embedded in TinyOS. In this way the TCM 120 can now receive and transmit both all EnOcean messages and messages in TinyOS style. Furthermore, software interfaces were created in TinyOS for the serial interface and A/D conversion, i.e. now it is possible to communicate simultaneously with EnOcean modules and the TinyOS world and to exchange sensor/actuator data, whereby the TCM 120 is the equal of nodes specially bred for wireless networks. For operation in a network, batteries or another energy source are currently needed. But for use in larger network applications, the TCM 120 module is being further developed to reduce energy consumption sufficiently so that the TCM 120 network node can work energy-autonomously with solar cells. For this purpose, the next step will be replacement of the PIC microcontroller by a more powerful and at the same time more

VISIONARY

Study for a solar-powered wire monitoring sensor

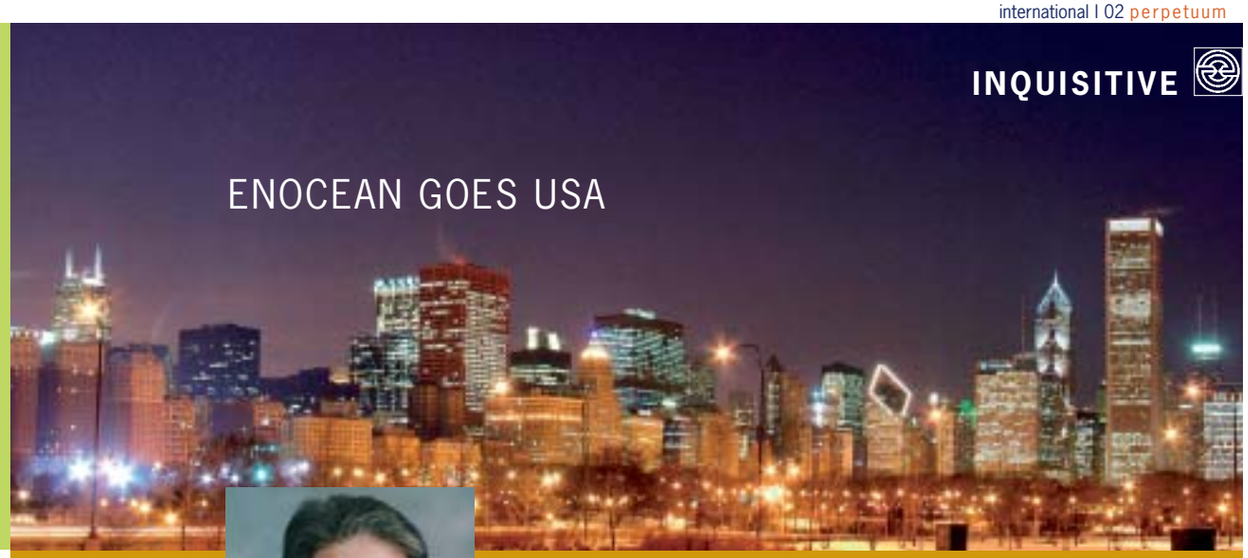
energy-economical, pin-compatible successor in nanowatt technology. Plus, SPI and I2C buses are lined up for connection of the appropriate sensors to the TCM 120. With this powerful wireless network node it will be possible to use all other EnOcean products and integrate them with other sensors/actuators in wireless sensor networks. Such possibilities are not presented by other platforms.

The additional network functionalities in this kind of combination mean entirely new application scenarios in building systems engineering, household and process automation, logistics, environmental protection and security.

Further information:
http://emt.hsu-hh.de

INQUISITIVE

ENOCEAN GOES USA



Introduction of Jim O'Callaghan,
Vice President Sales & Marketing

Jim O'Callaghan's career has focused on building brands, customers – and value – for a host of innovative technology companies, both public and private. He spent the first dozen years primarily in finance and accounting positions, culminating as CFO participating in two IPOs. For the last decade and a half he has worked almost exclusively in sales, marketing and management roles, in both technology and wireless ventures. He is best known as co-founder of Cirque Corporation, the originator of the touchpad pointing devices now common on virtually all notebook computers. Cirque won numerous awards including INC Magazine Top 500 and Utah Top 20 Fastest Growing Companies. A major Japanese technology manufacturer acquired Cirque in 2003. Following that Jim joined AeroComm, a leading Kansas City-based manufacturer of RF networking technologies for industrial applications. A Michigan native, Jim has a BBA in accounting from Western Michigan University and an MBA from Westminster College.

