www.domat-int.com

domat®
control system

DOMAT SYSTEM SOLUTIONS

Energy under control

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ABOUT THE COMPANY

Domat Control System s.r.o. was established in 2004 by technicians with extensive experience in the field of measuring and control systems. Domat Control Systems s.r.o develops, manufactures and supplies systems or system components for the measuring and control of various building functionalities and for energy/power equipment monitoring.

Company activities can be divided into two main groups:

- Product sales: development and supply of components, software and the distributor‘s technical support services
- System sales: turnkey implementation of systems used for measuring and control, including the creation of project documentation, supplies, installations, the creation of software applications, start up, commissioning and maintenance services
- Energy/power industry

The company‘s objective is to develop, manufacture and supply control systems for buildings, energy companies and industries on an international scale: the export share in product sales in 2012 reached more than 42 %, our distributors operate in 12 countries, and supplies from the Czech Republic are delivered directly to other states. Regular training sessions are provided to technicians and distributors, which enables them to cooperate on international projects. A subsidiary branch of Domat Control System s.r.o. owned by the Czech parent company operates in Slovakia. The company employs a sufficient number of permanent employees in order to ensure customer-based development and to handle the most complex orders, as proved by hundreds of positive references from satisfied customers all over the world.

The company‘s headquarters, from which peripherals and control systems are supplied, is located in the Czech Republic. Logistics, implementation and service departments are located in the city of Pardubice and the technical support centre is in Klecany, near Prague. Distribution organisations with employees highly experienced in measuring and control systems are also located in other countries. These organisations supply Domat systems to individual markets. Hardware and software development is done in the Czech Republic.

Domat Control System puts great emphasis on modern technology and communication standards, easy remote access to devices, reliability and flexibility: our development department is able to quickly respond to customer demands, which is the basic and most important requirement for the successful implementation of any current project. Standards and open communication protocols (which allow for system integration or may be integrated into other systems) are used at all system levels. We believe that an open system is the only way that leads to efficient technology development and customer satisfaction.

Selling a system is more than just the supply, installation and commissioning of a control system. We also act as partners for our customers during subsequent system adjustment and operation of the equipment. We are well aware that a building management system can be economically viable only if the system data are continuously evaluated and if the applied measures directly lead to savings. We are experienced in applications in many projects that have already provided the desired savings thanks to our consistent approach to measuring and regulation systems. Our goal is to make sure that cooperation with investors does not end with installation of the relevant building control system, but actually begins with the installation.

PRODUCTS

Domat Control System offers a broad portfolio of products and system solutions for building management and control systems, energy management, and measuring and regulation technologies. Standards and open communication protocols, signals and interfaces are used at all system levels. Therefore, the system is ready for a wide range of integrated solutions. In our range you can find comprehensive equipment for measurement and control, from process stations to peripherals - all supported by a single supplier.

BUILDINGS AND INDUSTRY

Domat Control System is a comprehensive solution for intelligent building control systems, energy efficiency, data management and the integration of information from other building infrastructure systems (supply of heat and electricity, security system, fire protection system, etc.). Control hardware and software is developed and manufactured in the Czech Republic and protected by Domat's industrial designs. Company employees have extensive experience in designing, installing and servicing control systems for buildings and energy management systems, both in the Czech Republic and abroad.

ENERGY AND POWER INDUSTRY

Domat Solar Control System controls energy sources and monitors their functions, mostly in the renewables field, including feedback on receipt of commands where required by the distributor. It can also communicate with the distributor control system using a protocol compliant with EN 60870-5-104. The monitoring system monitors operation of the sources at the lowest possible level. It uses algorithms to detect power output variations excluding common environmental influences such as snow-covered solar panels, clouds or high solar panel temperatures. Data are available via Internet. Therefore, investors can be sure that their sources operate properly and that the servicing organisation has an instant overview of the current status of the relevant technologies.

DOMAT IN THE WORLD

Domat Control System s.r.o. is headquartered in the Czech Republic, operates a branch in Slovakia and is represented in the following countries: Belgium, Brazil, Croatia, Italy, Latvia, Lithuania, Hungary, Malaysia, Germany, the Netherlands, Poland, Portugal, Romania, Slovenia and Switzerland.

WHAT WE CAN OFFER...

Household power systems
Intelligent solutions for building power management

Energy for industries
Energy management and control

Energy and power production
Management and monitoring

MANAGEMENT STATION
Visualisation of technologies (Merbon SCADA)

merbon SCADA

REMOTE ACCESS
Web access, SMS messaging, emails

Router/Firewall

DOMAT CONTROL SYSTEM
Process station, I/O modules

INTRANET

LOCAL DISPATCH
(LOCAL MANAGEMENT STATION)
Data acquisition, visualisation

Inverters, string boxes, low/high-voltage distribution cabinets, transformers, energy measuring

For investors and operators of photovoltaic power plants we provide comprehensive monitoring systems that use advanced algorithms to monitor production and other parameters of such power plants. These systems report decreases in production, which may indicate equipment failures. We also supply central dispatch rooms for major Czech and international companies involved in the management and operation of photovoltaic power plants. We can also predict production based on weather forecast models. As far as combined devices are concerned, such as production units installed at the place of consumption, we can optimize and manage power loads and reduce overall energy costs. In manufacturing plants we are able to control load shedding, measure consumption and provide energy technicians with easy-to-use tools necessary for their work.

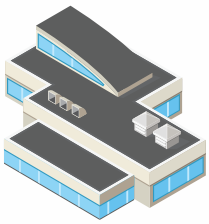
DATABASE SERVER
Data storage and processing

ContPort®

CONTPORT PORTAL
Services for energy management and maintenance activities

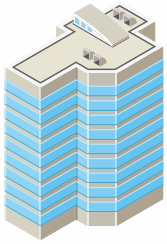
INTERNET

Residential buildings
Heating, ventilation, and air conditioning control systems

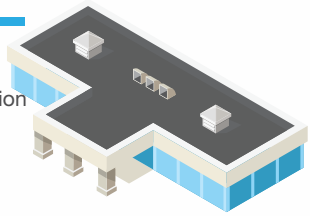


Public buildings - hospitals, schools
Resource optimisation and control of individual rooms

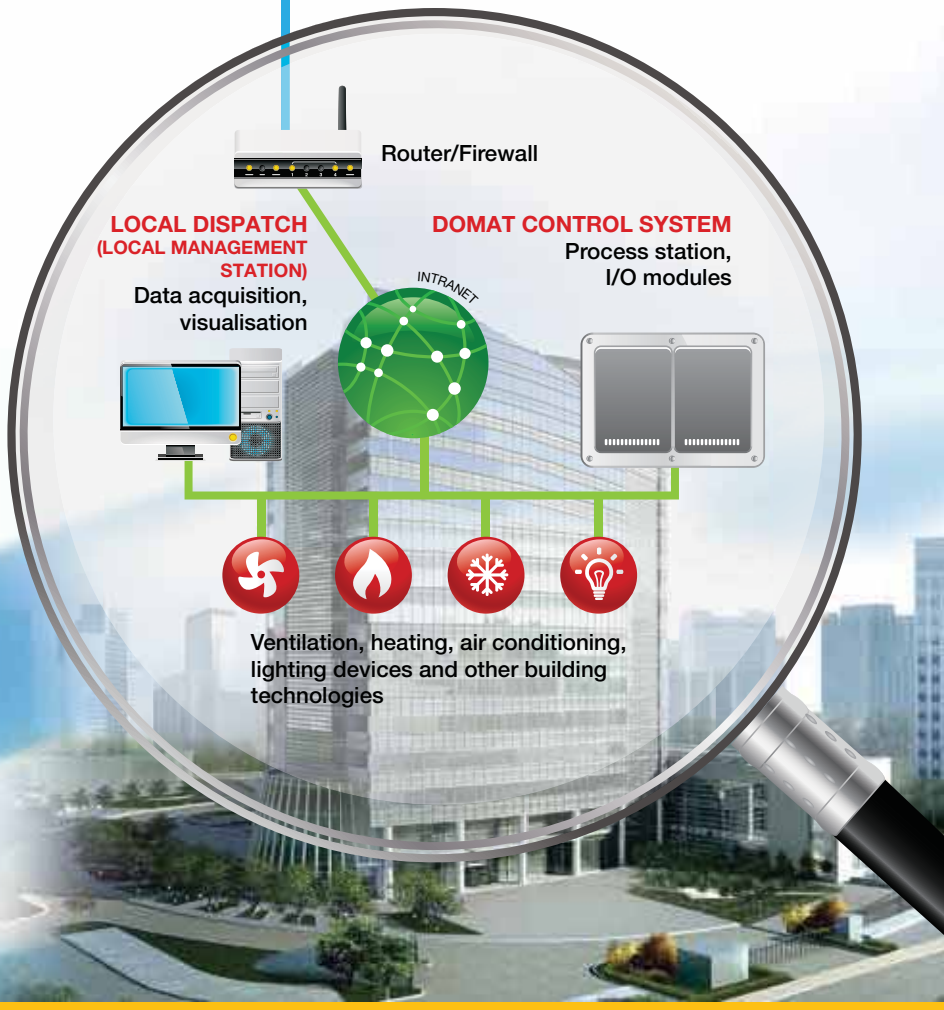
Office buildings, hotels
Integration of other building systems, zone control, power consumption measuring systems



