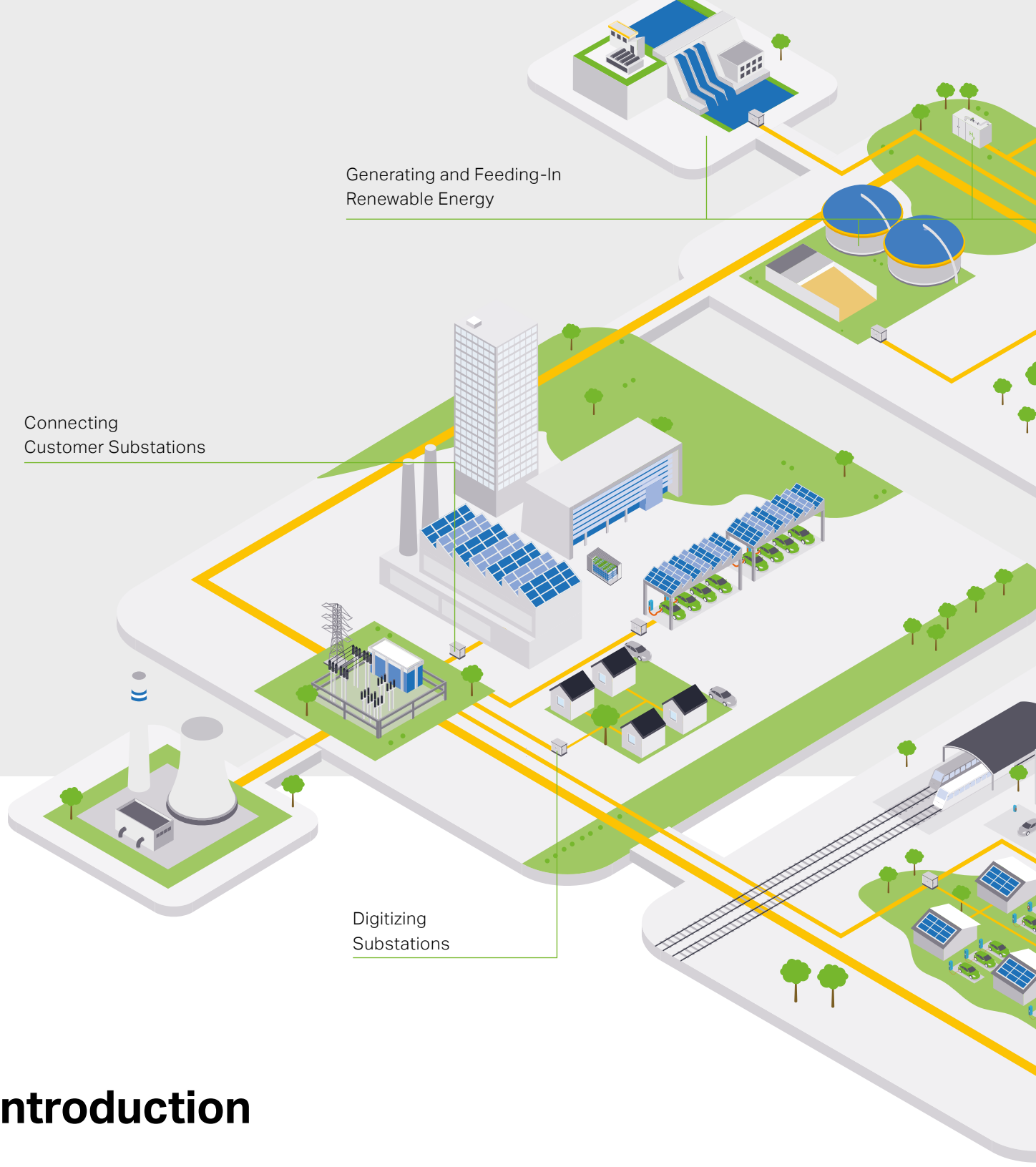
Energy Solutions

Solutions for the Distribution Grid

Content



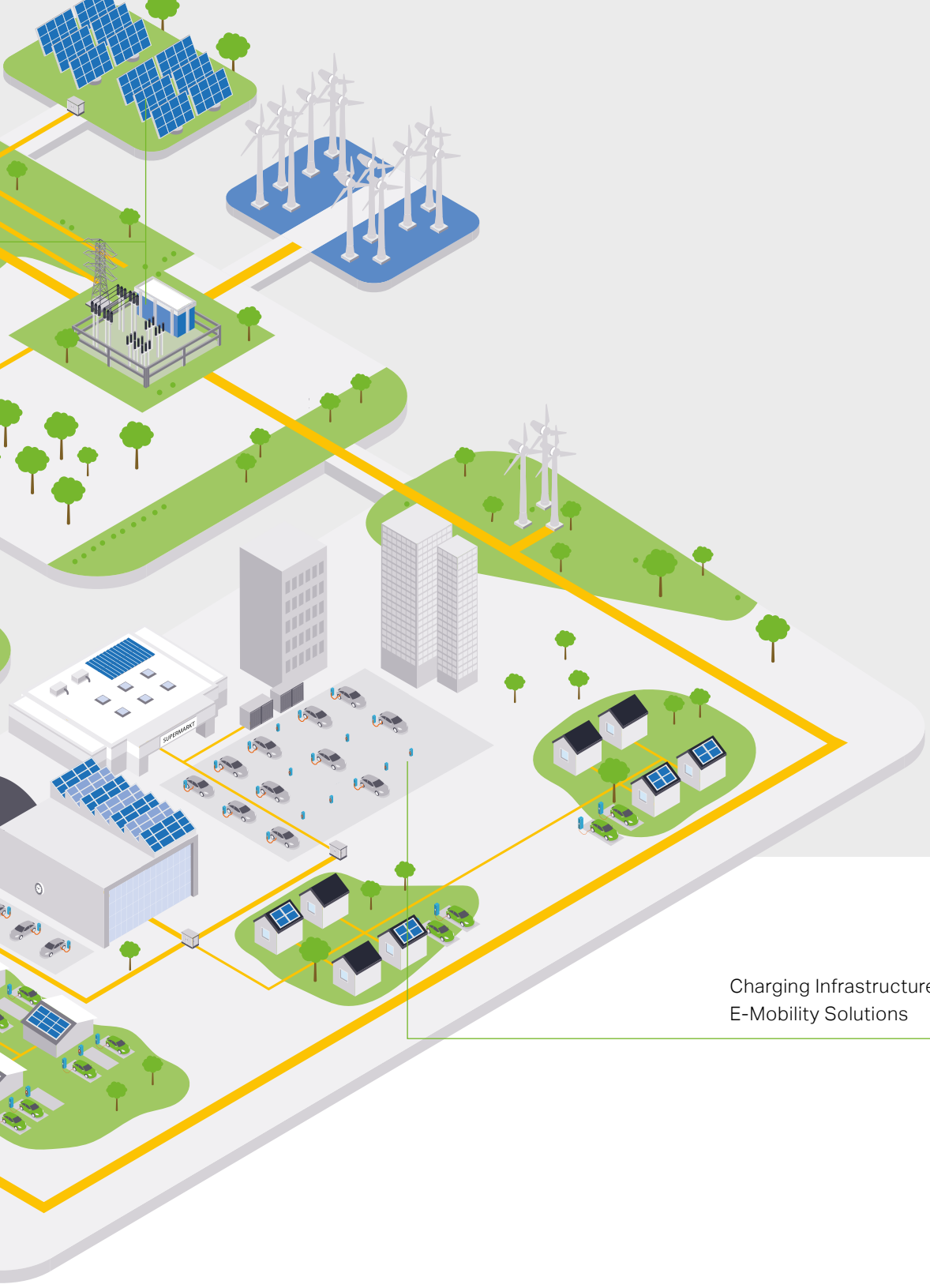
Introduction

Wherever new technologies need to be integrated into existing grids, WAGO makes a crucial contribution to progress.

For decades, this global company, headquartered in Minden in eastern Westphalia, has been a reliable partner for anyone seeking practical solutions in the energy sector – for both everyday applications and highly specialized challenges.

As a family-owned company, it focuses on each individual customer. WAGO's experts devote their full attention to the customer's needs and challenges above all, allowing them to develop solutions that fit these needs perfectly and are still easy to realize, implement, maintain and expand as needed. This process is supported by WAGO's entire portfolio of products and product ranges – as well as the know-how of WAGO specialists, who start from specific problems and go on to develop pioneering, forward-looking solutions for use across many different industries.

WAGO also upholds this high standard of quality when applying its problem-solving expertise to critical infrastruc-



Charging Infrastructure
E-Mobility Solutions

ture applications. In every project, the goal is to go above and beyond the usual standard. WAGO's international certifications attest to its ability to do so. These include various ISO certifications, such as 27001, 50001, 9001 and ISO 14001, ETEX and the ISO 62443 cybersecurity standard.

Especially at a time when the energy industry is facing profound changes, grid operators and industrial customers appreciate WAGO's pragmatic solutions, which are geared towards their actual needs. For more than a hundred years, electricity has flowed in one direction – continuously – from the generator to the consumer. But new technologies, new energy procurement channels and widespread digitization are changing the market permanently. Successful integration of these technologies lays the foundation for the success of a sustainable approach to energy – and sets the course for combatting climate change.

Telecontrol Technology and Power Grids

Electricity, gas, water and heat infrastructure involves spread-out service areas and remote stations. Smooth operation is essential. Malfunctions need to be detected and fixed immediately, since they can impact every aspect of our lives severely in no time. At the same time, the high quality of the products needs to be guaranteed to avoid health hazards and negative economic effects.

A Step-by-Step Explanation

- "Telecontrol" refers to monitoring and controlling objects from a distance.
- Processes that convert signals can be used to transmit process data to one or more locations and receive it from them.
- The data is usually obtained automatically from a telecontrol substation (e.g., a PLC).
- The substation forwards the data through various transmission media (GSM, radio or wired communication) to the central station or control system.
- Various data protocols are used to transmit this sensitive process data; the IEC 60870-5-101, -103 and -104, IEC 61850 and DNP 3.0 protocols have become established as standards for supply technology.
- In telecontrol technology, besides the importance of rugged construction, the focus is on probability of failure, as well as special security and data protection aspects.

Why Choose WAGO Telecontrol Technology?

WAGO is a success factor in telecontrol technology and the smart grid. Telecontrol technology has been an integral part of WAGO's product portfolio for over ten years. With its products, solutions and top service, WAGO can handle telecontrol technology of any size in all sectors – from public infrastructure, to renewable energy and the process industry. Further applications include control, regulation and remote monitoring of gas, water and heating networks. The integrated PLC handles automation tasks in a single step.

The system has all the major global approvals and can be used in the most demanding conditions, such as in power

stations of any all voltage level, mining, offshore installations and pipeline systems. It offers unique flexibility in the signal level and the available bus protocols.

WAGO telecontrol technology supports the IEC 60870, 61850, DNP 3 and Modbus® protocols. These are easy for non-PLC programmers to configure and operate.
WAGO telecontrol stations are designed for maximum security and offer the best possible protection. The controllers can be hardened according to the BDEW white paper standard.

