

RENEWABLE ENERGY

Applications & Solutions



**WE
INNOVATE!**



WAGO[®]



Our planet's resources are finite and climate change can no longer be denied. Renewable energy generation will play a key role in meeting the world's future energy demands – and will be essential to protecting the climate and conserving limited resources like gas and coal.



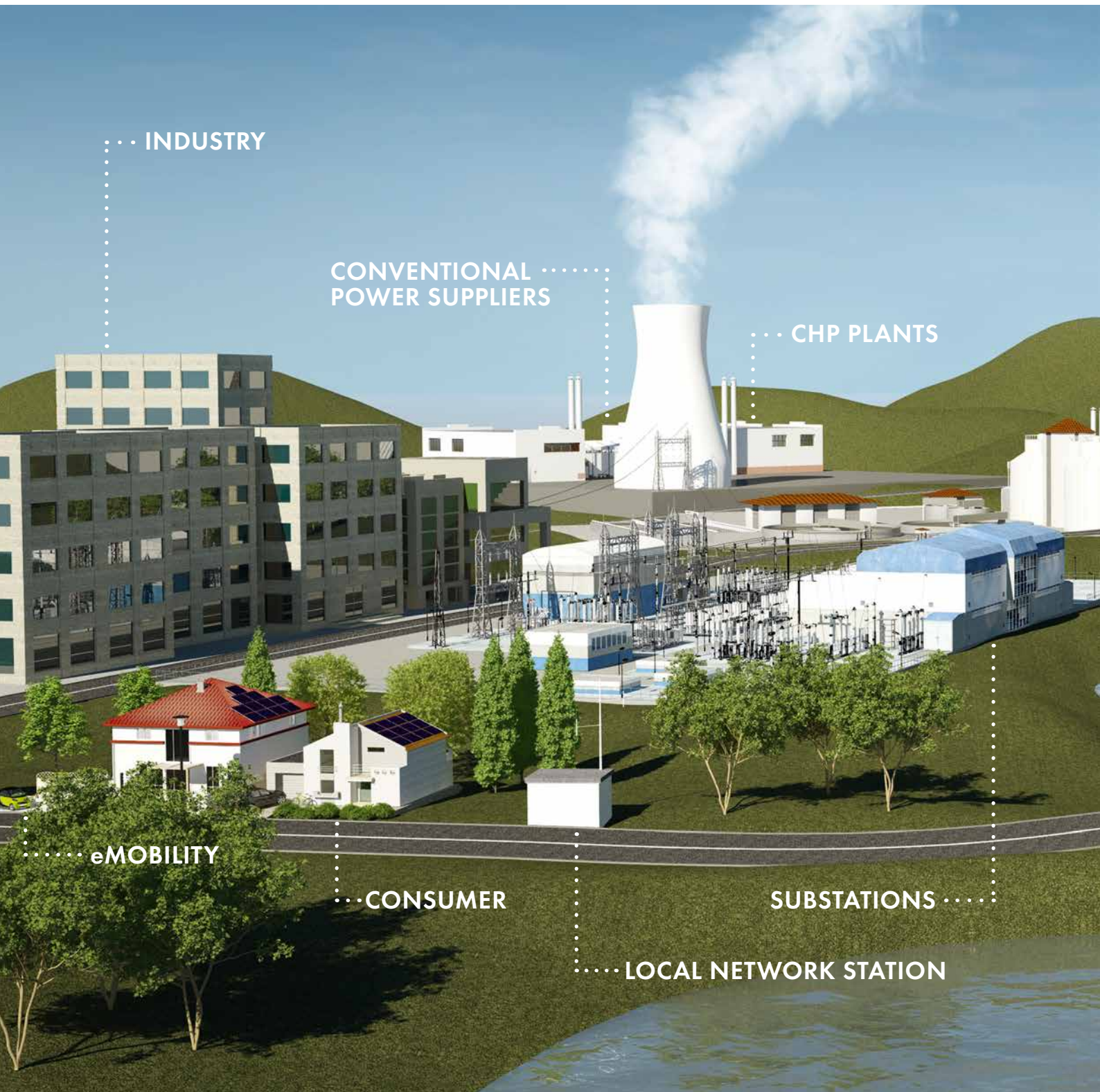
As a long-time specialist in the photovoltaics, wind energy and biogas sectors, WAGO understands these challenges. And, this is reflected in our products. WAGO products provide the greatest degrees of safety and quality. Take a look at our renewable energy portfolio – our expertise will ensure that your systems are operated safely, reliably and efficiently.

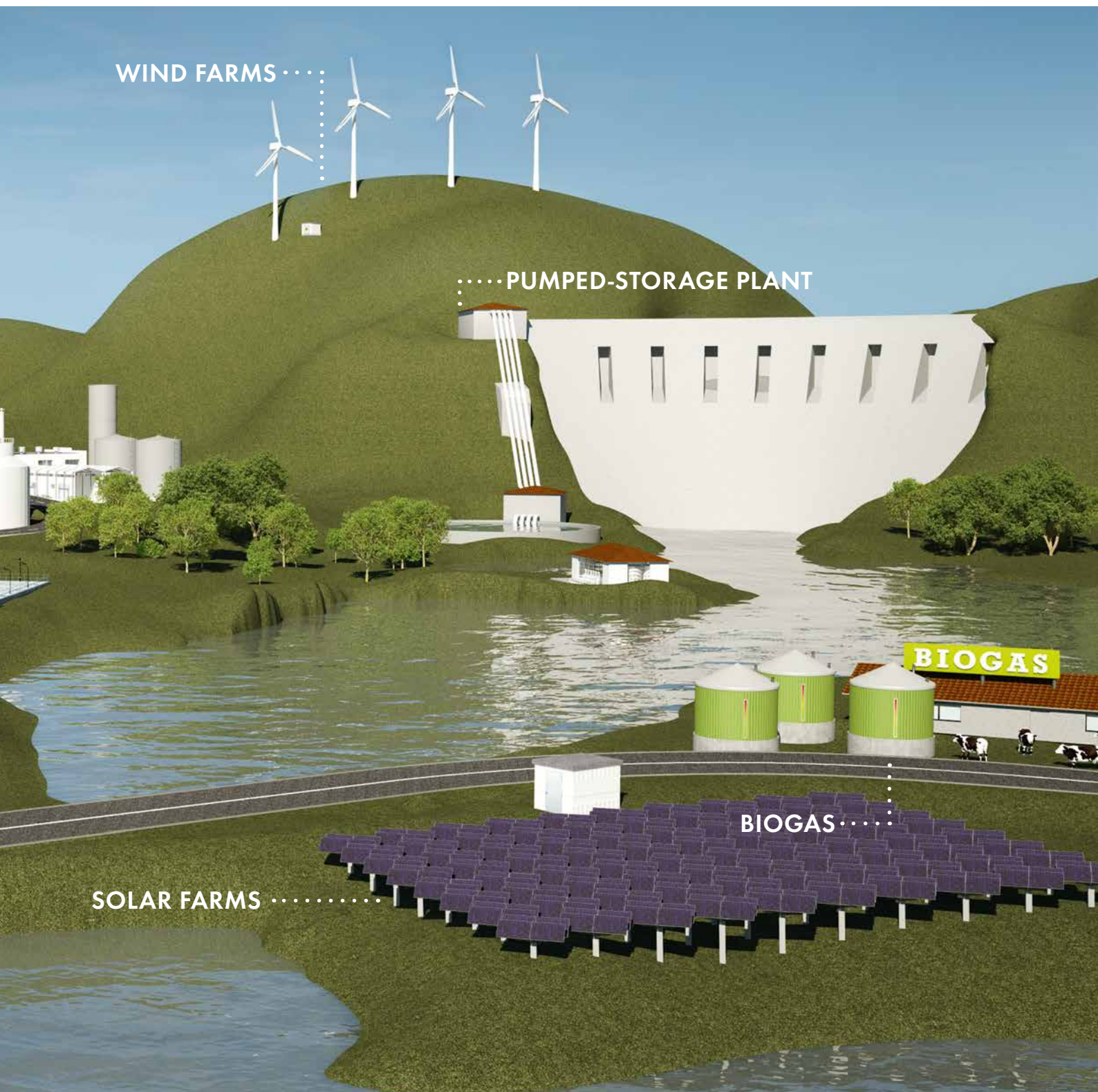
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SMART GRID – AN INTELLIGENT NETWORK FOR SMART SOLUTIONS





PHOTOVOLTAIC

Power Inverters



High-Current PCB Terminal Blocks

745 Series

- Terminate 12–6 AWG (4–16 mm²) conductors
- Common and distribute potentials via comb-style jumper bars
- Rated up to 1000 V / 76 A

2706 and 2716 Series

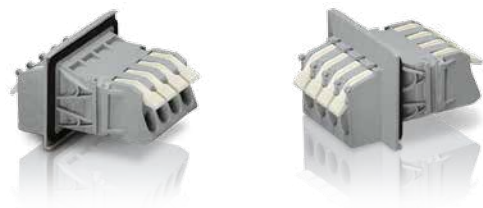
- Simple, easy-to-use operating lever
- Several clamping units can be held open simultaneously, simplifying the connection of multi-core cables
- Available with jumper slots
- Rated up to 1000 V / 76 A



