Protective relays for reliable mains protection

Protect, monitor, and control electrical grids

PHŒNIX CONTACT

Your partner for reliable mains protection

As a leading and global manufacturer of components and systems for electrical connections and industrial automation, Phoenix Contact has reinforced and further extended its portfolio in the power supply segment by acquiring the NSE AG.

The specialists in secondary technology round out our range of services as developers and manufacturers of protective relays and control units for the distribution grid.

A PHOENIX CONTACT COMPANY

Over 20 years of experience

As an expert partner, NSE has provided complete solutions in the field of protective technology for over 20 years. This includes all activities from planning to successful commissioning.

Phoenix Contact

Innovative developments

The holistic development process enables perfectly coordinated hardware and software. The powerful devices feature impressive user guidance that is very user-friendly.

Sophisticated production

The devices are built and intensively tested in compliance with the highest quality standards. This makes it possible to provide devices that are particularly reliable and long-lasting.

Reliable operation

In the "DACH region" of Germany, Austria, and Switzerland, more than 13,000 devices are currently proving their quality and durability. We stand by our products and provide a 5-year warranty on our protective units and control units as standard.

Our products for reliable mains protection

The comprehensive portfolio of protective and control devices ensures reliable grid operation in the voltage range from 10 kV to 110 kV. The focus of these IEDs (intelligent electronic devices) include single and double busbar applications as well as radial, looped, and meshed grids. They can also be used in insulated, compensated, rigid, and low-resistance grounded grids.

The devices are therefore perfect for use in substations and at feed-in points in the public power supply as well as in industrial power distribution applications.

	KOMBISAVE+
Protective functions	
Overcurrent and motor protection	•
Feeder protection with distance protection, ground fault detection, and field control	•
Transformer differential protection with field control	•
Line differential protection with distance protection, ground fault detection, and field control	•
Device properties	
Integrated power management (energy storage, transformer power supply)	
Maximum number of current/voltage/sensor inputs	8 / 5 / 0
Freely configurable function keys/displays	4 / 0
Maximum number of binary inputs and outputs	22 / 23
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POWERSAVE

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Find out more
with the web code

For detailed information, use the web codes provided in this brochure. Simply enter # and the four-digit number in the search field on our website.

i **Web code:** #1234 (example)

Or use the direct link:
phoenixcontact.net/webcode/#1234

Intelligent mains protection with KOMBISAVE+

The protective relays of the KOMBISAVE+ product family are perfectly suited for use in the distribution grid. Motors, transformers, cables, and lines can be protected in switching devices with single or double busbars.

The devices include a large range of functions, from overcurrent protection through to QU protection, distance and line differential protection, synchro check and automatic reconnection.

Device versions

With four design variants and numerous options, the KOMBISAVE+ product family is suitable for many applications.

Application examples

The extensive functions and the various applications are clearly brought into context.

Communication options

The protective relays can communicate via a wide variety of protocols and interfaces.

Your advantages

- ☑ Large range of functions with protection, control, and measurement functions in a compact design
- ☑ Intuitive operation with clearly laid-out front panel and easy configuration options
- ☑ Long service life thanks to a battery-free design and extremely low power consumption
- ☑ Satisfies IT security requirements in accordance with the BDEW white paper

Structural descriptions

The modular product family is available in various assembly options.

Technical data/order key

Define your product with all relevant order information or in our online configurator.

DIGICOM operating software

Learn more about the settings and evaluations of the protective relay with the DIGICOM operating software.

Device versions of KOMBISAVE+

1 KOMBISAVE+ RN

Easy overcurrent and motor protection with field control

Efficient protection of industrial and power generation systems

2 KOMBISAVE+ RF

Feeder protection with distance protection and ground fault detection with field control

Compact field control device for complex applications in switching devices

3 KOMBISAVE+ RQ

Stabilized differential protection for two-winding transformers with field control

Reliable transformer protection in the medium voltage range

4 KOMBISAVE+ RL

Stabilized line differential protection with distance protection and ground fault detection with field control

Main protection for cables up to 110 kV

|		1 **RN**	2 **RF**	3 **RQ**	4 **RL**
Properties of the versions					
Protective functions	**General**	49I&II, 50N/51N, 50P/51P, 68	27/59, 32N, 47, 49I&II, 50N/51N, 50P/51P, 59N, 67, 67N, 67NIEF, 68, 81O/U	49I&II, 50N/51N, 50P/51P, 68	27/59, 32N, 47, 49I&II, 50N/51N, 50P/51P, 59N, 67, 67N, 67NIEF, 68, 81O/U
	Motor protection	14, 37, 46, 48, 50M	14, 37, 46, 48, 50M		14, 37, 46, 48, 50M
	Distance protection (only with software option ZP)		21FL, 21N, 21P		21FL, 21N, 21P
	Smart Grid (only with software options QU, FE, or QF)		QU, UFLA		QU, UFLA
	Transformer differential protection (Software option TF)			24, 50P, 87T	
	Line differential protection (only with software options LT or LD)				24, 50P, 87L, 87LT
Protective functions		50BF, 50SOTF, 74TC, 79, 85, 86	25, 47, 50BF, 50SOTF, 60, 74TC, 79, 85, 86, MCS31, VTFF	50BF, 50SOTF, 74TC, 85, 86	25, 47, 50BF, 50SOTF, 60, 74TC, 79, 85, 86, MCS31, VTFF
Measurement	**Number of current transformers**	4	4	8	4
	Number of voltage transformers		4 or 5		5
	Measured values	3I, I0, 3I/15 min, Ith	3I, I0, 3I/15min, Ith, 3ULE, 3ULL, U0, P, Q, S, f, cosϕ, Udiff, fdiff, R/X, km/miles	3I, I0, 3I/15min, Ith, Idiff, Istab	3I, I0, 3I/15min, Idiff, Istab, Ith, 3ULE, 3ULL, U0, cosϕ, Udiff, fdiff
Standard properties of KOMBISAVE+					
Controller		Standard: Circuit breaker controller with graphical position indicator, local/remote switching, key switch Extended (only with software option AU): Complete field control, control of circuit breaker switch and earthing switch, trolley, use of interlock logic			
Message and status indicator / front panel		Standard: Predefined measured value tables, freely configurable LEDs Extended (only with software option AU): User-specific measured value and status panels, freely configurable virtual LEDs, freely customizable text and background colors			
Programmable logic (only with software option AU)		Integrated logic editor			
Communication interfaces		USB, electrical/optical Ethernet, serial electric/optical			
Communication protocols		Standard: IEC 60870-5-103 Extendable: IEC 61850 (Ed. 1/Ed. 2)			

Applications examples of KOMBISAVE+

Protection of a high-voltage double busbar with a KOMBISAVE+ RF

The RF version is a multi-functional feeder protection device with ground fault detection and field control. The device can be used in simple star or ring networks as well as in complex meshed networks with an isolated, compensated, rigidly grounded, or low-resistance grounded star point. In addition to the standard current protection functions, the protective device is used with the optional distance protection (full scheme) for complete protection of feeders. The device covers all ground fault protective functions of the above-listed supply system configurations. As in all versions, additional monitoring and measuring functions are also implemented alongside the purely protective functions.

In addition to the communication option implemented as standard via IEC 60870-5-103, IEC 61850 can also be used by selecting the appropriate software function.
The optional fault locator, the Synchrocheck function, and the automatic frequency reduction round off the protection package. The device can also take over the entire field control. The optionally integrated programmable logic allows the functions to be adapted to specific requirements, such as additional special locking, automatic switching, etc.

