SPRECON®-E

AUTOMATION PLATFORM FOR POWER UTILITIES

NEW PLANTS AND RETROFIT SOLUTIONS

IT SECURITY

ACCESS CONTROL
NETWORK SECURITY
SYSTEM INTEGRITY

CERTIFIED
ISO 27001

sprecher *automation*

AUTOMATION – PROTECTION – CONTROL – MONITORING

SPRECON-E is the result of our long-term experience in the areas of power system engineering and automation.

With its wide range of application fields – from traditional power stations to smart grids – SPRECON-E acts as a uniform and process-independent automation platform for the areas of station control, power system protection, telecontrol, power plant control and SCADA systems.

Power supply applications:

- Extra-high, high and medium voltage switchgears as well as distribution systems

- Power generation – centralised and decentralised (i.e. caloric, hydroelectric, wind, photovoltaic, etc.)

- Traction power supply

- Industrial networks

Municipal applications:

- Electricity

- Water and sewage

- Gas and oil

- District heating

Application-specific data transmission paths allow "open" communication at the highest possible security level. The consequent modular hardware and software design results in standardised as well as customer-specific solutions and facilitates step-wise realisation of automation systems of different characteristics as well as functional ranges.

Autonomous systems and devices of other manufacturers can be easily integrated into SPRECON-E. Beside standard protocols such as IEC 61850 and IEC 60870-5 also proprietary protocols are supported.

PLATFORM COMPONENTS

- SPRECON-V460 (control center system)

- SPRECON-E-C (multifunctional devices for automation and remote control)

- SPRECON-E-T3 (compact RTUs for automation and remote control)

- SPRECON-E-P (protection devices and combined protection and control devices)
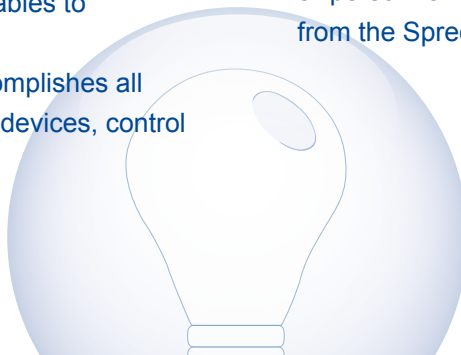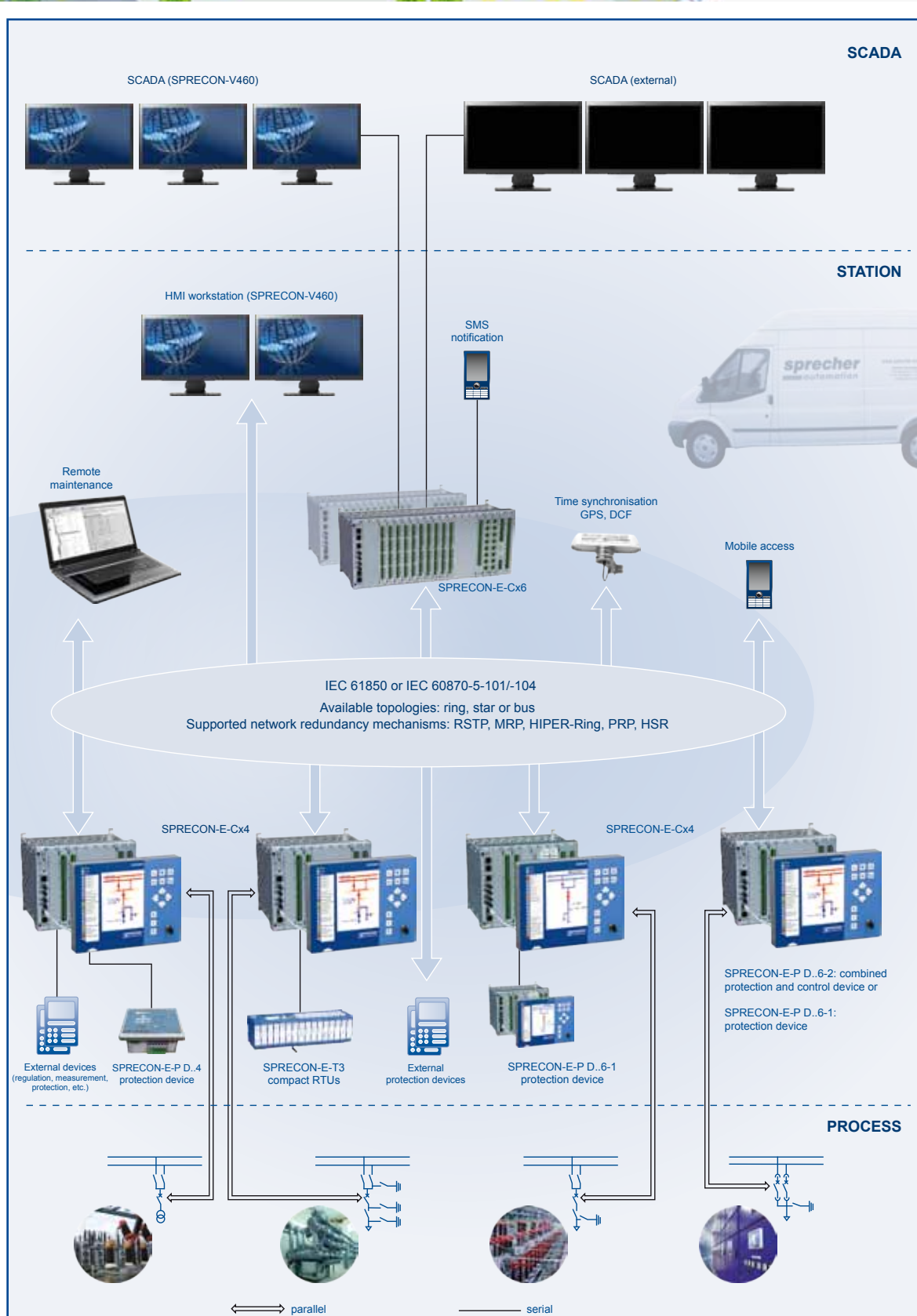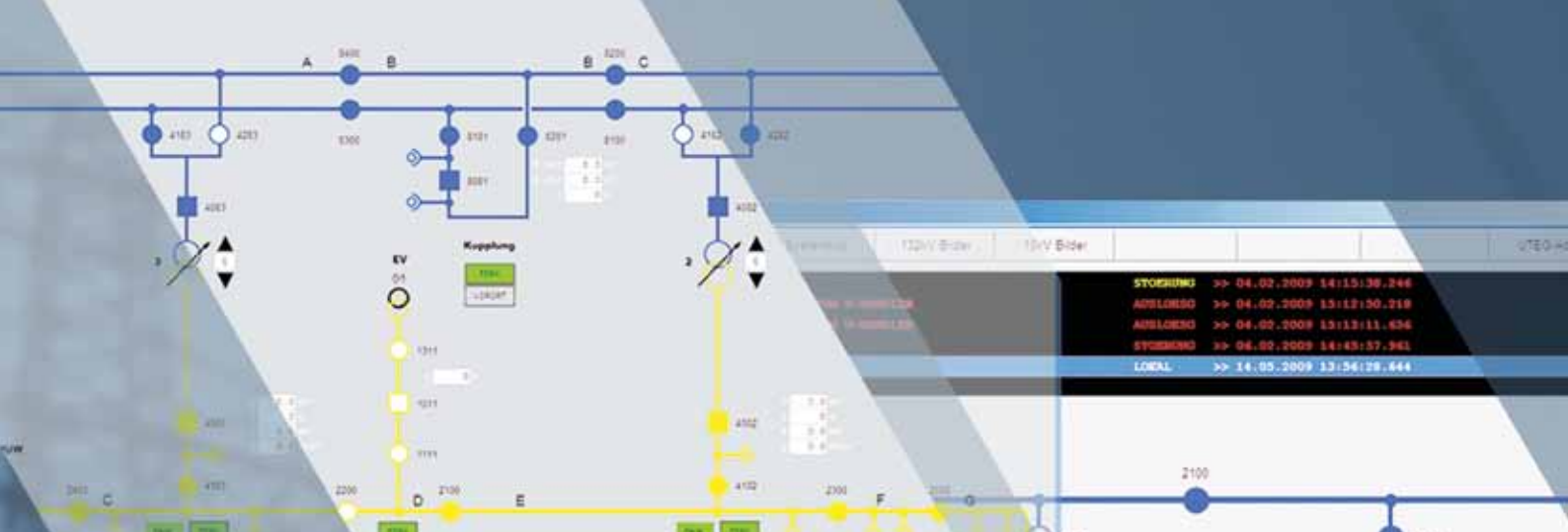
SPRECHER – EXPERT FOR YOUR TURNKEY SOLUTIONS