Shopping malls
Central dispatch stations, consumption optimisation, lighting system control



We install energy and environmental parameter measuring systems for operators of retail chains, banks and other entities with networks of business branches. We also store measured data in dispatch centres. This allows energy technicians to compare measured consumptions between individual branches. For hotels and office buildings we deliver building management systems with integrated security systems, fire protection systems, reservation systems and other units, which allow administrators to get an overview of all technologies and their statuses. We offer a comprehensive range of communicative zone controllers with links to primary technologies such as heat exchangers, boiler rooms, chillers and heat pumps. This means that only the necessary amount of energy is produced in the building.



ContPort®

energy management portal

ContPort for the energy industry

Great emphasis is put on reliability and high energy efficiency of the equipment used for the production and distribution of energy. In order to monitor and prove these properties, we need a powerful management system which reliably collects data from manufacturing plants and stores them in an independent database protected against unauthorized intervention. Data must be presented in a form which provides a clear overview of measured and derived parameters and allows for the sufficient flexibility necessary to create one's own assemblies and overviews, and finally, which enables the user to compare, examine and evaluate data.

In order to evaluate the efficiency of photovoltaic power plants, ContPort calculates so-called derived parameters, such as the amount of consumed electrical power or system power indicators compliant with EN 61724. For different types of manufacturing plants/ power plants, the system mostly displays accumulated values from meters and statuses of switching elements, and overcurrent and overvoltage protection devices. These values are available on a dashboard or in customer reports generated at predefined intervals. Breakdowns, such as downtimes of strings or inverters, or lower production than expected by the system based on current conditions, are immediately reported via e-mail or SMS.

Thanks to the integration of meters and current values, investors and technology managers always have a comprehensive overview of the status of the monitored technology. ContPort can also import data from other control systems and SCADA, and therefore enables comparison (benchmarking) of the technologies available in the entire manager portfolio.

ContPort for buildings

Efficient building management implies (besides other requirements) a controlled reduction in energy consumption. If we want to have control over consumed energies, we have to

- measure it continuously,
- evaluate the measured values,
- based on the derived parameters, identify weak links,
- and propose energy-saving measures.

The last two services are provided by the energy technician or a company which supplies energy management (sometimes together with building management). Measuring and evaluation may be part of the building control system. However, in the vast majority of cases the building control system - that is, the measuring and control system - only transfers data to SCADA and records data history. The control system does not process the data any further.

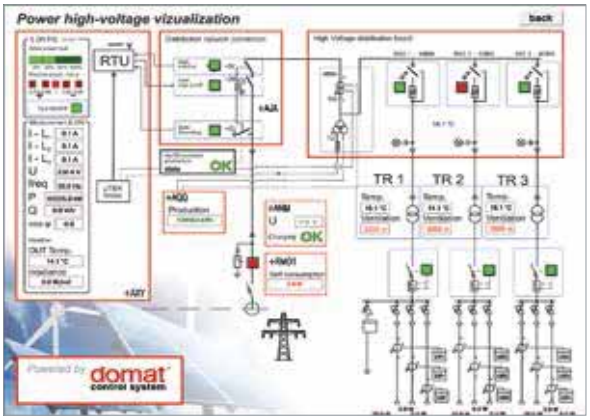
In order to evaluate consumptions and perform branch benchmarking, so-called derived parameters are used, such as energy consumption per square meter of floor area, or degree days. For example, in hotels these parameters represent the consumption of energy for one overnight stay, etc. To do so, we must know other variables and constant values, for example, the number of hotel guests, the floor area of the building or the level of office occupancy. These values are used in calculations which help us to establish whether operation of the relevant building is efficient in comparison with other buildings or accepted standards.

ContPort is a cloud service which collects data from control systems produced by different manufacturers, modifies them and works with them based on the requirements of the energy technician or facility manager. In addition to data processing, ContPort is also able to manage error reporting/messaging and tasks (ticketing), including the assignment of service costs to individual technologies or to their parts. This enables users to get a clear idea of all operational expenses - energies and services - in one overview. Thanks to this feature, ContPort is able to evaluate whether continuous repairs of the relevant technology would be economically viable or whether it would be better to let the old technology last out and replace it with a new one at the expense of temporary higher energy consumption. ContPort also offers predefined and customer reports generated manually at specific time intervals or automatically during regular periods. The technologies offer the option of storing catalogue sheets, floor layouts and other information which helps service technicians remove problems quickly and efficiently. Predefined regular events notify about the end of validity of revision reports and provide dashboards offering a quick overview of current and historical data.

Thanks to ContPort, facility managers and energy technicians always have operational cost data ready at hand.

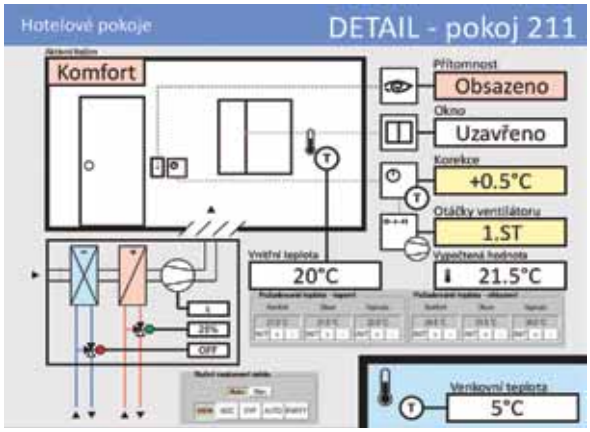
VISUALISATION OF TECHNOLOGIES (MERBON SCADA)

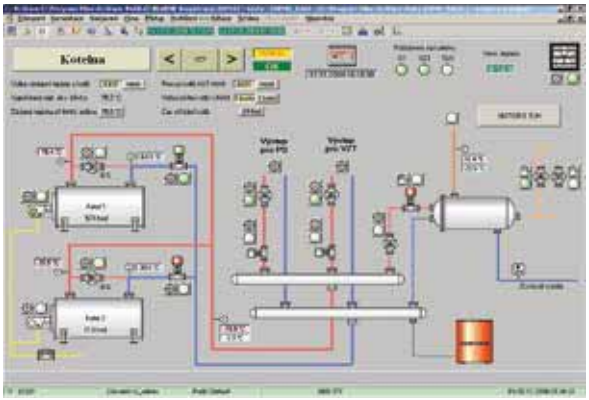
The operator must always have up-to-date and accurate information about the status of the relevant technology, regardless of whether this concerns a boiler room, a network of heat exchangers, an individual room control system in an office building or hotel, a photovoltaic plant or an energy source system which makes up a virtual power plant.