Compact field control device for complex applications in switching devices
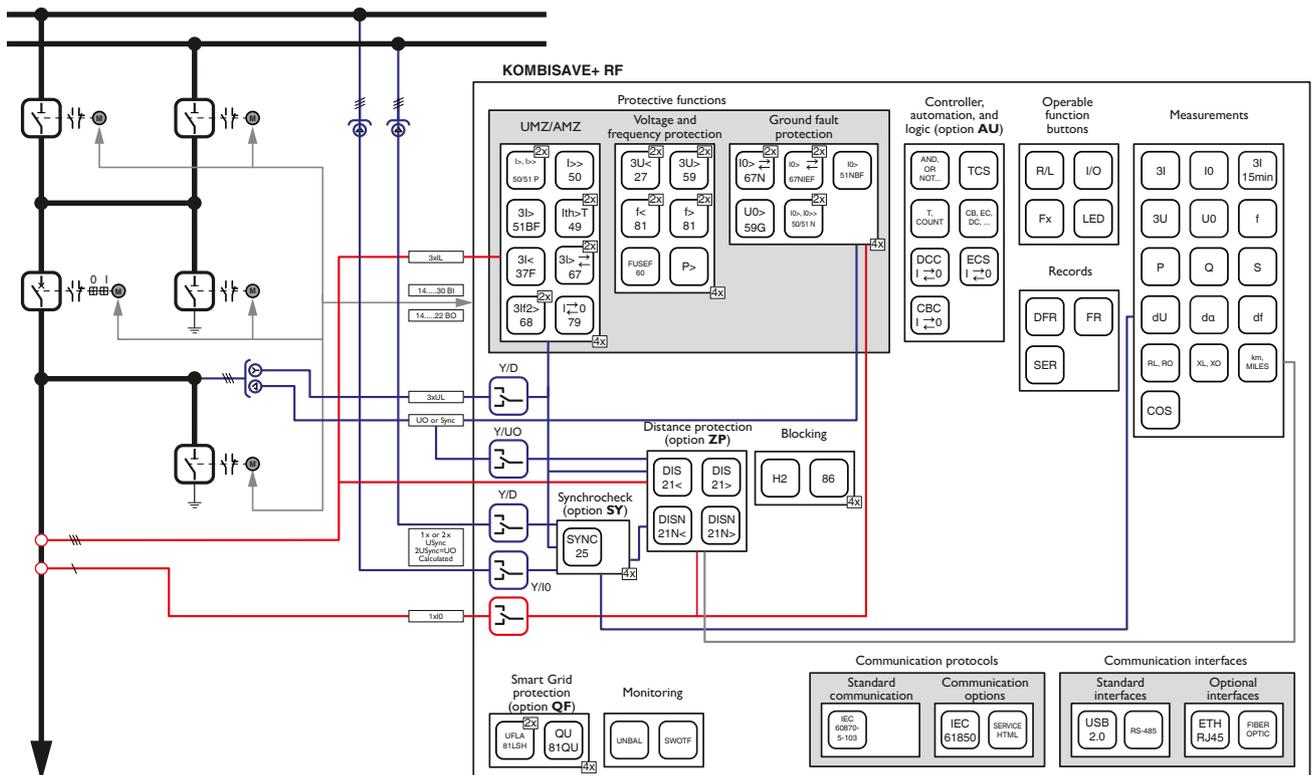
Protection of a two-winding transformer with a KOMBISAVE+ RQ

The RQ device version makes it possible to protect two-winding transformers on any voltage level. The integrated functions enable optimal ground fault protection when used in insulated, compensated, rigid, or low-resistance grounded grids.
The focus here is on stabilized transformer differential protection. Protection against false triggering when transformers are switched on (inrush) or overexcited is provided by measuring and evaluating the second and fifth harmonics. A standard thermal overload protection with a two-body model and the temperature measurements via Pt-100 inputs round off the functions of the RQ design variant. Like with all variants in the device family,

here there is also the option for the device to take over field control. The optionally integrated programmable logic allows the functions to be adapted to specific requirements, such as additional special locking, automatic switching, etc. IEC 60870-5-103 is available as the protocol for standard communication, and IEC 61850 Ed. 1/Ed. 2 is available as an option when the appropriate software function is selected.

Reliable transformer protection in the medium voltage range
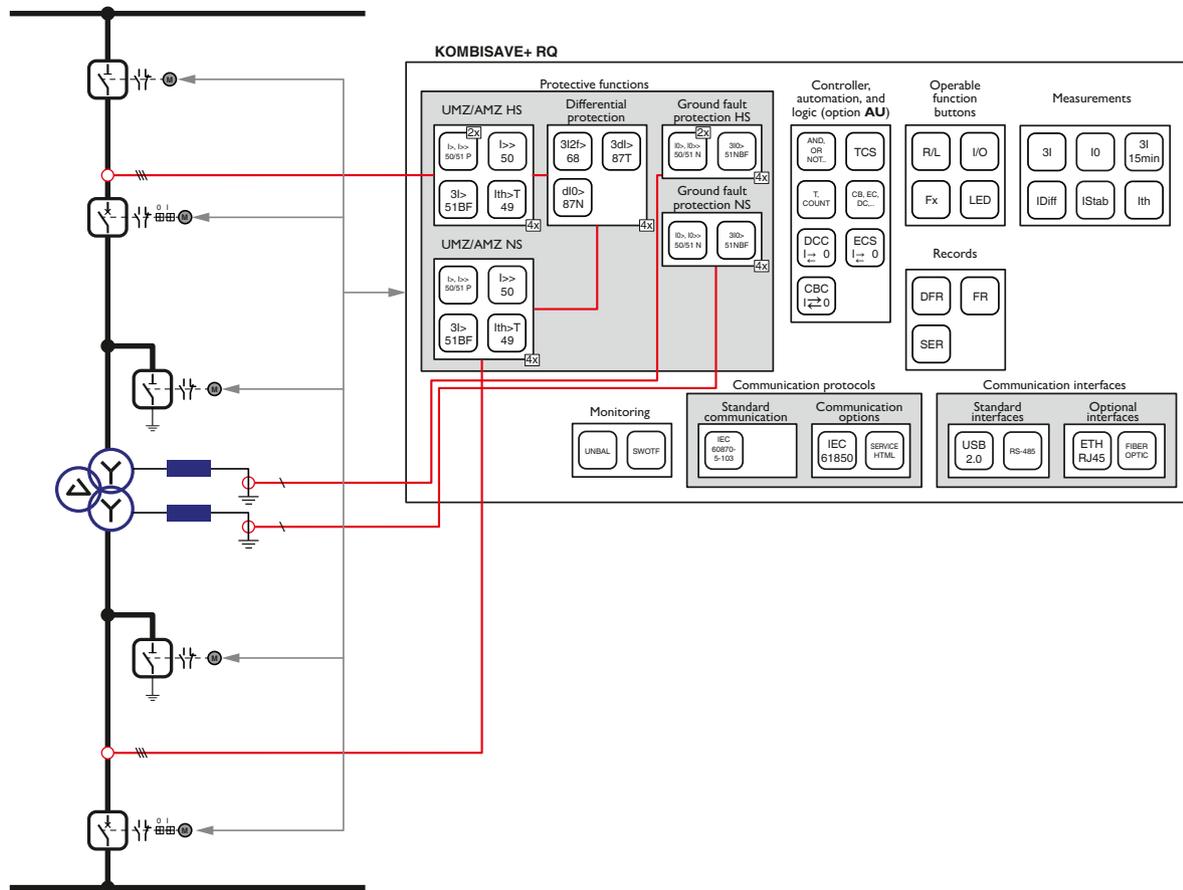
Applications examples of KOMBISAVE+

Smart Grid configuration with the KOMBISAVE+ device range

The application example shows how to use the device versions for the feed-in management of distributed power generation plants. The main protection of the transformer is provided in the RQ versions and the RF backup protection. Protection at the grid connection point is covered by the KOMBISAVE+ RF. Our device family is certified according to VDE-AR-N 4110 and VDE-AR-N 4120 for typical applications in the field of regenerative power generation, such as wind power or photovoltaic systems.

Here, the protective functions focus on the voltage and frequency functions as well as the Q-U protection. The Synchrocheck function can be used as an option. The device can also be used as a field controller. The optionally integrated programmable logic enables the protective functions to be adapted. Direct communication to a control system or a higher-level automation system can be achieved by IEC 61870-5-103 or optionally by selecting the appropriate software function IEC 61850 Ed. 1/Ed. 2.

Protection for wind turbine generators

Protection of a high voltage overhead line with two KOMBISAVE+ RLs

To protect high-voltage overhead lines, distance protection and line differential protection are generally used as the main protection. The RL device version covers both main protection functions in one compact protective device.