Each project step of a turnkey solution is accompanied and monitored by Sprecher experts with highly experienced process and system know-how.
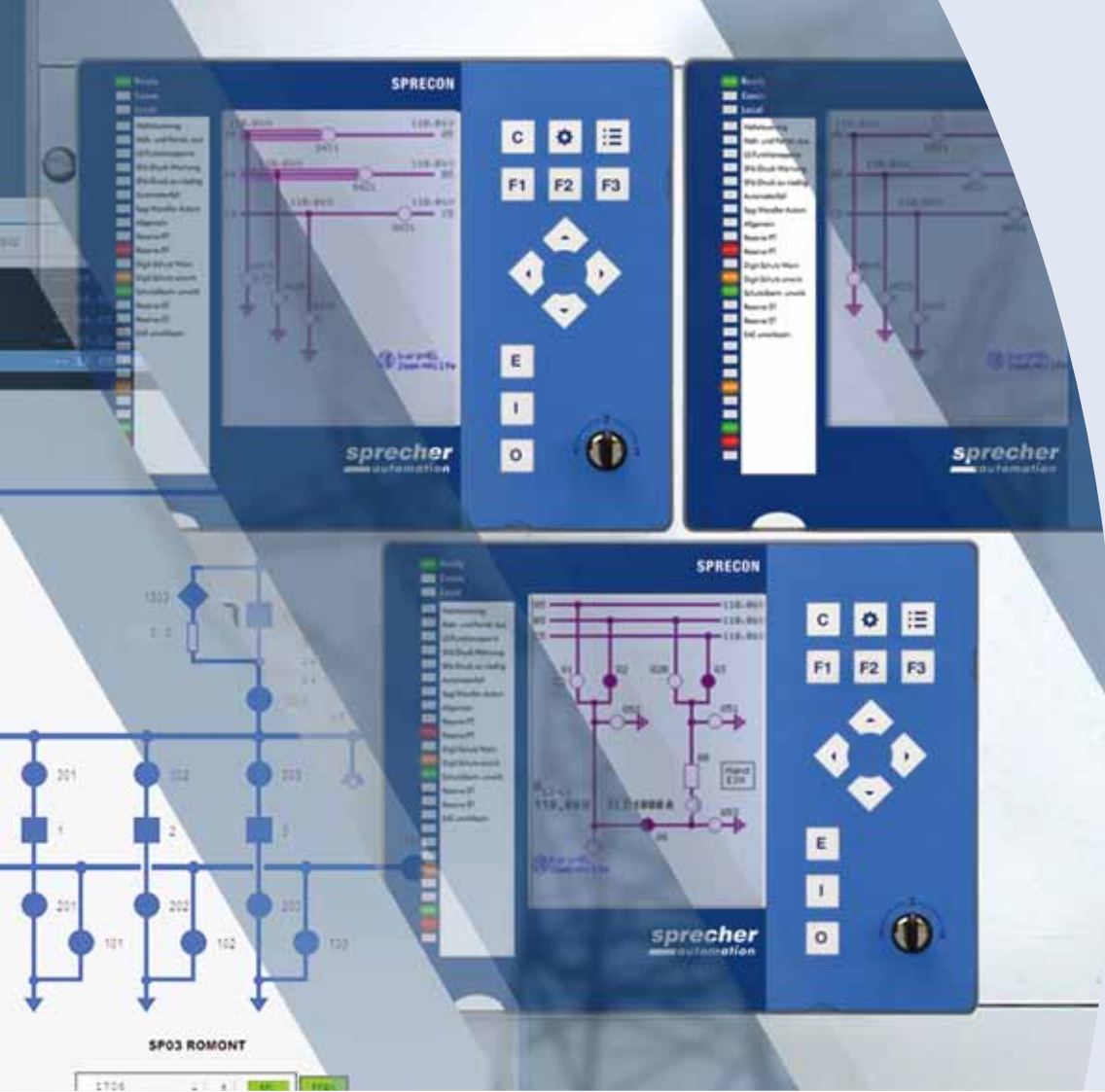
- Consultancy, planning and project management
  Optimal project planning and management is guaranteed by professional consultancy of our engineers.

- Engineering and documentation
  Project-specific configuration and parameterisation of application software is accomplished by an expert team for power systems.

- Manufacturing and factory tests
  Highly qualified personnel guarantees professional and on-schedule manufacturing and testing of the modules, devices, control cubicles and switchgears.

- On-site installation – from highvoltage cables to optical fibres
  A highly experienced erection team accomplishes all cabling and installation works regarding devices, control cubicles and switchgears.

- Commissioning
  Highly experienced personnel guarantees optimal, smooth and on-schedule commissioning.

- After Sales Service
  Sprecher Automation also offers a professional 24/7 customer service for all delivered systems.

- Training for operators and maintenance personnel
  At the Sprecher Training Center (TC) all responsible persons for operation and administration are educated and instructed by professional and experienced trainers – either at one of our locations or at the respective plant.

  The practice-focused engineering tool (ENGINEERING CENTER) for SPRECON also allows parameterisation of the application software and commissioning by customer personnel – preceded by appropriate training gained from the Sprecher Training Center.

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SCADA

SCADA (SPRECON-V460)

SCADA (external)

STATION

HMI workstation (SPRECON-V460)

SMS notification

Remote maintenance

SPRECON-E-Cx6

Time synchronisation GPS, DCF

Mobile access

IEC 61850 or IEC 60870-5-101/-104

Available topologies: ring, star or bus
Supported network redundancy mechanisms: RSTP, MRP, HIPER-Ring, PRP, HSR

SPRECON-E-Cx4

SPRECON-E-Cx4

SPRECON-E-P D..6-2: combined protection and control device or

SPRECON-E-P D..6-1: protection device

External devices (regulation, measurement, protection, etc.)