Panel Feedthrough Terminal Blocks

828 Series

- Easy-to-use design, rated up to 1000 V / 41 A
- Simple, tool-free installation
- Several clamping units can be held open simultaneously, simplifying the connection of multi-core cables
- 600 V UL



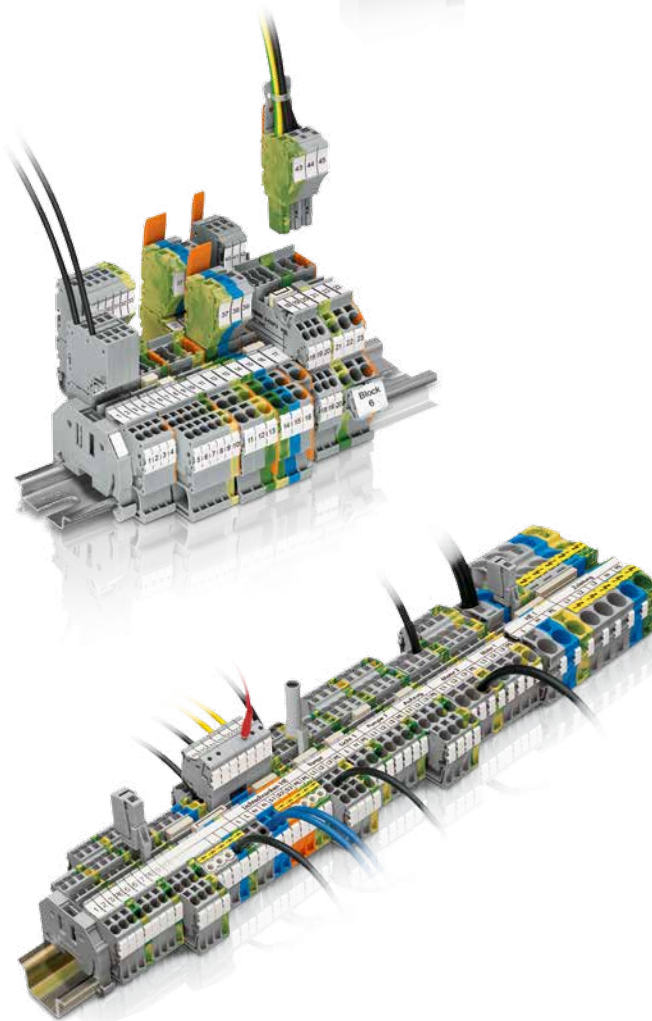
picoMAX® and picoMAX® eCOM Connectors

- Compact design reduces space by up to 30 %
- Simply push in solid and ferruled conductors
- Wire female connectors while mated or unmated
- Provide superior vibration-resistance
- Set new standards for wire-to-board, board-to-wire, wire-to-wire and panel feedthrough connections



Pluggable DIN-Rail Terminal Blocks

- **X-COM®S-SYSTEM**, 2022 Series: Terminate up to 12 AWG (4 mm²) conductors at 32 A
- **X-COM®S-SYSTEM-MINI**, 2020 Series: Terminate 16 AWG (1.5 mm²) conductors in a terminal block width of just 3.5 mm
- Cost-effective, pre-assembled system
- Protected against accidental contact while unmated
- Coding option prevents wiring errors
- Protected against mismating
- Can be combined and commoned with TOPJOB® S DIN-rail terminal blocks
- Feature dual jumper slots for various commoning options
- Continuous marker strips provide time-saving, cost-effective marking



TOPJOB® S DIN-Rail Terminal Blocks

- Industry's widest range of conductor sizes: 24-4 AWG (0.14-25 mm²)
- Push-in termination of solid and ferruled conductors
- Comprehensive jumper system for virtually any application
- Industry's fastest and most cost-effective marking system

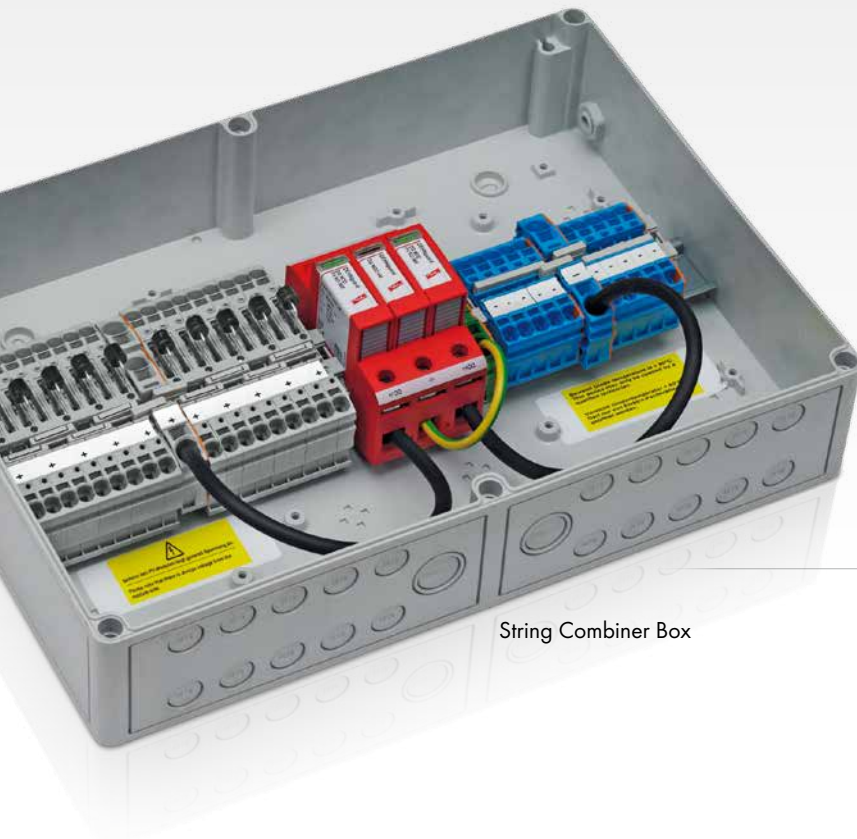
High-Current DIN-Rail Terminal Blocks

- Terminate up to 350 kcmil (185 mm²) conductors via spring pressure
- Maximum nominal current of 353 A and rated voltage of up to 1,000 V AC/DC and 1,500 VDC
- No need to prepare conductors for termination
- Vibration-proof, fast and maintenance-free



PHOTOVOLTAIC

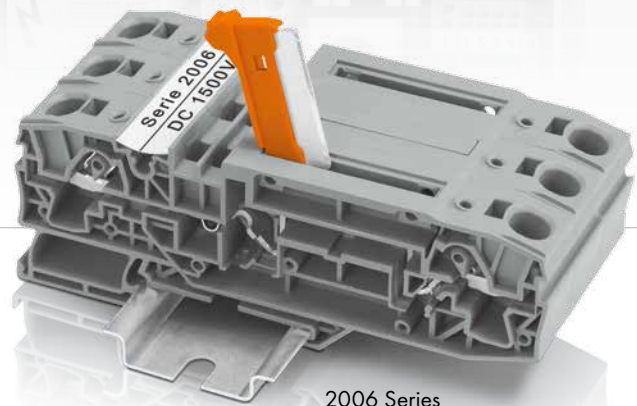
String Combiner and Generator Junction Boxes



String Combiner Box



Generator Junction Box



2006 Series

Reliably Connect Modules to an Inverter

TOPJOB® S DIN-Rail Terminal Block Benefits:

- CAGE CLAMP® S connection for all conductor types
- Tool-free termination of solid conductors (CAGE CLAMP® S connection)
- Space-saving, compact design
- Robust jumper system with full nominal current
- Accommodates pluggable connectors
- Cost-effective marking system
- Clearances and creepage distances allow for a system rated voltage of 800 V