The Benefits for You:

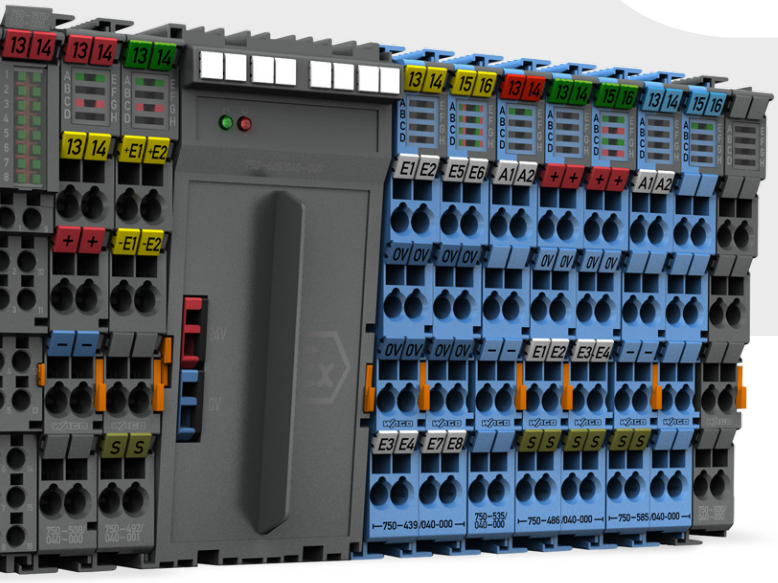
- Secure, cost-effective access, even to remote systems
- More than ten years of experience
- WAGO makes telecontrol technology and the smart grid a success factor – with WAGO products, solutions and top service
- For telecontrol technology in all sizes and sectors, such as public infrastructure, renewable energy and the process industry

Remote Terminal Units (RTUs) for Telecontrol Technology

As their platform, WAGO's RTU solutions use the modular WAGO I/O System, which has a long-standing record of success on the market. The controllers, which offer scalable performance, have been expanded to support special telecontrol protocols (IEC 61850, IEC 60870, DNP3 and Modbus®). In combination with the option of IEC 61131-3 programming, this allows flexible and, above all, easy handling of telecontrol communication and station automation tasks.

A Step-by-Step Explanation

- International approvals guarantee continuous operation under the most demanding environmental conditions.
- The Linux® operating system offers maximum flexibility and helps ensures long-term availability of the automation solution.
- It also meets the strictest security requirements for critical infrastructure applications.
- The system offers flexible communication and programming features.
- Extensive portfolio of I/O interfaces and program libraries
- Openness for automating solutions across industries – especially for power distribution grids, water resource management, oil and gas and infrastructure projects



Versatile Communication Interfaces

- Support for all major telecontrol protocols: IEC 60870-5, DNP3, IEC 61850, Modbus®
- Multiple gateway functions possible (client/server)
- IoT (MQTT), OPC UA, fieldbus, industrial ETHERNET and more

Straightforward Handling

- Highly modular I/O modules for custom node designs
- Intuitive configuration tools and project-specific Web interfaces make commissioning easier and reduce life-cycle costs
- Freely programmable IEC 61131-3 control logic
- Linux® MicroServices (Docker®) can be used directly
- Low lifecycle costs

Approvals for Substation Automation

- Meets the most stringent environmental conditions per IEC 60255
- Certified protocol conformity (GL_DNV, KEMA)
- Long product and service life
- CPU performance scalable to complex tasks
- Approvals even for harsh substation conditions

Absolute Security and Reliability

- Meets the highest security standards to guarantee greater system uptime and data integrity (ISO 27000)
- Hardened firmware for “critical infrastructure” (auditable) + remote firmware updates
- Onboard firewall and VPN functionality
- Secure and reliable: meets high cybersecurity standards

Cybersecurity in Critical Infrastructure

WAGO's wide selection of automation technology products has been in use across many industries around the world for more than a decade.
And WAGO systems meet international safety standards, allowing them to be put to the test again and again – so they are getting more secure all the time. Continuous updates guarantee maximum cybersecurity for WAGO components.
This is particularly helpful for the energy industry, since sensitive critical infrastructures are a particular focus of potential attackers on the network. To stay ahead of such unauthorized access attempts, external security experts constantly subject WAGO automation components to proactive stress tests to help identify potential risks early on. That gives WAGO and its partners the chance to fix any security vulnerabilities immediately – before they can ever be exploited.

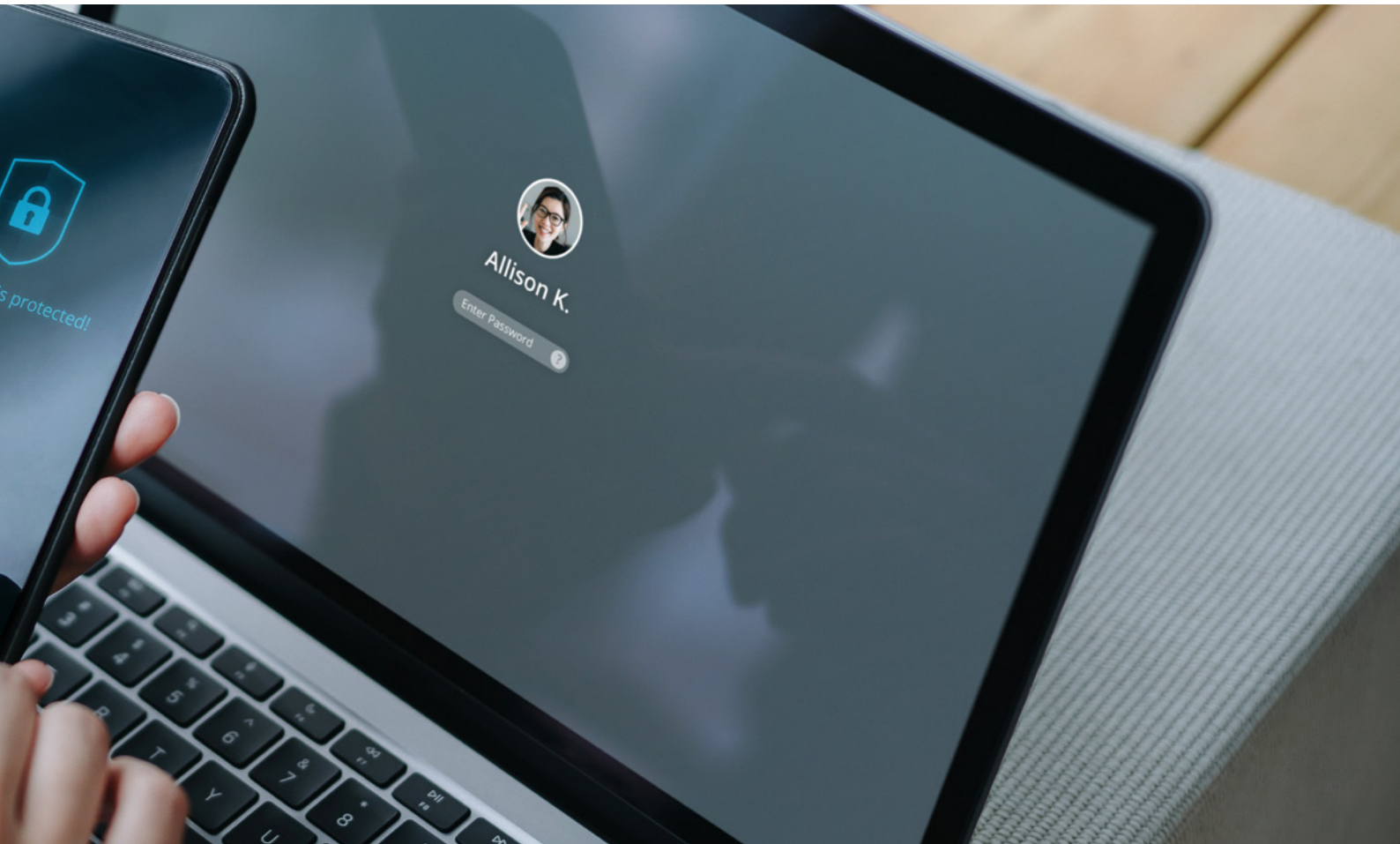
A Step-by-Step Explanation

- The PFC100 and PFC200 Controllers are equipped with cross-platform real-time Linux®.
- The PFC200 can be used as a scalable node.
- The Linux® foundation supports essential security protocols with constant further development.
- All PFC Controllers use an operating system offering long-term availability, scalability and update-capability.
- Support for tools like Rsync
- Support for CODESYS PLC runtime and tools such as Rsync, as well as a variety of interfaces and fieldbuses: CANopen®, PROFIBUS DP, DeviceNet®, IEC 60870, IEC 61850, DNP 3 and Modbus TCP
- Meets the security requirements of the ISO 27000 series
- On-board VPN functionality: VPN tunnel possible via IPsec or OpenVPN
- Data encoding on the controller via SSL/TLS 1.2 encryption
- Parallel data tapping
- Data transmission in the cloud via MQTT or OPC UA, also wireless
- WAGO meets all the relevant cybersecurity guidelines and the requirements of the German government's BDEW white paper for energy and water supply applications in "critical infrastructure."

The Benefits for You:

When it comes to software and cybersecurity, the WAGO Product Security Incident Response Team (PSIRT) offers proactive support to ensure the best possible protection of your existing industrial automation processes. Whenever new potential threats arise, we provide recommendations, patches and updates as quickly as possible to minimize the risk.
We rely on your assistance to help identify vulnerabilities. If you notice something about our products or services you think we should know, submit an incident report: psirt@wago.com

Learn More:
www.wago.com/global/automation-technology/psirt



Our Hardware for Telecontrol Applications

750 Series Telecontrol Station (RTU)
Compactness, heat- and cold-resistance and precise customization: These are the benefits the WAGO Telecontrol Station (RTU) for telecontrol technology offers on the product side.

The Benefits for You:
- Use from 0 to 55 °C (32 to 131 °F) / –20 to 60 °C (–4 to 140 °C) without air-conditioning
- Compact, space-efficient design
- Industrial standard per IEC EN 61000-6-2/-3
- Withstands acceleration up to 0.5g

XTR Telecontrol Station (RTU)
The WAGO XTR Telecontrol Station (RTU) – for environments no other telecontrol technology solutions can handle. It boasts extreme temperature resistance, immunity to interference and resistance to vibrations and impulse voltages. It is ready for use in renewable energy plants, substations, the petrochemical industry and water treatment and waste water facilities.

The Benefits for You:
- Resistance: –40 … +70 °C
- Ready for use per IEC EN 60870-2-1
- Allows greater availability even in unprotected areas; also compatible with standard telecontrol technology
- Resistance to impulse voltage up to 5 kV
- Withstands acceleration up to 5g

WAGO Edge Controller

The WAGO Edge Controller is designed for extensive RTU protocol gateways, as well as data concentrators, IoT connectivity and/or data pre-processing "on the edge."
With its easy engineering in ***e!****COCKPIT*, it fits seamlessly into the PFC and TP 600 Controller families and offers unlimited possibilities with the open Linux® operating system.

The Benefits for You:

- Powerful ARM Cortex-A9 quad-core processor allows implementation of comprehensive control and gateway functions.
- "IoT" connectivity and "Docker®-ready" for specific edge applications
- Integrated engineering and cybersecurity concept
- DRM license model for functional expansion (RTU, BACnet®, EtherCAT® and many more)
- Extended temperature range: −20 … +60 °C (−4 … 140 °F)

WAGO Touch Panels 600

With the powerful WAGO Touch Panels 600, comprehensive control and telecontrol functions are joined by local graphical user guidance – for applications like direct configuration of telecontrol applications via the operator interface.

The Benefits for You:

- RTU and touch panel integrated
- Powerful quad-core processor allows implementation of comprehensive control and gateway functions.
- "IoT" connectivity and "Docker®-ready"
- Integrated engineering and cybersecurity concept
- "Standard" variant or "Advanced" variant with capacitive touch available
- UL- and DNC-approved for demanding environmental conditions
- Ambient temperature (operation): −20 … +55 °C (−4 … +131 °F)

Integrated and Upgradable Telecontrol Licenses

With "Digital Rights Management" (DRM), specific second-generation telecontrol functionalities can be licensed to PFC200 family controllers as needed. These licenses can be used either individually or in combination.