SPRECON-E-P D..4 protection device

SPRECON-E-T3 compact RTUs

External protection devices

SPRECON-E-P D..6-1 protection device

PROCESS

parallel ⟷   serial ——

SPRECON-E SYSTEM ARCHITECTURE

SPRECON-V460 HMI workstations allow comfortable, secure and clear operation of power systems. Application areas of this multi-client visualisation system range from mobile operating such as local HMI panels, notebooks or smartphones to HMI workstations and superior SCADA systems for supply grids by additionally supporting redundant designs.

For local device operation, the SPRECON-E platform provides a full-graphical HMI control panel, which can be either directly attached to a device or mounted within a few meters' distance.

The system level (i.e. station level with central station control units/station computer or gateways), which is superior to the decentralised levels, can be also designed as a redundant system.

The SPRECON-E station computer is based on modular hardware design and features:

- Application-specific hardware

- Software for
  - Application-specific functions such as switchgear interlocking, automatics, regulators (i.e. voltage regulator), logics, etc.

- Process data management
- Process data archiving
- Logging
- Local and remote communication

For local as well as for remote operation via modem/network or Web, the SPRECON-E service computer features:

- System maintenance, configuration and parameterisation

- Automated data transmission (mass storage) and evaluation

- Secure system access

Data is processed by device-oriented, bay-oriented or central-oriented hardware (SPRECON-E-C/-P/-T3).

Standard protocols such as IEC 61850, IEC 60870-5-101, -103 and -104 allow high-speed and secure communication as well as data transmission to superior levels (i.e. SCADA). SPRECON-E also supports a high number of proprietary communication protocols.
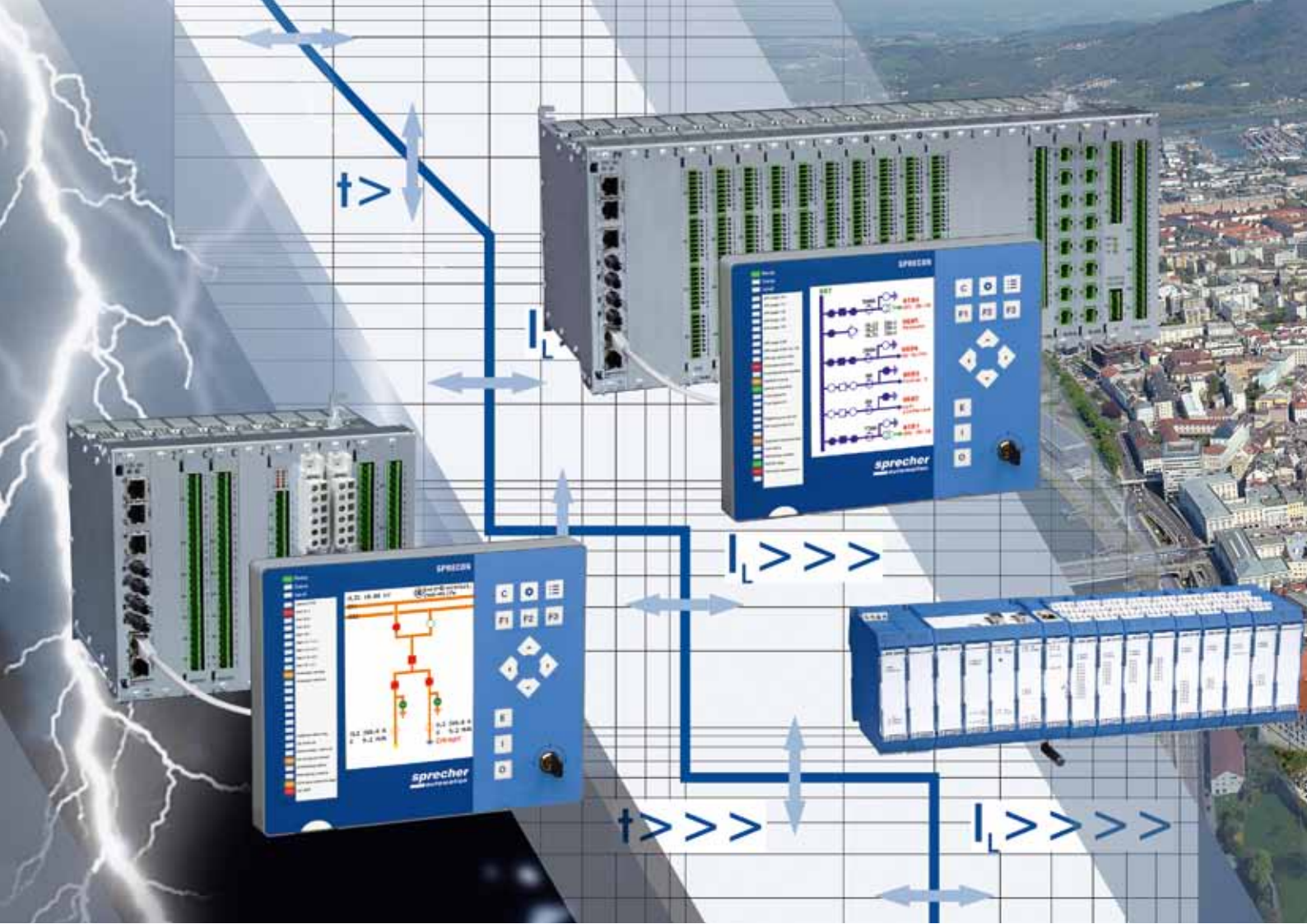
SPRECON-E DEVICES

The concept of SPRECON-E is based on technical and economical considerations in order to provide optimal solutions by simultaneously sustaining the overall system concept.

SPRECON-E Cx6 (19")

All SPRECON-E devices are based on a uniform and modular system architecture in terms of hardware, data structures, communication, logical functions as well as engineering and maintenance.

SPRECON-E Cx4 (19"/2)

SPRECON-E solutions can be easily and quickly adapted to various application fields due to the wide range of functions and different available rack sizes.

SPRECON-E Cx2 (19"/3)

Showing a high scalability range, the devices are applied as automation, protection and remote control units for all types of plants and utilities. Due to their modular design, SPRECON-E

SPRECON-E-T3 compact RTUs

devices can be used as station computers, bay computers, remote terminal units as well as gateways and other automation devices.

The SPRECON-E devices consist of a basic frame (rack, power supply, CPU), application-dependent I/O modules and, optionally, a detachable HMI control panel. By combination of different modules, the devices can be individually assembled in order to meet particular requirements.

A high-performance and manufacturer-independent CPU acts as the core of the process-oriented hardware. The CPU module provides most secure interfaces to the process and to the communication network.

"Open interfaces" allow connections to sub-systems (i.e. protection devices, control devices, etc.) of SPRECON-E or of other manufacturers via proprietary protocols.

SECURITY

IT security plays a more and more significant role in the area of energy automation as well. Therefore, great attention is paid to this particular topic within the SPRECON-E platform.

SPRECON-E devices are equipped with specific network functions such as SNMP V3, NTP, Quality of Service (QoS), VLAN according to IEEE802.1q, routing and IP aliasing.

In order to adapt to application-specific security standards (i.e. BDEW whitepaper), network services can be individually configured or deactivated. Also a firewall is integrated into the devices. Protocols like SSL or IPsec can be additionally used for encrypted data transmission.

DEVICE OPERATION

To each SPRECON-E device a full-graphical (monochrome or colour) control panel can be connected for local operation, bay operation or central operation of a specific plant section.