2006 Series TOPJOB® S Disconnect Terminal Block Benefits:

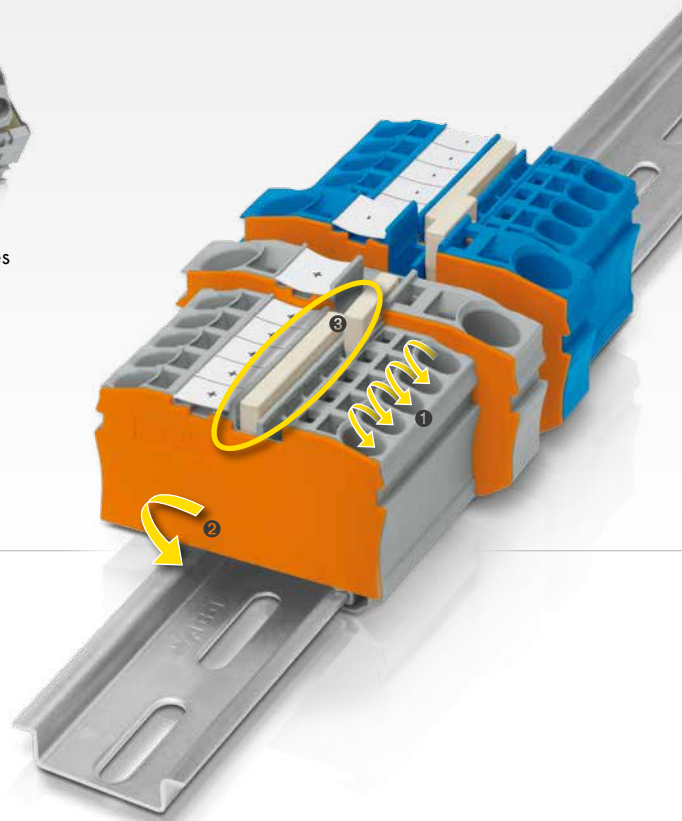
- Support 1,500 VDC IEC/1,000 VDC UL applications
- Available as disconnect, carrier and through terminal blocks
- Compatible with existing TOPJOB® S series



811 Series



288 Series



811 Series Fuse Terminal Block Benefits:

- Easy-to-use design and safe installation via simple lever actuation
- Jumper bar for quick and convenient commoning

288 Series Blocking Diode Module Benefits:

- Fast and reliable protection against backflow in thin-film module applications

1000 V Potential Block for Photovoltaic Systems

- ① Potential to potential
- ② Potential to DIN-rail
- ③ By commoning individual terminal blocks, it is possible to achieve a common potential to eliminate potential-to-potential clearances and creepage distances. The remaining clearances and creepage distances from potential to DIN-rail are sufficient for 1000 V applications.
- ④ Blocks with differing potentials (+,-) mounted next to each other on a DIN-rail are separated by an end stop that is at least 6 mm wide (not shown).

PHOTOVOLTAIC

String Monitoring



Precision Measurement for the Control Center

789 Series Current Sensor Benefits:

- High EMC resistance
- Up to 32 sensors can be connected in series per RS-485 line and expanded to a maximum bus cable length of 1,200 m
- Measurement range: 0–80 and 0–140 ADC
- 0.5 % full-scale accuracy
- Ambient operating temperature: -20 °C to +70 °C
- MODBUS communication



789 Series



WAGO-I/O-SYSTEM 750

Solar Farm Management

Networking, Automation and Visualization – Energy Data Recording and Monitoring

WAGO-I/O-SYSTEM 750 Benefits:

- Communication via standard protocols according to IEC 60870-5-101 /-103 /-104, 61400-25, 61850-7-420 (Server/Client), MODBUS, DNP3
- Direct communication between telecontrol system and power inverter or to PV system data logger
- Dual LAN: Separate ETHERNET interfaces permit the creation of parallel networks
- IT Security: Encryption that follows Europe's most stringent energy and security guidelines per BDEW and BSI
- Password-protected Web-based management prevents unauthorized users from changing system settings
- Free function blocks for expanded capabilities, e.g., data logging
- Easily implement varying requirements of different grid operators for active power feed-in and reactive power supply
- Connecting external network analyzers or short-circuit indicators via MODBUS TCP/RTU
- Seamless collection of power data via 3-phase power measurement module
- Simple parameterization and configuration via visualization
- Modular design: Digital, analog and specialty I/O modules can be combined within a node
- Select from more than 440 different I/O modules
- Parameterization/configuration via Web visualization
- Programmable to IEC 61131-3
- Supports radio technology



WAGO-I/O-SYSTEM 750

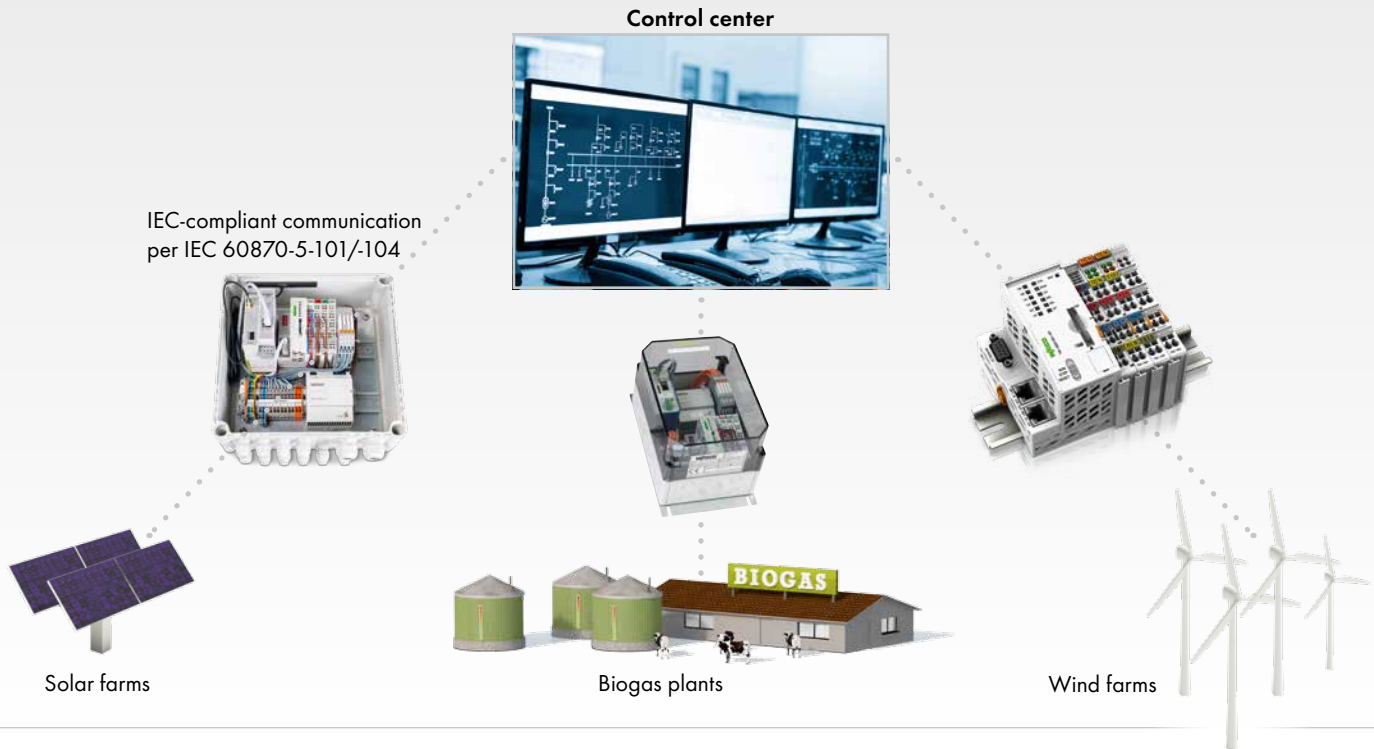
Fernwirkunterstation IEC60870-5-104 Server				
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CostPhi	Schwertbefehl	0.98		
Leistungsschalter Q8 EN / AUS	Doppelbefehl	EN	AUS	
Wirkleistung Kontrolle	Messwert	87	%	
CostPhi Kontrolle	Messwert	0.91		
aktuelle Wirkleistung	Messwert	1.65327	MW	
aktuelle Blindleistung	Messwert	0.09885	MVar	
Spannung L1-L3	Messwert	0.400	kV	
Leistungsschalter Q8 EN / AUS	Doppelmeldung	EN	AUS	
Erdschluss	Einzelmeldung	0		
Anregung Schutz	Einzelmeldung	0		
Aus durch Schutz	Einzelmeldung	0		
Einspeisemanagement gestört	Einzelmeldung	0		

MON	PYR
MON	PYR

Leitaystem IEC60870-5-104 Client				
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Wirkleistung	Schwertbefehl	100%	80%	20%
CostPhi	Schwertbefehl	0.91		
Leistungsschalter Q8 EN / AUS	Doppelbefehl	EN	AUS	
Wirkleistung Kontrolle	Messwert	0.71	%	
CostPhi Kontrolle	Messwert	0.91		
aktuelle Wirkleistung	Messwert	1.65327	MW	
aktuelle Blindleistung	Messwert	0.09885	MVar	
Spannung L1-L3	Messwert	0.400	kV	
Leistungsschalter Q8 EN / AUS	Doppelmeldung	EN	AUS	
Erdschluss	Einzelmeldung	0		
Anregung Schutz	Einzelmeldung	0		
Aus durch Schutz	Einzelmeldung	0		
Einspeisemanagement gestört	Einzelmeldung	0		

INTEGRATING PHOTOVOLTAIC SYSTEMS

Easy, Efficient and Cost-Effective



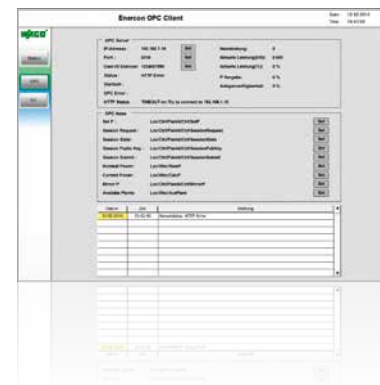
Compact and Economical Telecontrol Solution for Plant Control and Monitoring

The revised Renewable Energy Sources Act (EEG) mandates that photovoltaic plants (PV plants) must have a technical interface for the network operator that enables remote controlled power reduction. In the future, all plants (photovoltaic, wind, biogas) must disclose feed-in power data to the network operator.