Product	Description	Telecontrol with *e!COCKPIT*	Telecontrol with CODESYS V3.5	XTR	*e!RUNTIME* DRM license for telecontrol protocols
750-8210	PFC200 G2 4ETH	X	X		DRM
750-8210/0025-0000	PFC200 G2 4ETH T	X	X		DRM
750-8210/0040-0000	PFC200 G2 4ETH XTR	X	X	X	DRM
750-8210/0040-0001	PFC200 G2 4ETH Telecontrol/XTR	X	X	X	Integrated
750-8211	PFC200 G2 2ETH 2SFP	X	X		DRM
750-8211/0040-0000	PFC200 G2 2ETH 2SFP XTR	X	X	X	DRM
750-8211/0040-0001	PFC200 G2 2ETH 2SFP Telecontrol/XTR	X	X	X	Integrated
750-8212	PFC200 G2 2ETH RS	X	X		DRM
750-8212/0025-0000	PFC200 G2 2ETH RS T	X	X		DRM
750-8212/0000-0100	PFC200 G2 2ETH RS BACnet	X	X		DRM
750-8212/0025-0001	PFC200 G2 2ETH RS Telecontrol T	X	X		Integrated
750-8212/0040-0010	PFC200 G2 2ETH M12 XTR	X	X	X	DRM
750-8212/0025-0002	PFC200 G2 2ETH RS Telecontrol ECO T	X	X		Integrated
750-8213	PFC200 G2 2ETH CAN	X	X		DRM
750-8213/0040-0010	PFC200 G2 2ETH M12 CAN XTR	X	X	X	DRM
750-8214	PFC200 G2 2ETH RS CAN	X	X		DRM
750-8215	PFC200 G2 4ETH CAN USB	X	X		DRM
750-8216	PFC200 G2 2ETH RS CAN DPS	X	X		DRM
750-8216/0025-0000	PFC200 G2 2ETH RS CAN DPS T	X	X		DRM
750-8216/0025-0001	PFC200 G2 2ETH RS CAN DPS Telecontrol T	X	X		Integrated
750-8217	PFC200 G2 2ETH RS 4G	X	In preparation		DRM
750-8217/0025-0000	PFC200 G2 2ETH RS 4G T	X	In preparation		DRM
762-420*/8000-0001	Visu Panel 600 Standard Line	X	In preparation		DRM
762-430*/8000-0002	Control Panel 600 Standard Line	X	X		DRM
762-520*/8000-0001	Visu Panel 600 Advanced Line	X	In preparation		DRM
762-530*/8000-0002	Control Panel 600 Advanced Line	X	In preparation		DRM
762-620*/8000-0001	Visu Panel 600 Marine Line	X	In preparation		DRM
762-630*/8000-0002	Control Panel 600 Marine Line	X	In preparation		DRM
752-8303/8000-0002	Edge Controller	X	In preparation		DRM
751-9301	Compact Controller 100		X		DRM

Overview of Telecontrol Protocols

Protocol/Functionality		Target Device	*e!RUNTIME* DRM License
IEC 60870	Slave (server, telecontrol substation)	All	2759-0290/211-1000
	Master (client)	PFC200 G2 TP 600, Edge Device, Compact Controller 100	2759-0293/211-1000
			2759-0296/211-1000
IEC 61850	Server		
	Client M	PFC200 G2 TP 600, Edge Device, Compact Controller 100	2759-2243/211-1000
	Client L		2759-2246/211-1000
	GOOSE		
DNP 3	Slave (outstation)	All	2759-2290/211-1000
	Master M	PFC200 G2 TP 600, Edge Device, Compact Controller 100	2759-2293/211-1000
	Master L		2759-2296/211-1000

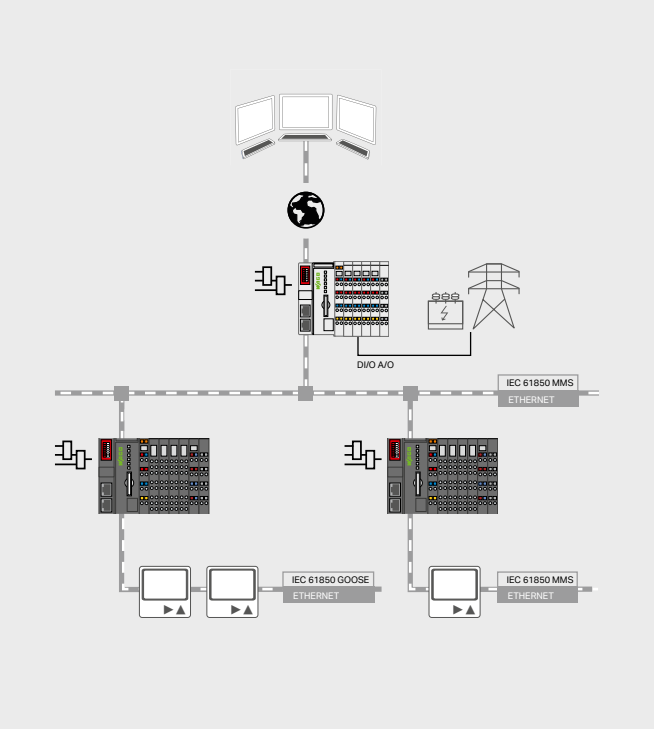
Telecontrol Technology Protocols for Different Programming Environments

Different configurations of the communication protocols are available depending on the engineering environment. Protocols can also be combined with each other (within the system limits) – for instance, in order to implement various gateway functions:

Telecontrol Protocol Configuration		*e!COCKPIT*	CODESYS V3.5
IEC 60870	Slave (server, telecontrol substation)	-101, -104	-101, -104
	Master (client)	-101, -103, -104	-101, -103, -104
IEC 61850	Server	x	x
	Client	x	x
	GOOSE	Publisher and subscriber	Publisher and subscriber
DNP 3	Slave (outstation)	TCP and serial interface	TCP and serial interface
	Master	TCP and serial interface	TCP and serial interface

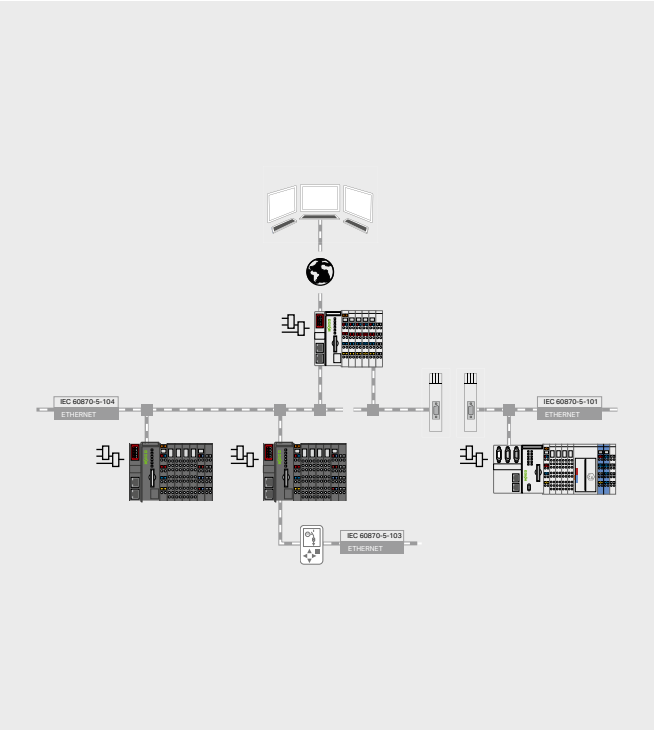
All the info available here:

The Three Applications



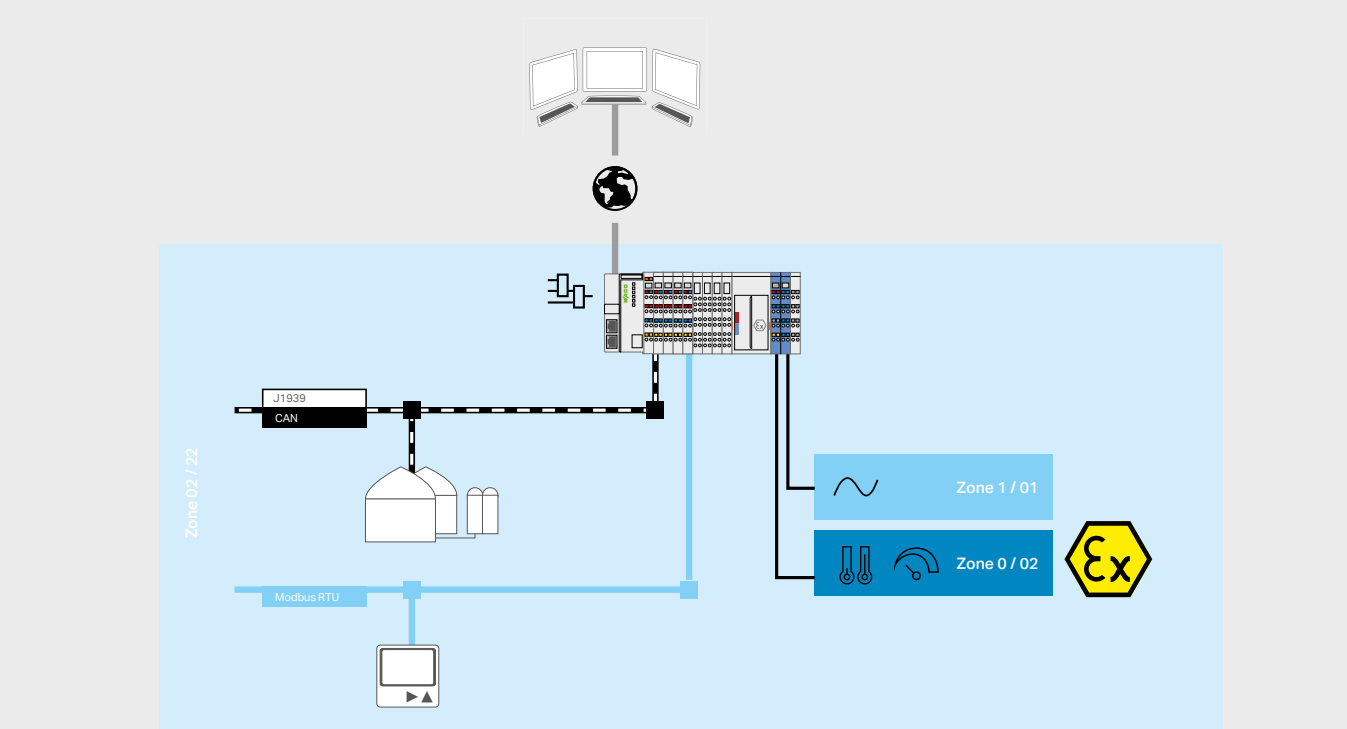
IEC 61850

- IEC 61850 MMS Server and Client
- IEC 61850 and IEC 61400-25 Server, Edition 1 and Edition 2
- 1 server with up to 20 logical devices (LD)
- 1 client with up to 20 server connections
- Freely configurable platform with up to 2000 or 5000 objects per station (depending on hardware and license)
- Buffered and unbuffered reporting
- GOOSE publisher and subscriber
- Server: Max. 20 data sets with max. 50 objects for each LD
- Server: Max. 20 RCB for each LD
- Client: Max. 32 requests per connection
- Client: Max. 32 data sets with 100 entries each
- Free expansion of the data model using its own LN (logical node), CDC (common data class), DO (data object) and DA (data attribute)
- Supported input formats: ICD, SCD, SSD and CID files
- Supported export formats: ICD and CID files
- Optional TLS encryption for server (TLS 1.2)