Beside configurable bay pictures (switching devices, measured-values, etc.), which can be designed with a comfortable editor, the SPRECON control panel also provides event and alarm lists as well as I/O monitoring.

Pictures and parameterisation data is stored in the SPRECON-E device and automatically loaded into the control panel when connected.

Beside the HMI control panel, Sprecher Automation also offers an alarm panel with 100 configurable LEDs. One control panel can be extended by a maximum of two alarm panels.

SPRECON-E-CP control panel

SPRECON-E-AP alarm panel

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SCADA

Visualisation of a substation
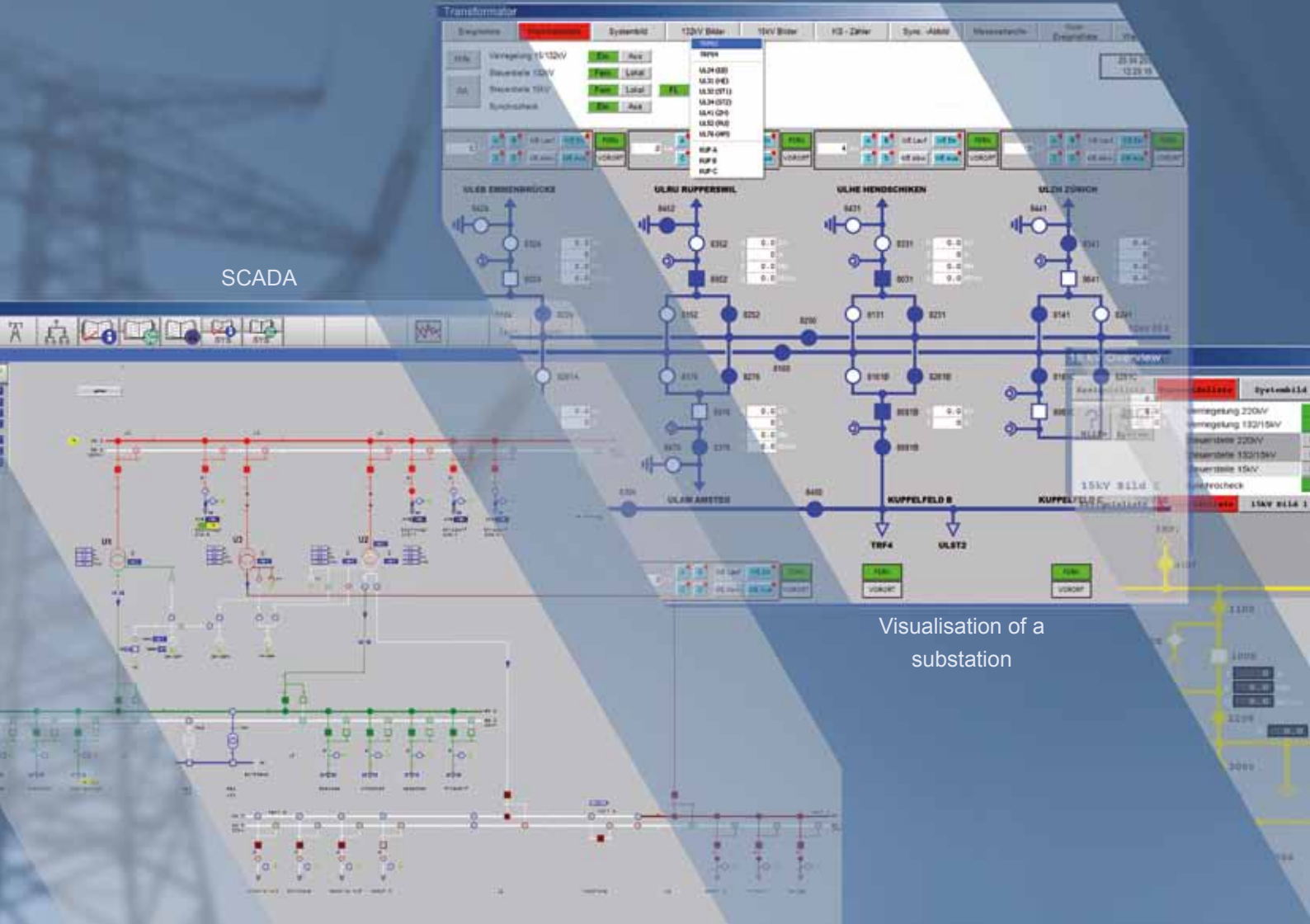
SPRECON-V460 PROCESS VISUALISATION

SPRECON-V460 meets all demands of modern control center systems concerning monitoring and evaluation of processes in the areas of power generation, transmission and distribution.

A multitude of functions and application possibilities are available due to consistent integration of international standards and technologies, the synergetic effects between energy economies and industrial applications as well as continuous development of the process visualisation system.

Beside the standard protocols IEC 60870-5-104 and IEC 61850, SPRECON-V460 also allows communication via various proprietary protocols.

Without additional efforts, all SPRECON-V460 functions can be designed redundant for the complete application and can be applied to various grids and network structures.

By the full continuity of SPRECON-V460 at all process levels, Sprecher Automation introduces a new standard to the SCADA world.

FROM LOCAL OPERATION TO SCADA

SPRECON-V460 facilitates process visualisations of all possible ranges:

- Local HMI panels
- HMI workstations at station control level, machine control level or local power plant control systems
- Hot stand-by, multi-hierarchical SCADA systems for various grids and network structures

SPRECON-V460 provides basic HMI functions such as process pictures, controls, trend diagrams of measured-values, acknowledgeable state list (ASL), operating logs, disturbance data storage center, alarm manager, variable status manager, user information manager. For SCADA applications, the system offers superior functions such as supply optimisation and forecasting, topological colouring, interlocking, earth fault and short-circuit detection, process simulation, reporting for consumption, graphical fault location and load balancing calculation with interlocking.

All process data can be retrieved via the SPRECON-V460 web server.

Visualisation of
traction power supply

Visualisation of a
hydroelectric power plant
(turbine)

For the development of SPRECON-V460, Sprecher Automation strongly focuses on the graphical user interface (GUI) and its design – especially on user guidance, general usability as well as on functional design.

Furthermore, the process visualisation system provides wide-ranging design possibilities for sophisticated process images, which accurately display current plant conditions at any time.

Beside system maintenance, the SPRECON-V460 Editor allows compatible creation of visualisation projects for various processes.

Project engineering with SPRECON-V460 does not require programming skills. All projects can be created with mouse clicks. Graphics, navigation and logics are configured via "properties" and predefined functions. The visualisation system allows easy and efficient centralised project engineering in an object-oriented way.

Additionally, SPRECON-V460 can be functionally extended by means of VSTA/VBA wizards and integrated automatic functions according to IEC 61131-3.