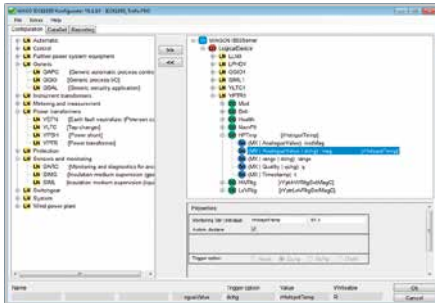
- Remote control for affiliates/power purchasers per EEG
- Output reduction usually occurs in four increments – 0 %, 30 %, 60 % and 90 % or multi-level $\cos \varphi$ regulation.
- Delivery of the current feed-in rate as measured or meter data
- System provides long-term investment protection
- The scalable WAGO-I/O-SYSTEM 750 allows system operators to easily pace government regulations via flexible hardware and software configurations.

Software benefits:

OPC/XML client,
for example



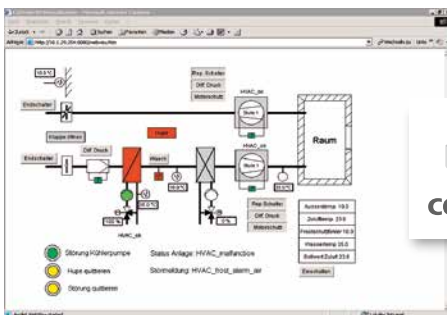
WAGO-I/O-SYSTEM 750 Benefits



Communication via standard protocols
per IEC 60870-5-101 /-103 /-104, 61400-25,
61850-7-420, MODBUS, DNP3



Easy parameterization
via Web visualization



Additional programming options that adhere
to IEC 61131



- **Expansion** via more than 440 different I/O modules for many applications
- **Integration** of specialty functions, e.g., reactive power/ undervoltage protection via I/O cards



Three-phase power measurement module
for network analysis (current, voltage, reactive power,
effective power, frequency and energy flow direction)
and comparative $\cos \varphi$ measurement

Connection
is possible via DSL, GSM, ISDN, analog, radio



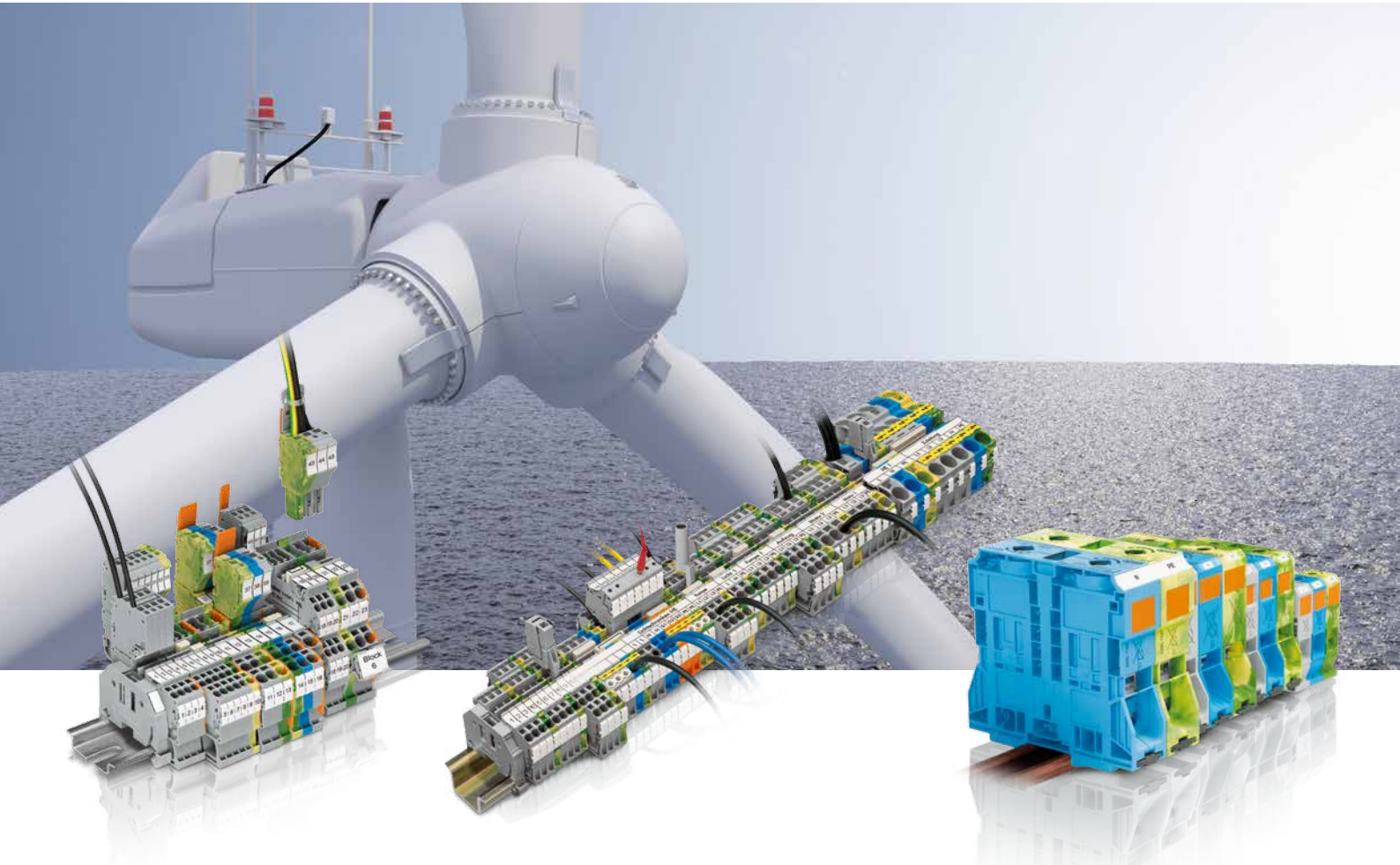
Encryption
via VPN tunnel (IPSec/OpenVPN)
directly from the controller



Components for temperatures ranging from
-40 °C to +70 °C are available

WIND POWER SYSTEMS

Pitch, Gondola and Navigation Lights



Pluggable DIN-Rail Terminal Blocks

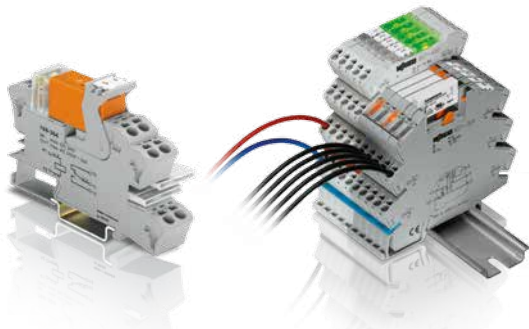
- **X-COM®S-SYSTEM**, 2022 Series: Terminate up to 12 AWG (4 mm²) conductors at 32 A
- **X-COM®S-SYSTEM-MINI**, 2020 Series: Terminate 16 AWG (1.5 mm²) conductors in a terminal block just 3.5 mm wide
- Cost-effective, pre-assembled system
- Protected against accidental contact while unmated
- Coding option prevents wiring errors
- Protected against mismating
- Can be combined and commoned with TOPJOB® S DIN-rail terminal blocks
- Feature dual jumper slots for various commoning options
- Continuous marker strips provide time-saving, cost-effective marking

TOPJOB® S DIN-Rail Terminal Blocks

- Industry's widest range of conductor sizes: 24–4 AWG (0.14–25 mm²)
- Push-in termination of solid and ferruled conductors
- Comprehensive jumper system for virtually any application
- Industry's fastest and most cost-effective marking system

High-Current DIN-Rail Terminal Blocks

- Terminate up to 350 kcmil (185 mm²) conductors via spring pressure
- Maximum nominal current of 353 A and rated voltage of up to 1,000 V AC/DC and 1,500 VDC
- No need to prepare conductors for termination
- Vibration-proof, fast and maintenance-free



Mechanical and Electronic Relays

- Easy termination of conductors ranging from 22–12 AWG (0.34–2.5 mm²) without preparation
- Optimized for any application
- Wide range of accessories (e.g., adjacent jumpers, markers)
- Switchable loads from 1 mA to 16 A