The stabilized line differential protection uses an optical INTERSAVE protection interface. Time synchronization of the devices used for line differential protection is not necessary. Depending on the distance, various SFP modules are possible as options. The protective devices are also suitable for applications with an internal transformer. Protective functions such as ground fault protection and voltage, power,

and frequency functions round off the protective package. Fault locators and Synchroncheck are likewise available as an option. The device can also be used as a field controller. Due to the integrated PLC, blocking functions can be implemented, for example. Direct communication to a higher-level automation system can be achieved by IEC 61870-5-103 or optionally by selecting the appropriate software function IEC 61850 Ed. 1/Ed. 2.

Main protection for cables up to 110 kV

KOMBISAVE+ RL

Protective functions

UMZ/AMZ
- I>, I>> 50/51
- I>> 50
- 3I> 51BF
- Ith>T 49
- 3I< 37F
- 3I> 67
- 3If2> 68
- I0 79

Voltage and frequency protection
- 3U< 27
- 3U> 59
- f< 81
- f> 81
- FUSEF 60
- P>

Ground fault protection
- I0> 67N
- I0> 67NIEF
- I0> 51NBF
- U0> 59G
- I0>, I0>> 50/51 N

Controller, automation, and logic (option **AU**)
- AND, OR NOT...
- TCS
- T. COUNT
- CB, EC, DC...
- DCC I 0
- ECS I 0
- CBC I 0

Operable function buttons
- R/L
- I/O
- Fx
- LED

Records
- DFR
- FR
- SER

Measurements
- 3I
- I0
- 3I 15min
- 3U
- U0
- f
- P
- Q
- S
- dU
- dα
- df
- COS

Synchrocheck (option **SY**)
- SYNC 25

Distance protection (option **ZP**)
- DIS 21<
- DIS 21>
- DISN 21N<
- DISN 21N>

Line differential protection (option **LD/LT**)
- 3I2f> 68
- 3dI> 87L
- 3dI> 87T
- dI0> 87N

Smart Grid protection (option **QF**)
- UFLA 81LSH
- QU 81QU

Monitoring
- UNBAL
- SWOTF

Communication protocols

Standard communication
- IEC 60870-5-103

Communication options
- IEC 61850
- SERVICE HTML

Communication interfaces

Standard interfaces
- USB 2.0
- RS-485

Optional interfaces
- ETH RJ45
- Glass Fiber
- SFP Optical

INTERSAVE

KOMBISAVE+ RL

Protective functions

UMZ/AMZ
- I>, I>> 50/51
- I>> 50
- 3I> 51BF
- Ith>T 49
- 3I< 37F
- 3I> 67
- 3If2> 68
- I0 79

Voltage and frequency protection
- 3U< 27
- 3U> 59
- f< 81
- f> 81
- FUSEF 60
- P>

Ground fault protection
- I0> 67N
- I0> 67NIEF
- I0> 51NBF
- U0> 59G
- I0>, I0>> 50/51 N

Controller, automation, and logic (option **AU**)
- AND, OR NOT...
- TCS
- T. COUNT
- CB, EC, DC...
- DCC I 0
- ECS I 0
- CBC I 0

Operable function buttons
- R/L
- I/O
- Fx
- LED

Records
- DFR
- FR
- SER

Measurements
- 3I
- I0
- 3I 15min
- 3U
- U0
- f
- P
- Q
- S
- dU
- dα
- df
- COS

Synchrocheck (option **SY**)
- SYNC 25

Distance protection (option **ZP**)
- DIS 21<
- DIS 21>
- DISN 21N<
- DISN 21N>

Line differential protection (option **LD/LT**)
- 3I2f> 68
- 3dI> 87L
- 3dI> 87T
- dI0> 87N

Smart Grid protection (option **QF**)
- UFLA 81LSH
- QU 81QU

Monitoring
- UNBAL
- SWOTF

Communication protocols

Standard communication
- IEC 60870-5-103

Communication options
- IEC 61850
- SERVICE HTML

Communication interfaces

Standard interfaces
- USB 2.0
- RS-485

Optional interfaces
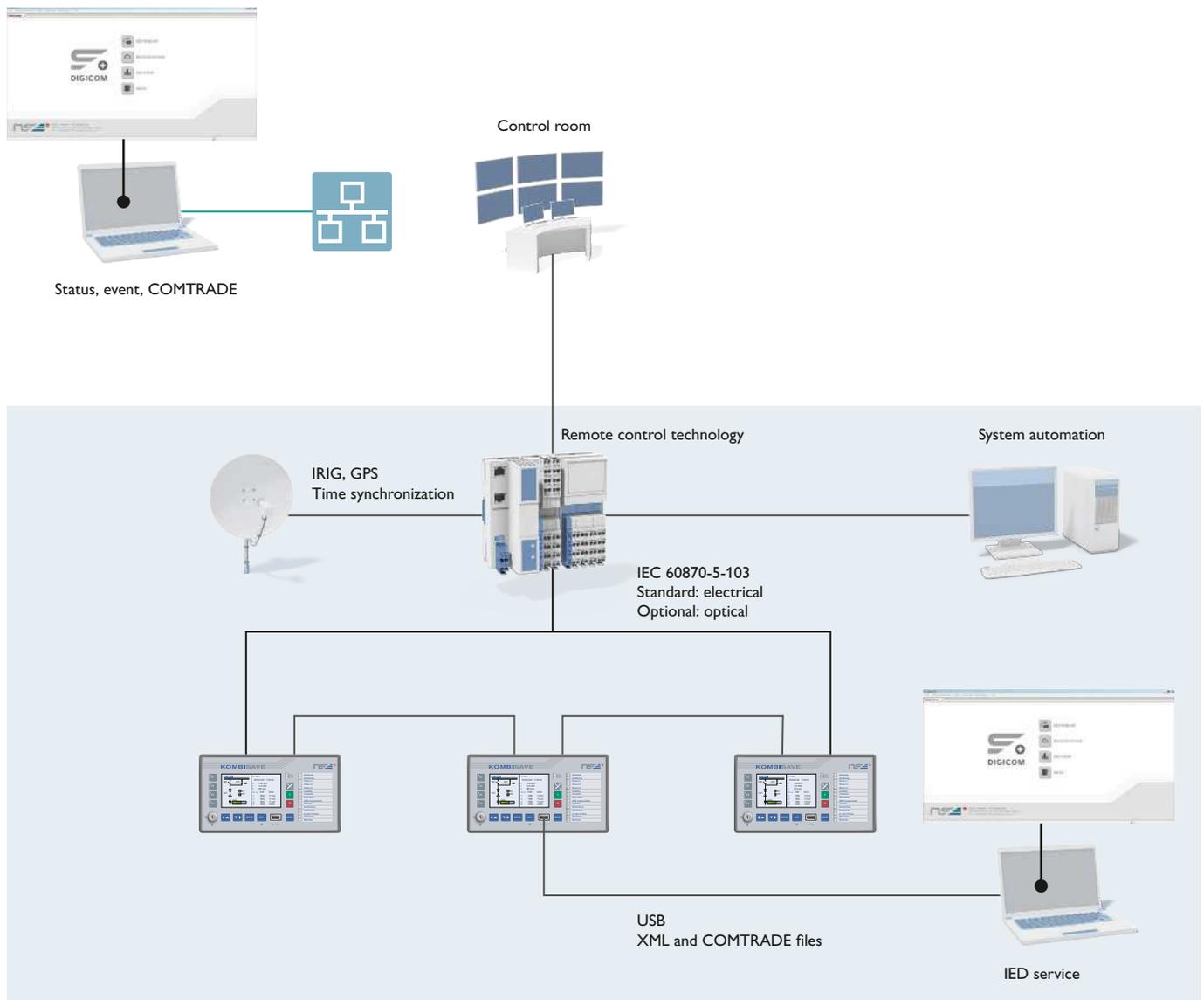- ETH RJ45
- Glass Fiber
- SFP Optical

