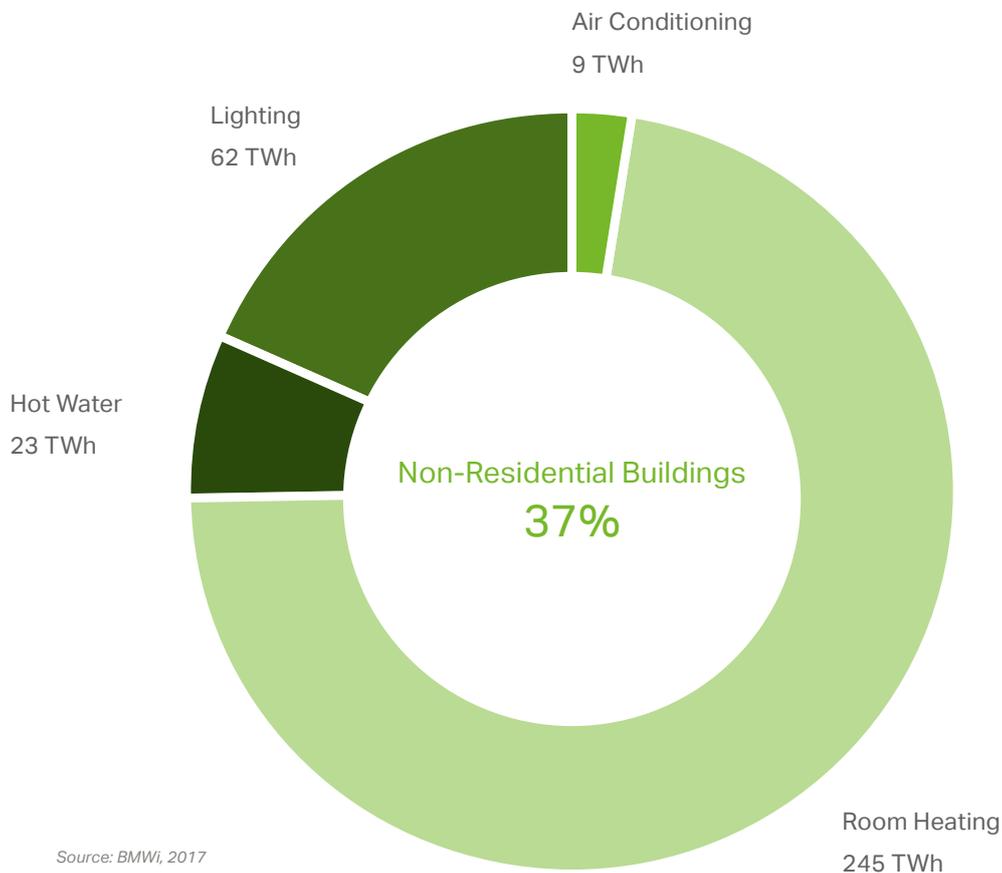


HVAC Solutions



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Source: BMWi, 2017

SUPPORT THE ENERGY TRANSITION WITH WAGO

Efficient energy consumption, optimal system operation and continuous improvement are just a few requirements that buildings must continue to meet – even after construction or renovation. Beyond base rental prices, users must factor operating costs for energy and maintenance into the bottom line. Therefore, it pays to look closely at the main factors behind building energy costs.

Heating, ventilation and air conditioning (HVAC) systems represent one of a building's major costs. Approximately 65 billion in costs for building energy occur annually in Germany.* 37% (24 billion) of these costs are in non-residential buildings. If the energy consumption of non-residential buildings is examined more closely, it is apparent that energy for room heating with 245 TWh (72%) and lighting with 62 TWh (18%) take by far the greatest share of energy consumption for these buildings.

Assuredly, the energy expense and the associated costs alone are adequate reason to be concerned with the energy saving potential in HVAC systems. If that were not enough, the climate change calls for immediate countermeasures in the form of CO₂ re-

ductions. However, the objective of a 40% reduction in CO₂ emissions by 2020 compared to 1990 will not be reached in Germany. Among other factors, this is because the renovation rate is far too low.

Building Automation from WAGO Pays Off

Building automation from WAGO helps to lower energy costs as well as CO₂ emissions for both new buildings and renovation objects. Automatically regulating HVAC systems minimizes energy consumption and improves the climate in a building. Planning and executing HVAC systems requires extensive knowledge from every building automation professional, starting with the creation of demanding control programs on through to visualizing energy flows. Extensive libraries with ready-made system macros from WAGO generally make extensive programming unnecessary. The use of these system macros contributes to standardization, significantly reducing costs.

This applies to both new buildings and renovation objects. Up-to-date building technology and efficiency-enhancing HVAC automation make a

*Source: BMWi, 2017c;

significant contribution in helping new construction meet today's energy savings regulations. For renovation objects, the maximum savings potential can be attained with corresponding control strategies and operations monitoring. This applies equally to schools, office and management buildings, commercial and industrial buildings, hospitals, department or retail stores, sports facilities or museums, as well as hotels and restaurants.

Leverage Savings Potential

Approximately 20% of Europe's final energy consumption could be saved by doubling boiler room energy efficiency via system-specific measures or by improving the energy efficiency of the building envelope.

A key part of the solution lies in system-related applications. The measure of success here depends on leveraging the huge potential for savings through modernizing outdated heating technology. Since May 1, 2014, the applicable standard has been the new German Energy Saving Regulation, EnEV 2014, with the added mandate that energy savings goals must be increased by a further 20% by January 1, 2016. Building contractors starting new construction projects must comply with this regulation. These new energy-saving guidelines are also applicable to building technology systems: heating, cooling, ventilation and lighting, as well as hot water supply.

One basic requirement for planning a building's technical systems: Everyone who participates in the construction shares a common and clear language. Among other standards, this is based on DIN EN ISO 16484-3.

Furthermore, the DIN EN 15232:2017 Standard (Energy Performance of Buildings – Impact of Building Automation, Controls and Building Management) involves extensive calculations and simulations to assess the potential savings that could stem from modernization through automation. In offices, this standard allows up to 25% of heating-energy savings to be economically generated through building and room automation – without changing the building envelope. The DIN EN also recommends KPIs that, after all fine-tuning is complete, will inform the operator of disruptions in the system before they lead to energy cost increases. Users and system operators can have a major influence on energy consumption through automation. Examples include integrating an automated system switch-off (when not needed), or by intelligently adapting a room temperature and demand-based HVAC system control. These automated control functions enable you to fully exploit – and benefit from – potential savings. Therefore, combining HVAC macros with other **e!COCKPIT** function blocks enables users to merge virtually every building system into one cohesive plan that effectively economizes the entire building.

INFO:

WAGO's eu.bac membership demonstrates its commitment and expertise in automation

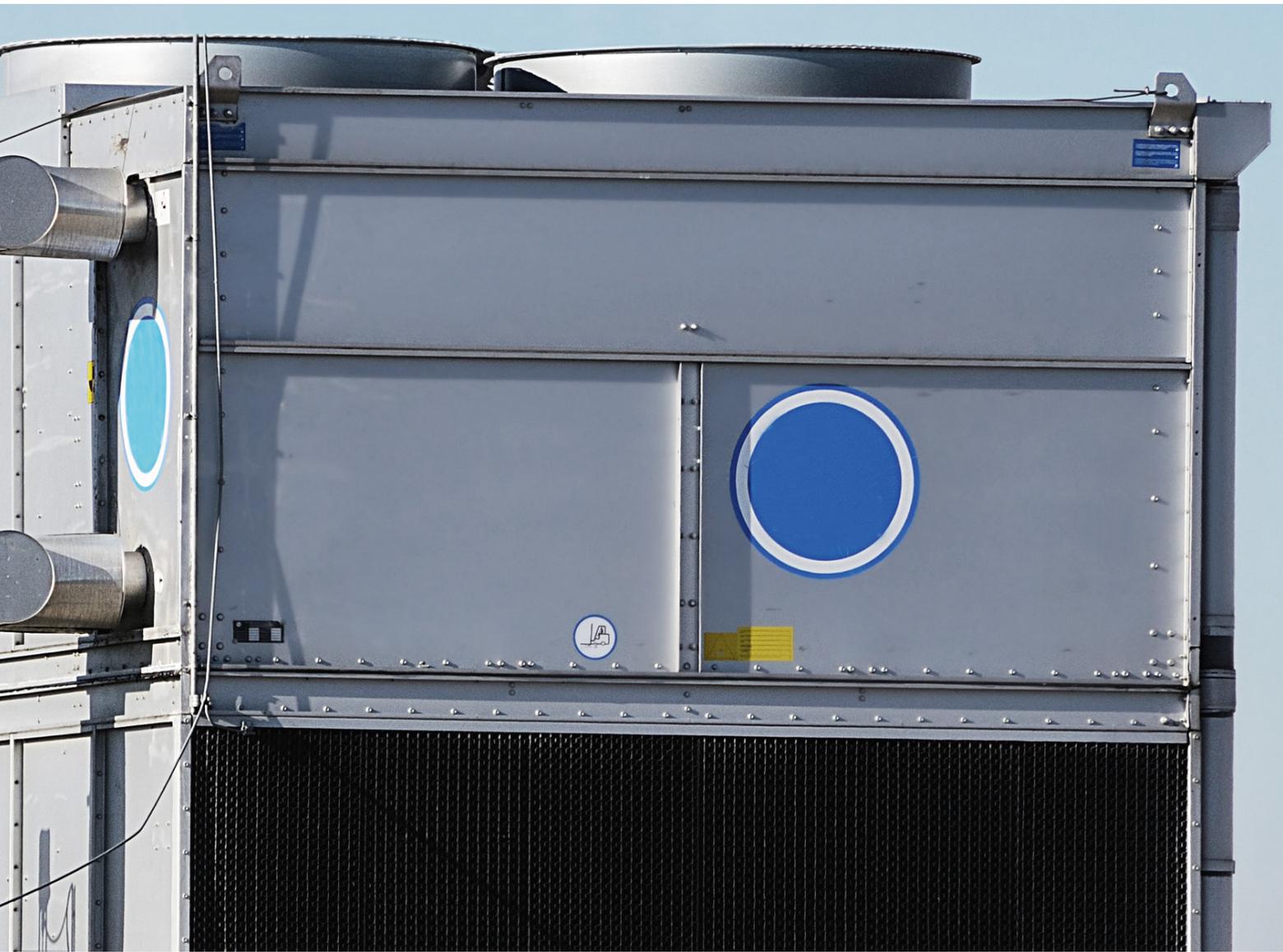


and controls. eu.bac, the European Building Automation and Controls Association, is a professional alliance of manufacturers and suppliers for home and building automation.

YOUR BENEFITS WITH HVAC AUTOMATION FROM WAGO:

- Cost savings through good price/performance ratio in procurement and lower ongoing operating costs
- Worldwide approvals
- Software for ease of use
- Ready-to-use programs (macros)
- Expand or modify system at any time
- Integration of standardized KNX bus systems





HVAC PRIMARY SYSTEM SOLUTIONS

An Efficient Process: Step-by-Step

Energy efficiency hinges on sensibly planning a building's technical systems. Modern automation systems conveniently combine all possible protocols and interfaces into one system – as opposed to the requirements of larger properties with mixed forms.

The WAGO-I/O-SYSTEM 750 is the hardware solution to meet this challenge. The controller, which takes on control tasks for building automation, can be easily expanded using various I/O modules – virtually any device can be connected to the system. Configuration, programming and visualization are easily performed using WAGO's available software packages. In addition to building automation, WAGO has a well-established

track record in building installations.

This experience is reflected in WAGO's integrated approach that cost-effectively combines these two worlds.

YOUR BENEFITS WITH THE WAGO-I/O-SYSTEM:

- Modular design
- Fieldbus-independent
- Future-ready, scalable solution
- Planning freedom via flexible solutions

HVAC PRIMARY SYSTEM SOLUTIONS

Universal, Compact, Economical – WAGO-I/O-SYSTEM

Engineer, control and visualize your projects even more easily and more conveniently with the PFC200 Controller thanks to **e!COCKPIT** and Linux®.

Bring new products to market faster and earn a quicker return on investment: WAGO offers you both with its new end-to-end software engineering. Thanks to an **e!RUNTIME**-based runtime environment and real-time-capable Linux® operating system, the PFC200 Controller is the efficient control solution for your automation applications.