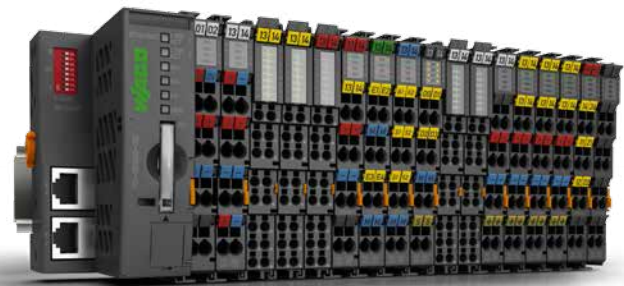
Industrial Switches, 852 Series

- Redundant DC power supply
- Wide power supply range: 9–48 V
- DIP switches for setting alarm functions
- Fully compliant with IEEE802.3, 802.3u standards
- Non blocking, store and forward switching
- Autonegotiation at all 10/100Base-TX ports
- Auto-MDI/MDIX (crossover) at all 10/100Base-TX ports
- Temperature range: -40 °C to +70 °C



EPSITRON® CLASSIC Power Supplies, 787-16xx

- Wide input range and UL/GL approvals for worldwide applications
- Slim and compact design
- Convenient pre-wiring via CAGE CLAMP® connection technology – 100 % protected against mismatching
- Robust metallic or plastic housing
- LED status indicator, DC OK signal/contact
- Nominal output voltage: 12, 24 and 48 VDC
- Integrated TopBoost permits cost-effective secondary-side fusing (for 787-16xx Power Supplies with ≥ 120 W)



WAGO-I/O-SYSTEM 750 XTR

eXTReme
temperature
from -40 °C to +70 °C

- No air conditioning required
- Compact footprint
- Lower energy and maintenance costs

eXTReme
isolation
up to 5 kV impulse voltage

- Can be used in unshielded areas
- Ideal for standard telecontrol equipment
- Increased system uptime

DIN EN 60870-2-1

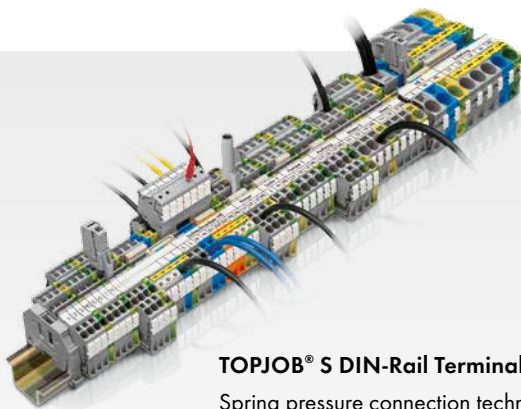
eXTReme
vibration
up to 5g acceleration

- Install close to vibrating and shock-generating system components
- Greater machine reliability
- Investment protection

DIN EN 60068-2-6

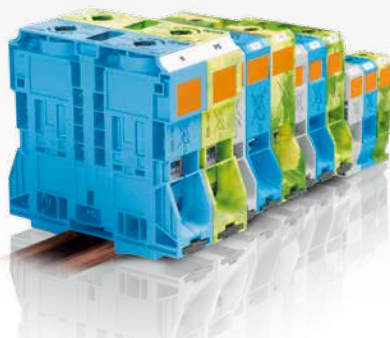
SMALL WIND POWER SYSTEMS

Complete System Solutions



TOPJOB® S DIN-Rail Terminal Blocks

Spring pressure connection technology:
fast, reliable and maintenance-free



High-Current DIN-Rail Terminal Block up to 185 mm² (350 kcmil)

Screw-less, high-current, DIN-rail terminal
block system in 2, 2/0, 4/0 AWG and
350 kcmil (35, 50, 95 and 185 mm²)



EPSITRON® Power Supplies, 787 Series

Complete power supply system
for industrial applications



Mechanical and Electronic Relays

Comprehensive range of products –
the right solution for any application

The Modular WAGO-I/O-SYSTEM Provides Highly Flexible, Tailor-Made Automation Solutions for Small Wind Power Systems

The right controller for every application!

- Support all standard fieldbus protocols and ETHERNET standards
- Scalable performance – modular controllers and control panels
- Select from 440+ different I/O modules within the WAGO-I/O-SYSTEM 750
- Flexible platform adapts to diverse applications and environments
- Compact design
- Programmable to IEC 61131-3



WAGO-I/O-SYSTEM 750 XTR

eXTReme
temperature
from -40 °C to +70 °C



eXTReme
isolation
up to 5 kV impulse voltage



eXTReme
vibration
up to 5g acceleration



WIND POWER SYSTEMS

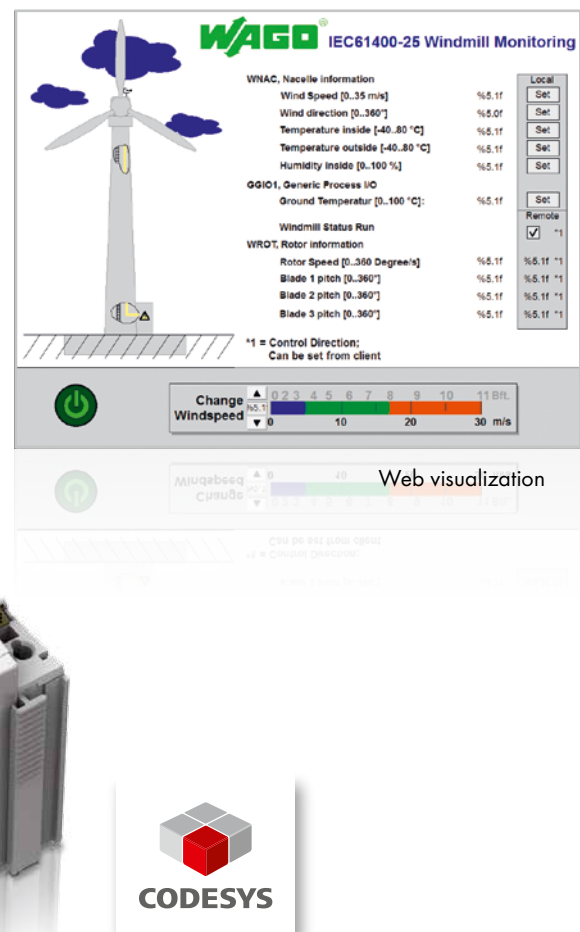
Wind Farm Management

Communication Access for the Grid Operator, Power Purchasers and System Operators

Reliable, secure wind farm control and monitoring with the WAGO-I/O-SYSTEM 750

Your advantages:

- Communication via standard protocols per IEC 60870-5-101 /-103 /-104, 61400-25, 61850-7-420, MODBUS, DNP3
- Robust and maintenance-free
- Scalable power
- Controllers for all standard fieldbus systems and ETHERNET standards
- Dual LAN: Separate ETHERNET interfaces permit the creation of parallel networks
- Programmable via CoDeSys 3 (IEC 61131-3)
- IT Security: Encryption that follows Europe's most stringent energy and security guidelines per BDEW and BSI
- Password-protected Web-based management prevents unauthorized users from changing system settings
- Free function blocks available
- OPC/XML client



WAGO-I/O-SYSTEM 750 with PFC200

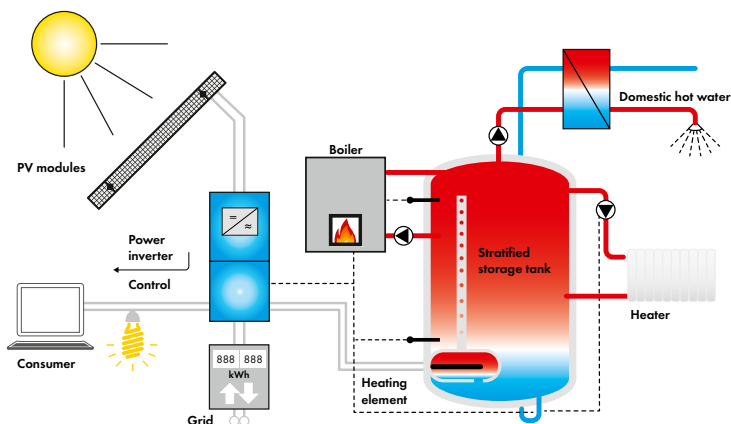
POWER TO HEAT

Intelligent Heat Storage Systems Fueled by Renewable Energy



Power-to-heat conversion is a technology used for load management. This technology absorbs temporary oversupply from wind and solar power and converts it into heat.

It is particularly well suited for applications generating high amounts of heat (e.g., district heating grids).