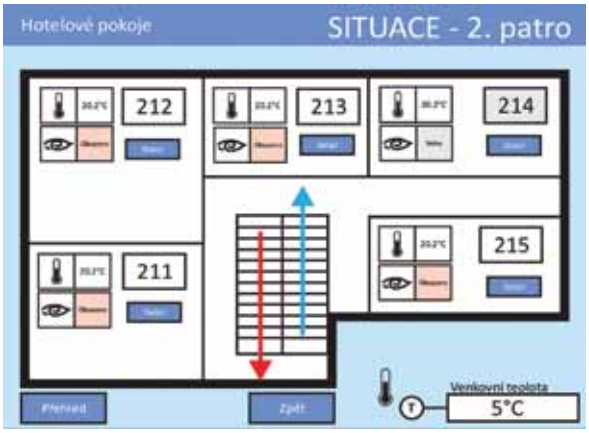
This information is provided by visualisation. Data are available in the form of tables and schemas offering current values, graphs, emergency and event overviews as well as other information. SCADA (Supervisory Control and Data Acquisition) can have various forms which largely depend on the scope of the monitored technology:

- easy web access directly at a substation, used for the simplest autonomous equipment and household automation systems
- a personal computer with visualisation software which is also used as a server to store historical data - used for medium scope projects such as office buildings, hospitals, etc.
- several redundant control centres monitoring larger technologies, such as centralized heat distribution network management or photovoltaic power plant management





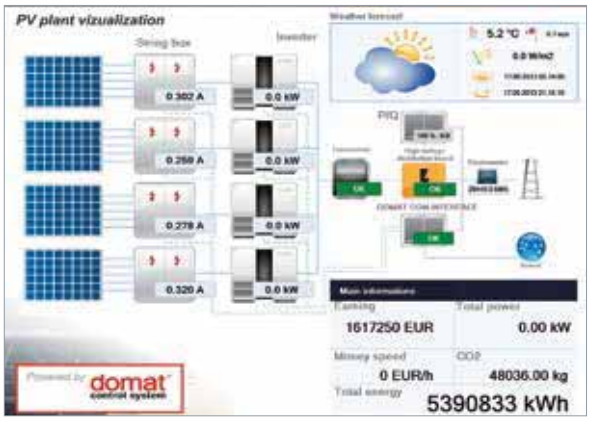
- a powerful web server providing access for dozens of users - used for user remote access in residential buildings
- a combination of two or more of the systems mentioned above and based on user needs and requirements.



Thanks to the fact that we not only supply visualisation and control systems to system integrators but also use them in our own projects, we are able to make use of feedback coming directly from users, which allows us to add additional modules to the system as needed.

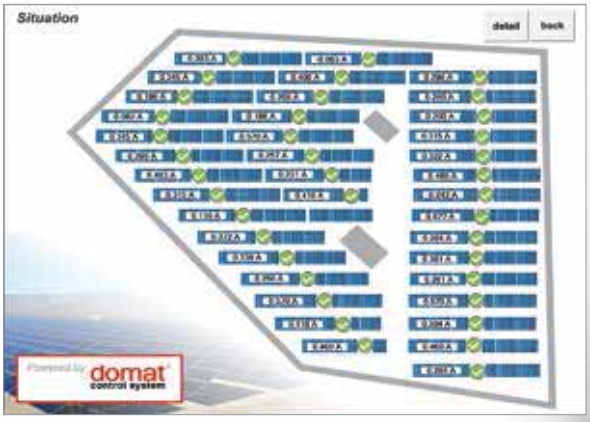
A graphic station is able to visualise and collect data not only from Domat control systems. As far as larger projects and installations are concerned (where technology is gradually refurbished or expanded based on the investment abilities of the operator), we are able to integrate visualisation with other control systems such as process substations, photovoltaic inverters, cooling equipment, boiler control systems or energy meters. For this purpose, Domat system offers a wide range of software components and drivers which allow communication with control systems produced by other manufacturers, either via standard protocols such as Modbus, BACnet, M-Bus or OPC, or via company-

specific protocols developed by other manufacturers. This allows us to display values at joint control/dispatch centres which we would not otherwise be able to compare or analyse.



When the relevant technology breaks down or is in an emergency status, it is necessary to get such information to the responsible person as soon as possible using a reliable communication channel. Alarm management is processed at the process stations or via the SCADA computer - based on the system size, and alarm forwarding and routing requirements. Alarms may be reported/displayed on a screen, via SMS, e-mail, an audio signal or through other methods. Alarm server is used for larger applications. This application collects events from several dispatch stations and sends them to users based on predefined criteria as well as on priorities, the technological unit, equipment placement, the time plan and preferred communication channel. This allows the system, for example, to report/display all alarms during working hours on a computer screen, and once the shift is over (based on the time plan or on information from the integrated attendance system) the system can send the user only critical alarms in the form of an SMS message which requires confirmation.

To store historical data (sampled values), own system resources (data files) are used in simpler installations. For very demanding requirements such as the storage of tens of thousands of values every minute, Domat uses either the SQL database (MySQL, MS SQL, PostgreSQL), or its own very powerful binary database optimized for value storage obtained from industrial processes, the Merbon DB. This database is capable of handling hundreds of thousands of values per minute. The database has an open interface (API), so data may also be read and used in other systems such as accounting and ERP software.



HEAT SOURCES AND CHILLERS IN BUILDINGS

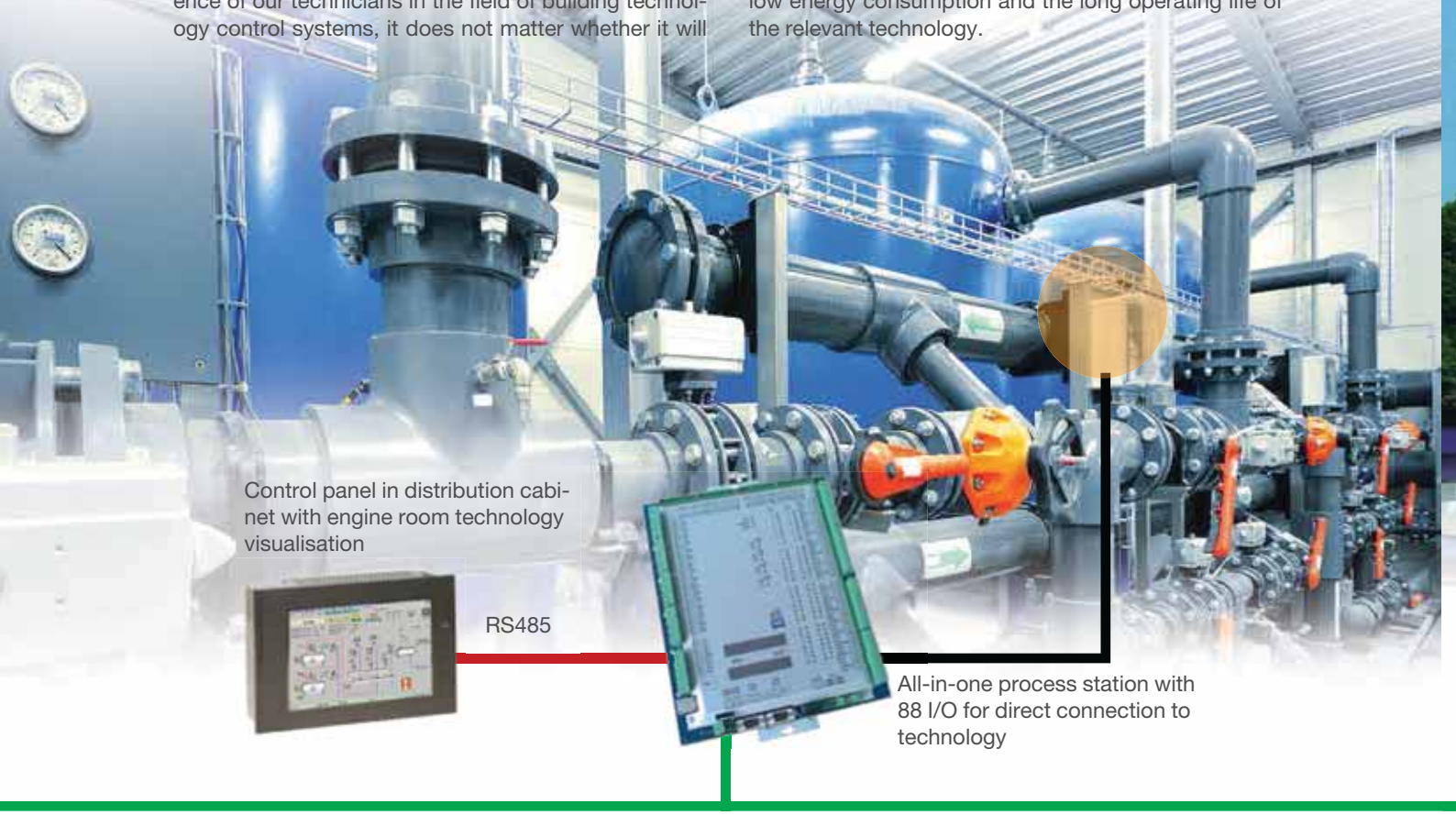
As far as energy consumption in buildings of various types is concerned (industrial plants, shopping malls, hotels, office buildings, etc.), the focus is on economic and efficient operation of heat sources and chillers.