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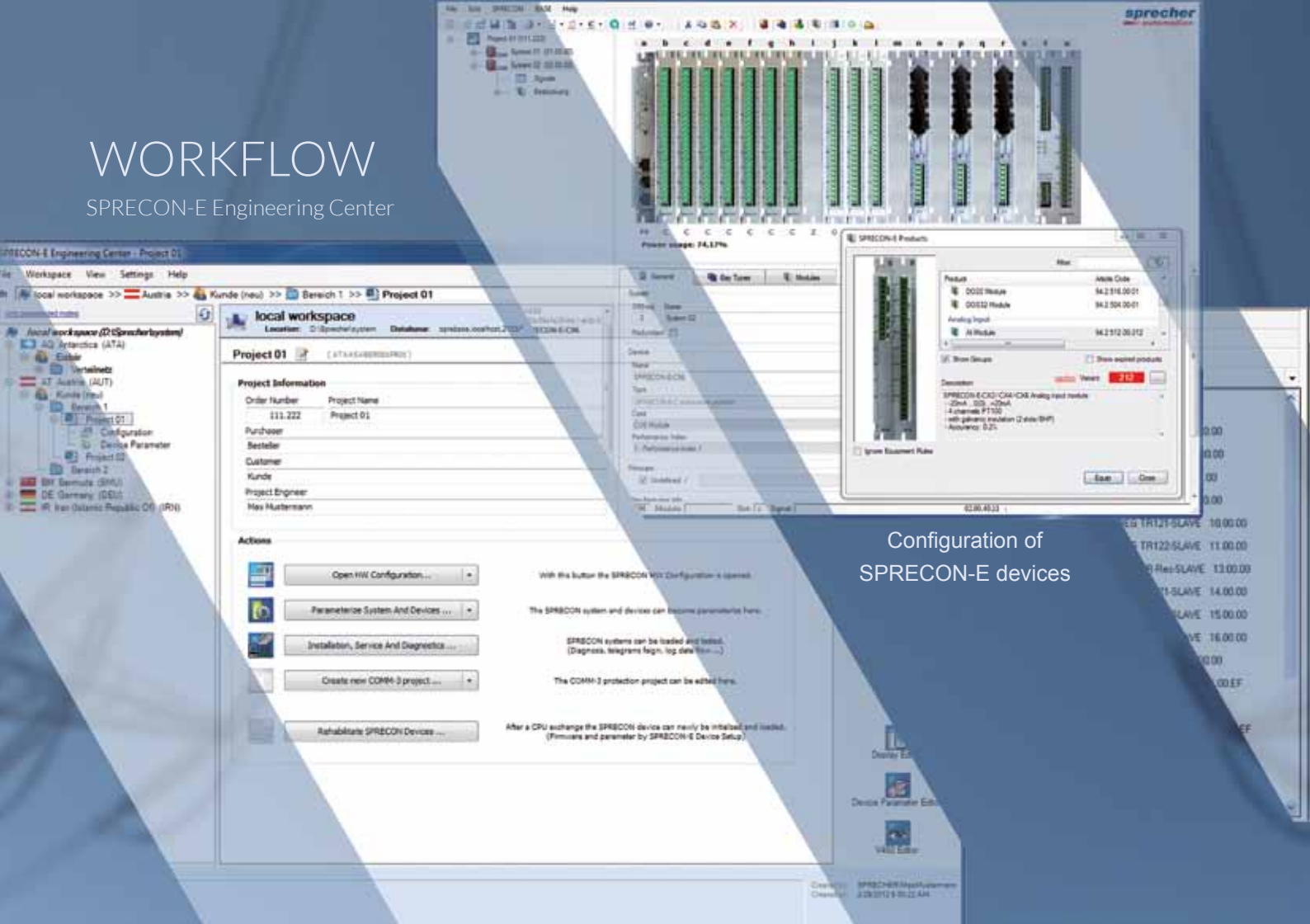
Configuration of
SPRECON-E devices

SPRECON-E ENGINEERING CENTER

The SPRECON-E Engineering Center is a workflow-oriented software platform for all SPRECON-E components. It covers configuration, parameterisation (application-specific settings), maintenance and diagnostics of SPRECON-E devices and systems.
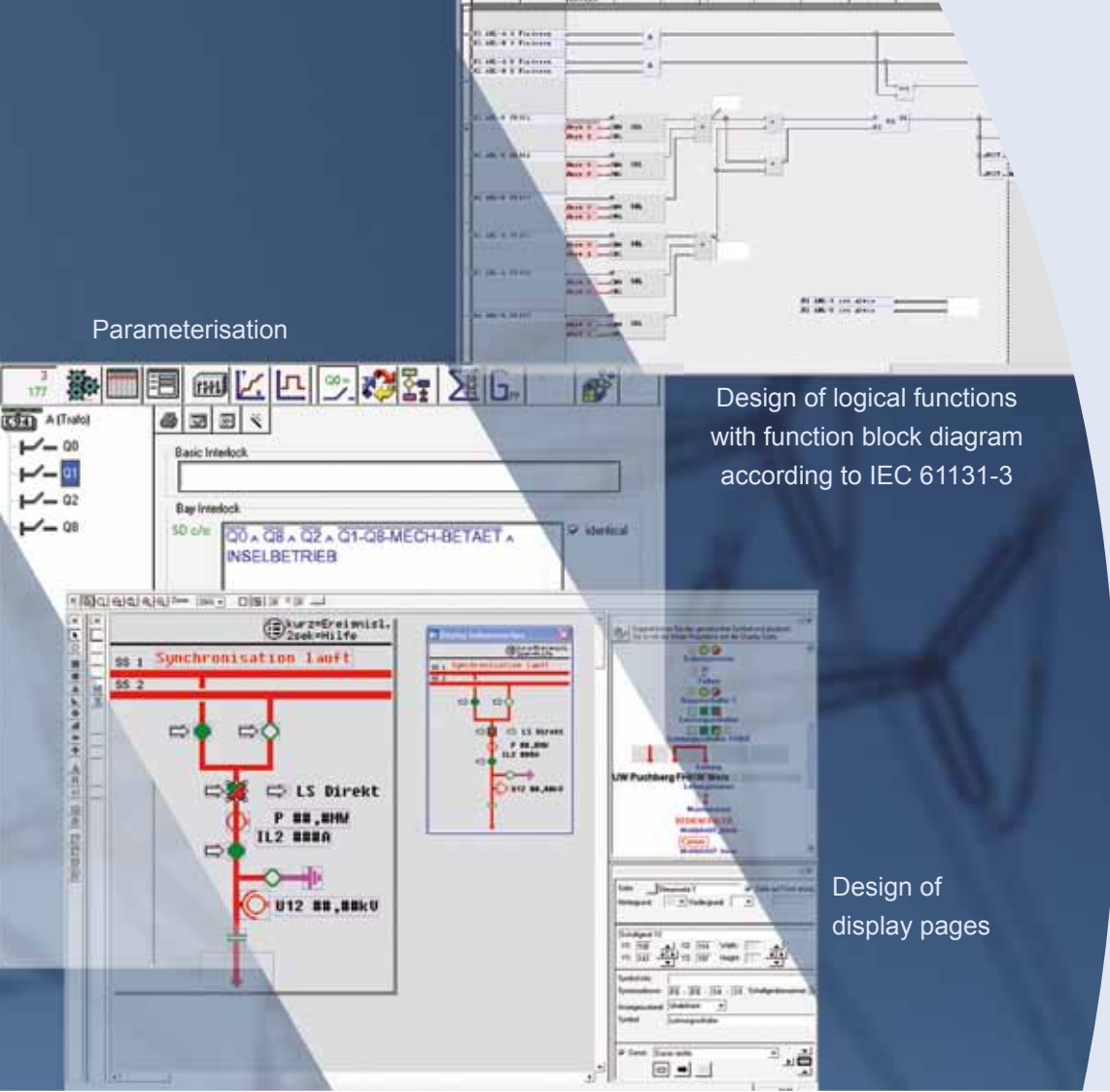
The software components are network-compatible and can be operated via a terminal server. Thus, the user faces an ideal working environment which is optimally adapted to the respective application field and provides extensive security functions.