YOUR BENEFITS WITH THE PFC200 CONTROLLER:

- Programming according to IEC 61131-3
- Can be combined with high-level languages
- PLC and IT functions all in one device
- Multiple interfaces, functions and application areas
- High cybersecurity standards (SSL, SSH, OpenVPN and firewall)
- Remote access via mobile communications



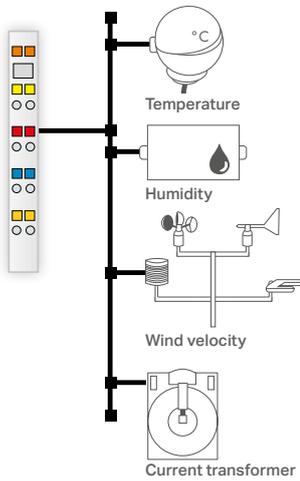
Modbus®-Capable Manual Operation for the Control Cabinet Door

Many types of operation and display modules for different data point combinations are available. Controller connection is established via an RS-485 interface. Communication is performed via Modbus RTU protocol.

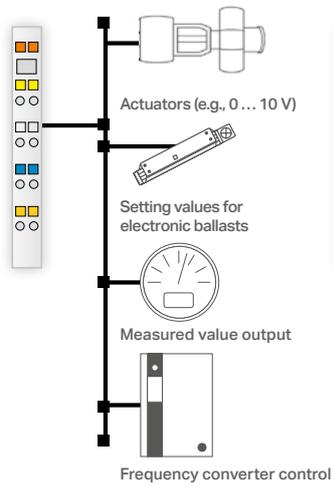
YOUR BENEFITS:

- Clear system status configuration and display
- Manual override of outputs via Modbus®
- Low wiring costs
- Minimum mounting depth
- Library for integration into the I/O System

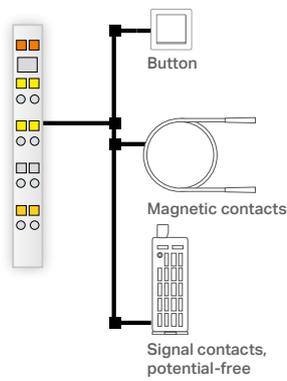
Analog Input Modules



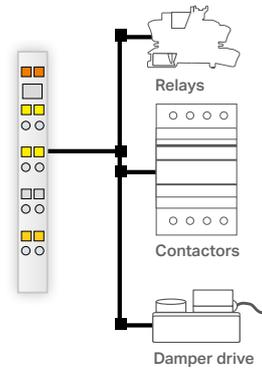
Analog Output Modules



Digital Input Modules

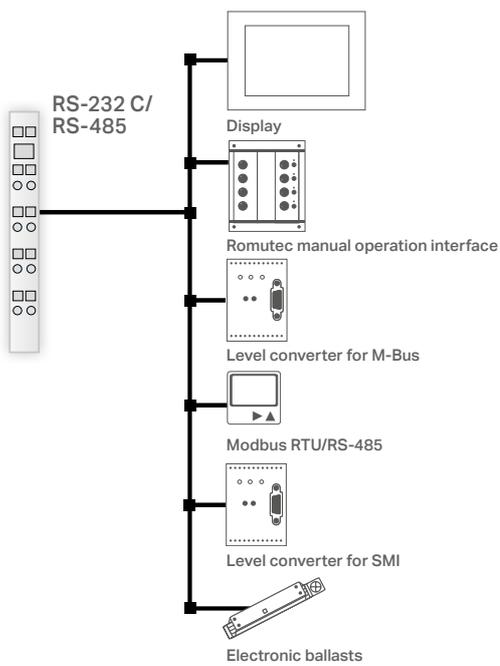


Digital Output Modules



Communication Modules

RS-232 C/RS-485



Specialty Modules

MP-BUS
TECHNOLOGY BY BELIMO

KNX

LONWORKS

M-Bus



3-Phase Power
Measurement
Modules

DALI

SMI

enocean



BASIC SOFTWARE

Programming and Configuring with e!COCKPIT

WAGO's e!COCKPIT Automation Software expedites operational system startup, while reducing development times for automation projects! Ensuring a project's long-term viability through sustainable cost savings hinges on a user's ability to quickly adapt to new software that offers a high degree of reusability. e!COCKPIT is an integrated development environment that supports every automation task from hardware configuration, programming, simulation and visualization up to commissioning – an all-in-one software package.

YOUR BENEFITS:

- Integration of new devices like Touch Panels and second-generation PFCs
- A smart design
- Graphical network configuration
- Extensive libraries with ready-made system macros



Configuring



Programming



Visualizing

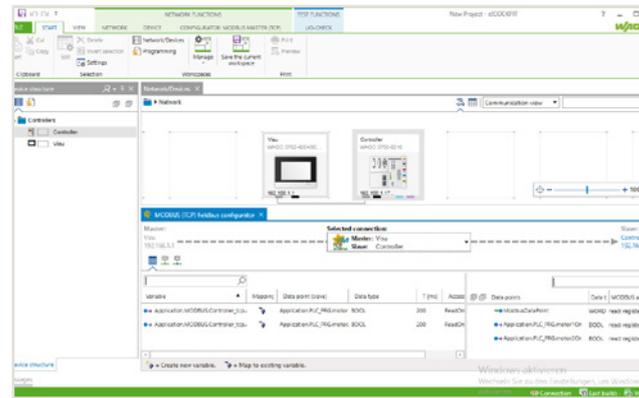
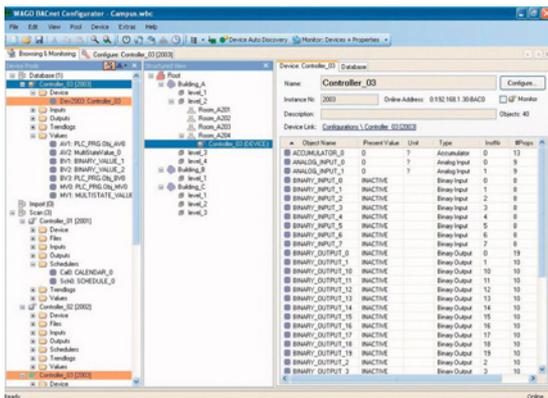


Diagnosing

Communication in the BACnet and Modbus® Network

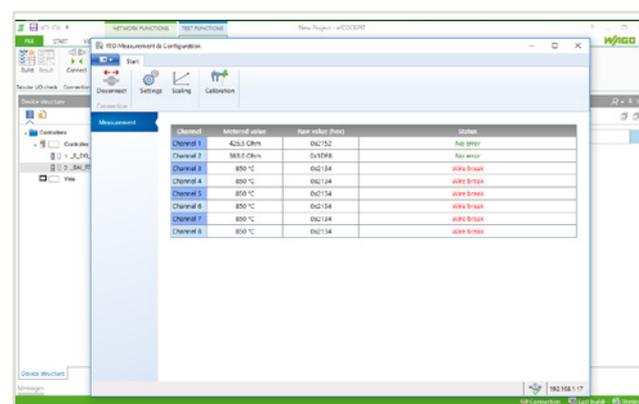
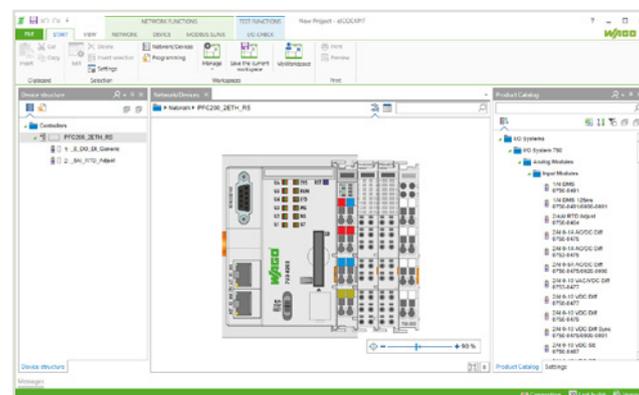
WAGO offers software tools specifically engineered for select technologies, applications and products. Among these are WAGO's BACnet Configurator and a Modbus® Configurator integrated into **e!COCKPIT**, which allow devices connected to a specific network to be easily and efficiently addressed and parameterized.

The Modbus® Configurator is integrated into **e!COCKPIT**; the BACnet Configurator is an extension application for the **e!COCKPIT** programming environment. Both configurators are used directly in the programming environment for fast integration of the WAGO Controller into the corresponding networks.

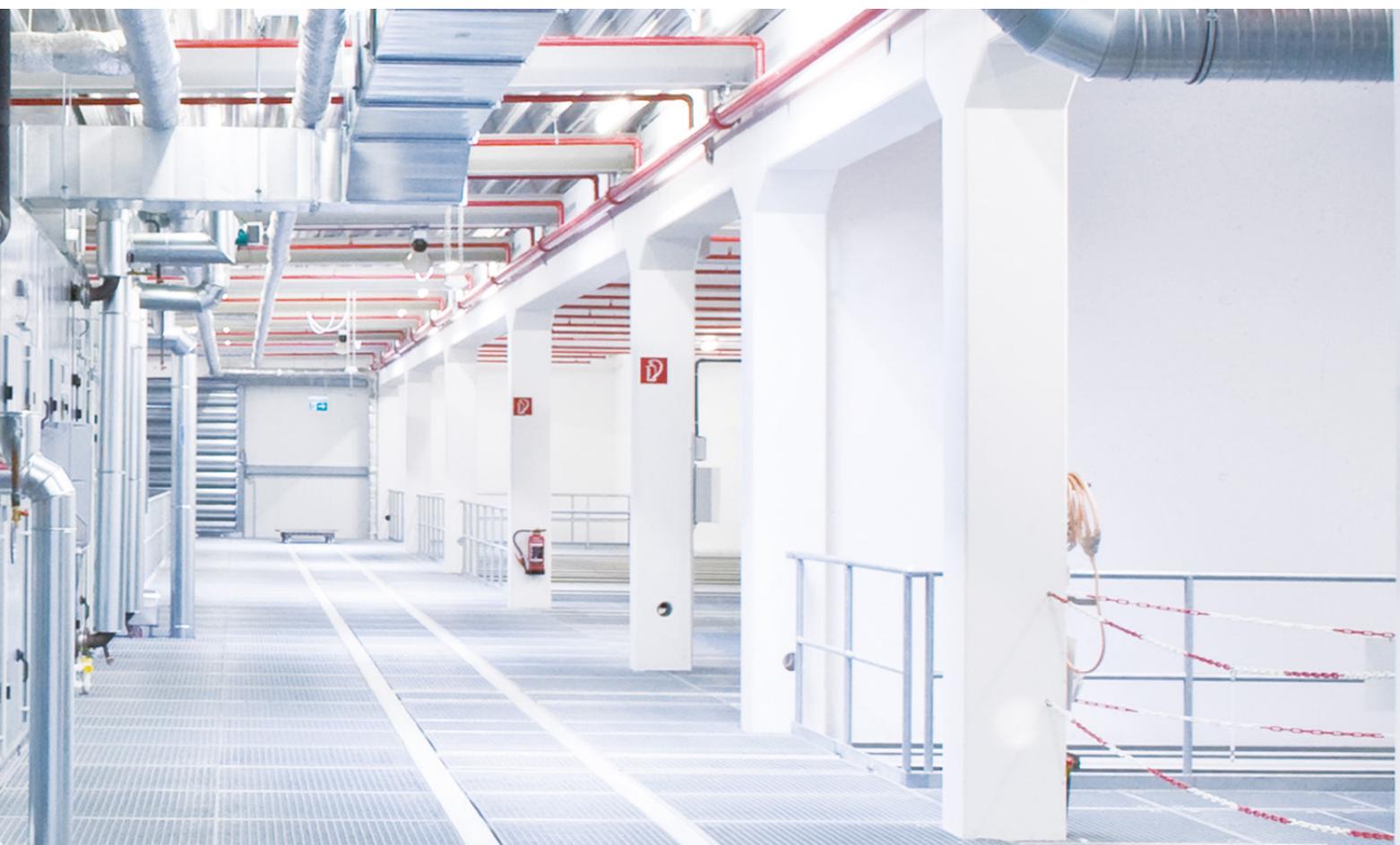


WAGO-I/O-CHECK in e!COCKPIT

As a component of **e!COCKPIT**, **WAGO-I/O-CHECK** is an easy-to-use Windows application for operation and display of a controller from the **WAGO-I/O-SYSTEM 750**, without the node having to be connected to the fieldbus system at the time. The software reads the configuration from the node and displays it as a graphic. The graphic can be printed together with a configuration list as documentation. With **WAGO-I/O-CHECK**, it is possible to display and determine the process data of the I/O modules. The field wiring, including all sensors and actuators, can thus be checked before startup.







SYSTEM MACROS

Parameter Setting – Not Programming

A Brief Introduction

WAGO provides comprehensive templates, which include ready-made system macros for many common applications. This time-saving convenience minimizes HVAC configuration for users. After rapidly configuring the application – via simple data point and system parameter assignment – the ready-made application can be directly commissioned.