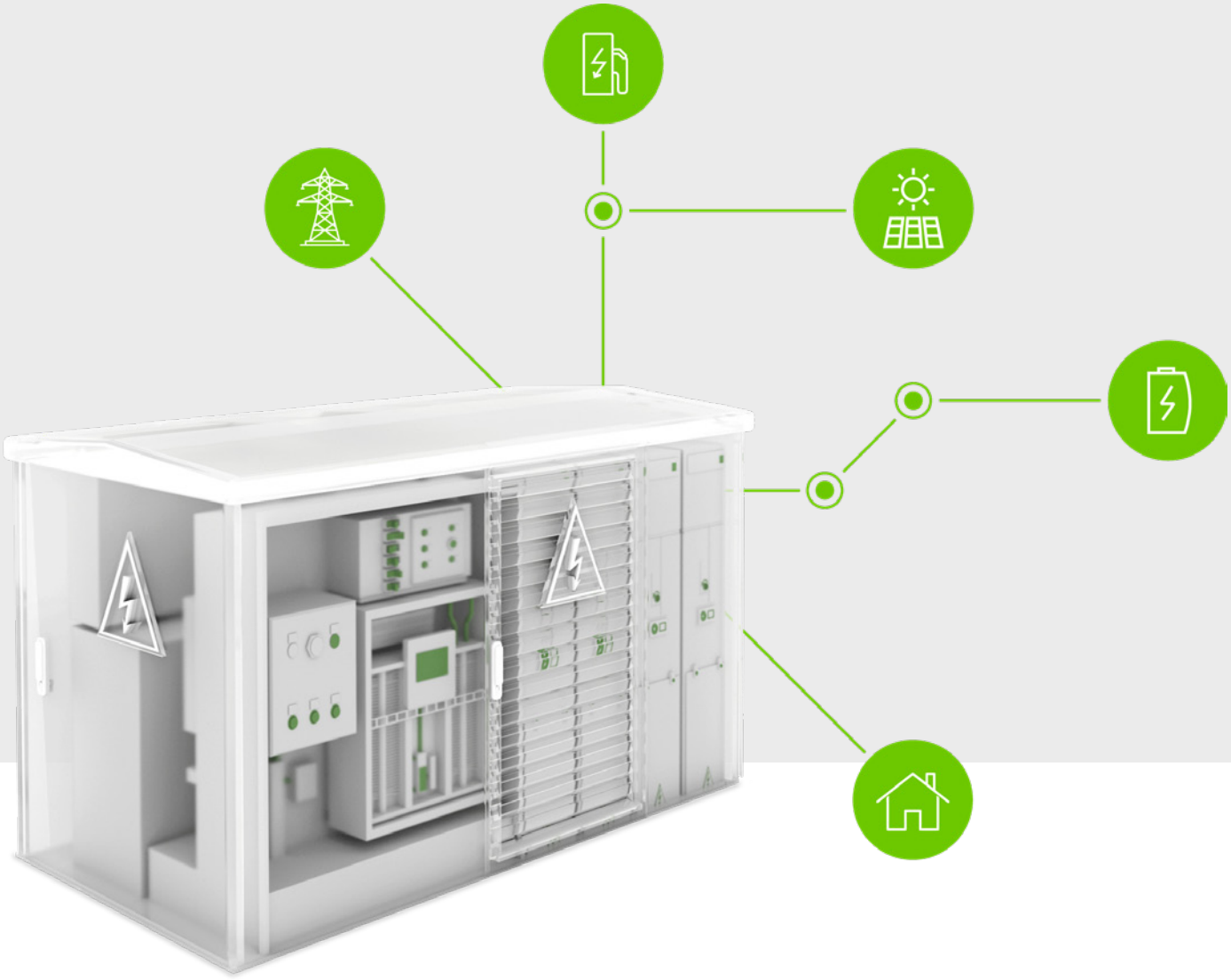
IEC 60870

- IEC 60870-5-101, -104 slave
- IEC 60870 -5-101, -103, -104 master
- 2 slave instances (IEC 104) or 4 slave instances (IEC 101) possible
- 1 ... 4 Multi-Master or Multi-Link client connections per slave
- IP address filter (white list)
- 1 ... 16 ASDU addresses configurable
- Scalable telegram length: 64 ... 253 bytes
- Freely configurable platform with up to 2000 or 5000 objects per station (depending on hardware and license)
- Direct execution of commands (Direct Operate) or selection and execution (Select before Operate)
- Command lock for single and double commands and aging management
- Support for count value modes A ... D
- Optional command responses for single and double commands
- 8 ... 256 kByte of historical data (remanent data storage on SD card possible)
- IEC-103 master: Receives error letters and saves them in COMTRADE format
- IEC 101/104 slave: File transfer (TK 120 ... 126)
- Time synchronization via NTP or TK 103
- Import/export function of data point lists in CSV format
- Optional TLS encryption for IEC 104 slave (TLS 1.2)
- DNV certification (IEC 60870-5-104 Slave)



DNP 3

- DNP3 outstation (server)
- DNP3 master (client)
- 1 ... 4 master connections, freely configurable for serial interface and ETHERNET
- Freely configurable platform with up to 2000 or 5000 objects per station (depending on hardware and license)
- IP address filter (white list) for ETHERNET connections
- Event buffer (<= 100000 events) in RAM or remanent storage on SD memory card
- Automatic or manual start index assignment for objects
- Scalable hysteresis of the analog inputs of the master (object group 34)
- Direct execution of commands (Direct Operate) or selection and execution (Select before Operate)
- Configurable 8/16 bit object qualifier
- Unsolicited messages (modes A ... E) with optional class-specific transmission parameters
- Outstation: File transfer for serial interface and ETHERNET (object group 70)
- Time synchronization via NTP or DNP3 (object group 50)
- Import/export function of data point lists in CSV format
- Import/export function of configuration and data point lists in “DNP3 Device Profile” format
- Optional TLS encryption for outstation (TLS 1.2)



Substation Digitization

Ensuring the stability and reliability of the power grid is the obligation of every grid operator.
That requires the grid to adapt to the increasing flexibility of energy flows. Mismatches between demand and generation, higher loads, decentralized power feed-in – these all cause voltage fluctuations.
Therefore, the energy flow needs to be managed properly. That requires processes that run uniformly – in intelligent substations – stations that balance load levels seamlessly and enable close cooperation between distribution and transmission network operators with the participation of the affected plant operators. In the process, digitization creates great opportunities for the value chain: The data collected helps increase efficiency and cut costs – and keep the grid stable.

Challenges for Grid Operators	Solutions through Digital Substations
Varying load profiles in households due to ▪ Solar power systems ▪ Heat pumps ▪ Battery storage systems **Redispatch 2.0** ▪ Enables data to be provided from the local network, e.g. for grid operators **E-mobility** ▪ Load peaks with unknown simultaneity factor ▪ Low-voltage grid: need for more information	**Requirements of the Federal Network Agency (BNetzA) etc.** ▪ Facilitating the control of distributed generators and flexible loads ▪ Enabling electricity consumers, who used to be passive participants, to play an active role as so-called prosumers in the future ▪ Improving the provision of information useful for the grid from distributed generators and flexible loads ▪ Increasing consumption transparency

Substations as Nodes in the Distribution Grid

Improving Grid Management and Operation

The WAGO Application Grid Gateway

With the WAGO Application Grid Gateway, you finally know what is happening in the grid. Our solution, consisting of hardware and software components, supports you on the path to the digital substation for greater grid transparency. In the largest-scale configuration, the WAGO Application Grid Gateway can be used with a single device to acquire data from two transformers with 17 outputs each on the medium- and low-voltage outputs.

Go to the details and videos:

www.wago.com/global/power-engineering/grid-gateway

The Benefits for You:

- Better network status assessments with live data
- Precise planning of substation maintenance cycles through access to the stored measured values and the digital drag indicator
- In the event of maintenance or faults in the grid: off-site preparation for the on-site situation
- Remote updates for software modules and extensions are possible, eliminating unnecessary travel
- Suitable for both new substations and retrofitting solutions

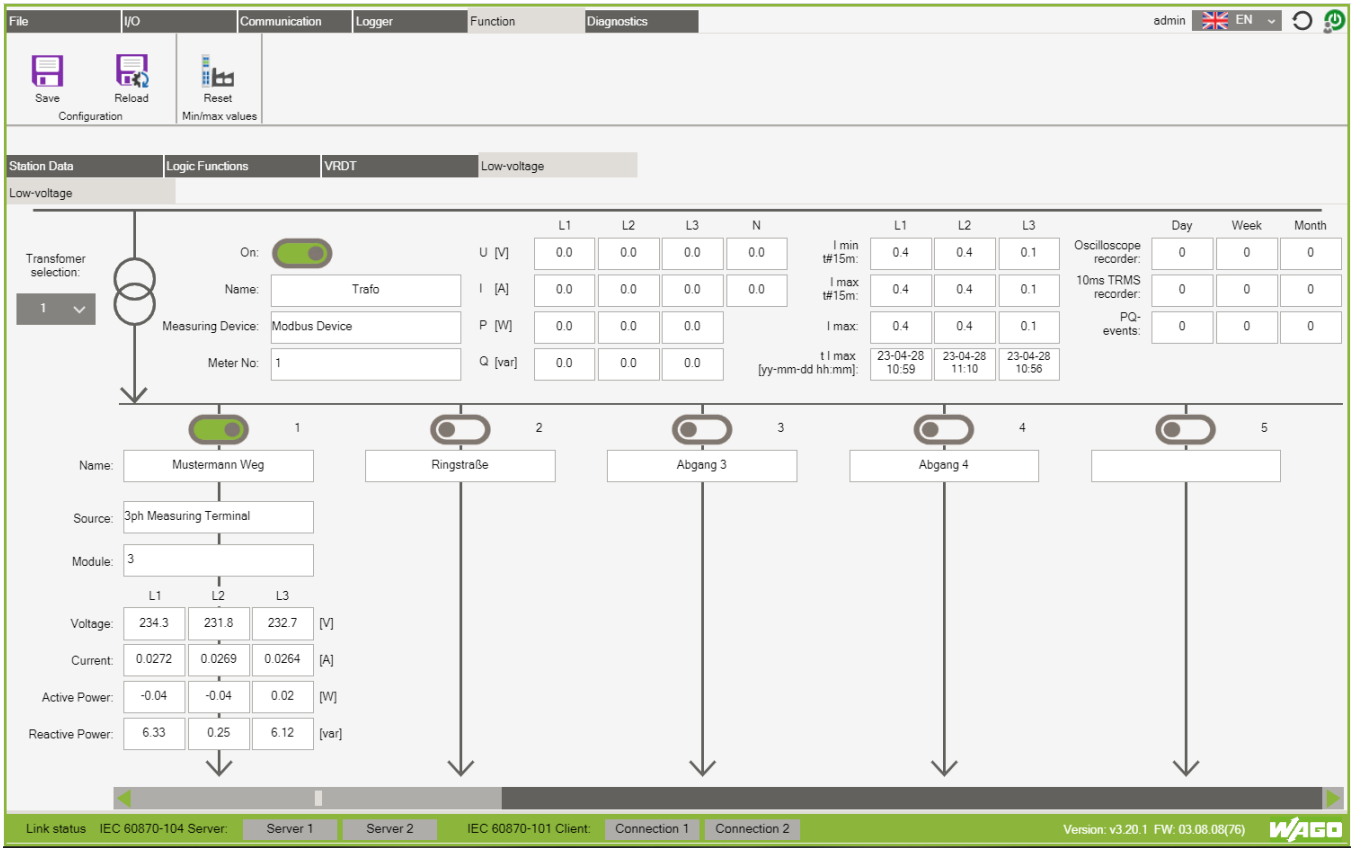
Commissioning of the telecontrol technology in the substation is performed by simple parameterization via a Web interface or a CSV import. The software is based on a mature, field-proven hardware and software concept: The PLC (RTU) stores and transmits second-by-second measurement data of the medium voltage, transformer, low-voltage outputs, position messages and temperatures in the substation.