These factors largely affect a building's operating costs. Another important requirement is to have a safe and, if possible, fully automated control system which minimizes human operator errors. The control system also oversees engine room emergency statuses and protects against critical situations. The safety features include room flooding and room temperature monitoring, the detection of flammable and explosive substances, automated pollution extraction, fire safety, an emergency shutoff system, etc.

The source (primary) technology section must cooperate with the appliance section - air handling units and heating circuits, etc., which provide signals about energy consumption allowing the power source to supply energy according to the required parameters, at the same time minimizing losses occurring in production and the distribution system.

Another aspect is comfort inside buildings. Engine rooms are controlled based on current weather conditions (equithermal control, control based on weather forecasts), and are always able to create a perfect inside temperature and provide comfort for all persons inside the building. Thanks to the extensive experience of our technicians in the field of building technology control systems, it does not matter whether it will be used to control boiler rooms, heat pumps, heat exchanger stations or large cooling units. For these types of technologies we also offer a unified and comprehensive solution including complete delivery of all measuring elements and actuators (sensors, valves, thermostats, relays, etc.), which greatly aids maintenance and follow-up servicing.

Domat system is also suitable for the management and control of engine rooms using different technologies. In buildings this applies most often to engine rooms delivering heat or cold (boiler rooms and heat exchange stations), including bivalent and trivalent technologies, i.e. gas or solid fuel boilers completed with heat pumps or solar technologies. As far as industries are concerned, we have already implemented systems controlling the technologies used for chemical water treatment, the preparation of compressed air, nitrogen, and for mechanical cooling, etc. In addition to years of experience in the design and algorithmic control of these technologies, we also offer cooperation with a technologist or supplier of mechanical and electrical parts. The result is a perfectly designed and well-balanced control system respecting all operational conditions while maintaining low energy consumption and the long operating life of the relevant technology.



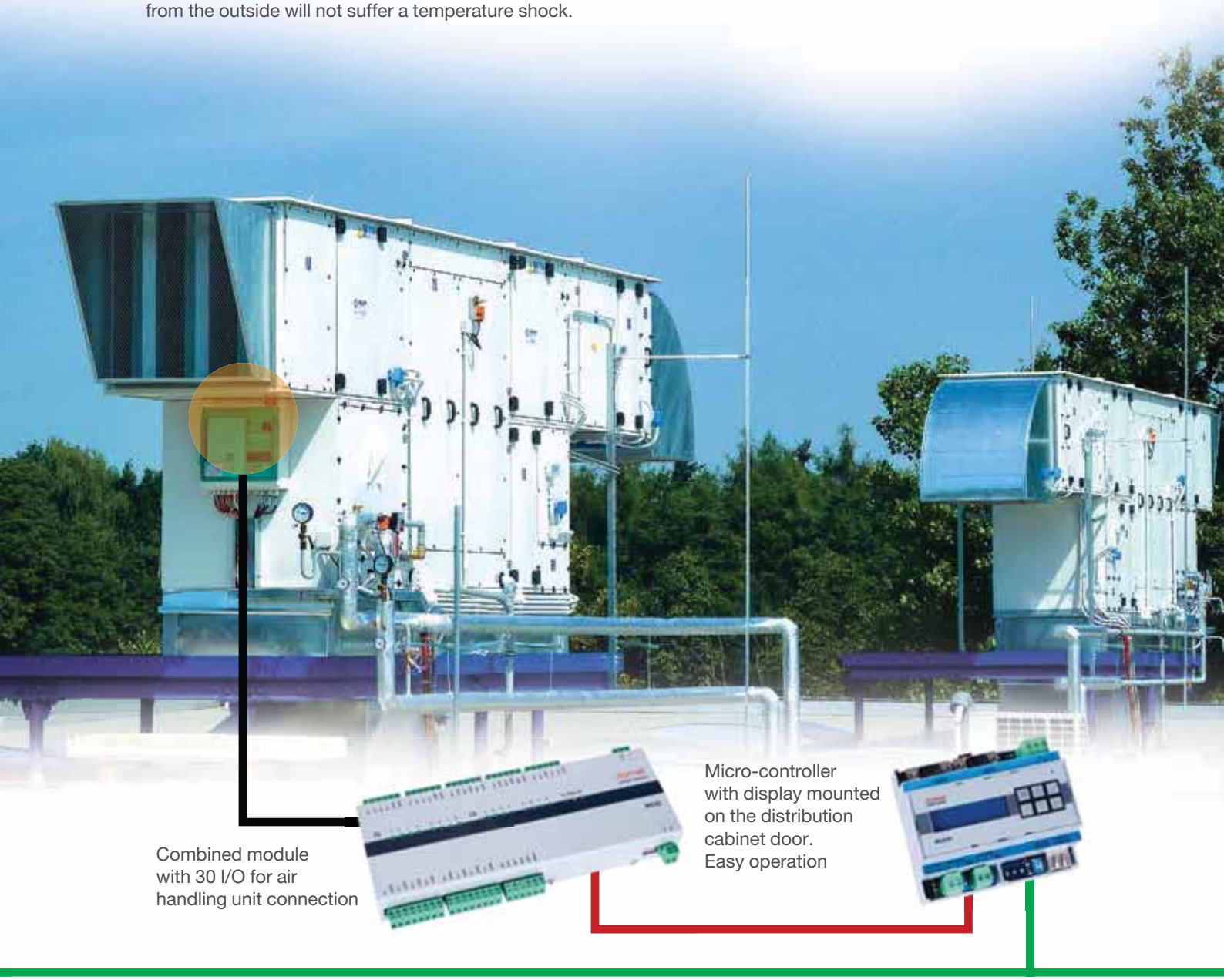
AIR HANDLING UNIT CONTROL

The most important requirement for air handling units is that they prepare and provide air based on the required parameters efficiently, and if possible, only in the required volumes. The Domat air handling unit control system is able to communicate with zone controllers which signal the need for ventilation in individual rooms; based on that, Domat uses primary units to prepare air according to the required temperature, humidity and quality.

The required parameters in the relevant environment are kept within the optimum comfort zone, which means that temperature and humidity are controlled in a certain way which provides personal comfort in the relevant rooms while eliminating unnecessary air processing. The summer compensation feature ensures that a person entering an air conditioned environment from the outside will not suffer a temperature shock.

Units with variable speed drives use room or exhaust quality sensors and CO_2 sensors. These sensors indicate the level of air pollution. Based on these values, the system adds clean and fresh air from the outside to a new air mixture. Waste air is recuperated - it gives up its heat, which is used to preheat the new fresh air. Variable speed drives are controlled via a communication interface: physical system inputs and outputs are not necessary and protection against interference is improved.

Safety features include frost protection with several levels: a mechanical frost protection thermostat, active protection through limiting the minimum temperature at the return, and winter start with smooth compensation in order to make sure that the unit operates in the most economical conditions.