KOMBISAVE+ communication options

Standard communication with IEC 60870-5-103

All versions of the KOMBISAVE+ device
family have a serial electrical interface
for communication via IEC 60870-5-103
as standard. In addition to the
RS-485 connection, there is an alternative
option to communicate via an optical
interface. The optical interface is suitable
for ST male connectors and fiber-optic
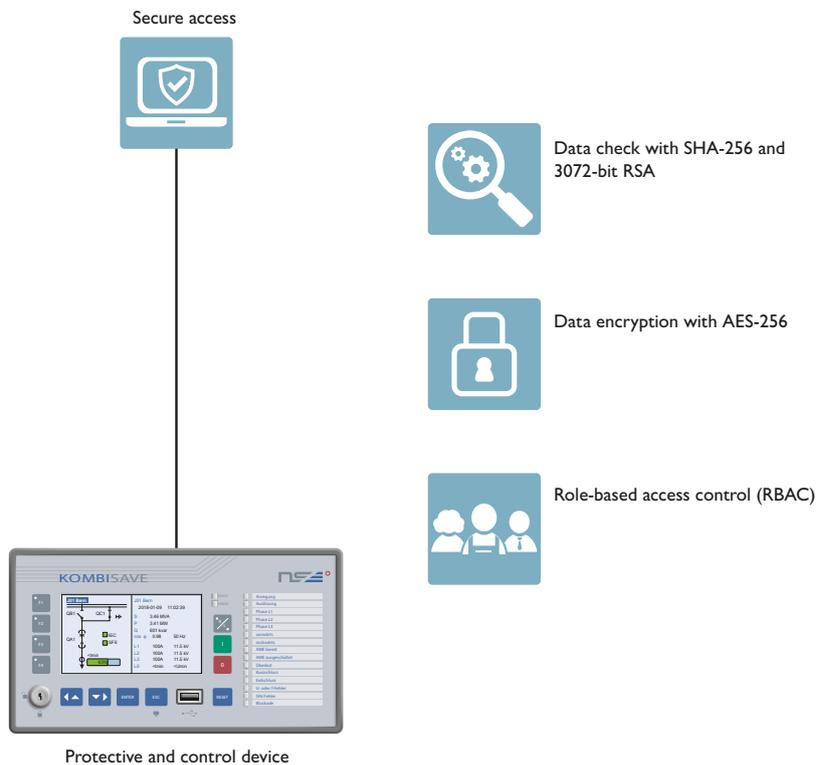cables of 820 nm. Programming is done
using XCFG files via the USB front interface.

Control room

Status, event, COMTRADE

Remote control technology

System automation

IRIG, GPS
Time synchronization

IEC 60870-5-103
Standard: electrical
Optional: optical

USB
XML and COMTRADE files

IED service

IT security

With regard to cybersecurity, our protective device families have been developed under consideration of the BDEW white paper. The aim is to increase IT security in systems in the energy sector against unwanted internal and external attacks.

Examples of central elements in this context are role-based access control and protective mechanisms at the communication interfaces. This includes both the management of user roles and rights (RBAC) and the recording of security-relevant events. Moreover, it prevents the installation of third-party software.

To verify data, files are signed using SHA-256 and 3072-bit RSA keys, e.g., for update and patch management. For particularly high data security, user files are stored encrypted with AES-256 independently of the configuration file and encrypted with TLS during data transmission via the Ethernet interface.

Further information is available at: https://phoe.co/fM2JT1

Secure access

Data check with SHA-256 and 3072-bit RSA

Data encryption with AES-256

Role-based access control (RBAC)

Protective and control device

KOMBISAVE+ communication options

Communication option IEC 61850

In addition to communication via
IEC 60870-5-103, it is also possible to
communicate via IEC 61850. All versions
of the KOMBISAVE+ device family are
available with IEC 61850 Ed. 1/Ed. 2.
The associated physical connections
can be selected as an electrical Ethernet
interface via RJ45 or optical Ethernet
with a 1,300 nm SC male connector.
The Ethernet port can also be used
as a dedicated service interface with
DIGICOM.
Options with electrical or optical switches
can also be selected to implement the
necessary redundancy concepts..

All devices with the IEC 61850 option
support MMS and GOOSE functionalities
(FAST GOOSE and SLOW GOOSE).
All of the existing Ethernet interfaces
can be used as service interfaces with
the DIGICOM operating software.
Programming is done using xcfg file files
via the USB front interface or Ethernet
service interface. Moreover, transmissions
of COMTRADE files for fault analysis
is also possible.

Status, event, COMTRADE

Control room

Remote control technology

System automation

IRIG, GPS
Time synchronization

IEC 60850 (electrical or optical)
MMS, GOOSE

DIGICOM via Ethernet

USB
XML and COMTRADE files

IED service
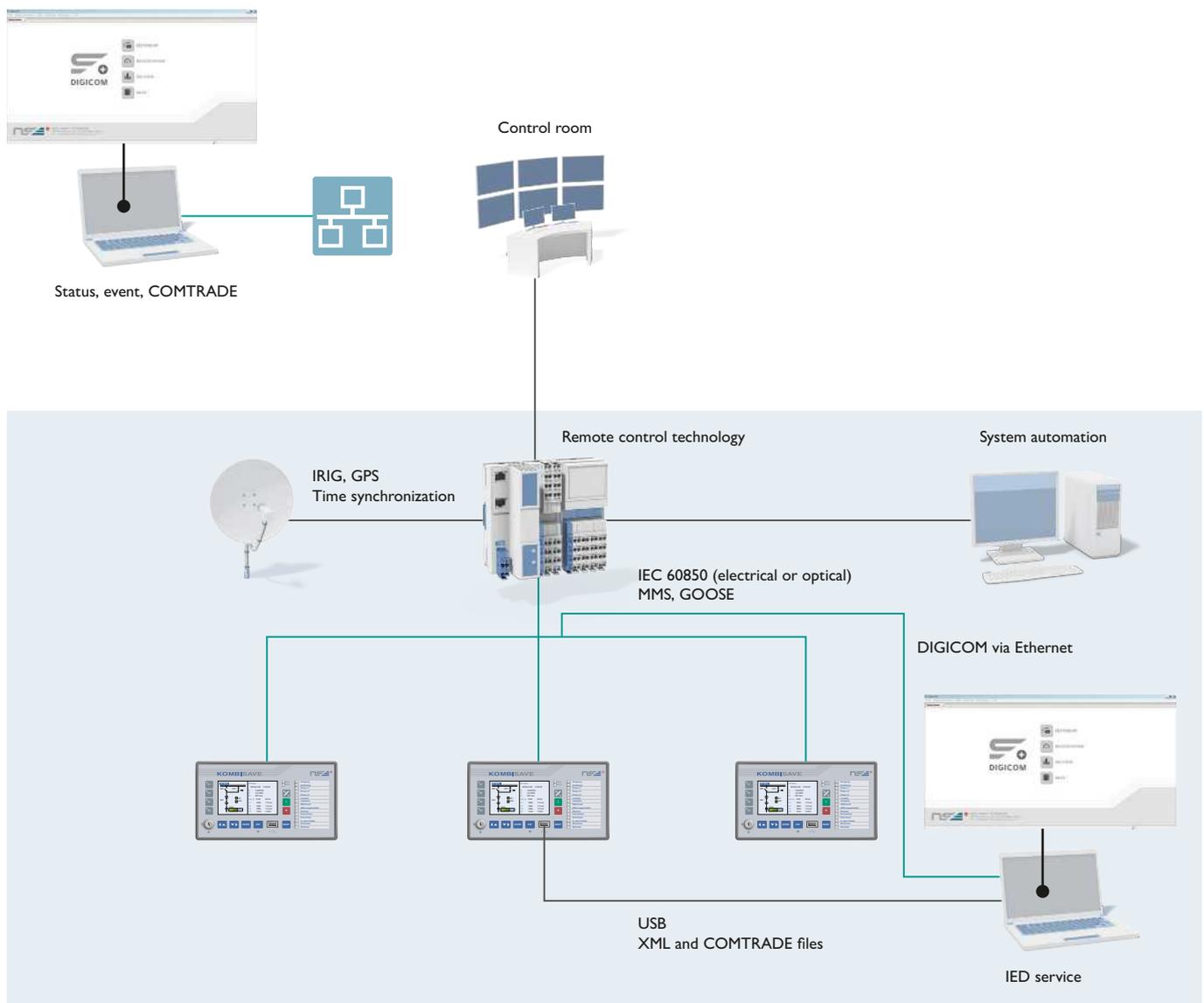
Redundancy concepts with IEC 61850

For IEC 61850 applications, the KOMBISAVE+ device family offers various redundancy concepts: Parallel Redundancy Protocol (PRP), High-availability Seamless Redundancy (HSR), and Rapid Spanning Tree Protocol (RSTP). With PRP, parallel transmission to two redundant networks takes place so that continuous operation is possible in the event of a fault. In this procedure, data is neither lost nor transmitted with a delay. The DAN functionality (Double Attached Node) is achieved with an integrated switch. By using SFP modules, the functionality can be implemented both electrically and optically with various FO options.