Jim will launch EnOcean's North American subsidiary, establishing distribution channels, building relationships with major OEMs in key targeted markets and introducing packaged, ready-to-use products to the lighting and building automation markets.

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INTERNATIONAL

ITALY: ABACUS ECC

Abacus ECC, the Italian operation of Abacus Group, is a specialist distributor of active, passive electromechanical and display technologies.

Founded in 1980 as a distributor of passive components, Abacus ECC became part of the Abacus Group in 2003. Abacus ECC has been able to keep pace with a fast changing market driving the customer's demand towards new technologies and innovative solutions.

Its strength is in its ability to innovate, offer solutions and support its customers from design phase onwards. It now offers cutting edge display solutions, Bluetooth, wireless components and operative systems.

Headquartered in Milan, Abacus ECC offers its customers local logistics and technical support through a network of seven regional offices. Thanks to a highly automated warehouse supported by dedicated software tools Abacus ECC can handle any logistic requirement including Kanban, consignment stock and MRP requirements.

Abacus ECC SpA, Via Volta 54,
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www.eccabacus.it

ABACUS PROMAX – LOCAL FOCUS WITH INTERNATIONAL STRENGTH

Abacus Promax is as of 2005 distributor for EnOcean in the Nordic region. The company's headquarters is situated in Denmark.

Since the foundation of the company in 1985, Abacus Promax has grown steadily over the years, becoming an Abacus Group member in 1994. Through its offices in Denmark, Norway, Sweden and Finland, Abacus Promax is today the competent partner with inside knowledge of the local conditions and unique requirements of the electronics industry in the Nordic region. Abacus Promax distributes components from a large range of global suppliers. Its local offices have specialized and in-depth knowledge of the product mix offered. It is a proactive, flexible organization, offering customized solutions, accessibility and adaptability.

A combination of efficient logistics and close-up dialog with suppliers makes Abacus Promax the local, flexible alternative available to customers who appreciate working with a local distributor backed by the financial strength of a European, publicly quoted organization.

Today Abacus Promax has about 90 dedicated employees across the Nordic region, and turnover of 265 million DKK. The corporate philosophy is "technical distribution with a human touch".

Abacus Promax A/S,
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www.abacuspromax.dk

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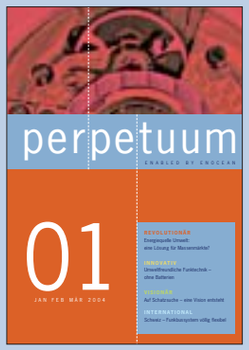

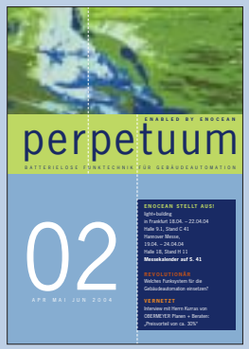

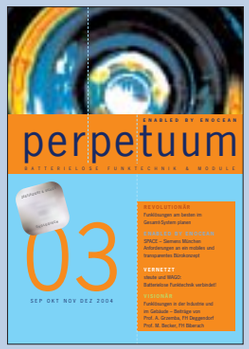

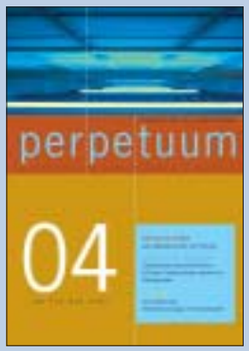

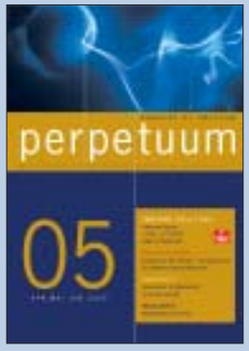

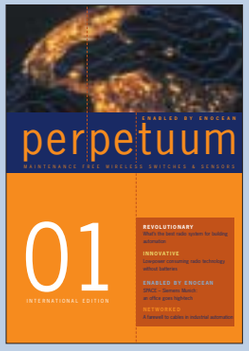

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