CONTROL OF INDIVIDUAL ROOMS

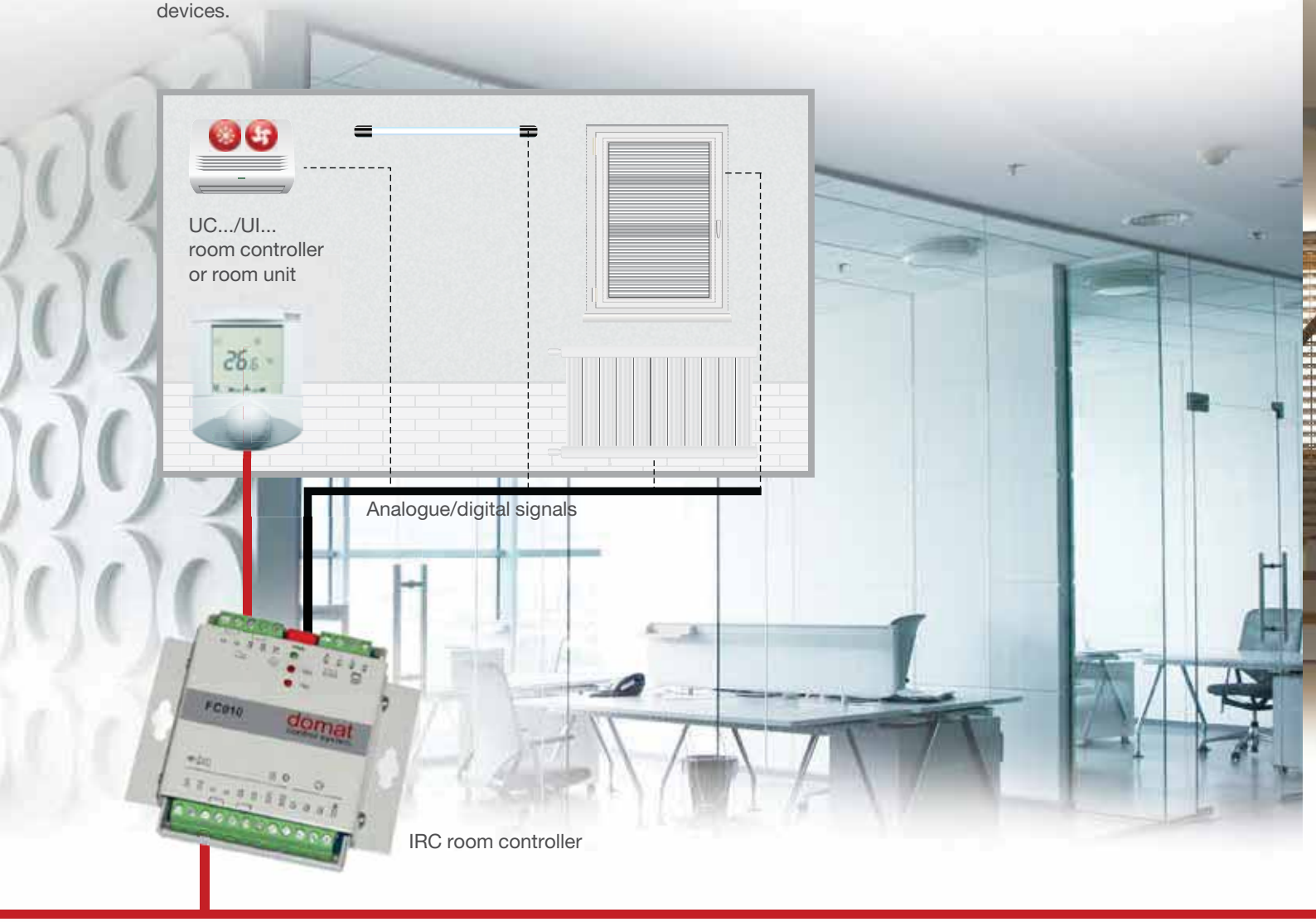
IRC controllers, room units and DOMAT regulators

Individual room control (IRC) ensures optimal thermal comfort in individual rooms. It offers the option to set the time schedules, to determine the presence of persons in rooms, window contact status readouts (interruption of the heating system when windows are open), the lighting system, window blind control and the control of other devices.

Individual parameter setting is easy. Setting is done either locally using a room unit or centrally from a dispatch computer. In this way you can control all rooms centrally. Heating/cooling system control is done individually based on current conditions inside the relevant room (for example, only when the room is being used). When compared to other control systems, this system saves up to 40 % of energy costs. Setting may be done remotely via the Internet or through mobile devices.

Thanks to its extensive product portfolio, Domat allows the user to control and regulate various types of devices in one room, such as floor heating, thermic valves of heating units and radiators, fancoils, air curtains, air conditioning units, unit heaters, induction units, cooling panels, etc.

Central control of electrical or lighting systems may be done through the use of Domat I/O control system modules or through DALI interface integration (Digital Addressable Light Interface), which allows the user to connect up to 64 electrical ballasts for the lighting device control system.



Modbus RTU / RS485

Ethernet

ROOM UNITS AND CONTROLLERS

The design line of communicative room controllers and units introduces an entirely new dimension to the room control system field. The large LCD display (60 x 60 mm) allows the user to read the actual temperature and equipment status from a distance of up to 5 meters, the rotary controller fitted with a push button makes everyday operation easier, such as temperature corrections and operation mode changes, and also allows control on several levels, including the adjustment of the weekly scheduler used with room controllers.

Universal room units provide an ideal solution for the control of HVAC units, small boiler rooms and other more complex devices. In addition to the basic functions (room temperature monitoring and setting, operation mode changes), these controllers offer other features such as selection of a suitable heating curve, outside temperature to start heating, domestic hot water temperature adjustment, relative humidity display and setting, and the display of two other values, etc. Functions available to the user are selected during commissioning. For example, by switching between operation modes you can choose the residential mode (day, night, automatic operation, off), or hotel or office mode (comfort, standby, off, or party mode). Operation modes may be set or adjusted over a communication bus by central time schedulers or modes such as cleaning, holiday, etc.

A wide range of room controllers with CO_2 sensors is supplied under the UI 09x label

UX100 heating and window blind regulator

UC150 and UC250 with Ethernet interface

Modbus RTU / RS485

Ethernet

BLINDS/LOUVER SYSTEM CONTROL

Domat system can integrate blinds control and thermal comfort setting into one room controller. It is no problem to connect the entire unit to a central control system and to have manual control and remote control of window blinds based on, for example, time schedulers, on the actual solar irradiation of the building facade, or on current weather conditions. This includes retracting window blinds in case of strong winds or pulling blinds down if the sunlight is too strong, which eliminates heat gains in air conditioned rooms.

LIGHTING SYSTEM CONTROL

Where required, the Domat system offers remote control for lighting devices by turning on or off individual lighting circuits using physical inputs and outputs, as well as integration of the DALI bus, which can directly control individual light sources, light modes and time schedulers, dimming and actual illumination based on outside light conditions.

INTEGRATION AND CONTROL SYSTEMS FOR OTHER EQUIPMENT

Thanks to the open nature of Domat systems, the control system can be integrated with other building technologies (fire protection system, security system, air handling units, air conditioning units, boiler and cooling unit electronics, variable speed drives used to control large fans, etc.), as well as with other energy producing equipment (solar inverters, transformers, high-voltage protectors, energy distributor control units, diesel-powered generators, etc.). These devices may be integrated into the system through physical inputs/outputs or via communication lines - thanks to the ever-increasing number of implemented communication protocols. Often we may use standard protocols such as Modbus, BACnet, M-Bus or OPC. Open Domat communication also allows interconnection with other competing control systems such as Johnson Controls, Honeywell, Siemens, Saia, etc., and to group them into one operational unit. In many cases this means that in order to implement the Domat control system, you do not have to replace your entire control system. Because we decided to take this path, our customers are able to keep their current investments, maintain healthy and operational sections of their current control system, and take advantage of one of the most universal systems available on the market.

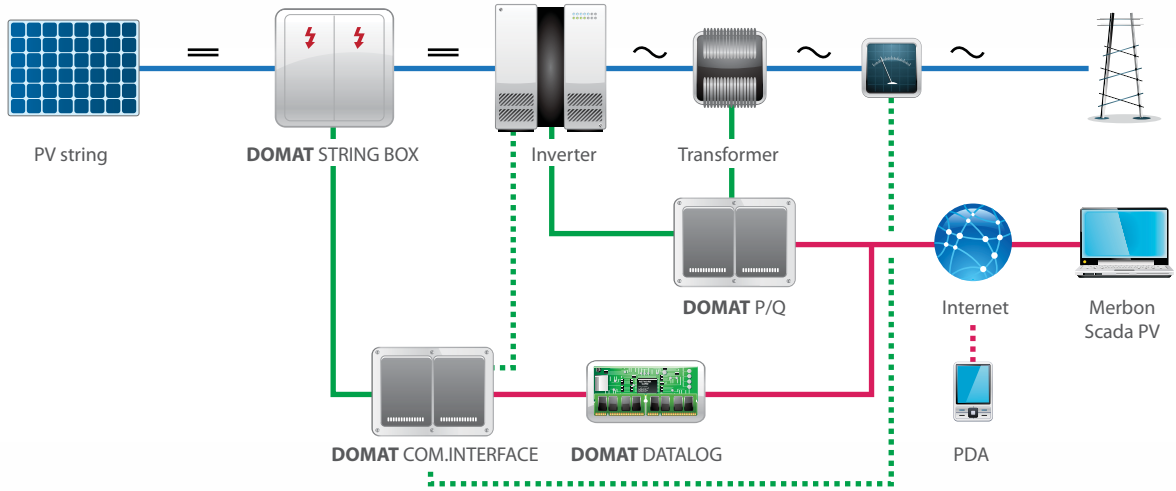
M090 - Modbus to DALI interface

Ethernet

CONTROL AND MONITORING OF POWER SOURCES

Domat supplies systems used to monitor and control solar power plants, local distribution grids, heat pumps and heat distribution networks. Domat also supplies devices used for energy equipment monitoring such as communication alarm boards for distribution stations, SCADA systems and systems for alarm transfers via SMS messaging, etc.