HSR allows the parallel transmission of the data in both ring parts. This means that there is no downtime if there is a malfunction of components within the ring. Non-redundant devices are connected via a redundancy box (Red Box).
With RSTP, transmission happens in the ring, which is virtually "open" at one point. Here, there are short downtimes if one component of the ring has a malfunction. Switching to a new topology is done automatically.

System automation

PRP/HSR
Red Box

IRIG-B, GPS
Time synchronization

LAN A   PRP   LAN B

PRP/HSR
Red Box   PRP/HSR Red Box

HSR

IED service

PRP/HSR
Ethernet switch   PRP/HSR
                                     Ethernet switch

DIGICOM

Electrical or optical RSTP

DAN   DAN   DAN   DAN

Structural descriptions of KOMBISAVE+

Dimensional drawing of the structural version in mm

Front view*

Side view

Drilling template for the fixing bracket
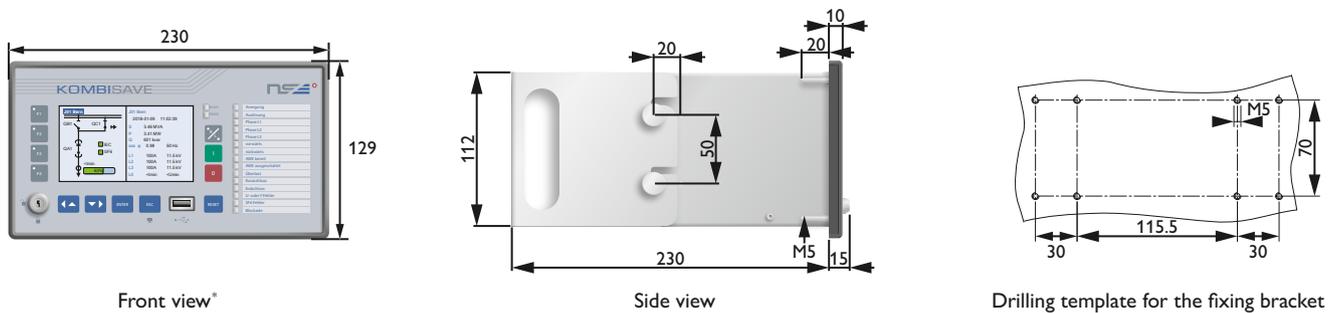
* To connect the device, the KOMBISAVE+ can be folded into the mounting brackets

Dimensional drawing of the installed version in mm
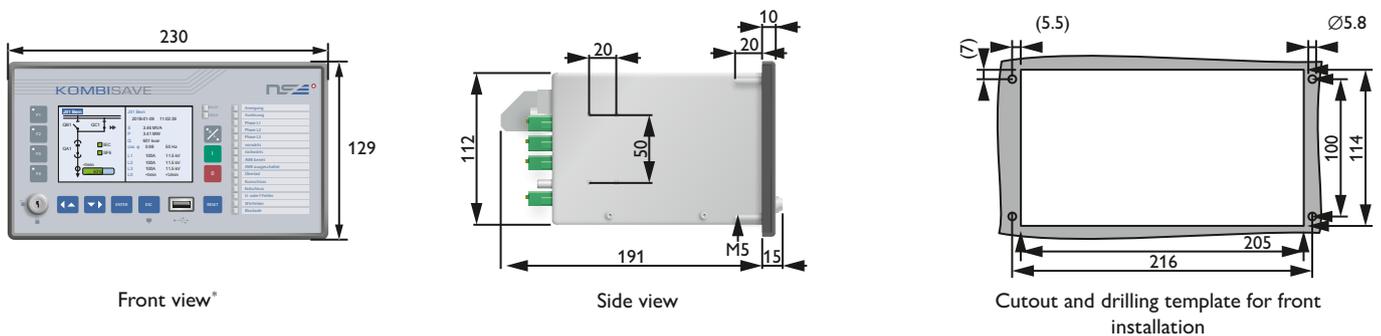
Front view*

Side view

Cutout and drilling template for front installation

Use FAME to design energy switching devices and interfaces that are easy to service

Regular testing of digital protection relays requires efficient and simple test connections in the switching device on site to ensure the safety of the system and the test personnel. The innovative FAME plug-in test system from Phoenix Contact was developed to perform these tests in the field of network protection technology for medium-voltage and high-voltage switching devices in a way that also optimized time and costs.

The modular system makes it possible to define standardized test plug-in test sockets in for nearly every application and to define the best test options for each protective device.

The plug-in test system is designed to be extremely compact with just 8.2 mm width per position. The offset arranged test sockets are compatible with up to 1,000 V in accordance with IEC 61010-1 for CAT III/CAT IV. The system can be assembled on the door, on the DIN rail, or in the 19" rack with two, three, or four rack units.

The FAME 1 series functions like an N/O contact and thus requires an operating plug. In comparison, the FAME 2, FAME 3, and FAME 3 rack series work without N/C contacts and thus without operating plugs. One special feature of the FAME 2 series is that the functional configurations are only possible in the male connector, which is therefore also coded to match the plug-in test socket.
FAME 2 also meets the technical specification of the VDE for test connector equipment. For maximum safety with

regard to current transformer connections, an automatically leading short-circuit is implemented during the test plug-in process. Plug-in test sockets and test plugs are designed to be touch-proof. Screw and Push-in connections as well as variants for ring cable lugs are available as the connection technology.

Web code: #2353

Easy and safe measurement and testing processes with the FAME plug-in test system

Front side of the KOMBISAVE+ device family

Multi-colored 4.5" TFT display to display system graphics with control, measured value tables, and virtual LEDs:
- Several sides can be configured for the specific user
- Colored dynamic texts

Button with a status LED to switch between remote and local

2 LEDs to display the system status

4 freely configurable function keys with LED

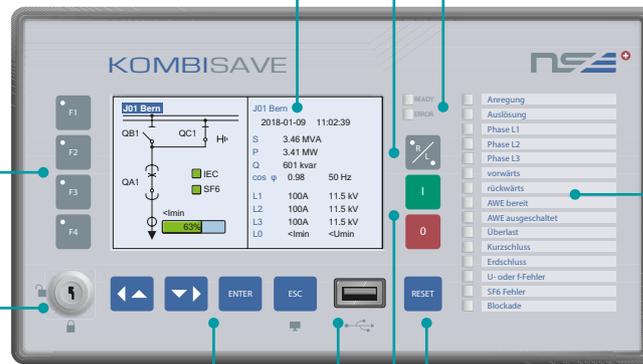15 freely configurable LEDs (tri-colored)

Key switch for unlocked control

4 navigation keys for simple operation

Reset button

USB service interface

2 buttons to switch switchable equipment on and off

Example rear side of a KOMBISAVE+ RL device version

Short-circuiting CT connections (X6)

Voltage transformer connections (X5)

Protection interface for line differential protection optical SFP module, max. 80 km (KOMBISAVE+ RL only)

Binary inputs and outputs (X8 and X4)

Binary inputs and outputs (X7 and X3)

Standard communication interface via RS-485 electric for IEC 60870-5-103 or remote configuration as well as binary inputs and outputs (X2)