Beside project management and the integrated program menu for easy program access, the SPRECON-E Engineering Center especially supports customised workflows for parameterisation of the application software as well as commissioning and maintenance of SPRECON-E devices and systems. Furthermore, the system provides web-based diagnostics and parameter analyses.

The platform supports the standard communication protocols IEC 61850 and IEC 60870-5. In addition, various proprietary protocols can be used.

The following software modules cover the complete engineering and maintenance process:

- SPRECON-E Engineering Center
  Administration center for all relevant automation objects

- SPRECON-E Configurator
  Configuration and component settings of
  control and protection devices

- SPRECON-E Designer
  Parameterisation of the application software

- SPRECON-E PLC-Designer
  Design of logical functions according to IEC 61131-3

- SPRECON-E COMM-3
  Protection function setting for protection devices and
  combined protection and control devices

- SPRECON-E Service Program
  Commissioning and maintenance with loading and
  test functions

- SPRECON-V460 Editor
  Design and parameterisation of
  process visualisation

Parameterisation

Design of logical functions
with function block diagram
according to IEC 61131-3

Design of
display pages

WORKFLOW OVERVIEW (TOP-DOWN APPROACH)

CONFIGURATION OF A SPRECON-E AUTOMATION SYSTEM BASED ON IEC 61850

IEC 61850 (non-proprietary)

Plant and system specification

Device specification

SYSTEM CONFIGURATION
System specifications containing configuration, equipment,
LNode definition, data type template

SCD configuration (data sets, services),
Functional Product Naming

SCD-File

SPRECON-E Engineering Center

Device configuration

SPRECON-E Configurator — Configuration and component settings of SPRECON-E automation devices

System parameterisation

SPRECON-E (PLC) Designer
SPRECON-V460 Editor — System parameterisation, Implementation of logic functions (i.e. by FBD), Parameterisation of process visualisation

Device settings

SPRECON-E COMM-3
SPRECON-E Service Program — SPRECON-E device settings including analyses and protection data evaluation

Inhouse test / commissioning / maintenance

SPRECON-E Service Program — Commissioning and maintenance of the SPRECON-E automation system
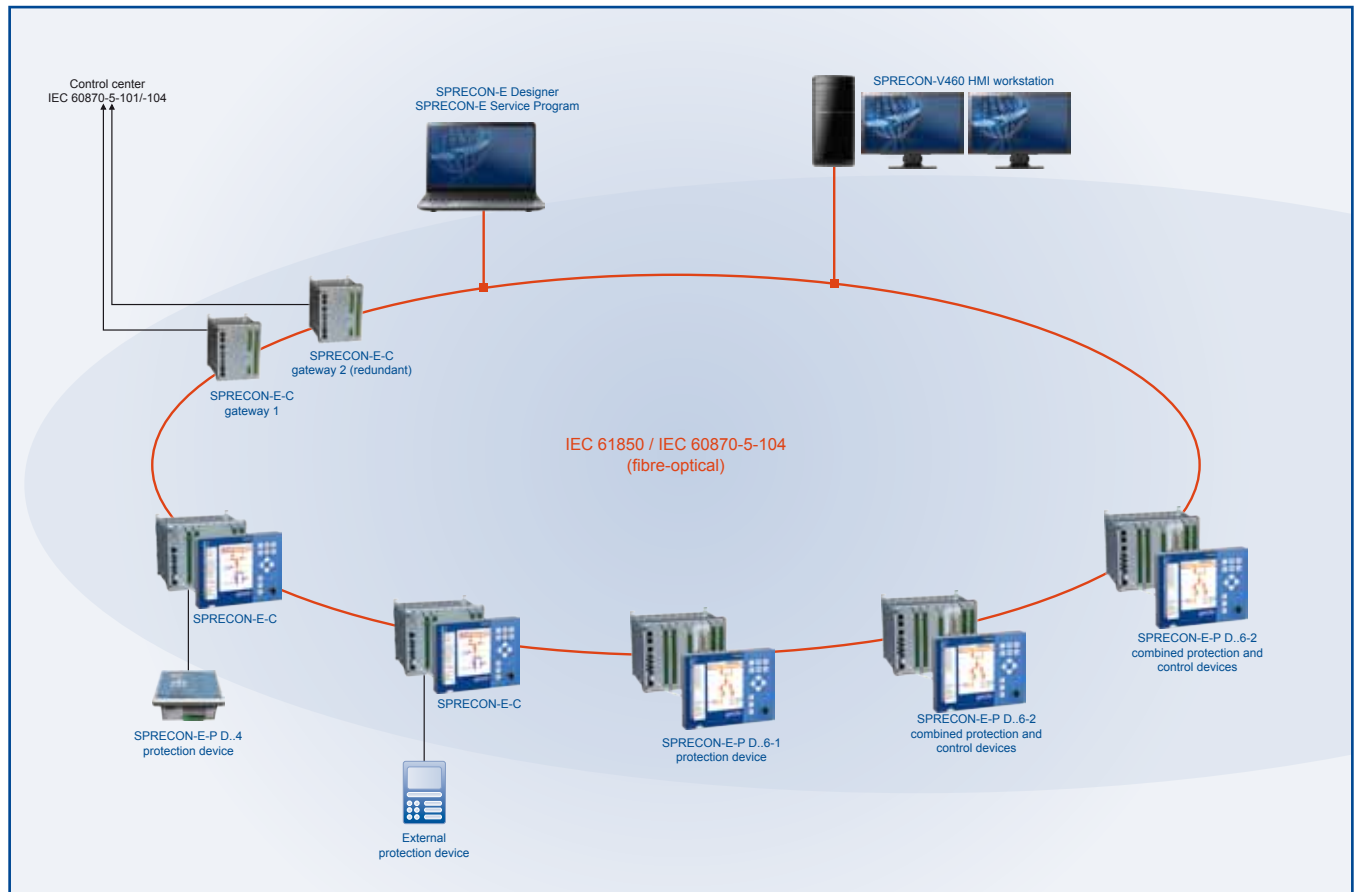
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STATION CONTROL

As a station control system, SPRECON-E is applied to switchgears and substations of all types and voltage levels. The flexible system concept and the wide-ranging scalability of the components allow practice-oriented, reliable and cost-effective configurations. As a result, adaptions to specific requirements can be easily accomplished.

Beside implementation into new plants, SPRECON-E is also perfectly qualified for plant retrofit due to its flexibility and robustness.

Highlights:

- Highest modularity and functional range

- Highest electromagnetic compatibility (EMC)

- Direct process interfacing
  (no extra relays required)

- Easily adaptable to specific requirements

- Station LAN with IEC 61850 and/or IEC 60870-5-104 or serial connection via IEC 60870-5-101/-103

- Ring topology with integrated optical switch or traditional star topology (option)

- Connection of external devices such as protection devices, regulators or power quality

- Bay operation via detachable control panel (SPRECON-E-CP) with full-graphical and configurable colour display

- Configurable automatic functions (function block diagram according to IEC 61131-3 or sequence processing with boolean operations)

- Software modules for certain functionalities such as protection, earth fault detection and localisation, voltage regulator or synchro-check

- Central station operation via a SPRECON-V460 HMI workstation

- Communication with superior control level via IEC 60870-5-101, IEC 60870-5-104 or proprietary protocols

- Devices for all voltage levels and tasks (protection, bay computer, station computer, local I/Os, gateways, etc.)