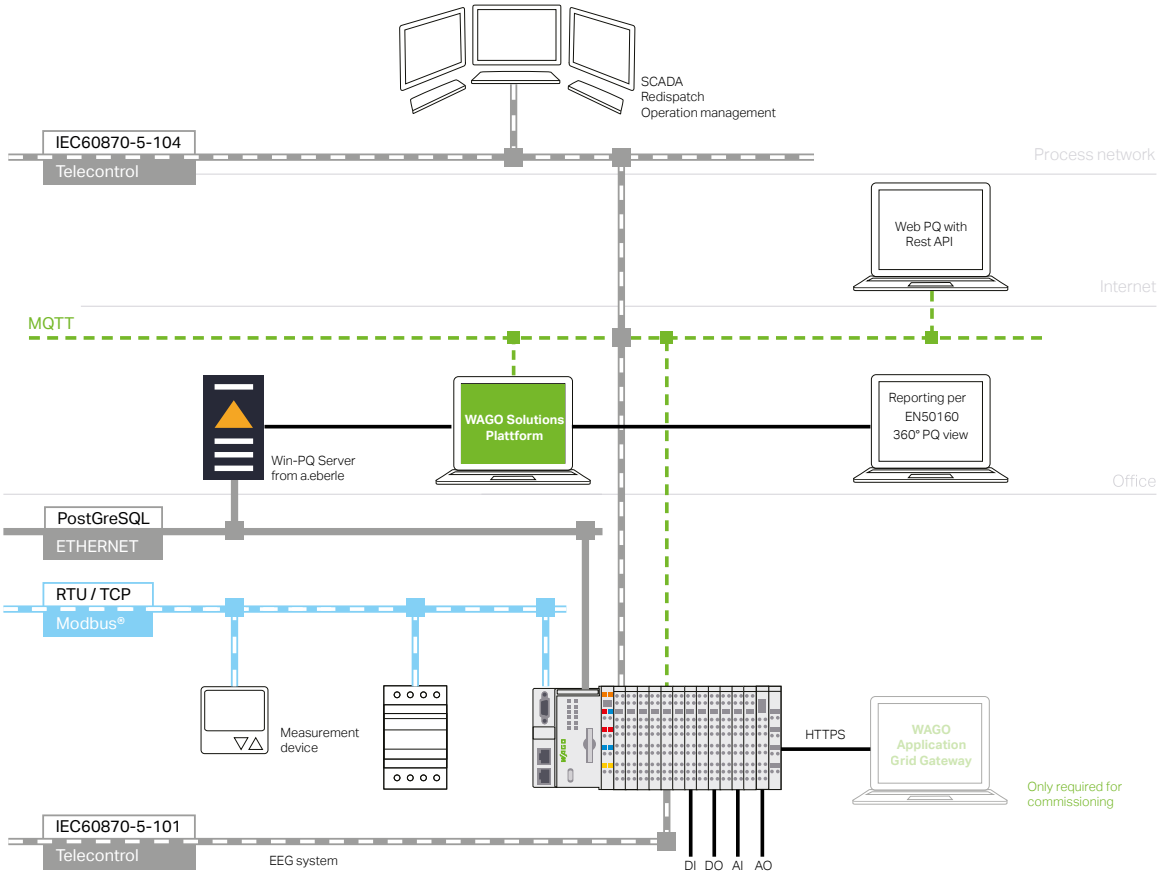
These are transmitted to the network control system via the IEC 60870-5-104 telecontrol protocol. Commands and setpoints can also be received and processed. External measurement systems such as short-circuit/ground-fault direction indicators can be easily parametrized via Modbus RTU.

More Possible Applications:

- Power quality measurement from the medium and low voltage (via external measurement devices) possible
- Bit test: By simulating all measurement data, the station builder can already commission a station at the network control system
- Patch and device management for application updates, configuration changes, security patches, firmware changes etc.
- On-premises or cloud-based data storage
- Application is critical infrastructure-compliant
- Measurement of temperature (environment/oil), door contact or global radiation (PV yield)
- Connection of EEG systems
- Logic functions such as voltage band monitoring

The application can display live data from the low-voltage grid, such as current, voltage or active or reactive power. Additional parameters can be enabled easily.





Solution for Power Quality Measurement in Substations

The new Power Quality function from a-eberle, which is integrated into release V2.4, extends the scope of functions of the WAGO Application Grid Gateway, control, regulation and measurement of local network stations (LNS) with precise measurement and quality testing per EN 50160. The Power Quality function measures voltages, current and power directly at the transformer supply with an accuracy of 0.1 % measured per IEC 61000-4-30 Class A Ed3. The plug-and-play solution with a-eberle devices and direct WinPQ database connection via an encrypted protocol offers additional benefits.

By evaluating the long-term voltage, faults – including ground fault and short circuit indication – are quickly identified and transferred directly to the "Scada System" control center. Data evaluation, reporting and alarms provide a 360-degree view of the low-voltage network to ensure security of supply.

A Step-by-Step Explanation

- Select and parameterize the right template via Modbus®.
- Activate the 3-Phase Power Measurement Module and individual low-voltage outputs.
- Connect to the WinPQ server.
- Set parameters for transmitting data.
- Open the results monitor, which can be transferred to the control center.

The Benefits for You:

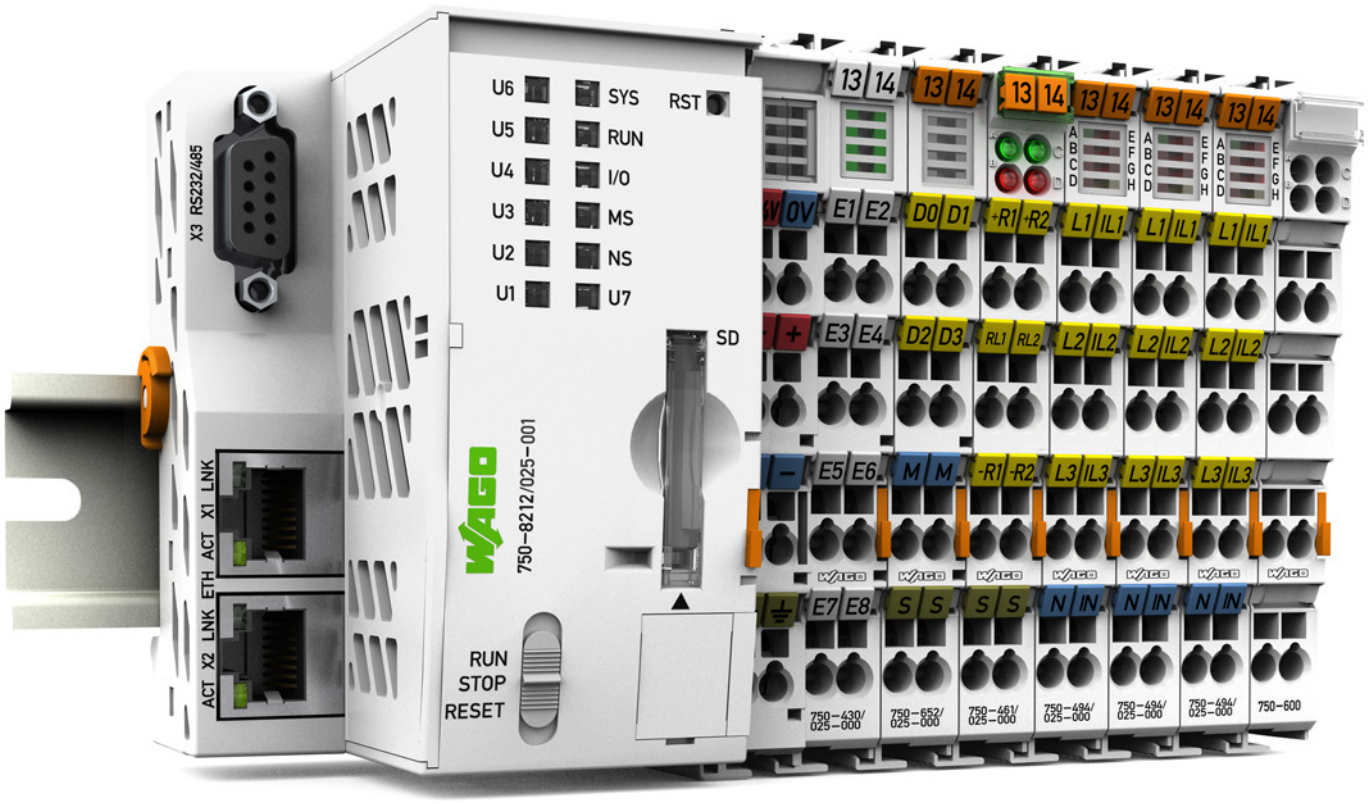
- Integrated WinPQ connection
- Precise evaluation of the low-voltage grid and voltage quality
- Current carrying capacity reporting
- Proof of voltage quality per EN 50160:2022
- Easier troubleshooting
- Knowledge of faulty tripping of circuit breakers
- All power quality and low-voltage data in a central database for targeted remote control and switch position transmission

Customized Hardware Configuration

The hardware compatible with the WAGO Application Grid Gateway is a PFC200. This second-generation WAGO Telecontroller, a programmable logic controller (PLC) with various interfaces, is freely programmable per IEC 61131 and allows additional open-source programming on the Linux® operating system. The modular telecontroller is durable and well-established in the industry. Digital input and output modules for controlling medium-voltage switchgear can also be added – an example being the motor drives of load switches and their feedback signals.

To make the low-voltage network on the substation's transformer output transparent, the required measurement technology for both the transformer and low-voltage outputs can be easily retrofitted by connecting 3- or 4-wire measurement modules to WAGO's small-scale telecontrol system.

We'll support you in customizing your hardware; together, we will find the right system solution for your digital substation. Contact us!



Medium Voltage Calculation – without Resistive Couplers

WAGO Application Medium Voltage Calculation

The WAGO Application Medium Voltage Calculation is an add-on application for medium-voltage calculation that does not require expensive resistive couplers or ohmic medium-voltage sensors. That is possible thanks to the very precise measurement of the low-voltage side of the transformer – with an accuracy class of 1.5 %.
These measured values can even form the basis for calibrating the short-circuit/ground-fault indicators and are essential for wide-range control. The process control systems or the data clouds of the grid operators to which the measured values are transmitted via telecontrol technology also require the measured values.

A Step-by-Step Explanation

- Input of transformer parameters via Web visualization or csv file upload
- The measured low-voltage side of the transformer uses either WAGO 3-Phase Power Measurement Modules (Item No. 750-495/040-010) or third-party devices that transmit their values via the Modbus® protocol, for example.
- The WAGO PFC200 Telecontroller calculates highly accurate values right in the substation without additional measurement technology.
- Incorporating various parameters, a complex formula calculates the medium-voltage side.
- The calculation takes individual transformer parameters into account (short-circuit voltage, no-load loss or loss in the event of a short circuit).

Item Number:
(DRM license): 2759-2016/0261-1000

The Benefits for You:

- Large potential savings through elimination of resistive (ohmic) medium-voltage sensors
- High-precision medium-voltage values (accuracy class: 1.5 %)
- Proven in critical infrastructure applications, thanks to firmware hardened in accordance with the BDEW white paper and a communication concept that can be implemented in conformity with the ISMS

Accurate Medium-Voltage Calculation – without Resistive Couplers

Voltage Regulating Distribution Transformers:
Control without Additional Hardware

VRDT: Control the Step Switch – without Additional Software

WAGO Application Voltage Regulating Distribution Transformer

Flexibility is an essential criterion for operation of a transformer station. While conventional non-regulating transformers run into problems, the WAGO Voltage Regulating Distribution Transformer application can change the transformation ratio during operation, allowing more solar power to be fed in without causing an unacceptable increase in the mains voltage, for example.
That alone makes this add-on application for the WAGO Application Grid Gateway an economical, future-proof solution for dynamic voltage value adjustment between the medium- and low-voltage grids. It conserves network coordination resources and enables efficient network expansion.