Solar power plant monitoring



Domat PV plant monitoring system certification - TÜV SÜD 2013

Photovoltaic power plants (sometimes incorrectly regarded as autonomous and maintenance-free) represent comprehensive and large systems with high potential for breakdowns; therefore, it is necessary to detect breakdowns early and remove them in order to maintain the high efficiency of the power plant and eliminate production losses. The monitoring system was designed not only for end consumers but also for investors, servicing organisations and OEM. Due to the fact that the performance of a photovoltaic power plant may vary considerably, Merbon Scada PV uses special algorithms to detect short-term and long-term power variations and simultaneously eliminates environmental effects such as cloudy weather, decrease or loss of solar panel performance due to snow, reductions in efficiency when the outside temperature increases, etc., to ensure that the technician is not confused by false alarms. Thanks to the long-term data registration, the user may also monitor and evaluate the estimated decrease in performance during the lifetime of the equipment and compare these data with the technical specifications guaranteed by the solar panel supplier. The modularity of the system makes the construction of dispatch centres easier, starting with the most simple visualisation of measured values and ending with distributed integrated systems designed for large energy/power grids and their power sources. Special emphasis is placed on high reliability, the fast creation of applications and easy setup which can be done even by less experienced users. Thanks to the innovative solution, the system can detect and report all technical and physical breakdowns occurring in the power plant.

DC distribution box with electrical current monitoring feature - string box

String box can connect 8, 12, 16, 20, 24 and 32 strings up to 20 A. The electrical current values measured by the Hall probes are transferred to the bus and transmitted to the Domat visualisation or monitoring system.

All independent dipole-fused sections are combined into a single output, protected against overvoltage. As an option, you can add a distribution box with panel temperature sensors, with a solar irradiation intensity sensor and a switch installed at the common DC output.

For larger installations, you may group several sections in the distribution box together in an unmonitored panel, and you can measure the electrical current in a joint higher-level distribution cabinet. This option is not as sensitive as measurement of each string, but saves considerable investment costs.

MAIN FUNCTIONS

- DC measurement
- DC string grouping
- temperature and solar irradiation measurement
- data communication
- protection/safety

DOMAT COM.INTERFACE

An assembled box for data acquisition obtained from measurements of direct currents from a set of string boxes, data acquisition from transformer stations, communication with inverters and data acquisition from individual electricity meters. The main element is an industrial minicomputer and multipoint input and output module. As an option, you may add to the installation sensors which will monitor the necessary values and statuses.

MAIN FUNCTIONS

- data acquisition obtained from direct current measurements
- data acquisition from the transformer station
- communication with inverters
- data acquisition obtained from electricity meters

DOMAT DATALOG

An intelligent tool for centralized data acquisition and data archiving, equipped with an output for graphic web server connection. An operation alarm management feature is part of the software equipment. The equipment consists of an industrial PC with Windows operating system, hard drive and the processing visualisation software Merbon SCADA PV. The archive database built on SQL prevents unauthorized access to data and reverse editing.

MAIN FUNCTIONS

- central data acquisition
- data archiving
- secure data
- alarm management
- communication with dispatch technician

Modbus RTU / RS485

Ethernet

Control of active and reactive power, dispatch resource management

The DOMAT P/Q interface allows the user to control the active and reactive power output of a power plant and to transfer data (operational statuses and values) over to a distributor control system. The interface receives from the distributor (customer) equipment data or binary signals, and transfers them to a bus which communicates with inverters. Then the interface reports command receipt back to the distribution system.

The regulator is compatible with I/O modules used to monitor direct current, which means that electrical current values can be displayed on a screen or web interface, or transferred to the monitoring centre.

We supply complete turnkey technical solutions including project administration steps, negotiations and approvals issued by a distribution company (ČEZ Distribuce, E.ON).

MAIN FUNCTIONS

- communication and data interface between power plant and distributor
- data communication with distributor systems
- transfer of distributor instructions to power plant system

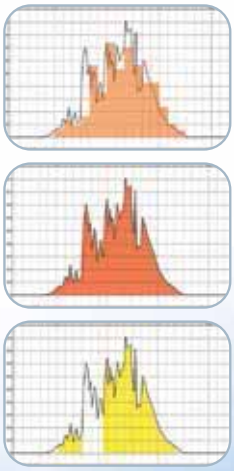
PV power plant efficiency measurements - Solar integrator

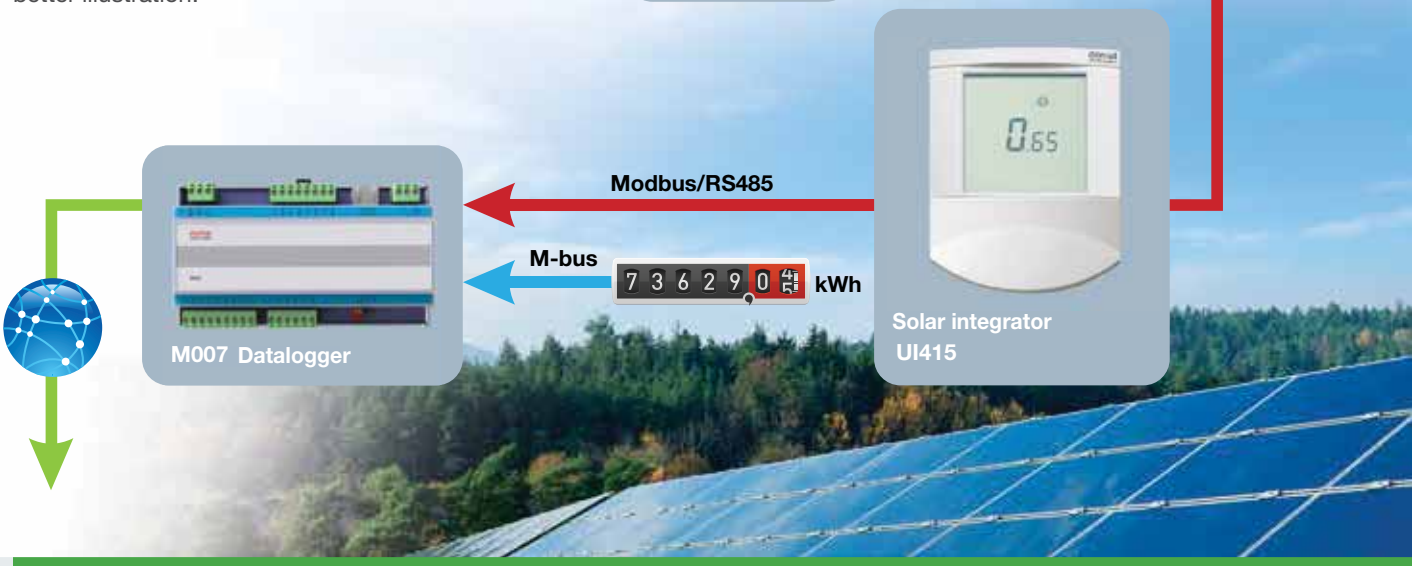
A unique solution for efficient evaluation of the performance of a PV power plant in terms of an area of panels, power plant structure and solar radiation intensity.

Measured energy with system illumination sampling and subsequent integration of the calculation (area of all orange rectangles). For clarity, we used a disproportionately long interval of 1h. The shorter the interval, the smaller the calculation error.

This is what energy measured by a solar integrator (orange area) looks like. Thanks to the integration interval of 1s, the energy is measured with Ws resolution. Accuracy is determined primarily by the properties of the used sun radiation sensor or pyranometer.

Energy integrated only during operation of the inverters (yellow area). Between 9:00 and 11:30 we see a downtime due to morning maintenance. Morning startup and evening run-out have been enlarged for better illustration.