Control center
IEC 60870-5-101/-104

SPRECON-E Designer
SPRECON-E Service Program

SPRECON-V460 HMI workstation

SPRECON-E-C
gateway 2 (redundant)

SPRECON-E-C
gateway 1

IEC 61850 / IEC 60870-5-104
(fibre-optical)

SPRECON-E-C

SPRECON-E-P D..4
protection device

SPRECON-E-C

External
protection device

SPRECON-E-P D..6-1
protection device

SPRECON-E-P D..6-2
combined protection and
control devices

SPRECON-E-P D..6-2
combined protection and
control devices

Configuration example of a station control system for a substation with IEC 61850 or IEC 60870-5-104

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POWER SYSTEM PROTECTION

The digital SPRECON-E-P protection devices and the combined protection and control devices (D..4, D..6) are used for protection of power lines, cables, transformers and motors. The devices were developed for all significant grids and neutral-point connections of high voltage and medium voltage switchgears.

SPRECON-E-P protection devices:

- Protection devices

- Combined protection and control devices

- Transformer-supplied protection devices

- Overcurrent-time protection, distance protection, motor protection, transformer differential protection, protection data concentration unit

- Directional earth fault protection device

- Capacitor release unit

The SPRECON-E-P D..6 devices are one-box solutions for protection and control, which allow protection of primary equipment by simultaneously accomplishing control and monitoring functions in electric power systems.
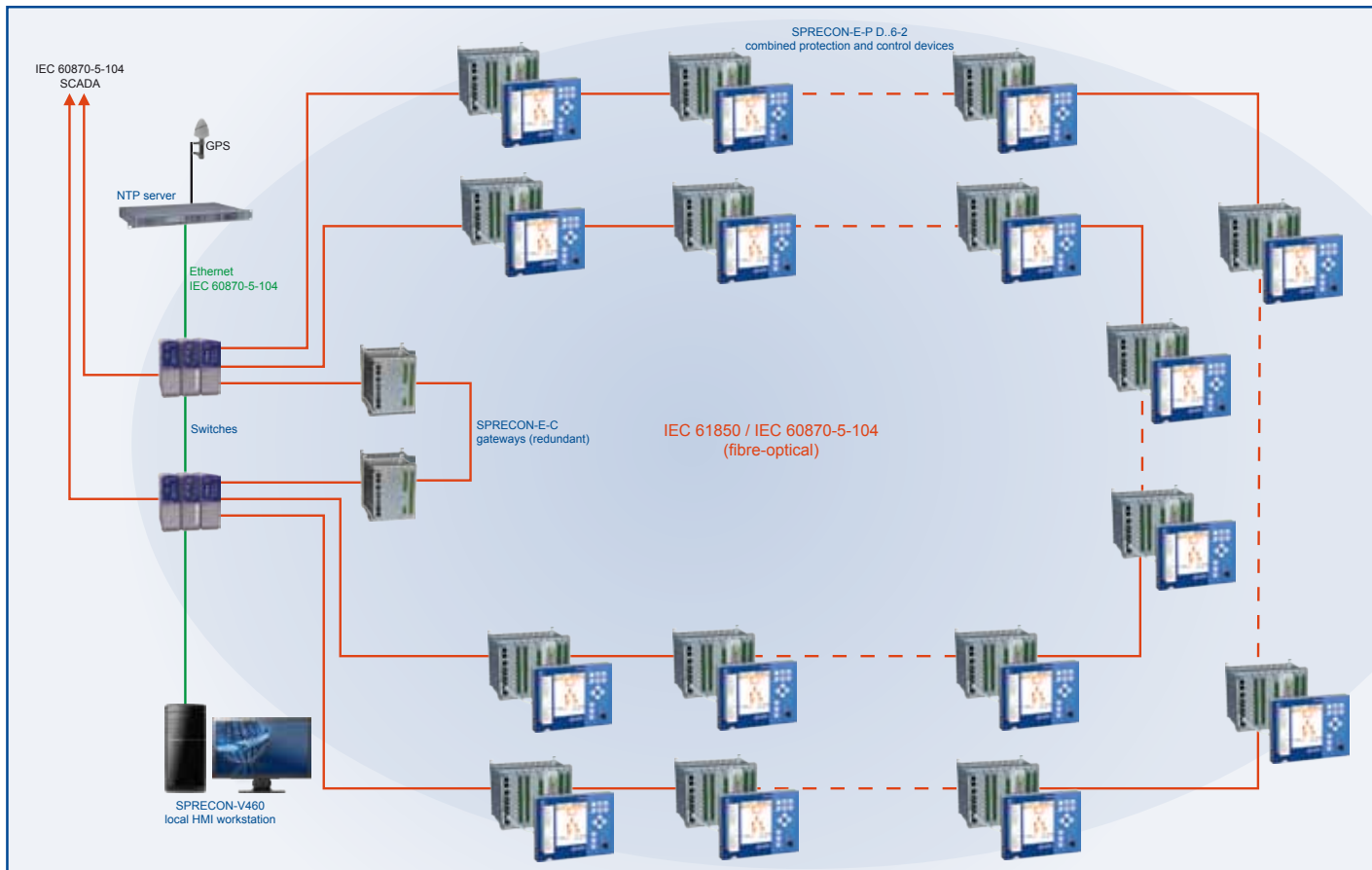
They feature a clear separation of control and protection which allows either combined or separated operation of control and protection functions:

- Separated data models

- Separated control and protection firmware

- Separated control and protection configuration

- Separated passwords

The devices are distinguished by their modular design and highest flexibility and scalability. Due to the consequent platform-approach, all modules of the SPRECON-E devices can be applied.

Standard protocols (IEC 61850, IEC 60870-5-103, IEC 60870-5-104) as well as proprietary protocols allow communication between different control systems.

All products can be controlled and configured with Sprecher's user-friendly protection software SPRECON-E COMM-3.

IEC 60870-5-104
SCADA

GPS

NTP server

Ethernet
IEC 60870-5-104

Switches

SPRECON-E-C
gateways (redundant)

SPRECON-E-P D..6-2
combined protection and control devices

IEC 61850 / IEC 60870-5-104
(fibre-optical)

SPRECON-V460
local HMI workstation

$I_L >$

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Configuration example of a medium voltage switchgear with combined protection and control devices

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TELECONTROL

Due to the modular architecture and the facility of flexible configuration, SPRECON-E also acts as the appropriate solution for telecontrol.

The system allows configuration of new and modern telecontrol networks realised upon appropriate topologies.

SPRECON-E components can be also integrated into existing networks without affecting the customer's philosophy in terms of system management and maintenance – a significant advantage for power utilities and infrastructures (electric power, gas, water, heating, tunnels, etc.)

The compact remote terminal units of the SPRECON-E-T3 series cover applications with low and medium I/O numbers whereas the SPRECON-E-C devices are used for medium and high capabilities. SPRECON remote terminal units (RTUs) can be also operated with the full-graphical HMI control panel (SPRECON-E-CP).

SPRECON-V460 is applied as the superior SCADA system. Besides, SPRECON-E also allows connection to external control centers.