A Step-by-Step Explanation

- WAGO Application Voltage Regulating Distribution Transformer can be commissioned quickly through simple parameterization.
- The voltage regulating distribution transformer (VRDT) is coupled through telecontrol technology.
- The application optimizes the controller behavior.
- Control parameters can be set and monitored conveniently via Web visualization.
- Optional: acquisition via the IEC 60870-5-104 telecontrol protocol and transmission to the tap changer
- The VRDT tap changer is controlled via Modbus RTU.
- No additional separate control unit required

Item Number:
WAGO Application Voltage Regulating Distribution Transformer , Item Number 2759-2017/0260-1000

The Benefits for You:

- Minimizes costs, space and avoidable sources of error in voltage regulating substations
- No additional control unit necessary for VRDT control
- Avoids further sources of error
- Easily parameterizable software that can be expanded at any time with flexible hardware that meets critical infrastructure requirements

Connecting Customer Substations to the Grid Quickly and Easily

WAGO Application Customer Substation

Whether for power plants, energy storage systems or load customers: When it comes to the medium-voltage connection, customer substations need to be linked through telecontrol technology. The specific grid operator's technical connection rules (TCRs) specify how this is to be done, as is required by the grid operation purposes and feed-in management in accordance with §9 of the German Renewable Energy Act (EEG).
With the WAGO Application Customer Substation software, this can be accomplished in just ten minutes. This application is a standardized software solution that is preconfigured for different grid territories. It allows quick and easy connection in about three-quarters of German medium-voltage grid territories. A complete, cost-effective solution from a single source, it was created from a combination of hardware and software and has been proven in practice. The application reduces the programming effort required for setting up a customer substation and saves time on commissioning.

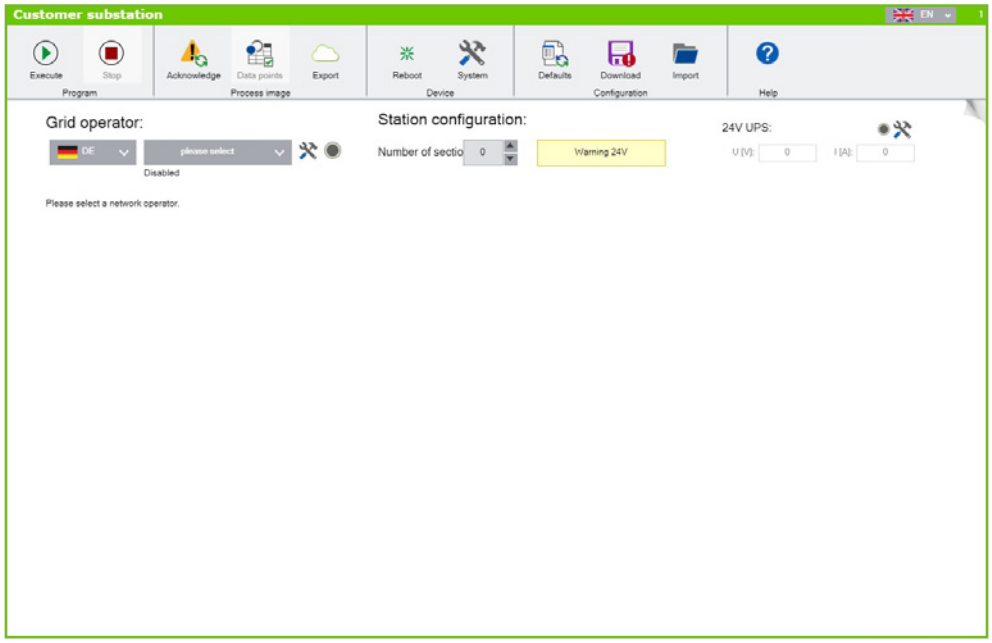
A Step-by-Step Explanation

- The specific grid operator can be selected from a menu in the software interface.
- The software provides the appropriate configuration.
- Customer systems communicate with the regional grid operator's control technology via IEC 60870-5-101 or IEC 60870-5-104 in accordance with the guidelines.
- Measured values like voltage, reactive power and active power are determined and monitored.

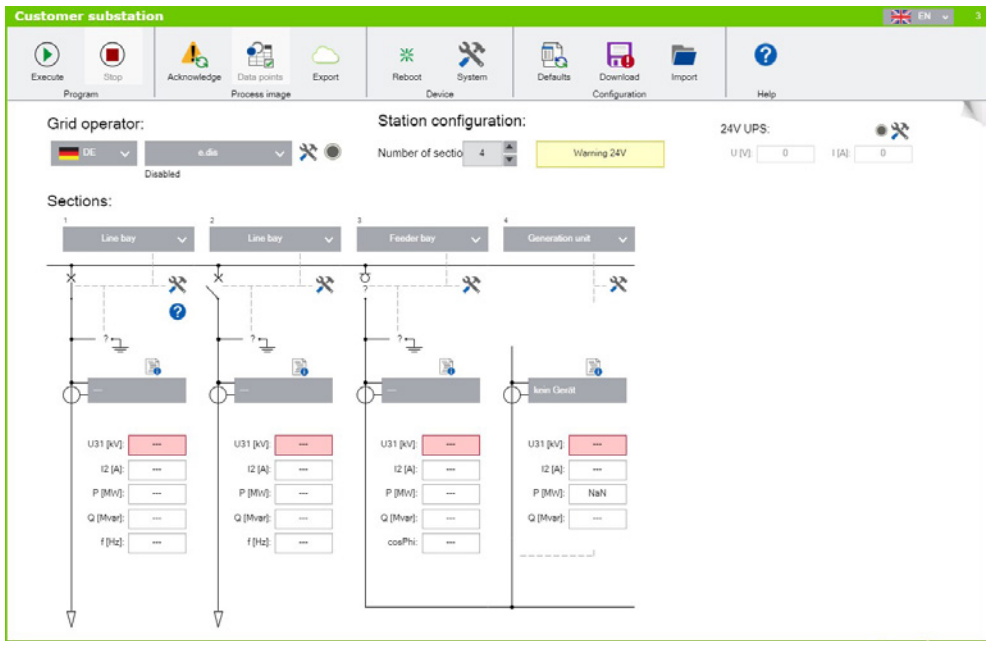
Optional: WAGO offers optional TCR-compliant, pre-wired, pre-programmed control cabinets.

Item Number:
WAGO Application Customer Substation (DRM license): 2759-2018/0260-1000
Preconfigured control cabinets, including software: e.g., 8007-0100/1000-0247; other variants, including protective functions, upon request

Simply select the corresponding grid operator's technical connection conditions (TCRs) from the drop-down menu. Data points required by the TCR are stored automatically.



Easy parameterization of the station according to customer's needs



Learn more in the video and view the detailed list of grid territories!

The Benefits for You:

- Easy TCR-compliant connection of customer substations in about three quarters of German medium-voltage grid territories
- Fast commissioning – no programming required
- Industry-proven telecontrol technology hardware; hardened per BDEW white paper
- Optional: a complete solution consisting of TCR-compliant, pre-wired control cabinets and software
- Possibility of integrating WAGO's Power Plant Control module and load management (WAGO Application Load Management)

Standards-Compliant Medium-Voltage Connection – According to Your Specific Requirements

Ensuring grid stability can be a complex and costly challenge. WAGO offers various options for quick and easy telecontrol connection of customer substations – individually tailored to your company's specific requirements or level or expertise:

Does Your Company Have Programming Know-How?

For System Integrators

WAGOAppRTU_Slaves

If you are already using WAGO telecontrol technology, the WAGOAppRTU_Slaves library can be used to access ready-made communication libraries in a simple modular system for guidelines-compliant IEC 60870 connection and can be integrated into an ***e!****COCKPIT* project as the programming environment. We provide the WAGOAppRTU_Slaves library for download free of charge for a variety of grid territories.

Parameter Setting – Not Programming!

For Switchgear Manufacturers

WAGO Application Customer Substation

As a ready-made software solution, the WAGO Customer Substation application (item number for DRM license: 2759-2018/0260-1000) reduces programming effort and saves time on commissioning customer substations. You can establish a grid-compatible medium-voltage telecontrol connection in just ten minutes. Furthermore, a direct marketer interface is already integrated into the combination of the WAGO telecontrol device* and the application. Therefore, it requires no additional hardware – that saves cabinet space and cuts costs.

Plug and Play!

For Station Builders

Ready-Made Control Cabinets

As a producer of high-quality telecontrol technology, WAGO also offers optional TCR-compliant, pre-wired, pre-programmed control cabinets. This combination of hardware and software yields a cost-effective complete solution from a single source that has been tried and tested in real operating conditions. The control cabinets are designed according to the TCRs of e.on's grid subsidiaries' grid territories (AVACON, E.DIS, SH Netz and Bayernwerk), Westnetz, WEMAG Netz, NetzeBW and EWE. Preconfigured control cabinets including software (e.g., item number: 8007-0100/1000-0247), a combination including protective devices (item number: 8007-0100/1000-0270) and other variants including protective functions are available upon request.

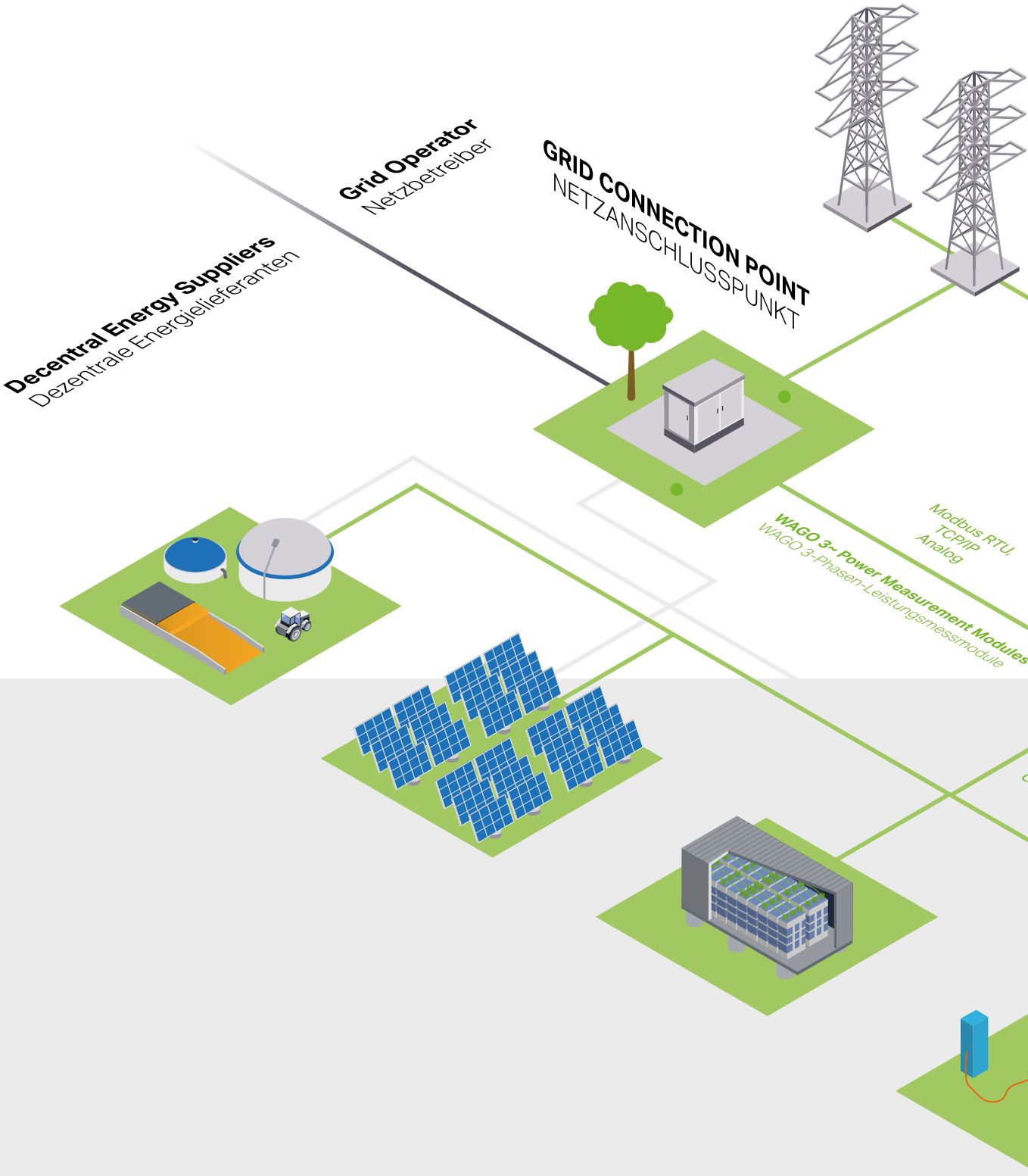
* Note: We recommend using WAGO's 2nd generation PFC200 Telecontrollers with suffix number 750_82XX/XXX-XX1 or -XX2, since these already include a telecontrol license. WAGO telecontrol devices without these suffix numbers require purchase of an additional telecontrol license.