Grounding with grounding strap
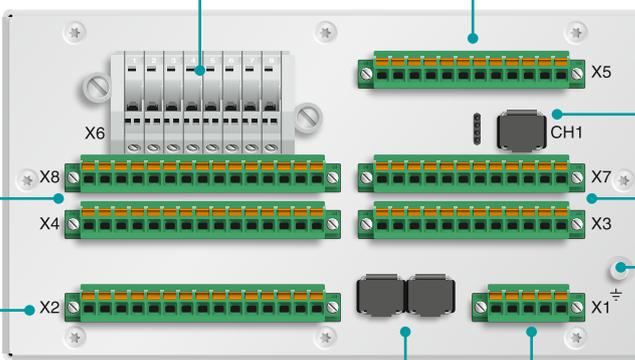
Extendable communication interface, e.g., Ethernet switch with two SFP modules (optional)
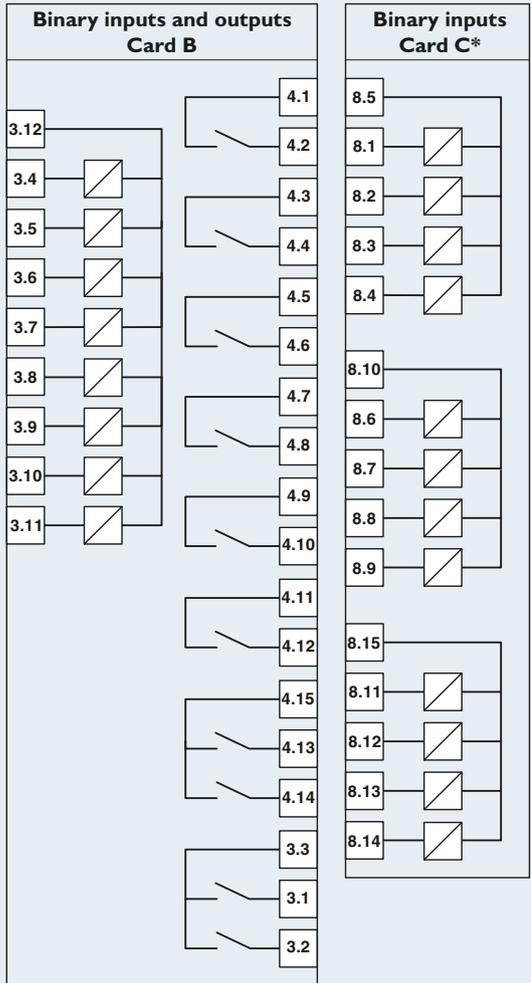
Auxiliary current supply and watchdog (X1)

Structural descriptions of KOMBISAVE+

Example technical connection diagram

KOMBISAVE+ RL: 1247779/X2/I4U5X/W2/B2C1/RS/SO/MM80

Our sales department will gladly help you with device-specific connection diagrams.

Power supply (X2)

44 ... 250 V DC / 50 ... 275 V AC 50/60 Hz

Voltage transformer inputs (I4U5X)

4x current inputs: 1 A/5 A
(can be selected using software)
5x voltage inputs: 100/110/400 V AC
(can be switched via software)

Optional protection interface INTERSAVE (W2)

Use of SFP modules
Optical Ethernet (LC male connector,
1,550 nm single mode)
up to a maximum distance of 80 km

Current transformers and voltage transformers

6.1	I1
6.2	
6.3	I2
6.4	
6.5	I3
6.6	
6.7	I0
6.8	
5.1	U1
5.2	
5.3	U2
5.4	
5.5	U3
5.6	
5.7	
5.8	U0
5.9	
5.10	
5.11	U4
5.12	

Power supply

1.5	
1.4	
E	

Standard binary' inputs and outputs

2.3	1.1
2.1	1.2
2.2	1.3
	2.4
	2.5
	2.6
	2.7
	2.10
	2.8
	2.9
	2.13
	2.11
	2.12

Standard communication interface

| 2.14 | RS-485 |
| 2.15 | IEC 60870 -5-103 / |

Protection interface INTERSAVE

Optical LC Ethernet/line differential protection and control

RX
TX

Extendable communication interfaces

Ethernet switch optical LC IEC 61850/parameterization

RX
TX
RX
TX

**Binary inputs and outputs
Card B**

**Binary inputs
Card C***

Binary inputs/outputs (B2C1)

22 binary inputs
20…250 V DC / 80…250 V DC
(2 binary inputs are also AC-capable;
switching threshold can be switched using
software)
Automatic contact cleaning
(contact fritting)
Max. 220 nF line capacity

17 binary outputs
Nominal voltage
440 V AC or max. 240 V DC
Permissible switching current
10 A @ 250 V AC (ohmic load), 2,500 VA
10 A @ 30 V DC (ohmic load), 300 W
Response time:
Standard max. 8 ms,
Fast max. 4 ms

Standard communication interface (RS)

Serial electrical for IEC 60870-5-103
(RS-485)

Extendable communication interface (SO)

Optical Ethernet switch, e.g., for IEC 61850
(2x LC male connector, 1,300 nm)

Technical data of KOMBISAVE+

Properties	ANSI	Descriptions	IEC 61850	Device variants			
				RN	RF	RQ	RL*
Protective functions							
General	27/59	Three-phase undervoltage and surge protection	PTOV, PTUV		●		●
	32N	Wattmetrically directed ground-fault protection based on zero system variables	PSDE		●		●
	47	Voltage asymmetry protection	PTOV		●		●
	49 I & II	Three-phase thermal overload protection with one or two thermal images (two-stage, e.g., for motors, cables, dry-type and oil transformers)	PTTR	●	●	●	●
	50HS	Three-phase undirected high current protection	PTOC	●	●	●	●
	50N/51N	Undirected ground-fault protection (two-phase, IEC DT, IEC VI, IEC EI, IEC LTI)	PTOC	●	●	●	●
	50P/51P	Three-phase undirected overcurrent protection and high current protection (two-stage, IEC DT, IEC NI, IEC VI, IEC EI)	PTOC	●	●	●	●
	59N	Residual voltage protection	PTOV		●		●
	67	Three-phase directed overcurrent protection and high current protection	PTOC		●		●
	67N	Directed ground-fault protection	PTOC		●		●
	67NIEF	Directed ground-fault protection for transient and intermittent grounding faults	PTEF		●		●
	67NIEF	Directed ground fault protection based on zero-system energy	PTEF		●		●
	67NIEF	Directed wiper relay	PTEF		●		●
	68	Three-phase inrush stabilization	PHAR	●	●	●	●
	81O, 81U	Frequency protection	PTOF, PTUF		●		●
Motor protection	14	Rotor blocking protection for motors	PZSU	●	●		●
	37	Undervoltage protection	PTUC	●	●		●
	46	Unbalanced load protection	PTOC	●	●		●
	48	Start-up time limitation for motors	PMSS	●	●		●
	50M	Load jump protection	PTOC	●	●		●
Distance protection	21FL	Fault locator (only with software option FO)	RFLO		(●)		(●)
	21N, 21P	Current excitation, under-impedance excitation with load suppression, U/I excitation (only with software option ZP)	PTOC, PSCH		(●)		(●)
		Polygonal six-system distance protection for phase-phase and phase-ground (only with software option ZP)	PDIS		(●)		(●)
Smart Grid	81LSH	Multi-stage load shedding at underfrequency with active power direction (automatic frequency relief) UFLA (only with software option FE or QF)	PFRQ		(●)		(●)
	QU	Q-U protection (reactive power undervoltage protection) (only with software option QU or QF)	-		(●)		(●)