To simplify programming, there are a multitude of pre-configured function blocks and applications available free of charge in the download area. In addition, there are templates for creating programs. These comprehensive examples of complex tasks – including functional system macros with the appropriate documentation – are available in PDF format. The manual override function within the system macros allows the operator to override individual system parts using the visualization screens.

A system macro consists of various function blocks that are linked to one another to enable the control

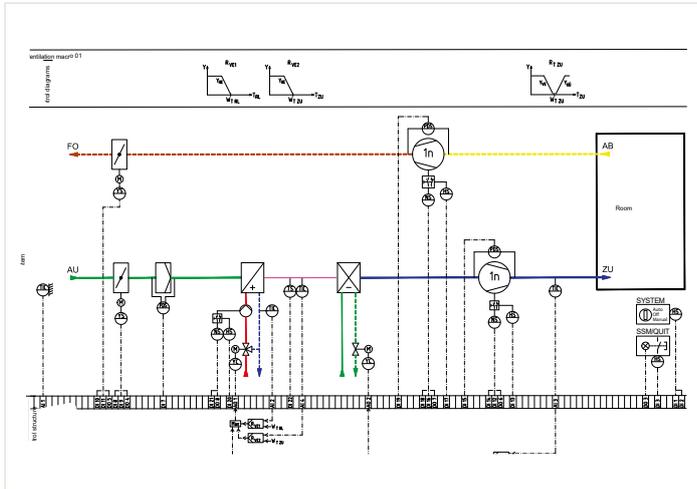
of an entire ventilation system, for example. The function blocks consist of sub-functions that are combined to allow control of a larger task, such as a complete air conditioning system. Using a system macro, you can also display and configure the entire system in a visualization interface.

YOUR BENEFITS WITH WAGO APPLICATION MACROS:

- Ready-to-use applications
- No extensive programming required
- Saves time and costs during commissioning
- Reuse standardized solutions
- Customize via open source macros
- Available as free download under www.wago.com/hvacdownload

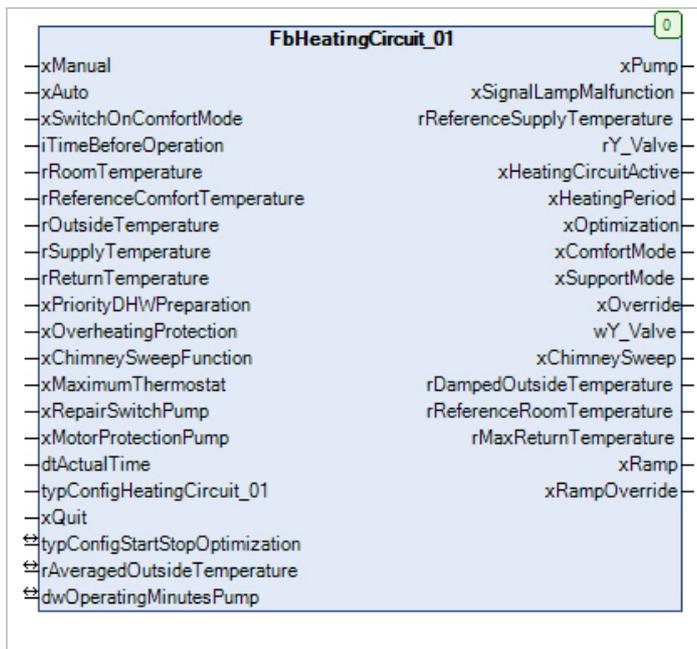
SYSTEM MACROS

Parameter Setting – Not Programming



System Diagram

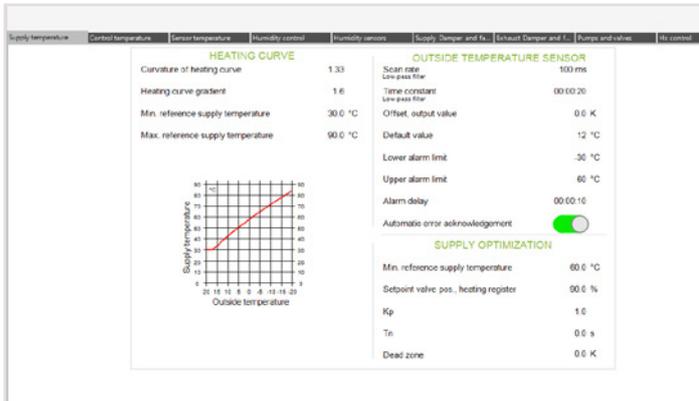
Matching the applications, standardized system diagrams for CAD and TRIC are available for easy integration into standard planning tools.



Graphical Function Block Representation

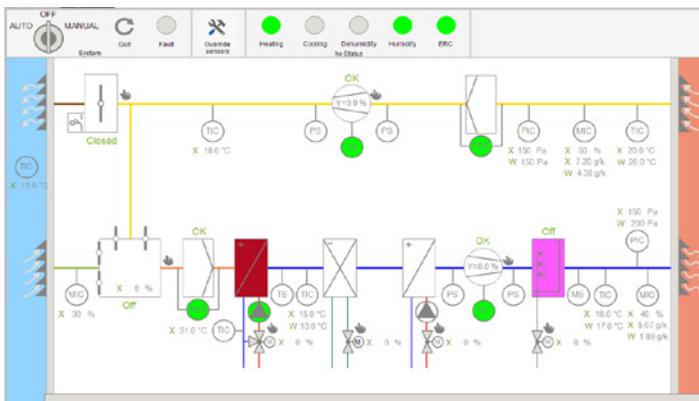
Using the graphical function block representation, a macro's functions can be clearly displayed to simplify assembly.

System Macro Components



Configuration Visualization

In addition to a visualization of the selected application, macros allow the user to easily adjust all relevant parameters through an online graphical interface.



System Visualization

Furthermore, the macros contain complete visualization interfaces for each completed application that allow you to monitor and control functions via the controller's embedded Webserver.

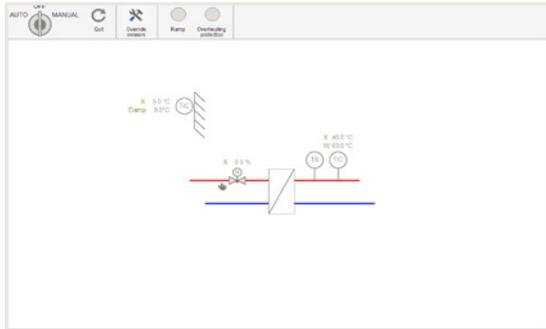
APPLICATION NOTE!

In addition to these graphical aids, the application note also includes a comprehensive function description, hardware information and a detailed tabular function block description.

SYSTEM MACROS OVERVIEW

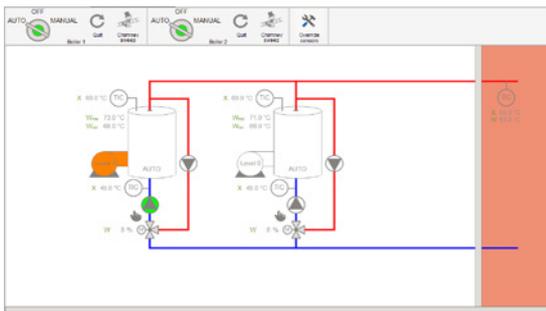
Parameter Setting – Not Programming

GENERATION



District Heating Transfer Station Macros

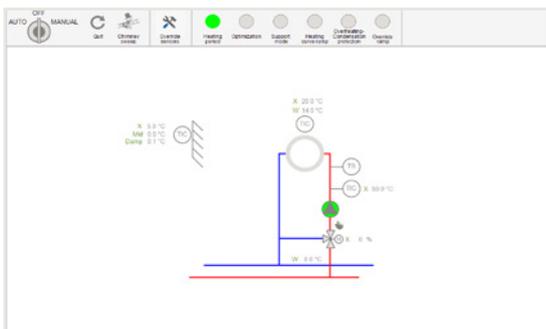
- District heating transfer station with supply temperature control and return temperature limitation



Boiler Macros

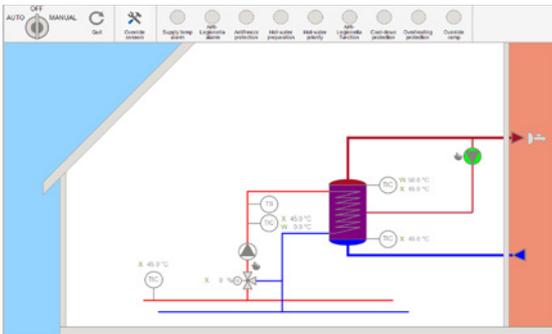
- Boiler strategy with two dual-stage boilers
- Boiler strategy with one dual-stage and one modulating boiler

DISTRIBUTION



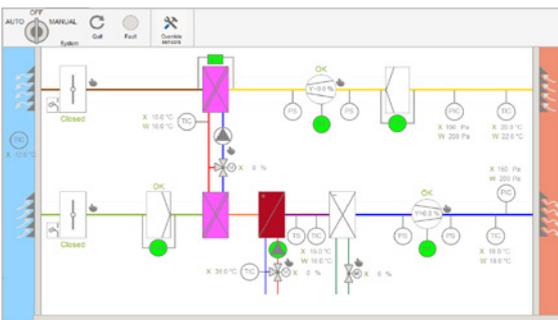
Heating Circuit Macros

- Heating circuit with circulation pump
- Heating circuit with heat exchanger, supply temperature control and return temperature limitation
- Heating circuit with supply temperature control and return temperature limitation



Domestic Water Heating Macros

- Domestic water heating with charging pump
- Domestic hot water production with heat exchanger
- Domestic hot water production with supply temperature monitoring



Ventilation Macros

- **Supply air temperature control or cascade control**
- Single-stage fan
- Dual-stage fan
- Mixed air fan with frequency converter
- Plate-type heat exchanger
- Run-around coil system
- Rotary heat exchanger
- **Full air-conditioning system**
- Fan with frequency converter
- Mixed air humidification and dehumidification



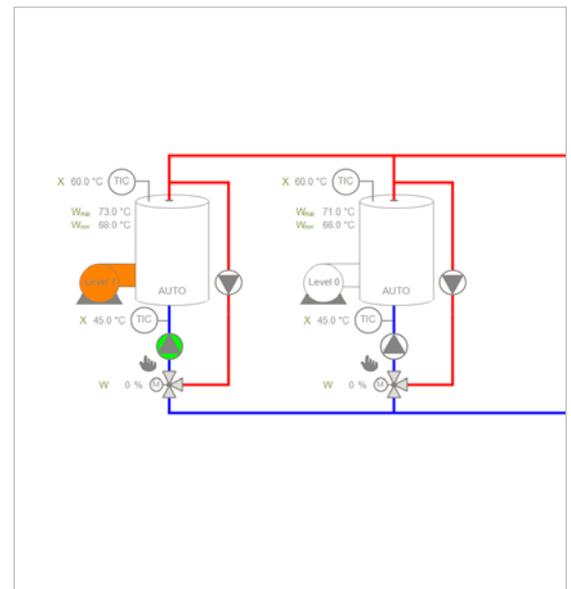
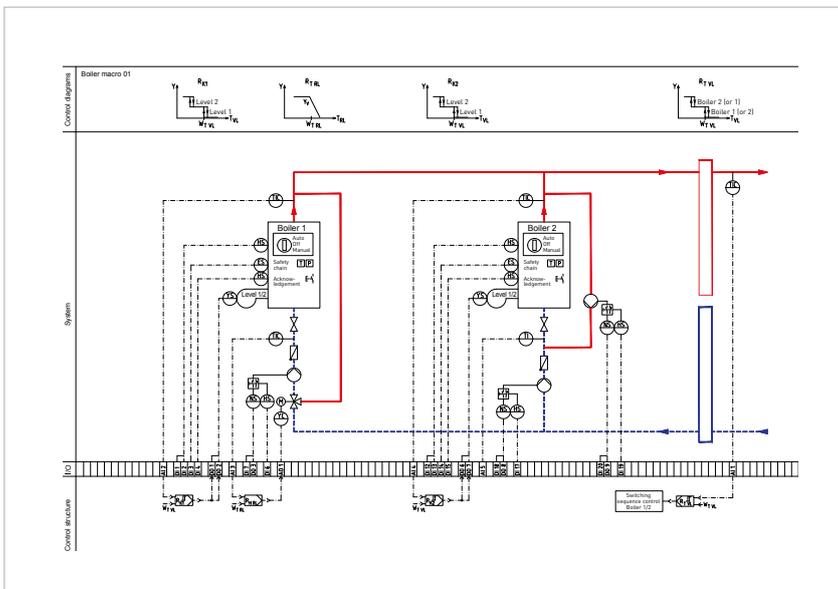
Single-Room Control

- PID single-room controller



GENERATION

Example: Boiler Macro



A boiler strategy with two dual-stage boilers meets these requirements:

BOILER STRATEGY

- Boiler strategy for two boilers
- Demand-dependent connection to the second boiler
- Dynamic switching of the lead boiler
- Automatic switching of the lead boiler in the event of a fault

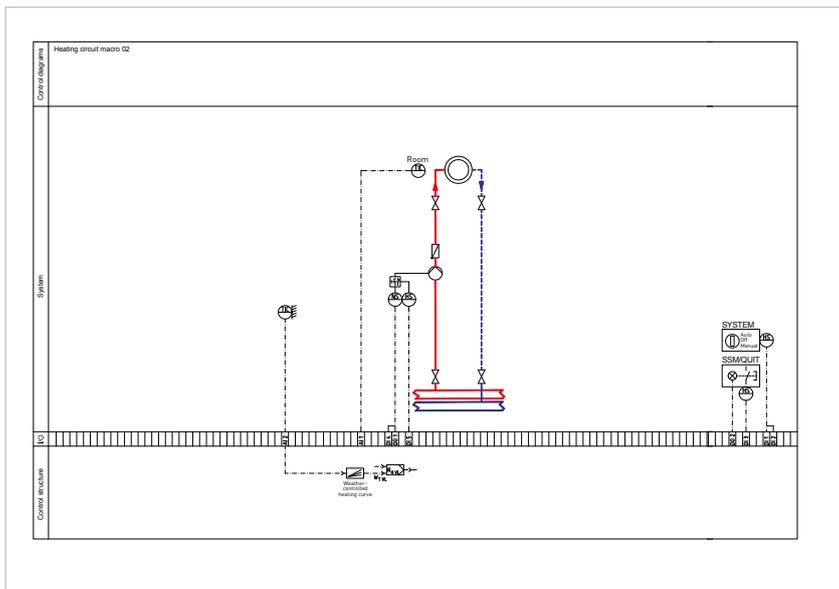
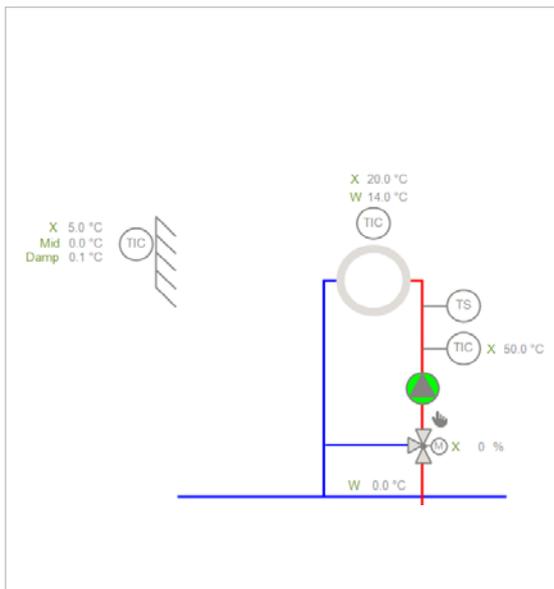
BOILER CONTROL

- Maximum limitation of the boiler supply temperature
- Minimum return flow temperature monitoring
- Maximum return flow temperature limit
- Unrestricted selection between mixing pump, three-way valve and boiler damper
- Boiler anti-condensation protection
- Anti-jamming function for pumps and valves
- Differing parameters for lead boiler and lag boiler
- Different start-up processes based on the components used



DISTRIBUTION

Example: Heating Circuit Macro



Heating Circuit with Supply Temperature Control and Return Temperature Limitation

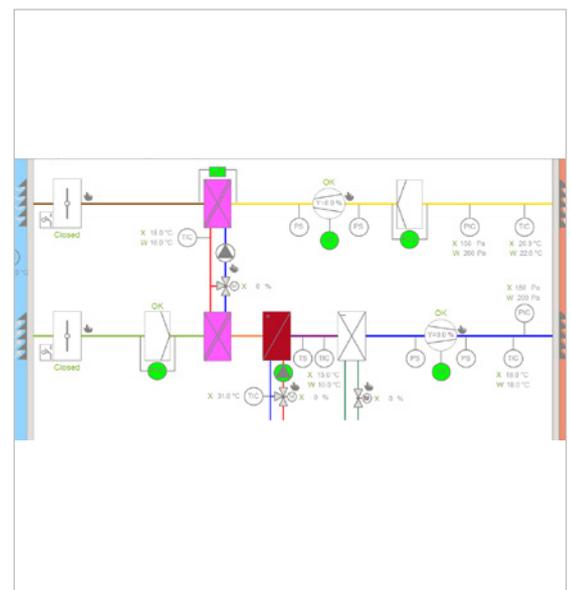
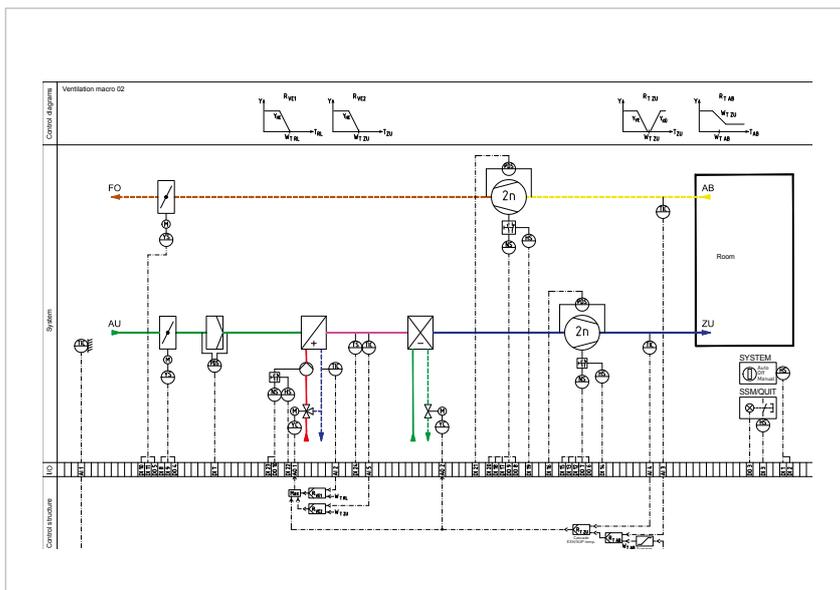
The following requirements are met:

- Heating limit dependent on outside temperature to determine heating periods
- Selection between overnight economy mode (parallel shift of the heating curve) and overnight shutdown (support mode)
- Self-regulating start optimization
- Heating curve
- Supply temperature setpoint with ramp function (crack protection)
- PI supply temperature controller
- Chimney sweep function with time limit
- Mandatory override (e.g., domestic water heating or overheating protection of the primary system)
- Return flow temperature limit based on outside temperature
- Antifreeze controller
- Demand-dependent pump activation
- Anti-jamming function for pumps and valves



CONSUMPTION

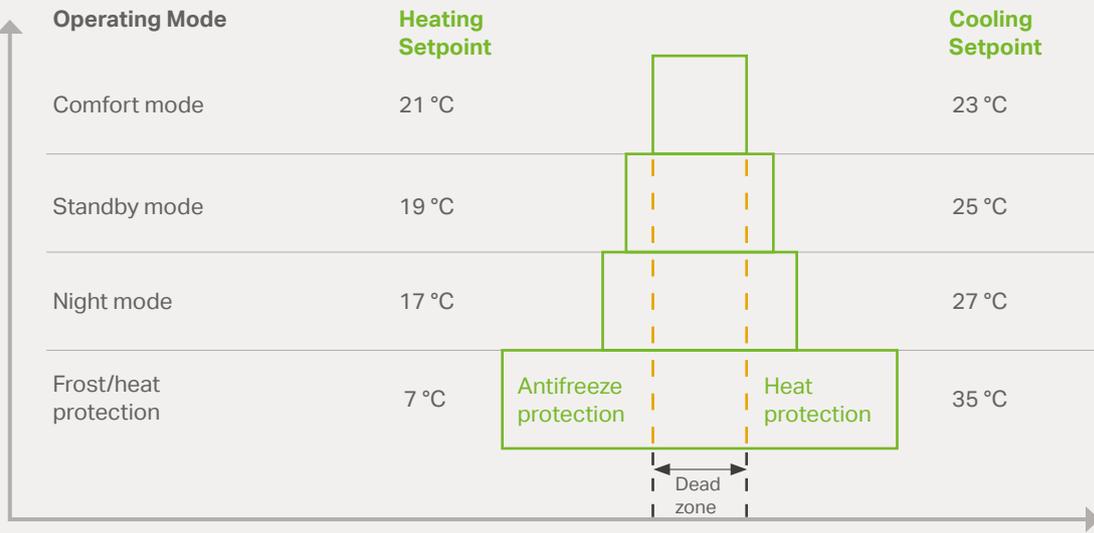
Example: Ventilation Macro



Cascade Control with Mixed Air and Fan with Frequency Converter

The following requirements are met:

- Continuous fan with contactor and operational monitoring
- Pressure control in supply and exhaust air duct
- Upstream and downstream frost protection
- Demand-dependent pump switching
- Anti-jamming function for pumps and valves
- Control of mixed air and exhaust air dampers
- Outside air filter monitoring
- Energy-optimized room/exhaust temperature control with summer increase per DIN 1946
- Supply air temperature control in cooling/mixed air/heating sequences
- Summer night ventilation
- Optimized setpoint supply temperature measurement



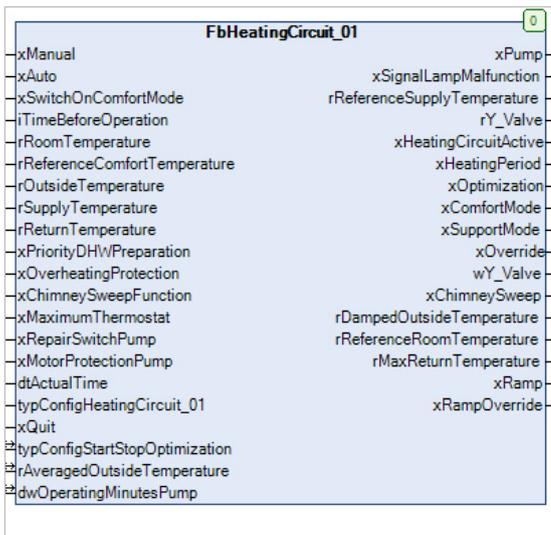
UTILIZATION

Single-Room Control

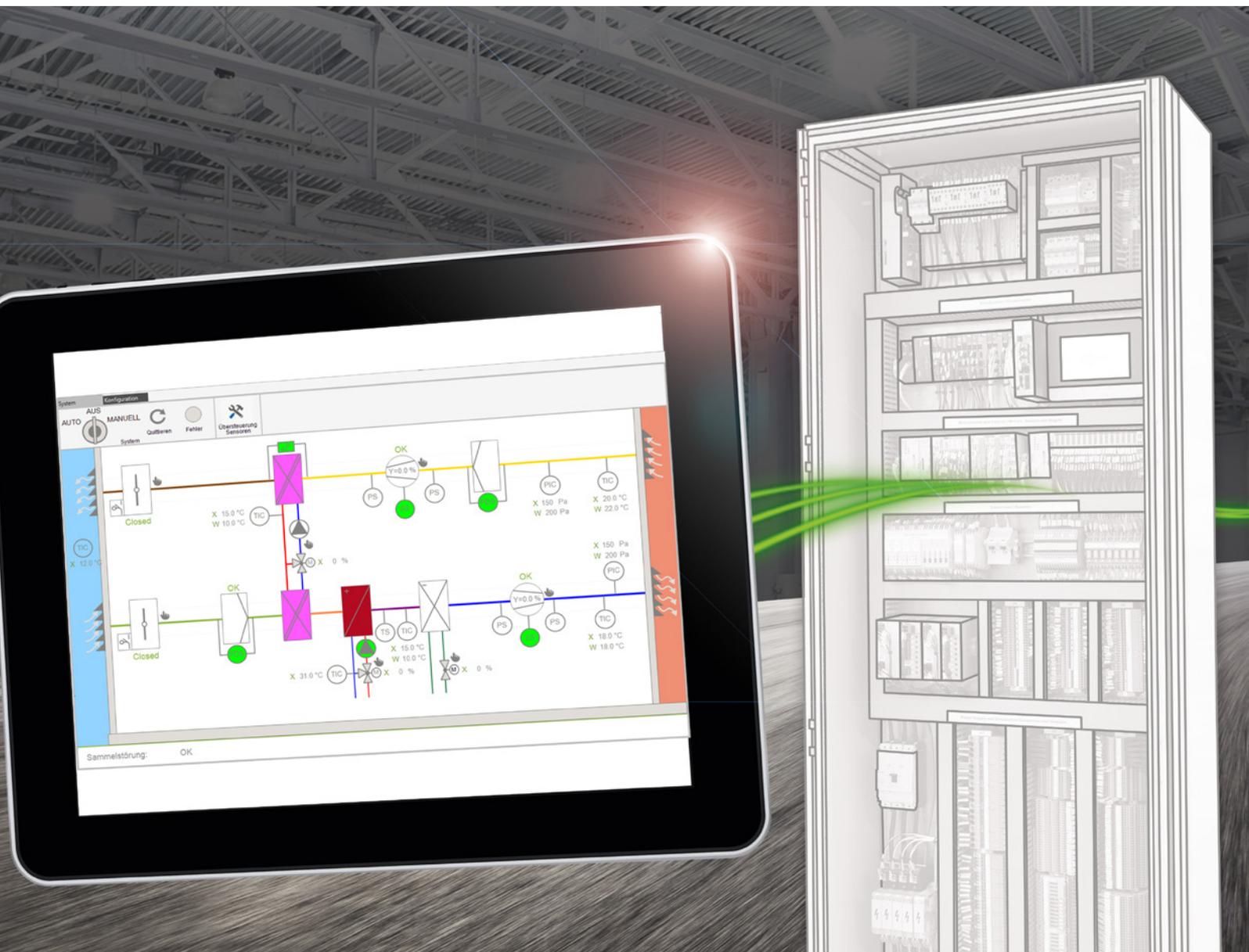
PID Single-Room Controller

This function block permits single-room temperature control while accounting for external factors.