Example of a Ready-Made Control Cabinet Solution with Grid and System Protection

Power Plant Controllers – the Perfect Interface

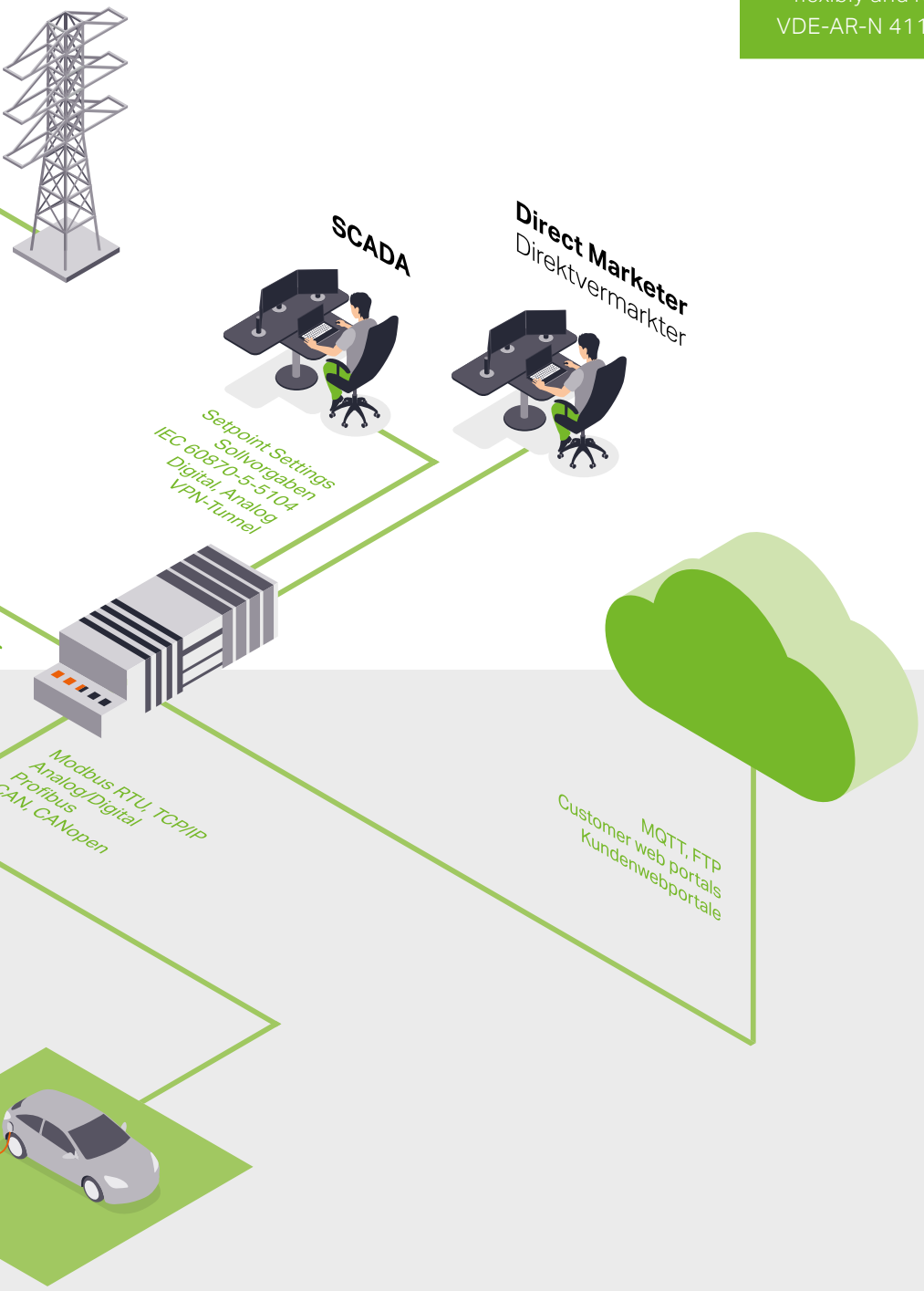
WAGO Power Plant Control

Power plant controllers help power plants achieve grid-compatible feed-in management at the grid connection point (GCP). They regulate the target values for active and/or reactive power at the GCP.
For this purpose, the target values are automatically compared to the actual measured values at the GCP, and the calculated control variable is communicated to the generating units. Power plant controllers form the perfect interface between the plant and the power supplier, the grid operator and the direct marketer; this allows the control power to be sold on the exchange, for example.

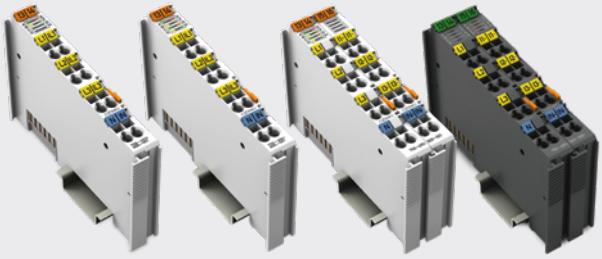


The Benefits for You:

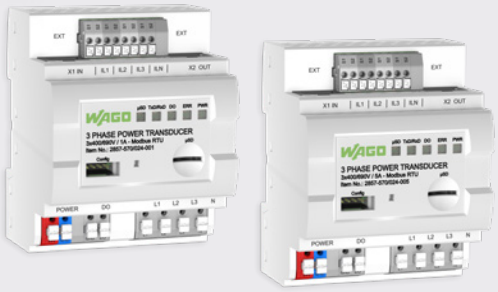
- WAGO Application Customer Substation already includes a certified power plant controller. This means that the customer substation can also become a feed-in station in just a few clicks.
- WAGO Power Plant Control allows plant operators and system integrators to meet the requirements for these controllers that are set on the grid side – flexibly and reliably. The solution is certified per VDE-AR-N 4110 and 4120.



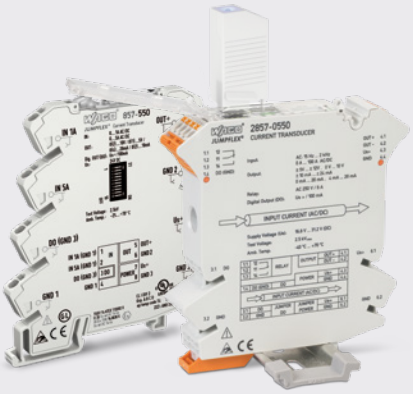
Energy Meters (MID)



3-Phase Power Measurement Modules



3-Phase Power Measurement Modules, 2857 Series



Current/Voltage Signal Conditioners and Power Measurement Modules,

Split-Core Current Transformers

WAGO Current and Energy Measurement Technology

Product Overview

Systematic energy management can make a significant contribution to taming rising energy costs – so the demand for it has never been greater. It used to be an exhausting puzzle made up of highly varied technological components, but the use of standardized, cost-effective automation technology now makes it much easier.
Many energy management projects have shown that, depending on the operating conditions, energy savings of 30 % or more can be achieved.

However, at the start of such projects, only the total energy costs are known initially. Detailed information is lacking concerning how much energy will be used at specific points and exactly where energy can be saved. Therefore, improvement processes begin by systematically recording the energy consumption in a company, as well as analyzing and evaluating it.

You can find more info about energy data acquisition here:

Plug-In Current Transformers with CAGE CLAMP®

Plug-In Current Transformers
with *picoMAX*® Pluggable Connectors

Rogowski Coils

Current and Voltage Taps

Voltage Taps

Energy Meters (MID), 879 Series
Energy meters measure active and reactive energy, mains frequency and current, voltage and power in all phases

3-Phase Power Measurement Modules, 750 Series
3-Phase Power Measurement Modules for the WAGO I/O System evaluate voltage and current, as well as power and energy consumption in three-phase networks

3-Phase Power Measurement Modules, 2857 Series
With the 3-Phase Power Measurement Module in a DIN-rail-mount enclosure, WAGO offers the ideal solution to measure currents and voltages in a three-phase supply network – remotely from the control level.

Current and Voltage Signal Conditioners and Power Measurement Modules,
857 and 2857 Series
Measure DC and AC currents or DC and AC voltages

Current Transformers, 855 Series
Convert AC currents
- Split-Core Current Transformers
- Plug-In Current Transformers with CAGE CLAMP®
- Plug-In Current Transformers with *picoMAX*® Pluggable Connectors

Rogowski Coils, 855 Series
Convert AC currents up to 4000 A

Current and Voltage Taps, 855 Series
Combining a current transformer and voltage tap, this solution can be quickly and easily mounted in the jumper slot of WAGO's 285 Series 2-Conductor Through Terminal Blocks

Voltage Taps, 855 Series
Safely tap the measurement voltage
- For insulated conductors
- For busbars

Rail-mount terminal blocks in use in a substation

WAGO Rail-Mount Terminal Blocks

The largest selection of rail-mount terminal blocks from the market leader: Here you can find the best rail-mount terminal blocks for all applications, along with answers to frequently asked questions! Our high-performance product portfolio provides the perfect basis for your control cabinet solution!