Properties	ANSI	Descriptions	IEC 61850	Device variants			
				RN	RF	RQ	RL*
Protective functions							
Transformer differential protection	24	Excitation protection	PVPH			●	
	87T	Differential protection for two-winding transformers	PDIFF			●	
Line differential protection	24	Excitation protection (only with software option LT)	PVPH				(●)
	87L/87LT	Differential protection for lines with/without transformers in the protective area (only with software options LD or LT)	PDIFF				(●)
Tolerances							
	-	Typical excitation times (15 ... 25 ms (sub cycle I>>> : 10 ms))	-	●	●	●	●
	-	Excitation tolerance (<2.5%)	-	●	●	●	●
	-	Relative time tolerance (<1%)	-	●	●	●	●
	-	Time tolerance of directed functions (Excitation: ~25 ms, trigger: ~32 ms)	-	●	●	●	●
	-	Fault location tolerance (<1% @ cable length, @ U/Usc >5% and 30°<j<90°)	-	●	●	●	●
	-	Time tolerance for distance protection (excitation ~27 ms, trigger ~37 ms)	-	●	●	●	●
	-	Time tolerance for distance protection (Excitation: ~15 ms, trigger ~20 ms)	-	●	●	●	●
	-	Frequency protection time tolerance (Excitation: ~80 … 120 ms)	-	●	●	●	●
Protective functions							
	16	Protection interface to transmit 16 binary information and current values	LCCH				●
	25	Synchrocheck (only with software option SY)	RSYN		(●)		(●)
	47	Rotary field direction monitoring	MMXU		●		●
	50BF	Circuit breaker failure protection	RBRF	●	●	●	●
	50SOTF	Three-phase short circuit switch-on protection	PIOC	●	●	●	●
	60	Automatic voltage transformer case	RFUF		●		●
	86	Restart inhibit	PSCH	●	●	●	●
	74TC	Circuit trip monitoring (only with software option AU)	SCBR	(●)	(●)	(●)	(●)
	79	Automatic restart (AWE) 1/3-pos.	RREC	●	●		●
	85	Signal comparison	PSCH	●	●	●	●
	85	Busbar protection with H2 logic	PSCH	●	●	●	●
	LAL	Carrying circuit	PSCH	●	●	●	●
	MCS31	Circuit monitoring (transformer monitoring)	MMXU	●	●		●
	VTFF	Voltage circuit monitoring	-		●		●
	-	Ground fault error – pulse localization	PSDE	●	●		●
	-	Monitoring the supply voltage	NZBAT	●	●	●	●

* Limited range of functions without a voltage transformer.
Please configure for precise information.

Technical data of KOMBISAVE+

Properties	ANSI	Descriptions	IEC 61850	Device variants			
				RN	RF	RQ	RL
Measurement							
Analog inputs	-	Current transformers: Nominal current 1/5 a, 50 Hz, measuring range: 0.01…64xIn, <0.2 VA Automatically short-circuiting plug contacts	-	4	4	8	4
	-	Voltage transformer: Nominal voltage 100/110/400(230) V, 50 Hz, measuring range 0.05 … 440 V AC; <0.2 VA	-	-	4 / 5	-	0 / 5
Current	3I	Three-phase current indicator (I_{L1}, I_{L2}, I_{L3})	MMXU	●	●	●	●
	I0	Ground current	MMXU	●	●	●	●
	Idiff, Istab	Differential and stabilizing currents	MMXU			●	●
	Ith	Thermal level	-	●	●	●	●
Voltage	3ULE	Three-phase voltage indicator LE (U_{L1E}, U_{L2E}, U_{L3E})	MMXU		●		●
	3ULL	Three-phase voltage indicator LL (U_{L1UL2}, U_{L2UL3}, U_{L3UL1})	MMXU		●		●
	U0	Residual voltage	MMXU		●		●
	Udiff, fdiff	Differential values between two systems with Synchrocheck: ΔU Δf Δα (only with software option SY)	MMXU		(●)		(●)
Frequency	f	Frequency	MMXU		●		●
Power	cosφ	Power factor	MMXU		●		●
	P, Q, S	Real power, reactive power, apparent power	MMXU		●		●
Other	3I /15 min	Slave pointer, three-phase, 15 min	MMXU	●	●	●	●
	F	Load profile	MSAT	●	●	●	●
	km/miles	Fault location (only with software option FO)	MMXU		(●)		(●)
	R/X	Impedances RLL, RLE, XLL, XLE (only with software option ZP)	MMXU		(●)		(●)
Controller							
	I↔O CB	Circuit breaker controller with graphical position indicator	XCBR, CSWI	●	●	●	●
	I↔O DCC	Control of disconnect and ground-fault switch with graphical position indicator (only with software option AU)	XSWI, CSWI	(●)	(●)	(●)	(●)
	I↔O CBT	Trolley control with graphical position indicator (only with software option AU)	XSWI, CSWI	(●)	(●)	(●)	(●)
	I↔O	Controller with locking logic (only with software option AU)	CILO	(●)	(●)	(●)	(●)
	CBAY	Field control (only with software option AU)	CBAY	(●)	(●)	(●)	(●)
	R/L	Local and remote switching	LOC	●	●	●	●
	KEY	Key switch	CILO	●	●	●	●

Properties	ANSI	Descriptions	IEC 61850	Device variants			
				RN	RF	RQ	RL
Message and status indicator on the front panel							
	-	Standard measured value tables and freely configurable LEDs	-	●	●	●	●
	-	Virtual LEDs and dynamically displayed texts (only with software option AU)	-	(●)	(●)	(●)	(●)
	-	User-specific measured value and status tables (only with software option AU)	-	(●)	(●)	(●)	(●)
	-	High-resolution RGB-TFT display with automatic energy saving function and alarm table in the event of a grid fault	-	●	●	●	●
	-	4 user-specific configurable function keys with white LED	-	●	●	●	●
	-	Key switch for unlocked controller	-	●	●	●	●
	-	Button for onsite/remote switching	-	●	●	●	●
	-	Direct control buttons	-	●	●	●	●
	-	15 tri-colored LEDs	-	●	●	●	●
	-	1 green "RUN" and 1 red "ERROR" LED pre-assigned, unalterable	-	●	●	●	●
	-	USB interface for communication to the PC or direct USB stick access	-	●	●	●	●
Programmable logic							
	RS	RS flip flops (only with software option AU)	GAPC	(●)	(●)	(●)	(●)
	TOF/TON	On and off time delay (only with software option AU)	GAPC	(●)	(●)	(●)	(●)
	UDCNT	Forward/reverse counters (only with software option AU)	FCNT	(●)	(●)	(●)	(●)
	-	Single-point information	GGIO	●	●	●	●
	-	Double-point information	GGIO	●	●	●	●
	-	AND, OR, NOT, XOR, CONSTANT (only with software option AU)	–	(●)	(●)	(●)	(●)
Communication options							
Standard communication	-	1x serial electrical for IEC 60870-5-103 or remote parameterization (RS-485)	-	●	●	●	●
	-	XML parameterization via USB		●	●	●	●
Communication options	-	1x optical Ethernet, e.g., for IEC 60870-5-103 (ST male connector, 820 nm) (only with hardware option RO)	-	(●)	(●)	(●)	(●)
	-	1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector) (only with hardware option EE)	-	(●)	(●)	(●)	(●)
	-	1x optical Ethernet, e.g., for IEC 61850 (SC male connector, 1,300 nm) (only with hardware option EO)	-	(●)	(●)	(●)	(●)
	-	1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector) (only with hardware option SE)	-	(●)	(●)	(●)	(●)
	-	1x optical Ethernet switch, e.g., for IEC 61850 (2x LC male connector, 1,300 nm) (only with hardware option SO)	-	(●)	(●)	(●)	(●)
	-	IEC 61850 (only with hardware option EE, EO, SE, or SO and software option 50): - Specification IEC 61850-6, 7-1, 7-2, 7-3, 7-4, 8-1 - Protocol IEC 61850-8-1 block 1, 2, 2+, 4, 4+, 5, 6, 9ab, 12abcd, 13, 14 - Receiver for 32 fast binary signals/locking mechanisms/individual notifications - Transmitter of 32 fast binary signals/locking mechanisms/individual notifications - Transmitter of 100 measured values/status signals - IEC 61850 MMS and GOOSE	–	(●)	(●)	(●)	(●)
Formats							
Event and malfunction data	DFR	Malfunction data recording (COMTRADE standard)	RDRE	●	●	●	●
	SER	Event lists	RSER	●	●	●	●

Technical data of KOMBISAVE+

Properties	ANSI	Descriptions	IEC 61850	Device variants			
				RN	**RF**	**RQ**	**RL**
Other hardware							
	-	Size 19"/2, 3HE	-	●	●	●	●
	-	Microprocessor arm 1x or 2x (for IEC 61850)	-	●	●	●	●
	-	Energy storage for malfunction data and events: POWERCAP <7T	-	●	●	●	●
	-	CPU printed circuit board binary inputs 20…60 / 80…250 V AC/DC with integrated "contact cleaning system", max. 220 nF line capacity	-	2	2	2	2
	-	Binary inputs 20…60 / 80…250 V DC with integrated "contact cleaning system", max. 220 nF line capacity	-	12 / 20 / 28	12 / 20 / 28	12 / 20 / 28	12 / 20 / 28
	-	Binary outputs 10 A@250 VAC (2,500 VA), standard max. 8 ms, high speed max. 4 ms (varies depending on design)	-	9 / 10 / 16	9 / 10 / 16	9 / 10 / 16	9 / 10 / 16
		Analog inputs (Pt 100)		4	4	4	4
Auxiliary voltage	-	22 … 28 V DC, P < 10 W, buffer time >50 ms (with hardware option X1)	-	(●)	(●)	(●)	(●)
	-	44 … 250 V DC, 50 … 275 V AC, P < 10 W, buffer time >50 ms (with hardware option X2)	-	(●)	(●)	(●)	(●)