Highlights:

- Configuration of multi-hierarchical networks with remote diagnostics and remote parameterisation
- Integration into existing telecontrol networks as front-ends and/or remote terminal units (i.e. outstations)
- Various communication protocols
- Integration of specific proprietary protocols
- Dial-up networking (VPN, GSM, PSTN, etc.)
- Integrated media converters (i.e. optical interface) and communication-modules (GPRS-modem, etc.)
- Configurable automation functions (function block diagram according to IEC 61131-3)
- Tunnelling functions for outstation messaging
- Integrated switch and IP security (encryption)
- Integrated firewall and routing functionality for highest security in telecontrol networks
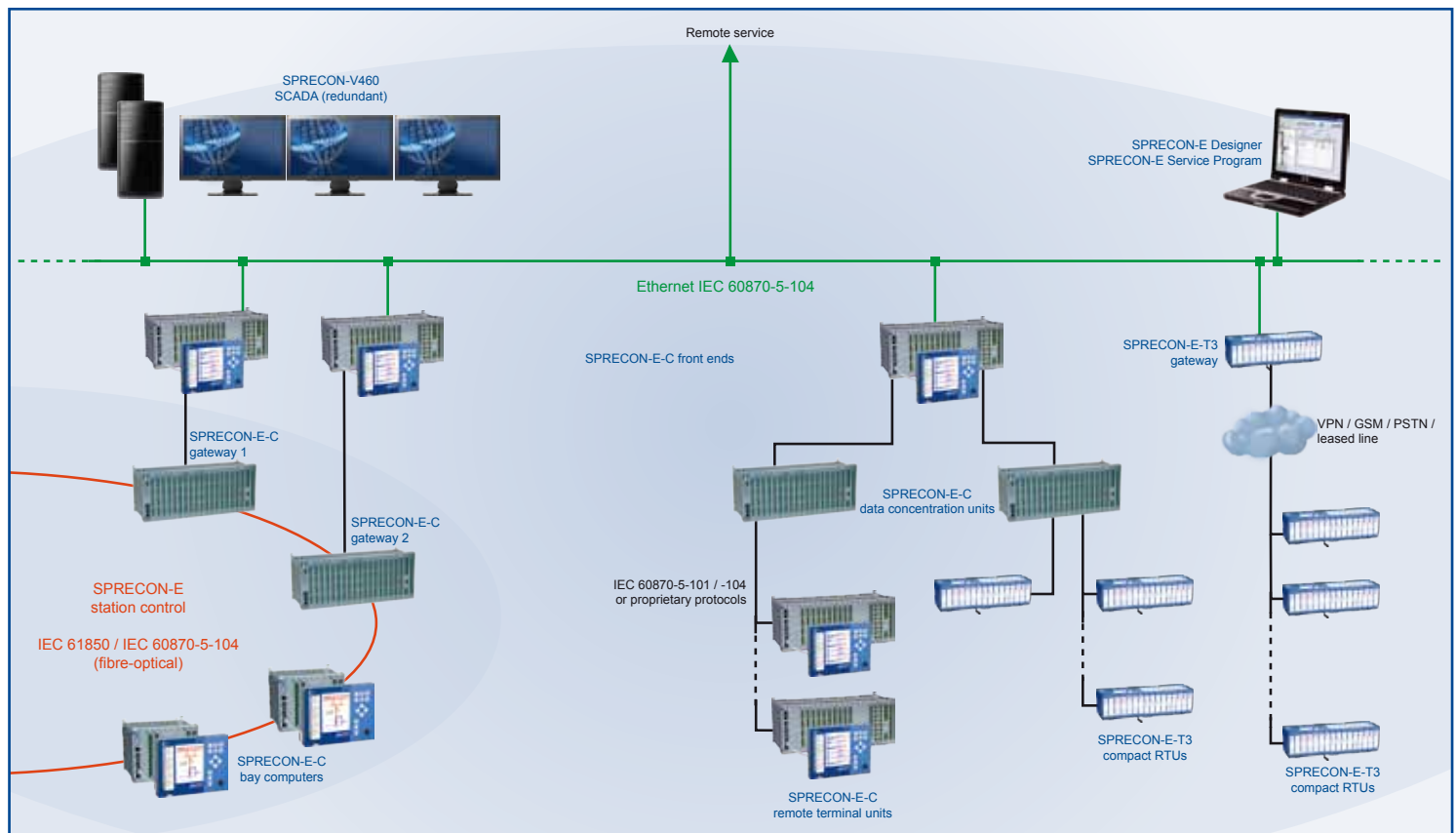
Configuration example of a telecontrol network with SPRECON-E-C devices and SPRECON-E-T3 (compact RTUs)

In the diagram:

Remote service

SPRECON-V460
SCADA (redundant)

SPRECON-E Designer
SPRECON-E Service Program

Ethernet IEC 60870-5-104

SPRECON-E-C front ends

SPRECON-E-T3
gateway

SPRECON-E-C
gateway 1

VPN / GSM / PSTN /
leased line

SPRECON-E-C
gateway 2

SPRECON-E-C
data concentration units

SPRECON-E
station control

IEC 61850 / IEC 60870-5-104
(fibre-optical)

IEC 60870-5-101 / -104
or proprietary protocols

SPRECON-E-T3
compact RTUs

SPRECON-E-C
bay computers

SPRECON-E-C
remote terminal units

SPRECON-E-T3
compact RTUs

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SMART GRIDS

Smart Grids are formed by communication networks for controlling all power generators, storages, electrical consumers and resources – ranging from transmission and distribution grids to households.

In concrete terms, a Smart Grid means to merge all SPRECON-E application areas (SCADA, telecontrol, station control, power plant control and power system protection) into one sophisticated network based on open and standardised interfaces (IEC 61850, IEC 60870-5-104 / -103 / -101 / ..., IEC 62056-21 [IEC 1107], etc.). This also includes:

- Connection of systems of other manufacturers such as metering, regulators and power quality

- Connection of alternative energy stations (i.e. solar, wind, cogeneration units, etc.)

For vertical and horizontal net-working of the resources, many different communication technologies have to be applied (GPRS/UMTS, radio, optical fibres, powerline, etc.).

Schematic image of a Smart Grid

POWER PLANT CONTROL

On this proved basis, Sprecher also offers solutions for smart distribution transformer stations and smart power supply management for renewable power suppliers.

Acting as a main feature of a SPRECON-E turnkey solution, an increase in efficiency is achieved through optimal utilisation of the existing primary systems. Therefore network losses can be reduced. This leads to a targeted utilisation of power generators and consumers in the network. Furthermore, an increase in the availability of power grids can be achieved by instant fault location, on-time and effective network reconfiguration for quick recovery and, eventually, automatically created island grids. As another feature, the system provides efficient support for reporting to public authorities and customers.

SPRECON-E is also applied as a control system for power plants with plant-specific process interfaces and configurable automatic functions according to IEC 61131-3 – independent of the various power plant types and technologies.

Here, SPRECON-V460 acts as a power plant control system distinguished by features like multitasking, integrated firewall as well as bumpless redundancy (hot stand-by with automatic and manual switching).

Beside implementation of SPRECON-E as a complete power plant control system, the platform can be also integrated as a partial system for new power plants or for modernisation (retrofit) of existing power plants.

A typical retrofit example is the implementation of a control center system by simultaneously sustaining existing process-related automation hardware.

The decisive requirement to automation is an approach to a one hundred percent availability. For this purpose, Sprecher Automation offers customised, redundant client-server-systems.

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