ENERGY CONSUMPTION OPTIMIZATION

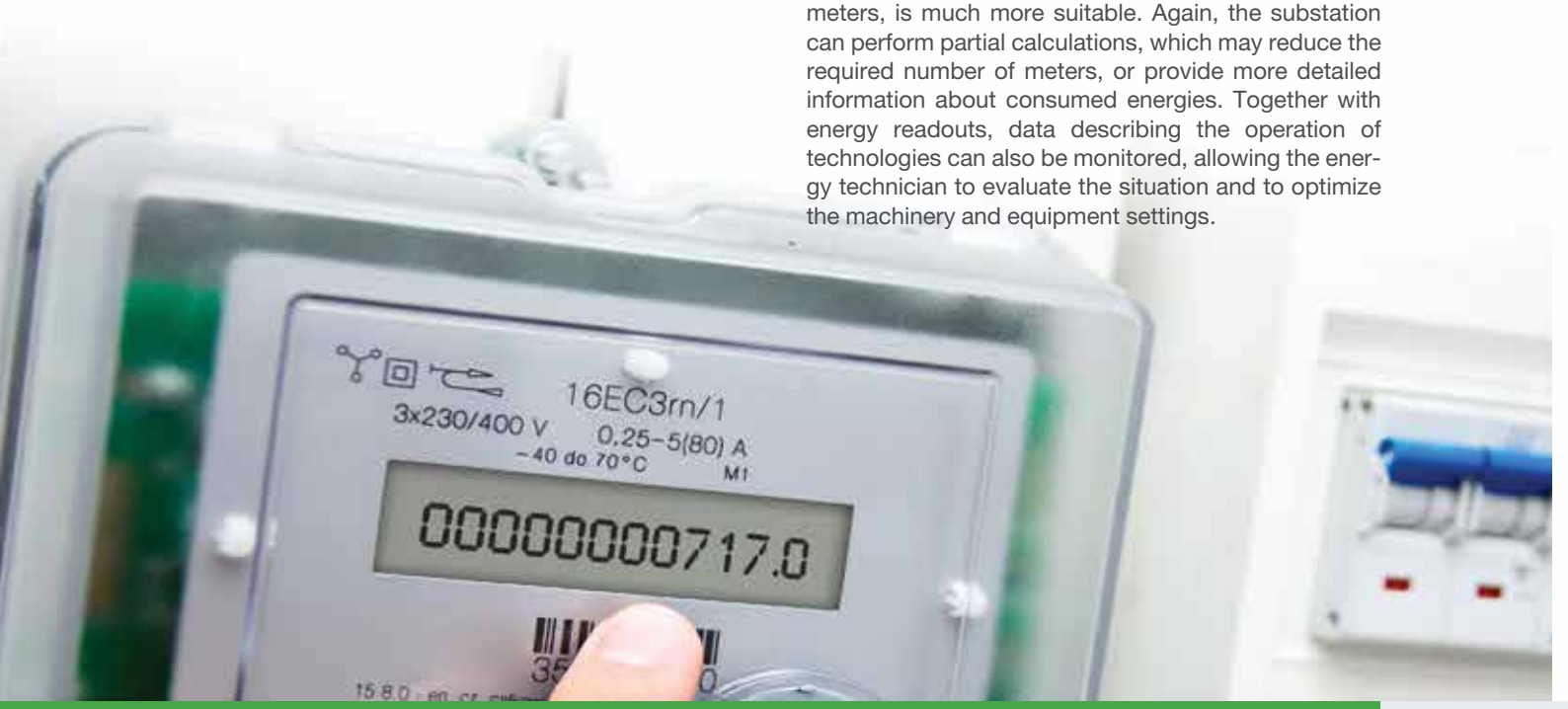
LOAD SHEDDING CONTROL

The load shedding controller ensures that the agreed 15-minute electrical energy consumption will not be exceeded. Unlike other commonly used systems, the regulator can monitor via the input or via communication buses whether turned-off technology is in operation - and if it is not, the regulator will skip the relevant group. All current values and parameters can be set via the LCD display, the bus, via the network from visualisation or through the web interface. All values can be dynamically changed. On the website you can also see a graph of the last 15 minutes and a consumption curve based on time.
Thanks to the fact that the load shedding control is managed via application software in a freely programmable regulator, the algorithm may be easily adapted to the requirements of the controlled technology. Maximum shutdown times, minimum switch-on times and other parameters of individual groups (up to 8 groups) can also be set. The entire control can be easily integrated into another building control system or into other software (for example, visualisations).

METER READOUTS

Thanks to its open system, Domat offers a wide range of options of how to read values from meters: starting with the interface with web access via a freely programmable substation offering other calculation options and management/control, such as suppression of peak demands in district heating networks, up to data acquisition to a powerful database with an open interface allowing access for other applications, such as accounting and ERP systems. Thanks to the broad support for almost all types of meters using the Modbus and M-Bus interfaces, it is no problem to integrate calorimeters together with water meters, electricity meters and gas meters, thus providing a complete overview of energy consumption within the relevant building or technology - regardless of whether it concerns current values or historical data.

We always select the solution which is best suited to the relevant task. Hundreds of minor technologies (heat exchange stations, store branches) are often fitted with the M007 readout module, which uses Internet communication. However, for larger buildings such as apartment buildings or office buildings, a concentrator in the form of a substation fitted with 4 ports and allowing the connection of up to 1,000 meters, is much more suitable. Again, the substation can perform partial calculations, which may reduce the required number of meters, or provide more detailed information about consumed energies. Together with energy readouts, data describing the operation of technologies can also be monitored, allowing the energy technician to evaluate the situation and to optimize the machinery and equipment settings.



ENERGY CONSUMPTION OPTIMIZATION

WEATHER FORECAST-BASED CONTROL

When creating a control strategy, information about weather conditions that will probably occur at the installation site during the next few hours may be very helpful. In this way, the system response time can be compensated to a certain extent. A solution can be provided by the RcWare Weather service, which obtains weather data and transfers weather forecast values to the system. Meteoserver can calculate 12 variables such as wind direction and speed, maximum and minimum temperature, precipitation, humidity, air pressure, clouds, etc. All the values are predicted in a mathematical model created for any location within Central Europe. Based on requirements, the system can be extended to other regions as well. Variables belonging to one license are linked to the geographical coordinates entered when the service was ordered.

For each variable you can set how many hours in advance the value is to be predicted. Times between 1 and 72 hours are used. You may also configure other variables which predict one value with different advance times, for example, temperature after one hour and temperature after six hours. Most often, the temperature 2 meters above ground is used - for example, for optimization of the heating curve, which eliminates overheating (when the outside temperature is rising, the heat water temperature is preset to a lower startup temperature in order to eliminate supplies of unnecessary energy to the system), or for a cold water tank charging strategy.

PREDICTIVE TECHNOLOGY CONTROL

The MPC predictive regulator (Model-based predictive control) uses weather forecasts and the mathematical building control model to minimize the planned energy consumption while maintaining the required thermal comfort. Thanks to the great computing power of today's technologies, we can create a model of a building and calculate the development of inside temperatures based on measurements of inside and outside temperatures and other values, such as solar irradiation or wind speed. These calculations are done on remote servers. Only required values such as the temperature of the heating system water are forwarded to the automated control unit.

In cooperation with the Czech Technical University in Prague, predictive heating system control done via SoftPLC software is being tested at the university buildings in Prague, Dejvice. For four years in a row now, this test has been obtaining energy savings of up to 26 %. A similar project with MPC is being implemented in Belgium, in the Hollandsch Huys building in the city of Hasselt.

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Heat pumps, Česká Lípa

Twenty heat sources with heat pumps and gas boilers, each producing a power output of around 100 kW, are being installed in the city of Česká Lípa. Further sites are under construction. The control systems are interconnected via the network and connected to the central dispatch station of the management company. Together with energy readouts, the manager can compare the efficiency of individual sources with the planned values at any time. Thanks to the Domat licensing policy, the system can be expanded without any additional requirements for the dispatch infrastructure.

Remote heating system, Trenčín, Slovakia

Reconstruction of 30 boiler rooms and 20 heat exchanger stations, and connection to a central dispatch station. The equipment is interconnected via a dedicated network, online data provided by all the technologies are permanently available at the control stations, historical data are stored in the Merbon DB database, which is also used for customer data export and for other calculations carried out in the cost allocation software. The control system consist of three RcWare Vision stations: two of those stations are installed at the main dispatch station in order to ensure online supervision, and the third one is installed in a biomass boiler room.

PV plant Ševětín monitoring and management

The third largest photovoltaic power plant in the Czech Republic, with a peak power output of 29.9 MWp, is situated near Ševětín in South Bohemia. Domat delivered a monitoring system for all 27 transformer stations, each equipped with two central inverters, and the monitoring of string groups (approximately 1,500 Hall probes are installed in the power plant for DC monitoring) and other values (such as solar panel temperature, sunlight radiation intensity, etc). The monitoring and control system communicates via the network with equipment of the distributor from which the system receives instructions to limit power output and to control the power factor. At the same time, the distributor also reads out basic operational parameters of the photovoltaic power plant. Data are visualised at several dispatch stations directly in the power plant as well as at the owner's headquarters.