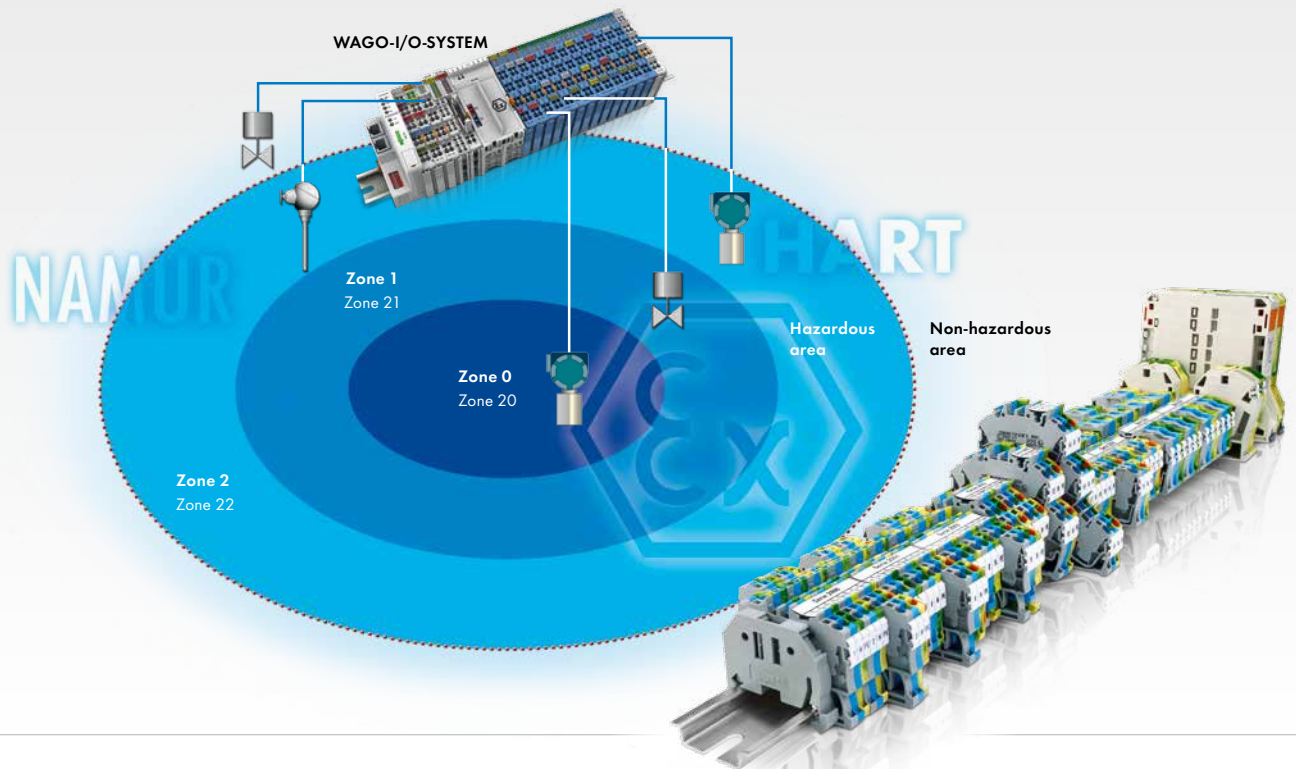


Your advantages:

- Connecting heat generator and accumulator via one control system
- Multiple interfaces: PROFIBUS, CAN, KNX, LON®, IEC 60870/61850/61400, MODBUS, etc.
- OPC/XML client
- Convenient measurement and monitoring of generator/accumulator parameters (e.g., effective power, temperature, storage volume)
- Integration of current consumption forecasts and weather data
- Programmable to IEC 61131
- Communication telecontrol protocols per IEC 60870-5-101, -103/-104, 61400-25, 61850-7-420, DNP3
- Easy parameter setting via configurator
- Scalable via more than 440 different I/O modules for many applications (e.g., 3-phase power measurement module for network analysis)

POWER TO GAS

Modern Gas Storage Systems with the WAGO-I/O-SYSTEM



Using power-to-gas technology, electricity can be converted from renewable energy to hydrogen or synthetic natural gas and stored in the natural gas grid.

Requirements:

- Grid-connected integration of electrolyzers for storing large amounts of electricity
- Integration into the power distribution or transmission grid
- Direct connection to an energy producer (e.g., wind or solar farm)
- Permanent monitoring and control of process parameters, e.g., from pressure regulators and producer gas separators – including explosion-proof components

Your advantages:

- Multiple interfaces: PROFIBUS, CAN, KNX, LON®, IEC 60870/61850/61400, MODBUS, etc.
- Standard I/O modules and intrinsically safe Ex modules in one control unit*
- OPC/XML client
- Programmable to IEC 61131
- Communication telecontrol protocols per IEC 60870-5-101, -103 /-104, 61400-25, 61850-7-420, DNP3
- Scalable thanks to more than 440 different I/O modules for many applications (e.g., 3-phase power measurement module for network analysis)

* in explosion-proof (Ex) housing, based on the installation location

ENERGY GRIDS

Network Analysis and Regulation



Measurement, Regulation, Control and Telecontrol Technology All in One System

The ever-increasing decentralized infeed from EEG plants to low- and medium-voltage grids has made voltage regulation particularly complicated for grid operators. Ongoing control intervention is commonplace. Regulation traditionally performed by large-scale power plants has now shifted to the local grid level.



PFC200

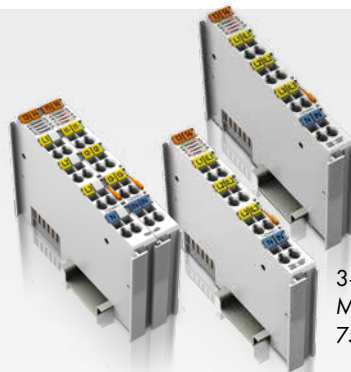
- Network analysis (voltage, reactive power, effective power, current, $\cos \phi$, frequency, harmonic analysis and energy flow direction) in 3- and 4- conductor networks
- Direct integration of electronic household meters via OBIS, SML protocol, etc., upon request
- Direct connection with existing network analysis devices or short-circuit indicators via Modbus/TCP or RTU
- Supports IEC 60870-5-101, -103 and -104, IEC 61850, as well as MMS and GOOSE communication standards
- Safe communication via IPSec or OpenVPN directly from the controller
- Programmable to IEC 61131 for control and regulation tasks
- Easy parameterization via Web visualization
- Integrated visualization allows all measurement values to be displayed on-site via browser or Web panel
- Optional: Temperature-resistant from -40 °C to +70 °C
- Optional: Software solutions for measured-value acquisition and evaluation, visualization, network analysis and communication

CURRENT AND ENERGY MEASUREMENT TECHNOLOGY

Recording and Analysis



Plug-in Current Transformers, 855 Series



3-Phase Power Measurement Modules, 750 Series



Rogowski Coils, 855 Series



Split-Core Current Transformers, 855 Series



Plug-In Current Transformers with picoMAX® Pluggable Connector, 855 Series



Visualization

Comprehensive Network Analysis and Energy Measurement

- Identify, optimize and economize energy consumption
- Easy integration into existing systems
- Energy characteristics according to DIN EN ISO 50001

Measured variables:

- Energy consumption
- Voltage
- Current
- Phase position
- Active energy/power
- Reactive power/energy
- Apparent power/energy
- Cos φ
- Rotary field detection
- Power factor
- Four-quadrant operation
- Harmonic analysis (up to the 41st harmonic)
- N-conductor measurement