- Separate PID controllers for heating and cooling
- Three different operating modes (comfort, standby and night)
- Adjustable dead zone between heating and cooling
- Setpoint correction via room operating panel
- Window contact analysis to determine switch to frost/heat protection (support mode)
- Dew point detector monitoring
- Optimized setpoint supply temperature measurement



| Operating Mode | Heating Setpoint | Cooling Setpoint |
|-----------------------|---|---|
| Comfort mode | Basic setpoint: 21 °C | Basic setpoint + Dead zone: 2 K |
| Standby mode | Basic setpoint, temperature decrease - Standby mode | Basic setpoint + Dead zone + Temperature increase, standby mode |
| Night mode | Basic setpoint, temperature decrease - Night mode | Basic setpoint + Dead zone + Temperature increase, night mode |
| Frost/heat protection | Frost protection setpoint: 7 °C | Heat protection setpoint: 35 °C |
| Dew point alarm | Setting value: 0 (heating off) | Setting value: 0 (cooling off) |



VISUALIZATION

Web Visualization

The macro library includes graphic elements that enable fast, simple creation of a user interface with **e!COCKPIT**. Visualization is performed via HTML5 pages on a Webserver, which runs locally on the ETHERNET Controllers. This allows the HTML5 visualization to be displayed in a Web browser on any Internet-connected computer; e.g., for remote maintenance. The Web visualization can also be accessed on a tablet or smartphone using an app.



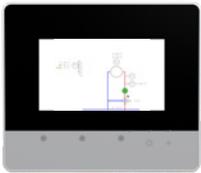
TOUCH PANELS 600

An Aesthetic Design Meets High Performance

Operate, observe, and diagnose in buildings: Touch panels with different display sizes in the versions Web Panel, Visu Panel and Control Panel that master the balancing act between contemporary design and convincing features are available for small- to mid-sized control and visualization tasks.

WEB PANELS

Web Panels are provided with an optimized Web browser for accessing WAGO Controllers via standard Web protocols with integrated Web visualization for display. Web visualizations that are created with *e!COCKPIT* and based on state-of-the-art technology like HTML5 can be displayed.



STANDARD LINE

Standard Line Panels are equipped with resistive touchscreens for standard control cabinet applications.

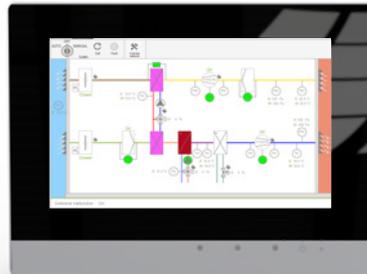


VISU PANELS

Visu Panels are suitable for direct display of a visualization generated with *e!COCKPIT* and obtaining the data referenced in it from PFC200 Controllers or other field devices via Modbus TCP. These panels can also provide a Web visualization via the integrated Webservice.

CONTROL PANELS

Control Panels allow simultaneous execution of a control and visualization task generated with *e!COCKPIT*, representing a very compact form for an automation solution. Using a dedicated library, these panels become IoT controllers that send data from the field level to the cloud.



ADVANCED LINE

Capacitive multi-touch Advanced Line Panels with glass surfaces allow gesture recognition for intuitive operation. These panels are ideal for applications where tougher mechanical and chemical resistance is required.



YOUR BENEFITS:

- High operating speed with the powerful Cortex A9 Multicore processor
- Perfectly tailored hardware features for a wide range of applications
- Scaled software functionalities: Web, Visu and Control Panels
- Flexible programming in IEC 61131 or directly under the Linux® open source operating system
- Standard connection to WAGO's cloud solutions with Control Panels

INDUSTRIAL SWITCHES

High-Performance and Security

WAGO's range of switches ensures the scalability of your ETHERNET network infrastructure, while providing outstanding electrical and mechanical characteristics. These robust switches are designed for industrial use and optimized for control

cabinet applications. The product line extends from simple unmanaged switches to managed switches that optimize availability, performance and security in your applications.



Industrial Eco Switches – Economical and Compact

- For small- to medium-sized networks
- Surrounding air temperature (operation):
–40 ... +70°C
- Auto-negotiation and auto-crossing for easy network creation and extension
- Gigabit versions for high data throughput
- ETHERNET connection with Power over Ethernet (PoE+)



Industrial Switches – Versatile

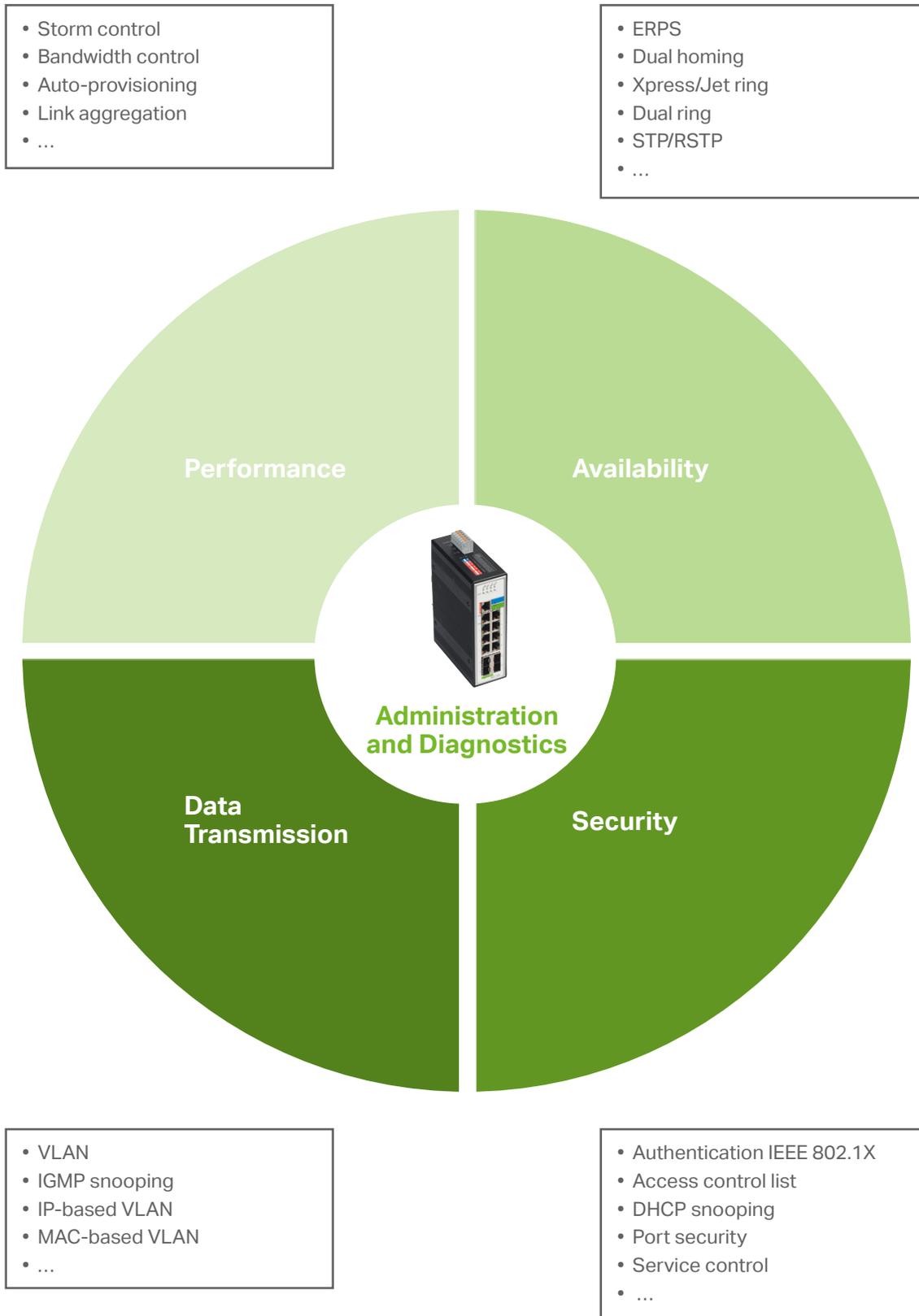
- Alarm contact configuration via DIP switch
- Isolated connection with fiber optic cables
- Surrounding air temperature (operation):
–40 ... +70°C
- Alarm contact: Monitoring power supply and network cables
- Signaling via PLC or remote I/Os



Industrial Managed Switches – High-Performance and Security

- Surrounding air temperature (operation):
–40 ... +70°C
- Isolated connection with fiber optic cables
- Integrated Web-based management
- Alarm contact and status LED
- Network diagnostics via SNMP, Modbus TCP or Web-based management
- Redundancy functions

FUNCTION OVERVIEW OF INDUSTRIAL MANAGED SWITCHES



SECURE HVAC AUTOMATION NETWORKING WITH CLOUD CONNECTIVITY

Added Value for Your Company

Recording, digitizing and linking data profitably – this is not the core concept behind only Industry 4.0. As the interface between automation and information technology, cloud connectivity meets this challenge. Installed on the WAGO PFC Controllers, system data can be transferred via MQTT to nearly any cloud; e.g., Microsoft Azure, Amazon Web Services, IBM Cloud, SAP Cloud and last but not least WAGO Cloud, where the information can be aggregated and used for analysis. This capability creates true added value for your company – whether for increasing the efficiency of operational systems, implementing energy management or developing additional end-customer services.