More information on our rail-mount terminal blocks:

The Benefits for You:

- The right handling variant is available for every application
- A complete high-performance product portfolio for every application
- The highest level of safety: testing beyond the requirements of standards
- Industry-proven spring pressure connection technology: fast, vibration-proof, maintenance-free
- Additional savings through shorter wiring times, faster project commissioning and the elimination of service costs
- Eliminate time-consuming preparation – no ferrules or crimping required

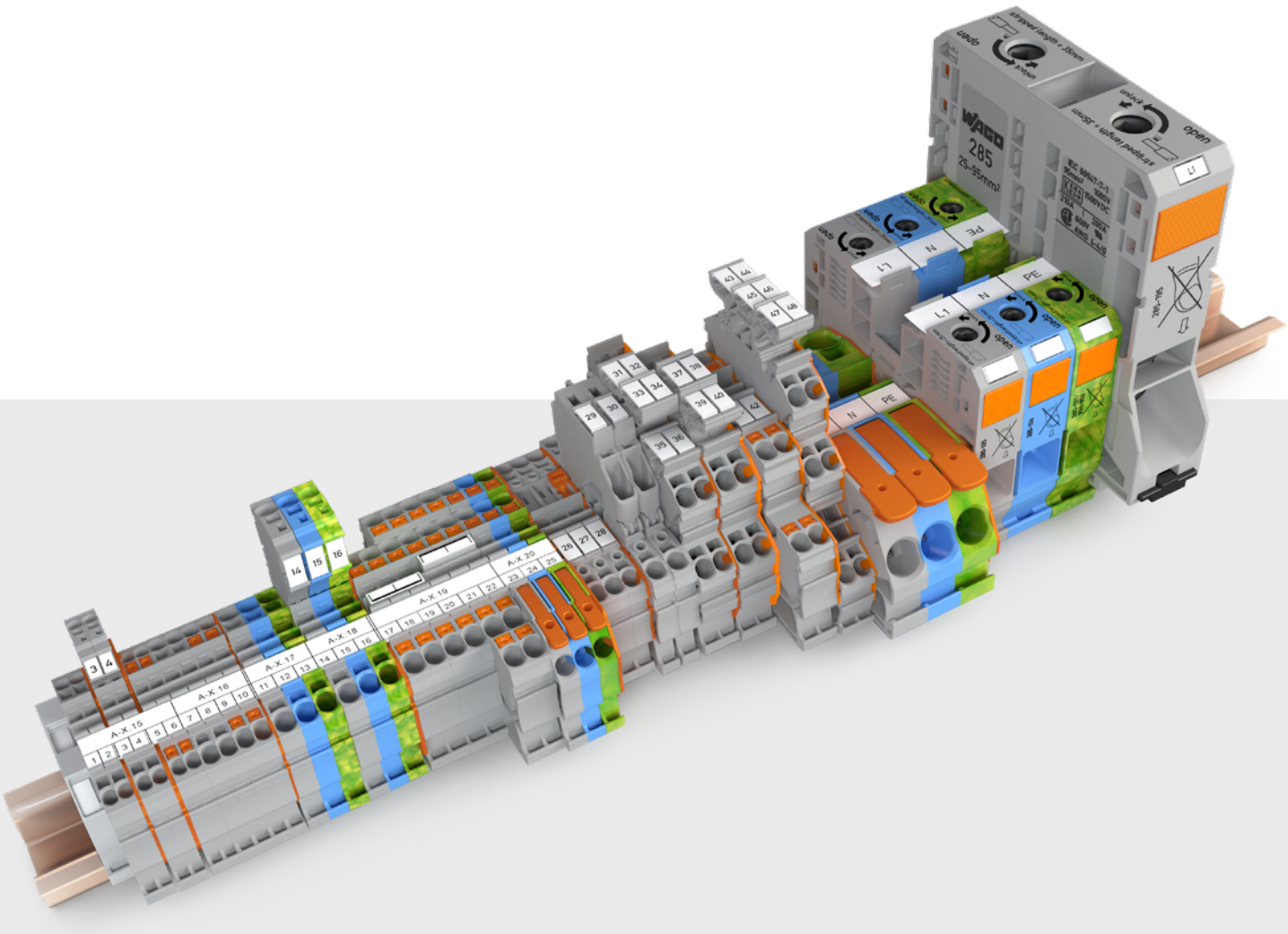
WAGO Rail-Mount Terminal Blocks with Lever, Push-Button or Operating Slot

WAGO rail-mount terminal blocks are available in three different actuation variants: lever, push-button and operating slot, offering the right rail-mount terminal block for every application. The marking system and the multifunctional range of jumpers for WAGO's popular TOPJOB® S Rail-Mount Terminal Blocks can also be used for the new rail-mount terminal blocks with levers.

More information on our TOPJOB® S Rail-Mount Terminal Blocks:

The Benefits for You:

- Three actuation variants: lever, push-button and operating slot
- Comprehensive marking options
- One existing range of TOPJOB® S jumpers for all three variants
- Push-in connection technology: direct insertion of solid and fine-stranded conductors with ferrules for all variants
- Test options for all variants



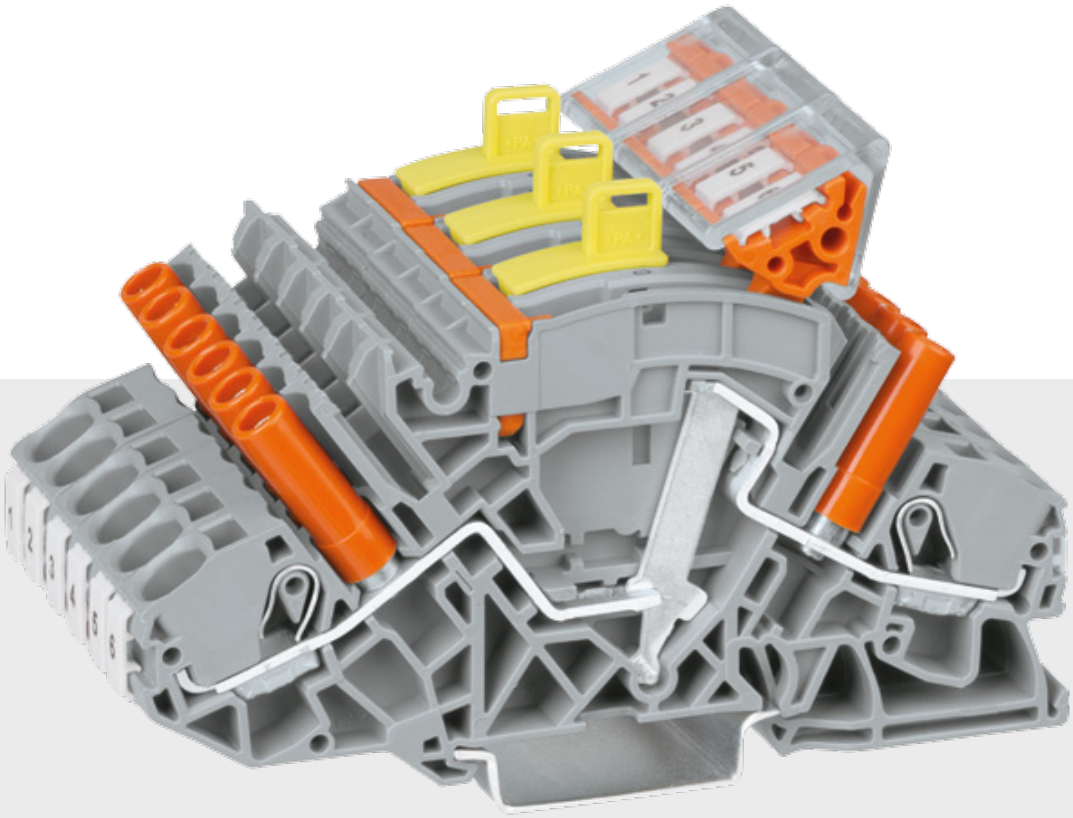
WAGO TOPJOB® S Disconnect/Test Terminal Blocks for Transformer Circuits

The current transformer terminal block or disconnect/test terminal block (item number: 2007-8821) is designed for use in current transformer circuits.

First, the current transformer is shorted with the via disconnect link and the inserted circuit jumper (insert jumper, move disconnect link from operating position I to shorting position II, activate shorting path). Once the circuit has been completely shorted (disconnect link in measuring position III), a measurement device can be connected via test socket on the meter side.

The Benefits for You:

- Top-of-unit circuit jumper slot for shorting path activation
- Easy, intuitive operation, as well as exact indication of switched status
- Combines high performance with a compact design – only 99.6 mm long and 8 mm wide
- All 2007 Series Terminal Blocks are rated at 30 A/500 V (IEC) and 300 V (UL)
- With a terminal block width of 8 mm, the maximum cross-section is 10 mm² (8 AWG) for solid and fine-stranded conductors and 6 mm² (10 AWG) for ferruled conductors
- Touch-proof test sockets for 4 mm Ø test plugs on transformer and meter side
- Compatible with through and ground terminal blocks with the same profile



WAGO Power Supplies

Pro 2

Applications with high power demands call for professional power supplies capable of handling power peaks reliably. WAGO's Pro 2 Power Supplies are ideal for such situations.

Classic

WAGO's Classic Power Supplies are exceptionally robust and offer optional TopBoost integration. Their wide input voltage range and an extensive list of international approvals allow them to be used in a great variety of applications.

Eco

Many basic applications only require 12 or 24 VDC. This is where WAGO's Eco Power Supplies excel as economical solutions.

Compact

These small, high-performance power supplies in DIN-rail-mount housings are available with output voltages of 5, 12, 18 and 24 VDC, as well as nominal output currents up to 6.5 A.

More information on our power supplies:

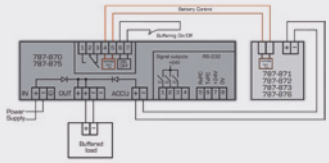
WAGO Uninterruptible Power Supplies

Reliable Compensation – Even for Longer Power Outages

Go to the product list:

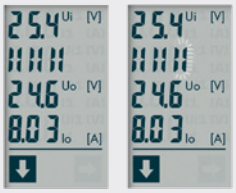
Battery Control Technology

- Allows continuous data exchange between intelligent battery modules (item number: 787-87x) and a UPS charger/controller
- Automatically detects a connected battery module (item number: 787-87x)
- Maximum battery life thanks to temperature-controlled battery management



Display with Charge Level Indicator

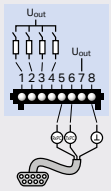
- Indicates actual current and voltage values
- Bar chart indicates the charge level of connected batteries
- Integrated fault memory



RS-232 Serial Interface

- Free download* of the configuration and visualization software (item number: 759-870)
- Free download of function blocks for visualization on standard PLC systems
- Serial communication cable (item number: 787-890 or -892) available as an accessory

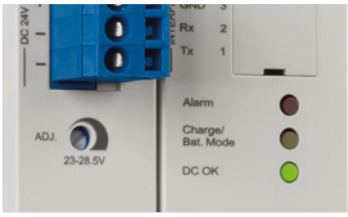
* **www.wago.com**



787-890

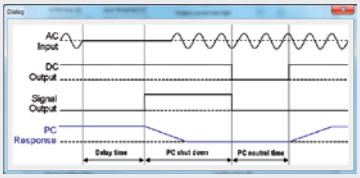
Diagnostics, Monitoring, Configuration

- LEDs display operating status, warnings and errors
- Signal outputs can be processed as a digital signal in a PLC
- Potential-free signal contacts
- Parameter setting via on-unit buttons or rotary switch
- Visualization or configuration via RS-232 serial interface



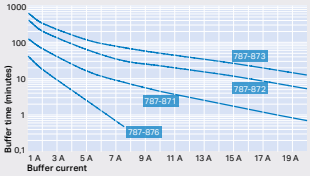
IPC Mode

- Function for controlled shutdown of controllers and PCs
- Shutdown signal transmitted to controller through UPS
- Adjustable wait times and dead times



Buffer Time

- Based on battery capacity and discharge current
- Several battery modules available with capacities from 0.8 to 12 Ah (up to 26 Ah upon request)
- Parallel connection of up to three battery modules of the same type to extend the buffer time – any lead battery modules can be connected



WAGO GmbH & Co. KG
Postfach 2880 · D-32385 Minden
Hansastraße 27 · D-32423 Minden
info@wago.com
www.wago.com

Headquarters +49 (0)571/ 887 - 0
Sales +49 (0)571/ 887 - 44 222
Orders +49 (0)571/ 887 - 44 333

60535601 – BRANCH BROCHURE ENERGY 1.2 DE – 0888-0181/0102-6901 – MM-443572 – 09/2023 – Printed in Germany – Subject to changes