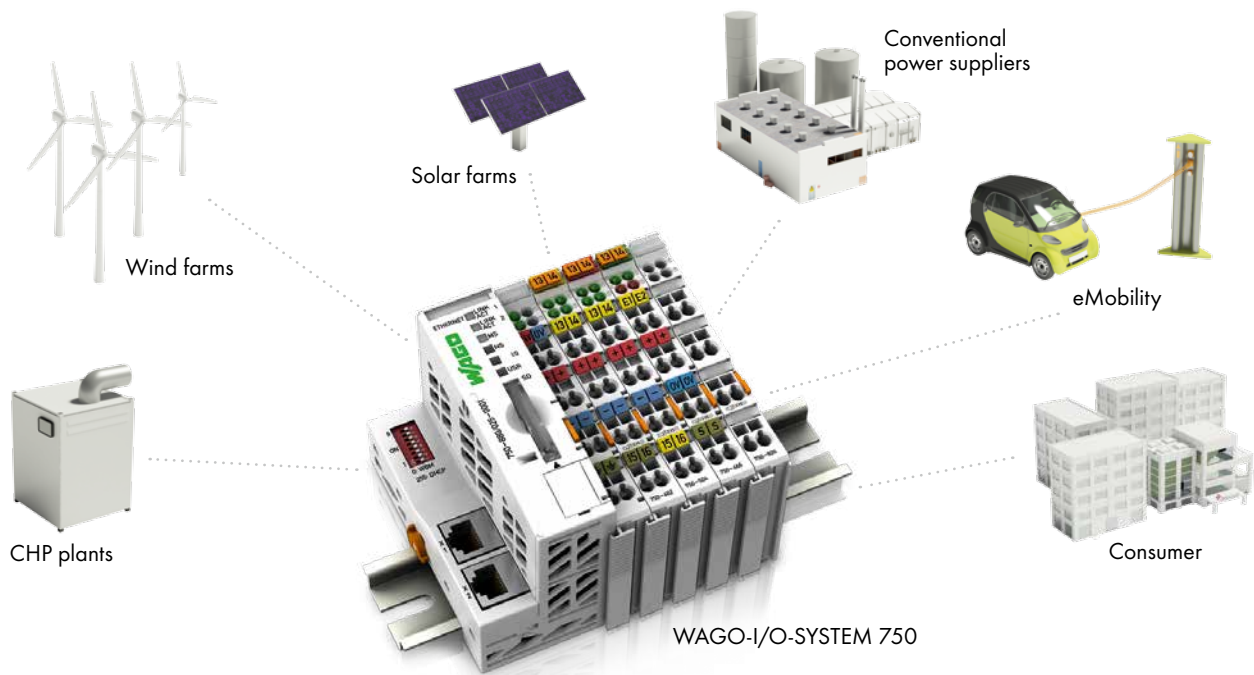


WAGO-I/O-SYSTEM 750

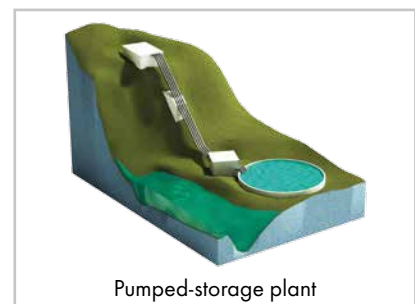
ENERGY STORAGE MANAGEMENT

Designed for the Future

Energy-Efficient Charging and Discharging via Smart Controller



Examples of energy storage systems:

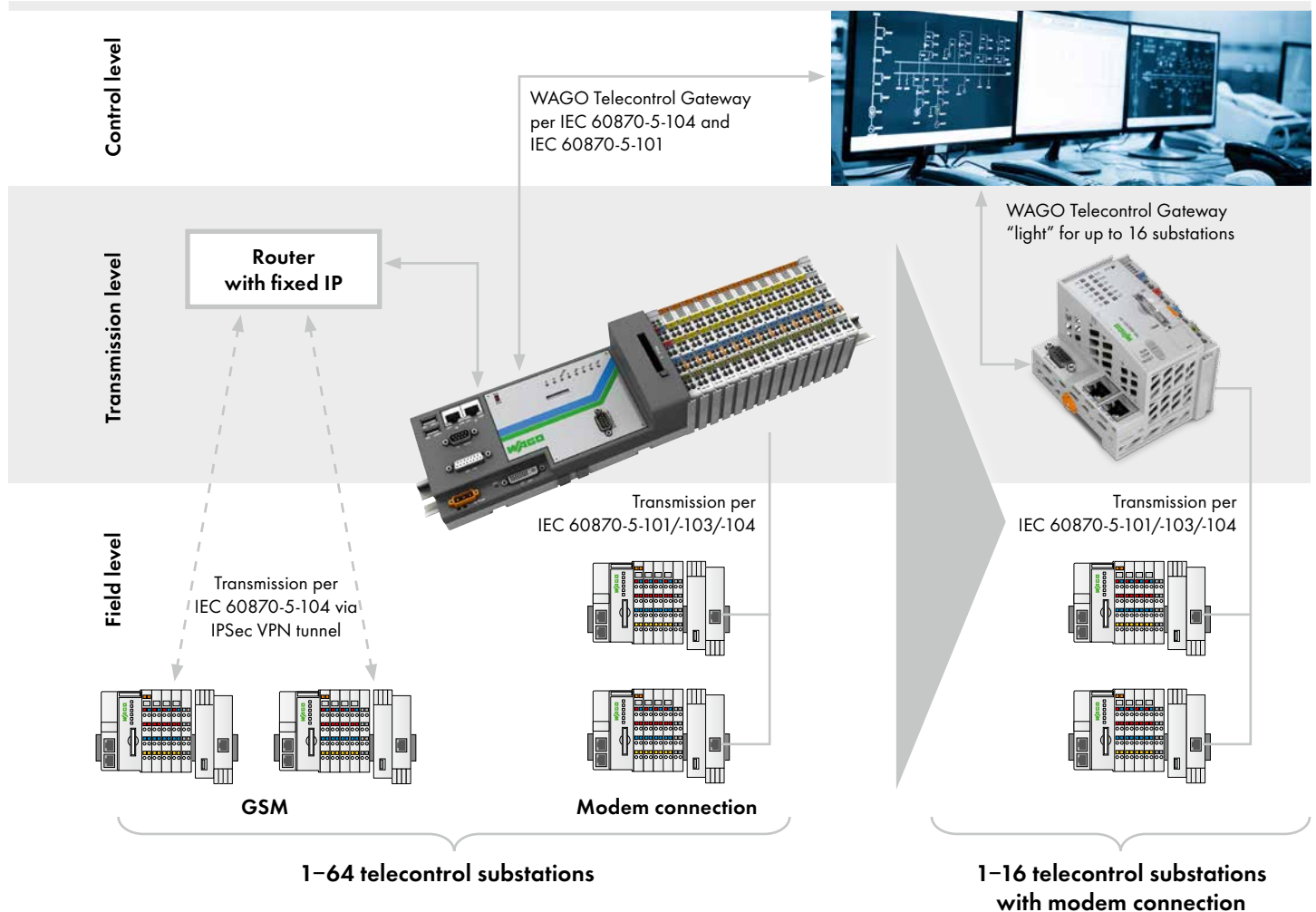


Your advantages:

- Convenient measurement and monitoring of feed-in or consumption rates (e.g., voltage, reactive power, effective power, current, $\cos \phi$, frequency and energy flow direction)
- Programmable to IEC61131
- Communication telecontrol protocols per IEC 60870-5-101, -103 /-104, 61400-25, 61850-7-420, DNP3
- Easy parameter setting via configurator
- Scalable via more than 440 different I/O modules for many applications (e.g., 3-phase power measurement module for network analysis)

TELECONTROL GATEWAY

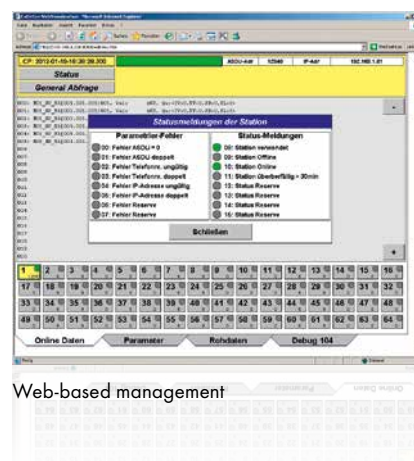
Configuration:



Manufacturer-Independent Connection of Telecontrol Substations with up to Two Redundant Control Systems

Your advantages:

- Communication per IEC 60870-5-101/-103/-104
- Connection to the substation via GSM, dedicated or dial-up line
- No control system limiting the number of connections
- Easy parameterization via Web-based management
- Transmitted data requires no parameterization
- Optional redundancy



SYSTEM SOLUTIONS

WAGO's Extensive Portfolio

01

WAGO PORTFOLIO

WAGO-I/O-SYSTEM 750, Switches, EPSITRON® Power Supplies, Relays, JUMPFLEX® Signal Conditioners, Isolation Amplifiers, DIN-rail terminal blocks and more

02

WAGO SYSTEM BOX

Standardized distribution boxes for easy integration

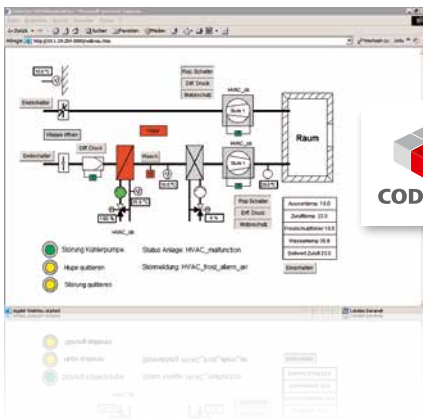
03

PROGRAMMING

Engineering, manufacturing and programming

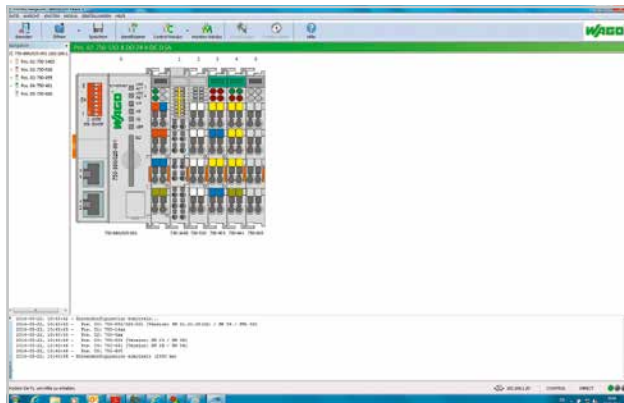
Your advantages:

- Engineering, manufacturing and programming by WAGO
- Standardized distribution boxes for easy integration into industry-wide applications
- Just one contact for service and support
- Ready for on-site integration
- Easy installation and commissioning, e.g., by the system integrator
- Efficient commissioning via SD card, parameter files or Web browser