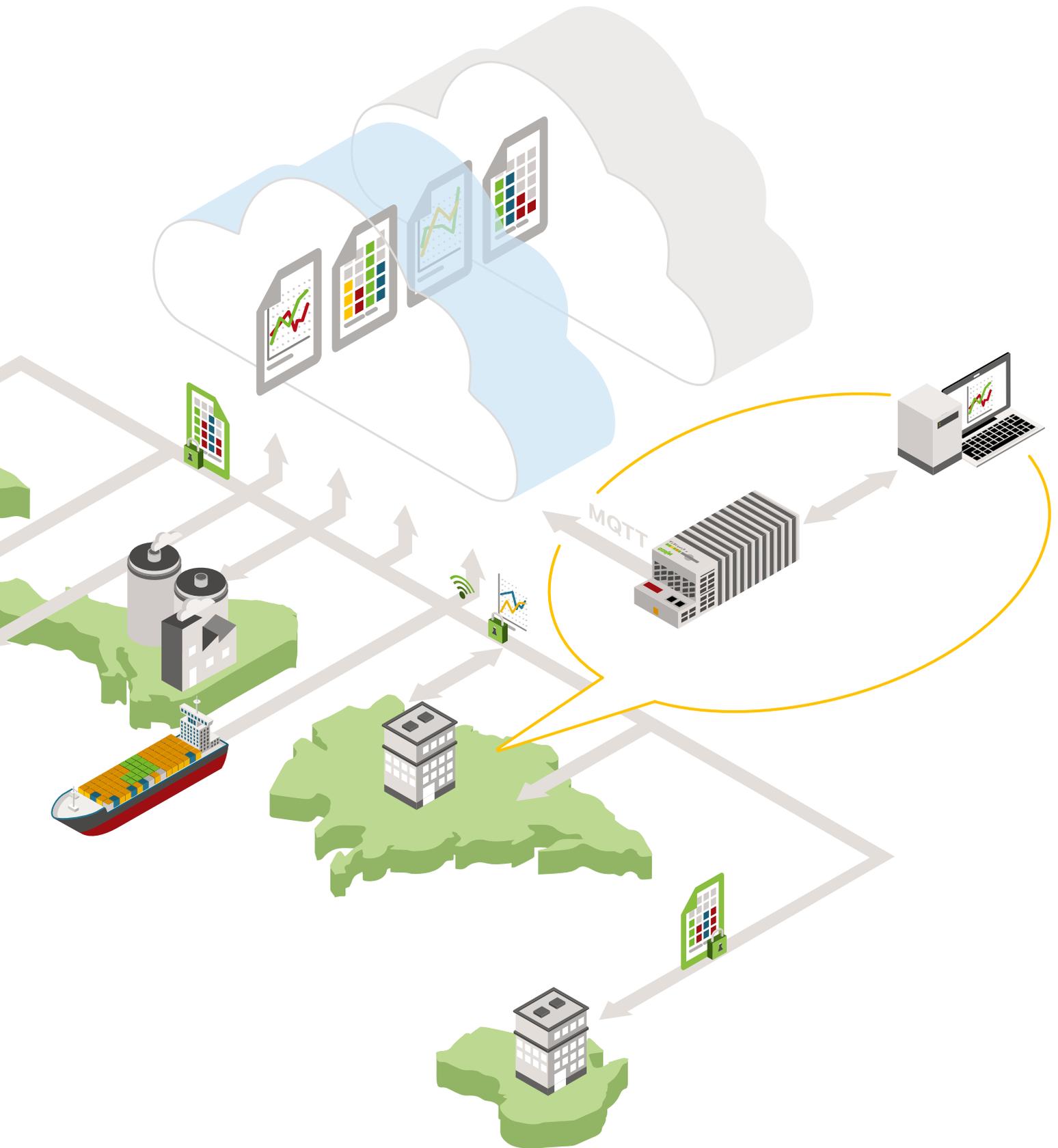
Full Control at All Times

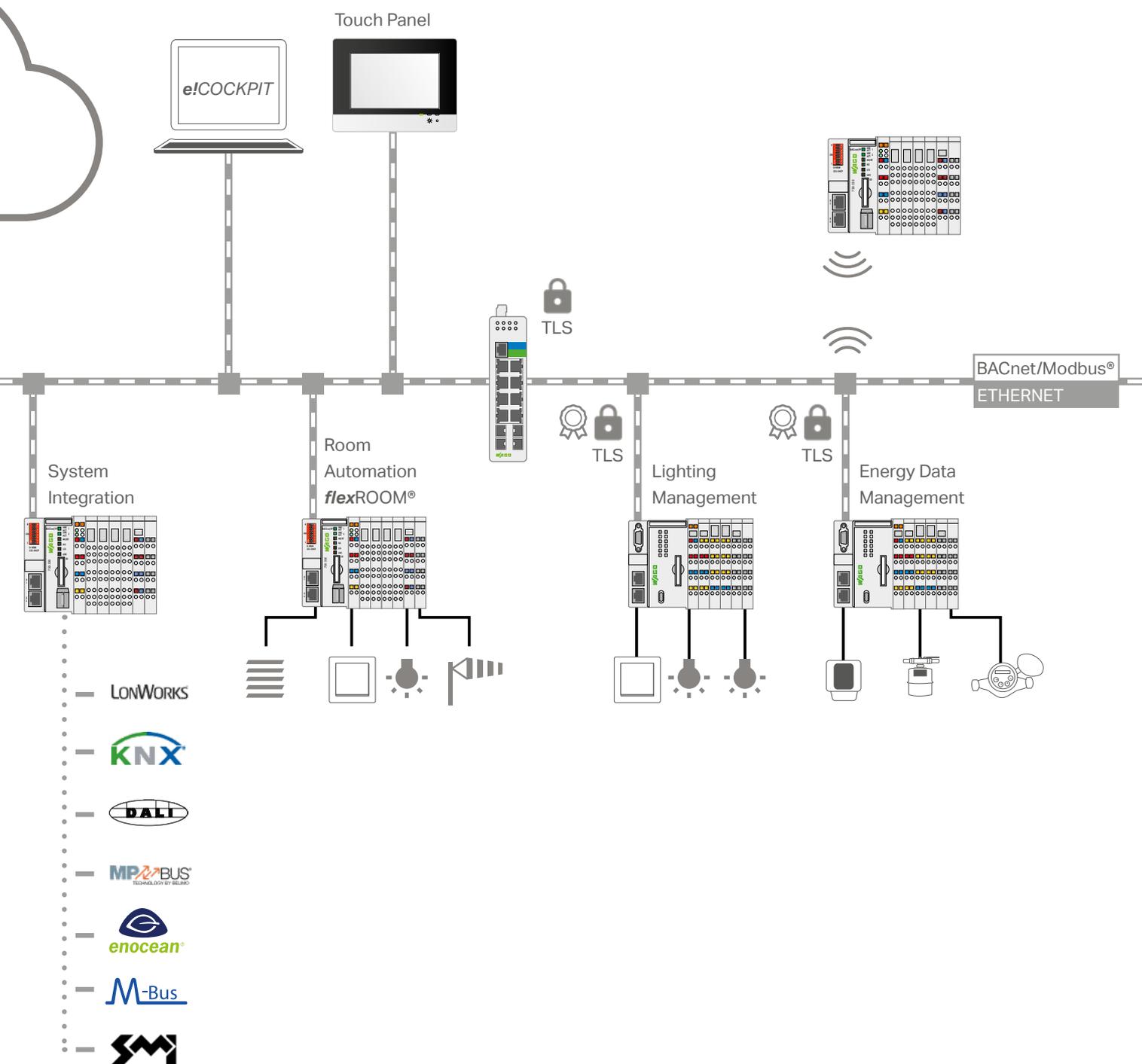
The cloud connection data is configured individually via the WAGO Controller's Web-based management. Furthermore, with the corresponding IEC library from **e!COCKPIT**, you determine what information should be transferred to the cloud and what information should be processed locally on the controllers exclusively. This allows you to maintain complete control of your data at all times. Controller information, such as run/stop, connection status and device information can also be transferred to a cloud solution with cloud connectivity or distributed via MQTT broker. Cloud connectivity is included by default with PFC Controller firmware version 11 and above, and the required library has been included in **e!COCKPIT** since version 1.4.

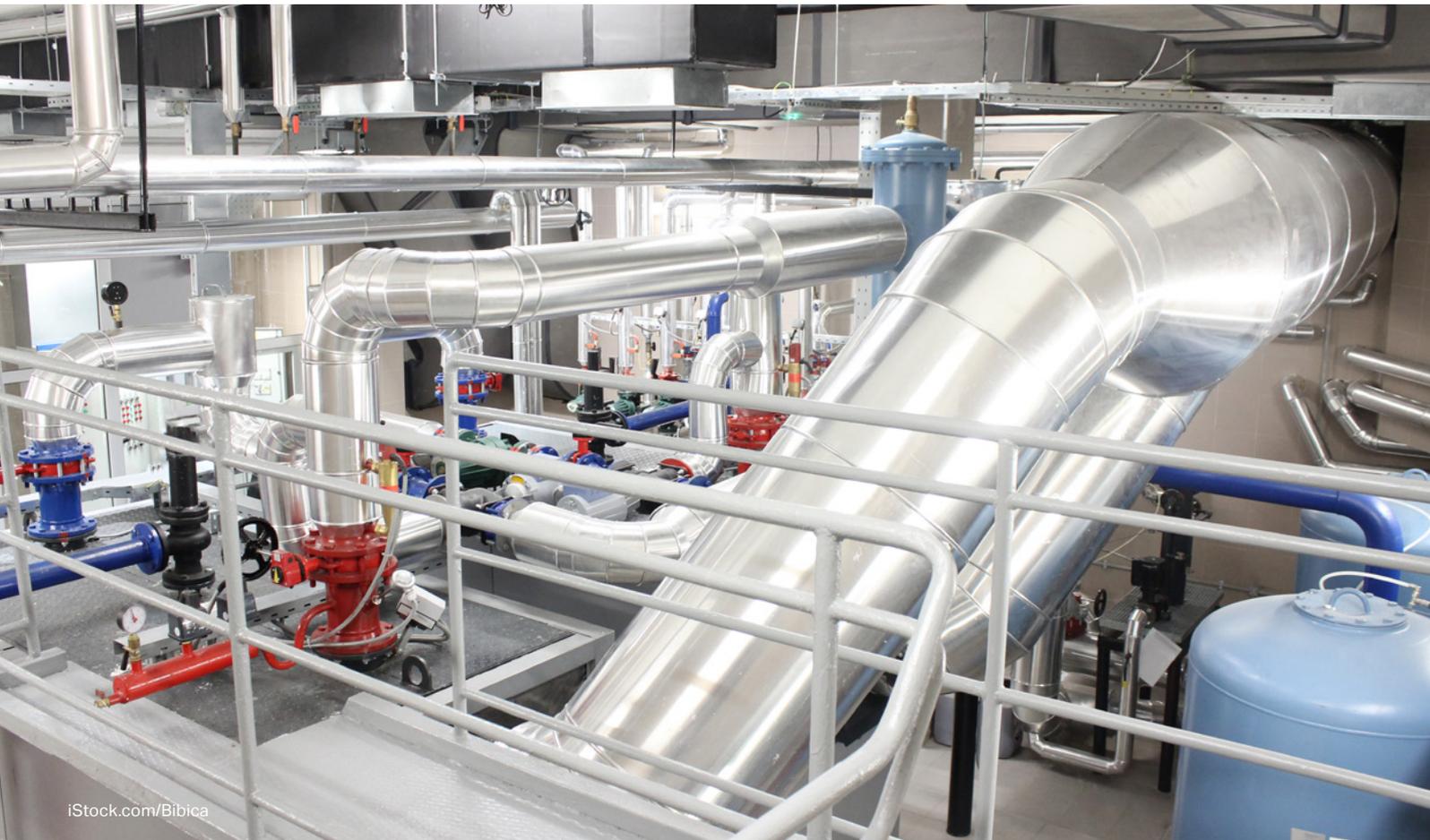


YOUR BENEFITS:

- Field level connection directly to the cloud
- Expansion of existing systems with our PFC Controllers as an IoT gateway
- Distributed data acquisition and visualization from anywhere
- Connection to Microsoft Azure, Amazon Web Services, IBM Cloud SAP Cloud or other MQTT brokers via standardized MQTT protocol
- High level of security thanks to TLS encryption







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BACnet

Fast Control Solution for Complex Applications

BACnet is a building automation communication protocol standardized according to DIN EN IS 16484-5. BACnet standardizes communication between products from different manufacturers. To meet this goal, profiles of device types, services, communication objects, object properties and transmission media have also been defined in this standard.

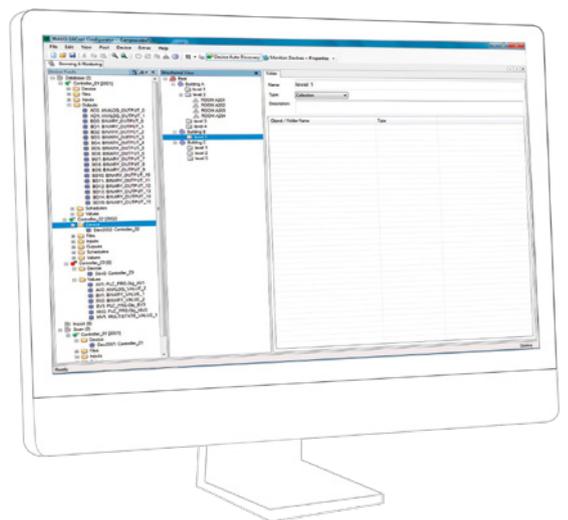
WAGO's BACnet Controllers comply with the BACnet Building Controller (B-BC) profile and communicate via BACnet/IP.