PV plant Dobšice management and monitoring

Ten investors were involved in a set of photovoltaic power plants in Dobšice. This project is equipped with 8 different inverter brands, some of which do not offer a software power-reducing option. The supplied control system had to come up with a "fair solution" of how to control active and reactive power between investors, which was successfully achieved thanks to the extensive communication options and freely programmable substations. The control algorithm performs the instructions from the distributor, and, at the same time, it divides the switched-off power output evenly between all 10 sections of the power plant. The monitoring system oversees the correct functioning of the inverters and reports breakdowns, enabling the servicing organisation to respond in a timely manner and to keep the supplied power output as high as possible.

Monitoring of photovoltaic power plants in Italy and Bulgaria

Between 2011 and 2012, a set of power plants with a total power output of 56 MWp was built over several construction stages. This project is interesting thanks to the actual modularity of these power plants - the investor did not know in advance who would buy these power plants and therefore opted for a modular solution: Eighteen clusters are installed in Italy and twelve in Bulgaria, each putting out 1 MWp. Clusters may be virtually combined into bigger units - if a customer wishes to purchase a power plant producing several megawatts. The central management web server is situated in the Czech Republic and allows the power plant owners to get an overview demonstrating system functions, production statistics and breakdown indications. The remaining 26 MWp was designed using typical methods on several multi-megawatt fields connected to two centres inside the managing companies.

REFERENCES

Harfa Gallery, Prague

The Harfa Gallery has 49,000 square meters of sales area and is the largest business centre in Prague. It was opened in November 2010 and offers 160 stores on 3 floors. Its biggest attraction is a roof terrace with a garden accessible from the food court and restaurants. The terrace offers a large children's playground, ice-skating rink and various fountains and multimedia objects. The underground parking lot can accommodate up to 1,600 vehicles. The building has its own heat exchanger station and two Trane cooling machines with a power input of 2 x 1MW. The peak electrical input of the building may reach up to 3 MW and therefore parameterized algorithms were used to control load shedding. There are 62 air handling units in the building and an additional 30 smaller units used for additional heating and air extraction. The control system contains more than 6,300 data points (processing variables).

Interspar and Spar

Building control systems for Interspar and Spar supermarkets in the Czech Republic, Hungary, Slovenia and Croatia. Large supermarkets are fitted with local dispatch rooms for local technicians; and smaller store control systems are designed with touch screen controls. All data are transferred via the network to a centre situated in each country, where they are supervised by central energy technicians. These technicians have a clear overview of equipment statuses, temperatures, energy consumed by the heating and air conditioning systems, etc. The system located in the Czech Republic covers 28 buildings. The systems in the other four countries cover 170 stores. Domat has been cooperating with the Spar group since 2004 and focuses on reconstructions and service and installation of technologies in new buildings.

Shopping centre Dalma, Yerevan, Armenia

The Dalma Garden Mall is the first building of its type in Armenia, and offers bank branches, a cinema, a variety of restaurants and coffee shops, a supermarket, construction material shop and other stores and service shops. It covers 43,500 square meters on 2 floors. The boiler room is equipped with 3 boilers, each putting out 1.4 MW. The total nominal power output of 4.2 MW is distributed to four circuits: Approximately 600 kW is used for water heating and 3.8 MW is used for the air handling units and for two two-pipe fancoil circuits. The boiler room control and measuring system contains approximately 150 physical data points and even exceeds European standards in some aspects. For example, the investor required for all twin pumps continuous measurements of differential pressure as an indication of pump operation.

Žižkov TV tower in Prague

The Žižkov TV tower is without a doubt the most noticeable and dominant feature of Prague. It reaches 216 meters and is the tallest structure in the Czech Republic. The structural design is made up of three tubes, which together reach a height of 134 m. After that only a single column (the West column) goes higher and turns into an antenna extension. Three cabins are attached to these tubes: The One Room Hotel and a restaurant is attached at a height of 66 meters, an observation cabin is attached at 93 meters and, finally, a booth with broadcasting technology is attached slightly above that. Platforms with lattice columns and structures for antennas, VHF radio

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transmitters and other wireless communications are higher up. In 2011, an interior adaptation process begun, which included the reconstruction of 10 air conditioning units, heat source units and the electric floor heating system.

Central Railway Station building in The Hague, Netherlands

This multifunctional reinforced concrete building with a glass facade 60 meters tall was constructed between 1970 and 1973. The building has 15 floors where you will find offices, stores and restaurants. The first two floors seamlessly turn into the main railway hall. After 38 years of operation, the building was renovated in 2012. The main reason was the high energy consumption: originally, the building was rated as energy class G. The heating system was designed with sub-window heat exchangers where the old control system was replaced with Domat communicative controllers. Thanks to the fact that the regulators use the open Modbus communication protocol via the RS485 bus, it was no problem to integrate control of individual rooms into the main building control system (supplied by Priva). There are a total of 693 regulators in the building, installed on the 2nd to 13th floor. After the application of energy-saving measures, the building fell into energy class D+.

IMPACT, Kuala Lumpur (Malaysia)

The centre of the international organisation IMPACT (International Multilateral Partnership Against Cyber Threats) was opened in the summer of 2009 in the Malaysian city of Cyberjaya, which has a high concentration of technological companies. On an area of 5,000 m² you will find laboratories, training rooms and research centres; but most importantly, an operations centre which monitors network attacks and helps keep the world's cyberspace protected and safe. The building is air conditioned through the city's central cold-water distribution system. Individual sections of the building are equipped with air handling unit control technologies and with three-stage fancoils. During the design of the regulation system, emphasis was put on energy savings and the optimization of operations in terms of different operating schedules of individual units (the operations centre works continuously). Even basic component models are resistant to tropical weather conditions - high temperatures and humidity.

TechnoPark, Pardubice

A total of four buildings (three production and office buildings and a customs office) heated by 6 heat pumps providing a total power output of 600 kW - scheduled increase to up to 10 pumps with a total power output of 1 MW. Each building is fitted with a heat exchanger station with local control. Offices are fitted with regulators controlling individual rooms (more than 70 rooms in the entire facility). During summer, offices can be cooled down using cold water from wells. The control system is also fitted with active anti-condensation protection. The control and regulation system is integrated with window blind control systems and with window contacts provided by the secu-

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rity system. Produced and consumed energy is measured using communicative heat/cool meters. Process stations in buildings communicate via Ethernet with the central dispatch station located inside the customs building.

Billa Czech Republic and Slovakia

BILLA chain stores in the Czech Republic and Slovakia are gradually being equipped with new control systems used for air handling units and lighting systems. Individual stores are connected via Ethernet to a centre in Modletice. Currently, the centre connects 70 stores. Operators communicate with the system at local levels via a web server, using any computer in the network. The RC Vision SCADA station in Modletice monitors and controls these stores. Remote control carried out from the central dispatch station allows the user to compare the energy demands of individual buildings. This directly translates into energy savings and at the same time reduces servicing costs.

Czech Savings Bank

Data acquisition from more than 400 branches situated around the Czech Republic. Branches are gradually being fitted with communicative modules used to transfer data from calorimeters and electricity meters. Installation is often done once the relevant measuring and regulation system has been reconstructed. Data are transferred to the central dispatch stations of companies which provide building management services for the bank. Long-term monitoring of parameters and energy consumption allows the user to compare branches (benchmarking) and to identify problem spots and circuits. From dispatch stations, the user can also change required values, set time schedulers, etc.

Cable car Pec pod Sněžkou

We can also find Domat controllers and peripherals in air handling and heating control systems in three operational buildings for probably the most popular Czech cable car. Pec pod Sněžkou: Five air handling units - kitchen, refreshment room, operational spaces; two electric boilers, 30 kW each, designed for a radiator heating system, Růžová hora: Two air handling units equipped with an electric heating system for a workshop and support area, Sněžka: one air handling unit equipped with electric heating and variable speed drive integration. The construction project began in 2013 in order to have the equipment ready for the 2013 - 2014 winter season.

Czech Embassy in Tokyo, Japan

Reconstruction of heating and air conditioning system. The measuring and regulation system controls heat and cold water sources - heat pumps. Each of the nine distribution boxes is fitted with a process station and the input/output modules necessary to control the technologies. All data are transmitted over a network to a computer handling data recording and visualisation. The system contains approximately 750 data points, including data acquisition from energy meters via M-Bus.

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