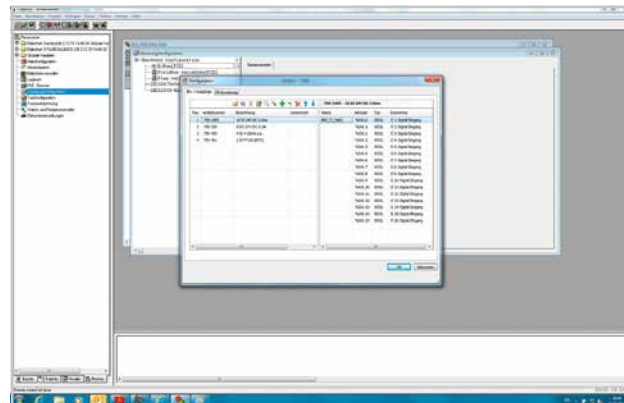


CONNECTING TO A TELECONTROL SYSTEM

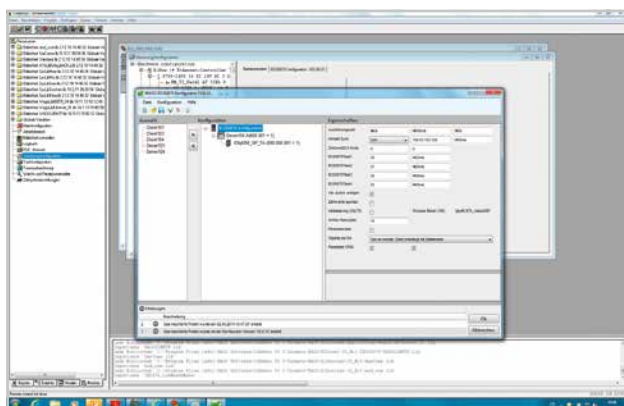
Fast Commissioning via IEC Configurator



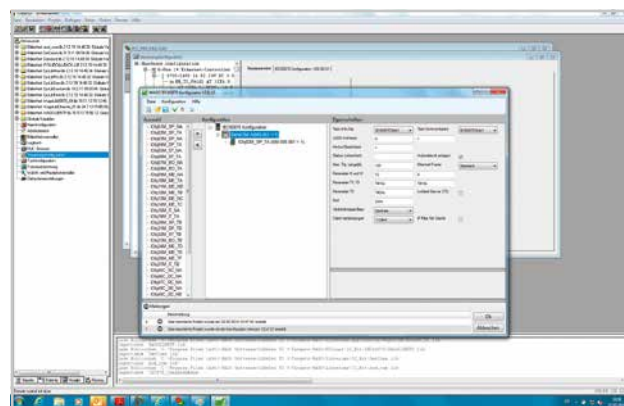
Reading the hardware setup via WAGO-I/O-CHECK



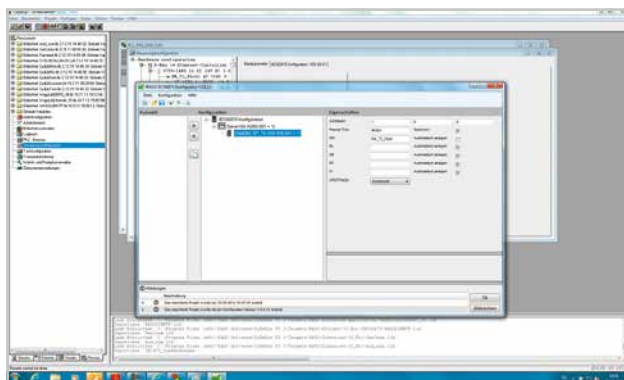
Optional: Assigning plain text variables



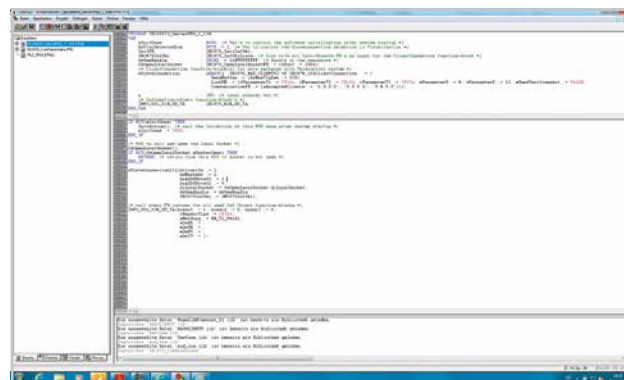
Setting parameters for a telecontrol substation



Defining the type message



Linking the plain text variable to the type message



Creating the CODESYS source code automatically

QUALITY AND RELIABILITY

Innovation – Quality – Safety



ABS

BV



Quality Through Experience and Unconditional Care

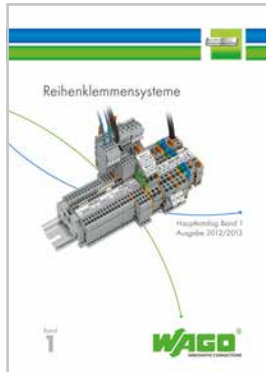
- Quality assurance is integrated into the production process
- 100 % tested for proper functioning
- In-house accredited laboratory for internal electrical and mechanical testing on terminal blocks and connectors, as well as for environmental simulation per DIN EN ISO/IEC 17025
- In-house accredited EMC laboratory
- Worldwide approvals

Proven Quality Thanks to Certified Processes and Products

- DIN ISO 14001:2004 Certificate
- DIN EN ISO 50001 Energy Management Certification
- DIN ISO 9001:2008 Certificate
- IRIS Certificate
- KTA approval for selected products

WAGO CATALOGS/BROCHURES

WAGO-I/O-SYSTEM 750 – Versatile and Flexible



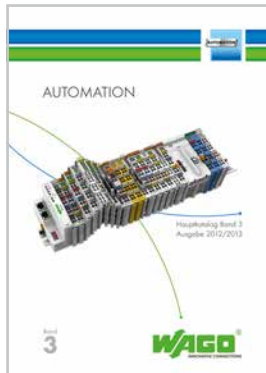
Volume 1, Rail-Mounted Terminal Block Systems

- Rail-Mounted Terminal Blocks
- Modular Connectors (X-COM®-SYSTEM and X-COM®S-SYSTEM)
- Patchboard Systems
- Terminal Strips
- PUSH WIRE® Connectors for Junction Boxes
- Lighting Connectors
- Shield Connecting System



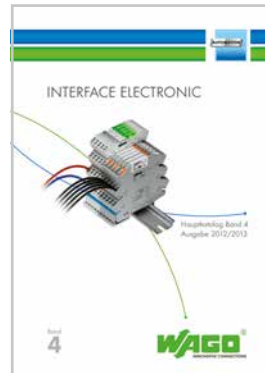
Volume 2, Connectors and PCB Terminal Blocks

- PCB Terminal Blocks
- Feedthrough Terminal Blocks
- MULTI CONNECTION SYSTEM (MCS)
- Pluggable PCB Terminal Blocks
- Specialty Connectors



Volume 3, AUTOMATION

- IP20 Modular I/O-SYSTEM
- Radio Technology, TO-PASS® Telecontrol Technology
- Industrial Switches, PERSPECTO®
- IP67 Modular I/O-SYSTEM, IP67 Block I/O-SYSTEM
- IP67 Sensor/Actuator Boxes, IP67 Cables and Connectors
- Power Supplies



Volume 4, INTERFACE ELECTRONIC

- Relays – Optocouplers – Specialty Functions
- Interface Modules
- Signal Conditioners
- Power Supplies
- Overvoltage Protection
- Radio Technology
- Empty Housings and DIN-Rail Mount Carriers



Volume 5, WINSTA® – The Pluggable Connection System

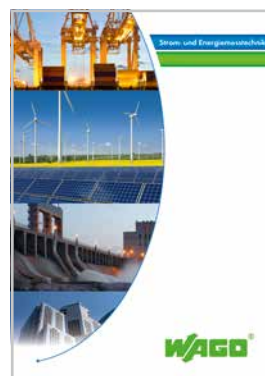
- WINSTA® MINI – Pluggable Connectors
- WINSTA® MINI special – Pluggable Connectors
- WINSTA® MIDI – Pluggable Connectors
- WINSTA® MIDI special – Pluggable Connectors
- WINSTA® MAXI – Pluggable Connectors
- WINSTA® RD – Cable Assemblies
- WINSTA® KNX – Pluggable Connectors
- WINSTA® IDC – Flat Cable Systems



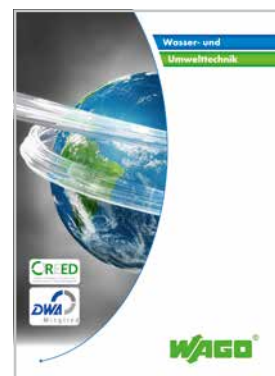
WAGO-I/O-SYSTEM 750



WAGO-I/O-SYSTEM 750, 750 XTR Series



Current and Energy Measurement Technology



Water and Environmental Technology



WE INNOVATE!

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