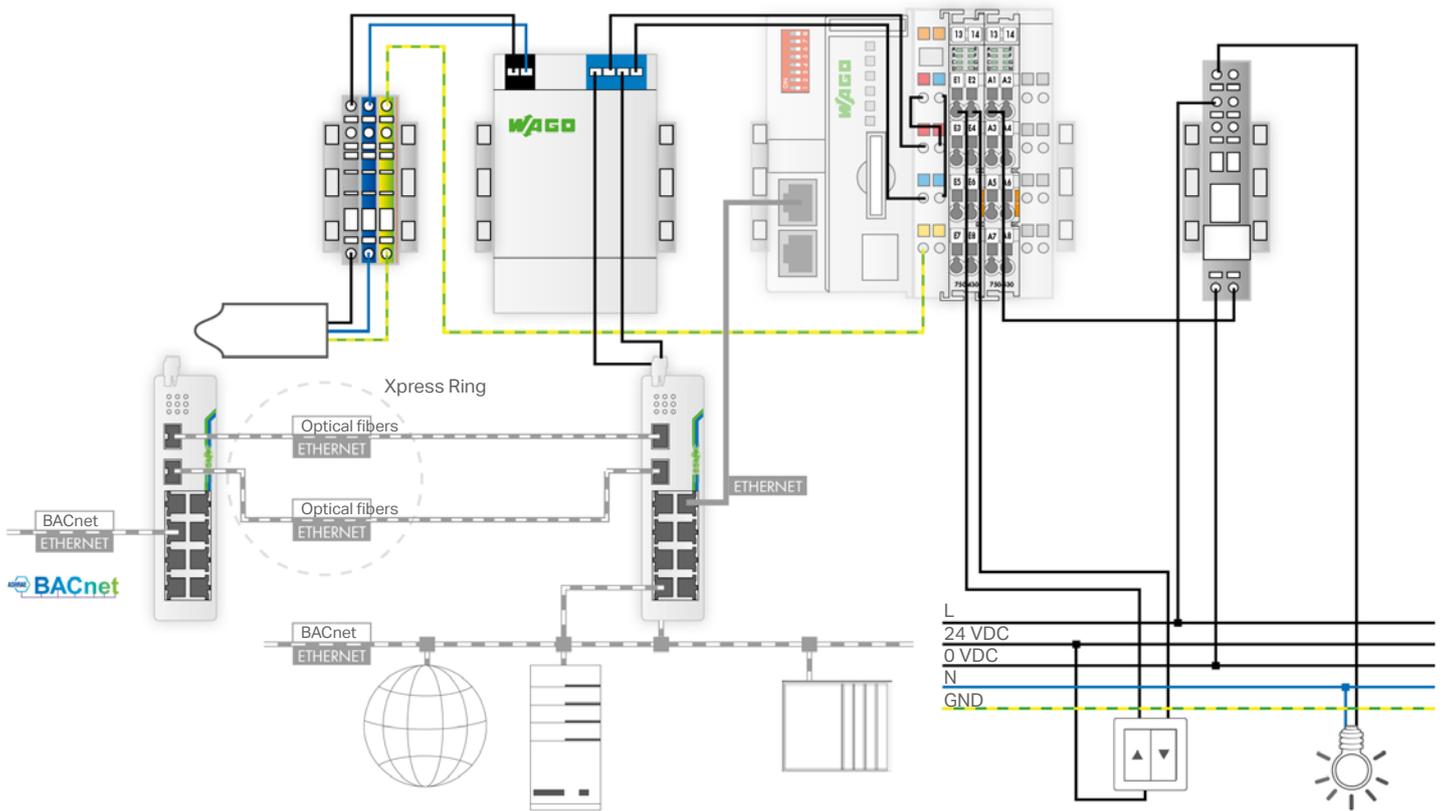
BACnet Configurator

The BACnet Configurator is the tool for configuring and operating BACnet Controllers in a heterogeneous BACnet network. Logically structuring the network and addressing the controller, as well



as configuring both client and server can be performed on the configuration interface. In addition, the properties of BACnet objects can be accessed using a value browser.





Additional Benefits

The freely programmable BACnet Controllers offer users a device that corresponds with the BACnet Interoperability Building Blocks (BIBBs) associated with the B-BC profile defined in the BACnet Standard. The sheer diversity of available input, output and specialty modules for sub-buses – such as KNX/EIB, MP-Bus and DALI – complete the system, making the WAGO BACnet Controllers very versatile.



YOUR BENEFITS:

- Manufacturer-independent
- Tested by independent laboratories
- Constantly upgraded and updated standard
- Supports timer functions, trend data recording and alarm generation/distribution



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MODBUS TCP/IP



Fast and Lean Communication

Extending 1979's Modbus TCP protocol for PLCs, the well-established Modbus® protocol has become the de facto standard for building automation. The advantage: Modbus® is a streamlined protocol that ensures ultra-fast ETHERNET data transmission. A manufacturer-independent data structure also permits communication between devices from different manufacturers.

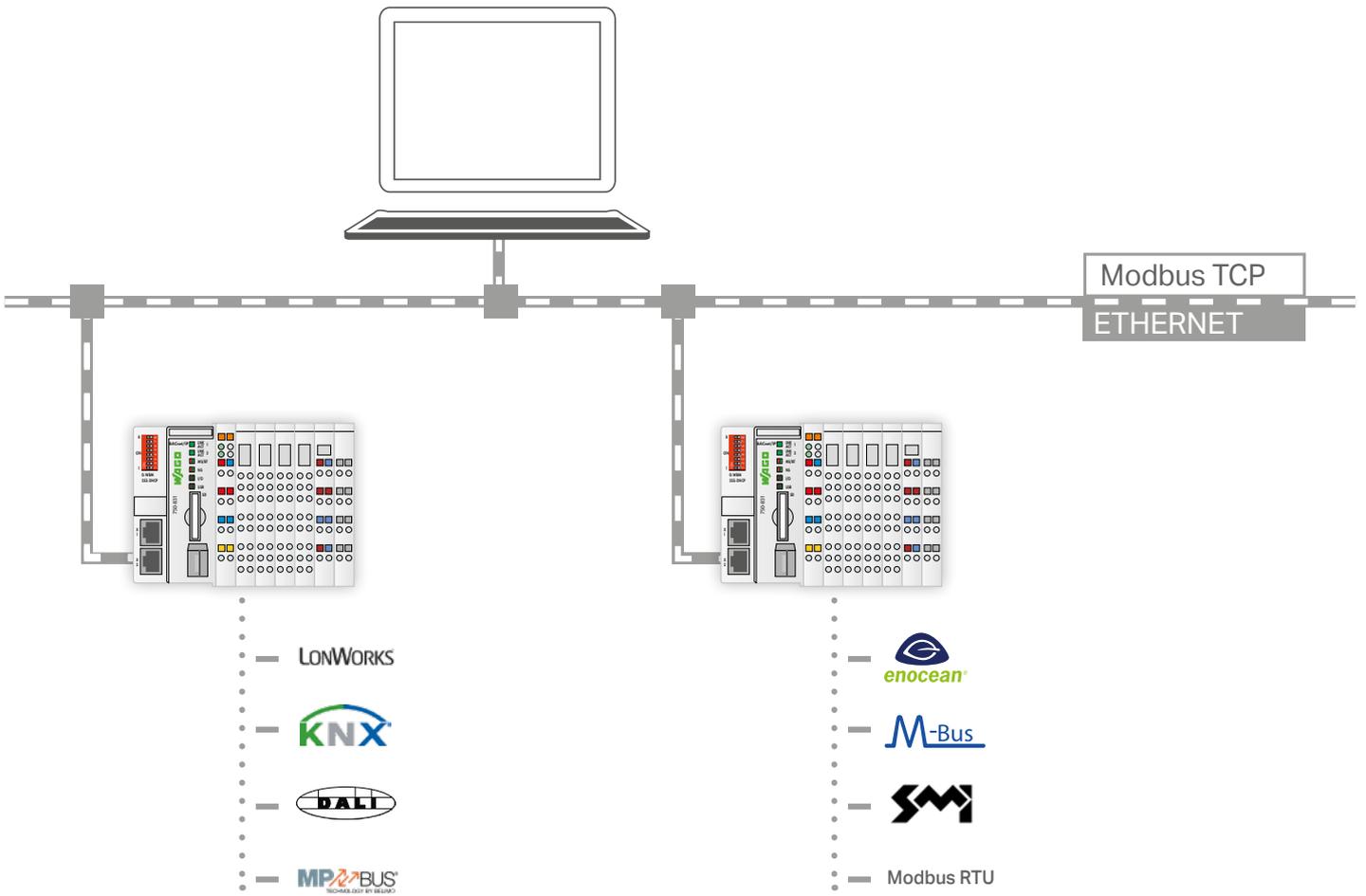
Thus, Modbus TCP is recommended for applications that collect data and/or network intelligent controllers with self-sufficient control logic. Therefore, in addition to the respective fieldbus

protocol, WAGO's ETHERNET-based controllers for building automation also support Modbus TCP.

Modbus RTU establishes serial master/slave communication via the RS-232 or RS-485 interface. In order to communicate via Modbus RTU, first the serial communication parameters must be known and/or defined. These parameters include baud rate, parity and stop bits. The slave address(es) to be addressed by the master also come into play. In this case, conductor length with RS-232 is limited to 15 m and with the RS-485, 1200 m.

YOUR BENEFITS:

- Uniform data exchange compliant with standards
- Very fast data transmission
- Independent of technology and manufacturer





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MP-BUS CONNECTION

Control According to Sensors

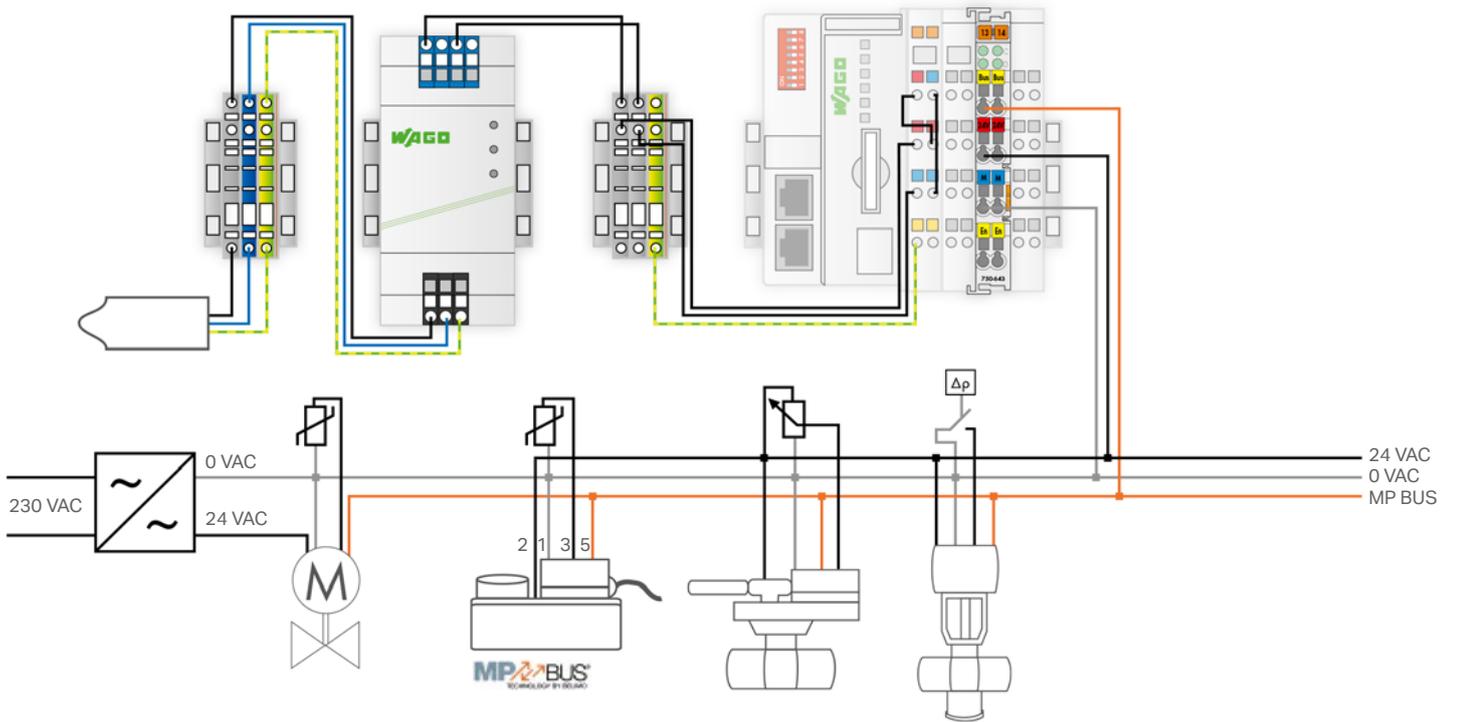
The MP-Bus controls HVAC actuators for dampers, regulator valves or VAV air volume controls.

The actuators have connections for sensors (temperature, humidity, ON/OFF switches), which are also accessible via MP-Bus. Devices that are equipped with an MP-Bus connection can communicate with a higher-level control system via bus cable.

Up to eight actuators can be controlled by an MP-Bus master. The MP-Bus Master Module (750-643) can manage up to eight slaves (actuators) and eight sensors (one sensor can be connected to each slave) via a common bus line, which considerably reduces actuator and sensor wiring (for

MP-bus cable lengths; see the 750-643 Module manual). There is no line topology limitation. Star, ring, tree or mixed configurations are possible. Up to eight slaves can be connected to a master. The actuators feature Multi-Function Technology (MFT) and include: Damper actuators, MFT(2) valve actuators, MFT fire damper actuators, VAV compact controllers and Belimo's FLS window ventilation system. Data exchange between master and slaves is possible (e.g., absolute/relative volumetric flow, minimum/maximum limits, angular position, sensor value, operating status and fault messages).

The WAGO-I/O-PRO Software is required for commissioning the I/O node.



YOUR BENEFITS:

- Up to eight drives on the M-Bus can be actuated via the MP-Master.
- It is possible to connect one active or passive sensor and one switch to the MFT2/MP drive.
- No line topology limitations: Star, ring, tree or mixed configurations are possible.
- Data exchange between master and slaves is possible (e.g., absolute/relative volumetric flow, minimum/maximum limits, angular position, sensor value, operating status and fault messages).



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M-BUS MASTER



For Direct Connection of Energy and Consumption Meters

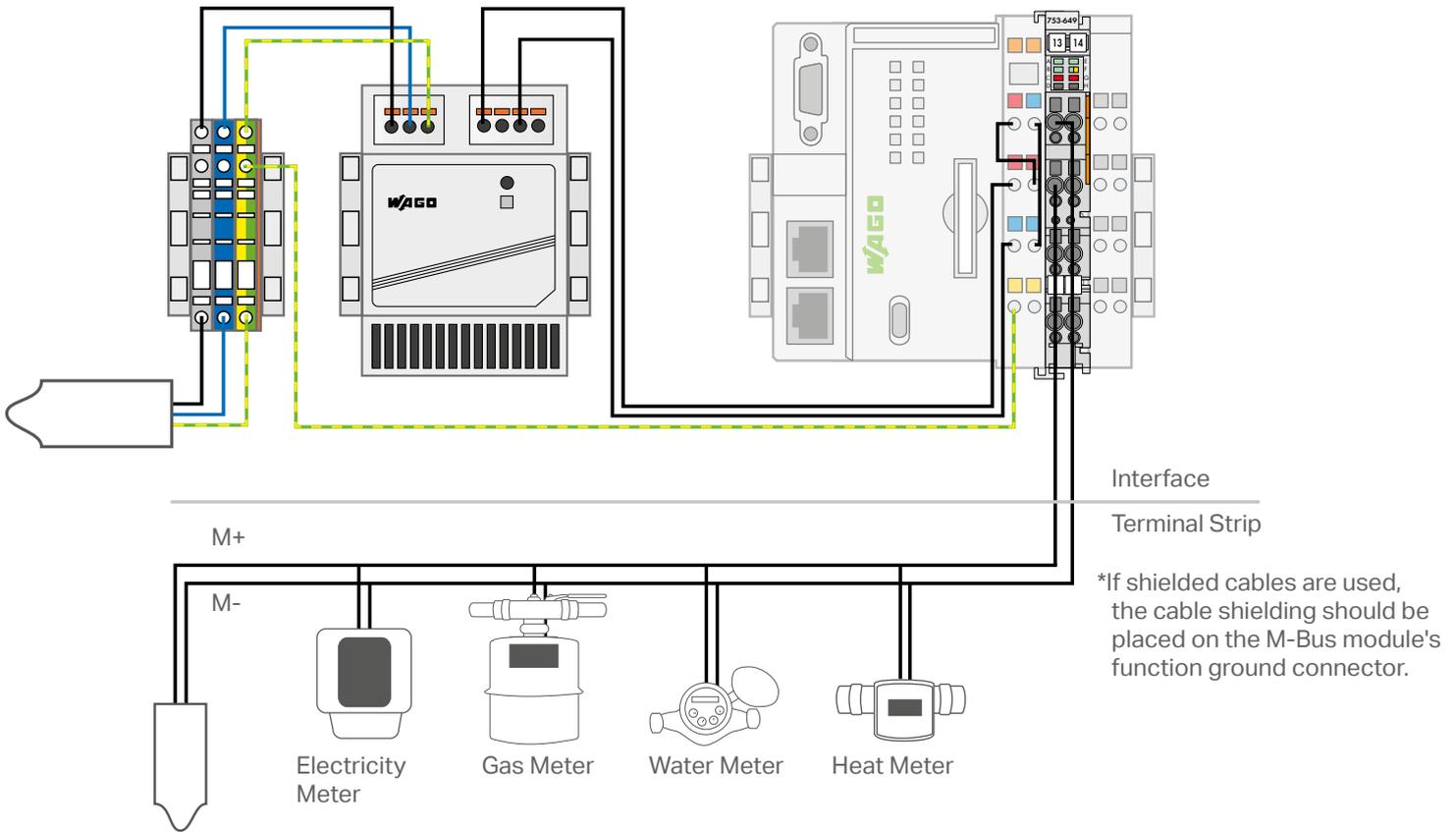
System Description

The M-Bus (Meter-Bus) is used to read different types of utility meters (e.g., electricity, heat, water). It is standardized as a European standard for all meters, excepting electricity meters.

The M-Bus Master communicates with the M-Bus slaves and when required, reads energy consumption data via the M-Bus two-wire line and transmits it to the higher-level control system for further

processing or visualization. Alternatively, PLC queries can be implemented via the PLC using IEC 61131-3 function blocks or via a PC application. The M-Bus slaves are powered via the M-Bus Master. The use of a separate level converter is not required.

The WAGO-I/O-PRO Software is required for commissioning the I/O node.



YOUR BENEFITS:

- Direct (no external level inverters) and cost-effective connection of M-Bus devices to the I/O system
- Highly flexible by combining with other I/O modules and I/O system's interfaces
- Use of multiple modules for larger data volumes



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SERVICES

Technical Support

WAGO's technical support staff is ready to assist all customers with advice and guidance – from selecting the right product, through telephone support during commissioning, all the way up to on-site troubleshooting. Customers directly benefit from knowledgeable WAGO experts who dramatically expedite project implementation.

WAGO provides advice and support with:

- Product selection
- Product commissioning
- Troubleshooting
- Technical questions about WAGO's wide product range

Product Support

Phone: +49 (571) 887-44 555
Email: support.de@wago.com

Project Support

WAGO's technical support offers consultation and project planning services to help devise the best possible solutions for your custom building automation and installation projects. Our experienced team of professionals will gladly help you implement your projects with WAGO products.

Large-scale applications include:

- Production facilities and warehouses
- Office buildings
- Shops and display areas
- Schools
- Hospitals
- Airports

Planning and project design:

- Conceptual design
- Network planning
- Application design
- Component selection
- Quote generation

WAGO helps customers with:

- Advice from experts with years of experience in planning construction projects
- Customizing solutions to ensure the technical and financial success of large projects.
- Technical support while implementing building projects

Project Sales Building Automation

Phone: +49 (571) 887-49160
Email: info.projektplanung.de@wago.com



WAGO Seminars

Innovative ideas and advanced technology are the driving forces behind the development and creation of WAGO's market-leading products. Attending WAGO training seminars provides you with product insights that will enable you to maximize the benefits of WAGO products. The skills and expertise gained in our effective, user-focused sessions will ultimately save you time while getting the most from our products.

Professional Environment – Effective Learning

- Small groups in which all questions will be addressed.
- Collaborative learning is effective because group settings encourage the exchange of experiences.
- Highly practical – we believe your experiences are the ideal base to build upon with product information that's uniquely tailored to you.

Building Automation Seminars

- Building automation with KNX components
- Building automation with BACnet components
- Building automation with LON® components
- HVAC applications
- DALI applications
- EnOcean applications
- **flexROOM®**

Custom, On-Site Training

In addition to these open-forum seminars, WAGO also offers sessions that are specifically tailored to your organization and its particular needs. Upon request, we can conduct these seminars at your location.

WHAT CAN WE DO FOR YOU?

Benefit from responsive service, comprehensive consultations and experienced contacts.

<https://www.wago.com/de/contact>



3-Phase Power Measurement Module



Rogowski Coil RT 500



Power Supplies



Plug-In Current Transformers
picoMAX®



Relay Module



RJ-45 Connectors



Industrial Switches



Relays

MODULES FOR CONTROL CABINET MANUFACTURING

The products and solutions outlined in this brochure form a solid foundation for building automation. However, additional peripheral systems, control modules and components are required for complete automation solutions.

WAGO not only provides a wide range of products, but can also furnish tailor-made solutions consisting of fully equipped system distribution boxes.

Key Components at a Glance:

- **WAGO-I/O-SYSTEM**

Benefits of WAGO's successful fieldbus system: Solution with scalable performance, high integration density and an unbeatable price/performance ratio.

- **Industrial Switches**

Redundant, stable network solutions that are also economical:

With switches from WAGO, reliable data distributors are ready for your machines and systems.

- **Pre-Assembled Custom Solutions**

WAGO product specialists have the experience and efficient solutions to assist you from initial specs to final installation.

- **WAGO Power Supplies**

Provide 24 V to power controllers and IPCs.



Controllers



TOPJOB® S Rail-Mount Terminal Blocks



WINSTA® Pluggable Connection System



Distribution Boxes

- **Network Infrastructure Components**

From a simple switch to configurable communication capabilities with a fiber optic connection

- **Customizable ETHERNET**

User-configurable ETHERNET RJ-45 connectors

- **Interface Modules**

For RJ-45 patch cables and universal connections, such as a 9-pole Sub-D RS-232 connection

- **Relays**

To control loads, such as lights, shutter drives and much more.

- **WINSTA® Pluggable Connection System**

Innovative connectors from the WAGO WINSTA® line of preassembled components ensure fast, safe on-site installation; they accommodate conductor cross sections up to 4 mm² (12 AWG) and nominal currents up to 25 A.

- **Screwless Rail-Mount Terminal Blocks**

WAGO TOPJOB® S is a range of screwless rail-mount terminal blocks for building installations with conductors rated 1.5–16 mm² (16–6 AWG).

- **Current Measurement**

Coupled with electronic interface devices and the WAGO-I/O-SYSTEM 750, WAGO offers a comprehensive range of perfectly tuned energy efficiency solutions.

YOUR BENEFITS:

- Lower assembly time
- Error-free installation
- Simplified commissioning



HEATING WITH ICE

The Company leitec® Gebäudetechnik GmbH Uses an Unusual Method for Building Air Conditioning

Energy is created when water freezes to ice. An identical amount of energy is required to heat water from 0 to 80 degrees Celsius. Viessmann, a heating technology company, used this crystallization principle for their innovation, and developed a system based on an ice energy store and heat pumps to provide energy for heating and cooling. Users of the technology include leitec® Gebäudetechnik GmbH, a complete service provider in energy and building technology, headquartered in Heilbad Heiligenstadt in Thuringia.

The idea was to cover the complete demand for heating and cooling by using an ice energy store, thereby completely eliminating the need for fossil fuels. To do so, an underground concrete tank with 400 m³ capacity was integrated into the building as the ice energy store.

The heat pump-ice energy store combination

functions most efficiently when it is used to generate both heating and cooling. In the winter, the heat pump withdraws energy to ensure that the water tank freezes from the inside out. In hot months, the resulting ice mass is used to supply the collectors in the offices with cold water to lower room temperatures. For economical system operation, photovoltaic modules on the roof deliver electricity to operate the heat pumps.

The system is controlled by the WAGO-I/O-SYSTEM 750. These included the operating modes of heating with the ice energy store, heating with the solar thermal collectors, cooling the ice energy store, regeneration with the solar collectors, and cooling with the heat pump.



A CLIMATE IN TUNE WITH THE ART

**The Augusteum in Oldenburg, Germany,
Employs the Latest Technology to Protect its Artworks.**

When one is entrusted with preserving valuable artworks, the atmosphere they are exposed to takes special consideration. With a new HVAC system and individual room controls, the Oldenburger Augusteum now has the perfect technology for safeguarding its exhibitions. This installation exactly implements the requirements of the German Mechanical and Electrical Engineering Task Force (AMEV) 2011 guidance for HVAC systems: The temperature in the museum is held at a constant 20°C with a relative humidity of 50%, while the sound pressure level never exceeds 45 dB. To fulfill these requirements, a central HVAC system was installed in the basement. The system handles heating, cooling, dehumidification and air circulation functions and is equipped with a highly efficient rotary heat exchanger, with a heat recovery factor of about 75% during heating operation.

The air humidity is carried out by a separate steam generator in a downstream humidifying chamber. Decentralized air treatment modules (ATMs) were also installed in the exhibit rooms. They heat, cool, dehumidify, and transport the air in the rooms. The heart of the automation system is the modular WAGO-I/O-SYSTEM 750. In addition to the information node, equipped with a touch panel, nine subdistributors are used in the Augusteum. The automation stations communicate with each other via an IP network. The technology was ingeniously concealed within the walls of this listed historical building.

WAGO Kontakttechnik GmbH & Co. KG

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