Properties	Standards	Tests
Electrical tests		
Standards	IEC 60255-1 IEEE Std C37.9.0/.1/.2 UL 508 VDE 0435	
Dielectric test	Type check	5 kV, 1.2/50 ms, 0.5 J
	Series check	2.5 kV, 50 Hz, 1 min.
Electromagnetic compatibility	IEC 60255-26	Replacement for IEC 60255-22-1, -2, -3, -4
	EN 61000-6-2	
	VDE 0345 Part 301 and 110	
Noise emission of housing	IEC CISPR 11	30 MHz … 1,000 MHz
Auxiliary power supply malfunction message	IEC CISPR 22	150 kHz … 30 MHz
Irradiation with HF field frequency run	IEC 61000-4-3	10 V/m, 80 MHz … 1,000 MHz and 1,400 MHz … 2,700 MHz, run 80% AM, 1 kHz
Irradiation with HF field individual frequencies	IEC 61000-4-3	10 V/m, 80, 160, 380, 450, 900, 1,850, 2,150 MHz, 80% AM, 1 kHz, duration 10 s
Electrostatic discharge	IEC 61000-4-2	6 kV contact, 15 kV air
Rapid transient disturbance variables/bursts	IEC 61000-4-4	Communication: 2 kV 5/50 ns, 5 kHz, both polarities Other connections: 4 kV, 5/50 ns, 5 kHz, both polarities
Energy-rich surge voltages	IEC 61000-4-5	Pulse: 1.2/50 ms Auxiliary voltage: Conductor to ground: 4 kV, 10 Ω, 9 µF Conductor to conductor: 2 kV, 0 Ω, 18 µF Communication: Conductor to ground: 4 kV, 0 Ω, 0 µF Other connections: Conductor to ground: 4 kV, 40 Ω, 0.5 µF Conductor to conductor: 2 kV, 40 Ω, 0.5 µF

Properties	Standards	Tests
Electrical tests		
Conducted HF, AM	IEC 61000-4-6	Communication: 10 V; 150 kHz…80 MHz; 80% AM, 1 kHz Other connections: 20 V; 150 kHz…80 MHz; 80% AM, 1 kHz
Operating frequency magnetic field	IEC 61000-4-8	30 A/m continuous; 300 A/m for 1 s …3 s
Slowly damped oscillating waves	IEC 61000-4-18	Communication: CM: 1 kV at 1 MHz, 200 Ω Other connections: DM: 1 kV; CM: 2.5 kV at 1 kHz and 1 MHz, 200 Ω
Operating frequency	IEC 61000-4-16	Binary inputs: Zone A; DM: 150 V, 100 Ohm, 0.1 mF; CM: 300 V, 220 Ω, 0,47 µF
Voltage fluctuations and flicker	IEC 61000-4-11 IEC 61000-4-29	In the entire indicated auxiliary voltage range
Immunity for the functional ground connection	IEC 61000-4-6	150 kHz … 80 MHz 10 V, 150 Ω, 80% AM
	IEC 61000-4-4	Burst: 4 kV, zone A
Shocks and vibrations		
Standards	IEC 60255-21	
Sinusoidal oscillation	IEC 60255-21-1	5Hz...8Hz, amplitude ±7.5mm
	IEC 60068-2-6	8 … 150 Hz; 20 m/s^2 acceleration, frequency hub 1 octave/min, 20 periods in 3 axes orthogonal to each other
Shock	IEC 60255-21-2	Half-wave, acceleration 150 m/s^2, 11 ms duration of each vibration in both directions on all axes
	IEC 60068-2-27	
Sinusoidal vibrations during earthquakes	IEC 60255-21-3	Horizontal: 1 ... 8 Hz, ±3.5 mm amplitude
	IEC 60068-3-3	Vertical: 1 Hz ... 8 Hz, ±1.5 mm Amplitude horizontal @ 1g: 8 ... 35 Hz Vertical @ 5 m/s^2: 8 ... 35 Hz Frequency hub 1 octave/min, 1 period on all axes
Half-wave sinusoidal vibrations during earthquakes	IEC 60255-21-3	Acceleration 100 m/s^2, 16 ms duration every 1,000. Vibration in all directions
	IEC 60068-3-3	
Vibration and duration of shaking during transport	IEC 60255 21 1	Half-wave, acceleration 150 m/s^2, 11 ms duration of each vibration in both directions on all axes
	IEC 60068-2-6	
Climatic ambient conditions		
Standard	IEC 60255-1	Operating temperature: -10°C ... +55°C Storage temperature: -25°C ... +55°C Transport temperature: -25°C ... +70°C
	IEC 60068-2-17	Test conditions over 16 hours: -25°C ... +85°C Temporarily permissible for 96 hours with possibly impaired display during operation from +55°C: -20°C ... +70°C
	Humidity	Annual average < 75%, condensation/ice formation not permissible Monthly average < 95% at max. +40°C, condensation/ice formation not permissible
	Installation altitude	<3,000 m above sea level

KOMBISAVE+ order key

Configure your protective relay directly in the online configurator

Configure and order your protective relay online at any time. To do so, simply enter the web code into the search field on our website.

Alternatively, you can put your individual order key together on the following pages.

| i | **Web code:** #2274

1. Defining the hardware

The KOMBISAVE+ device family is divided into four customizable basic designs (see overview on Page 9). The variants thus contain different hardware adaptations and device-specific equipment options. Depending on the basic version, you can determine your individual protective and control device by using a predefined selection of hardware options. The options listed on the right are used here as an overview.

1 Auxiliary power supply

2 Measuring transducer inputs

3 Binary inputs and outputs

4 Communication options

5 Protection interface (is not present in the version shown, but only in KOMBISAVE+ RL)
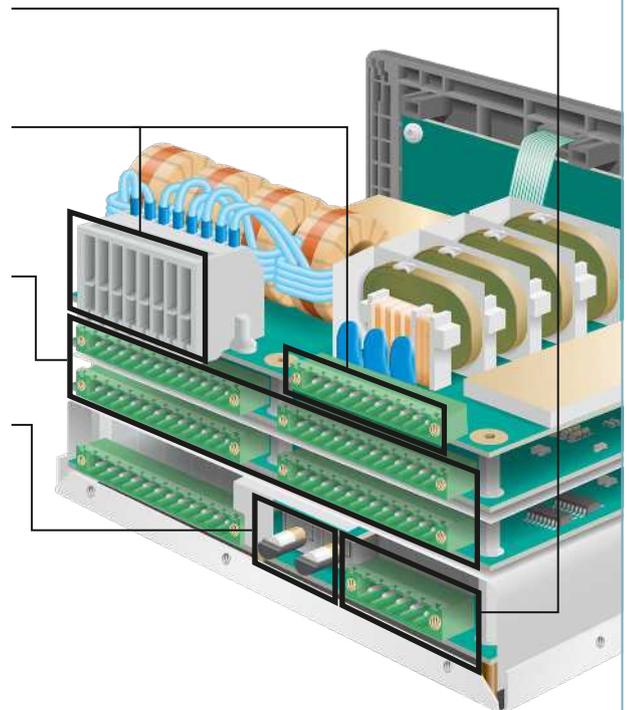
2. Defining the device-specific software (see pages 31, 33, 35, 37)

The devices are supplied with a predefined range of functions as standard. Depending on the hardware specification, you can select additional software functions. The device-specific software functions A–G can be selected on pages 31, 33, 35, and 37.

A Additional communication protocol
B Synchrocheck
C Smart Grid protection
D Fault localization
E Distance protection
F Differential protection
G System automation/field control
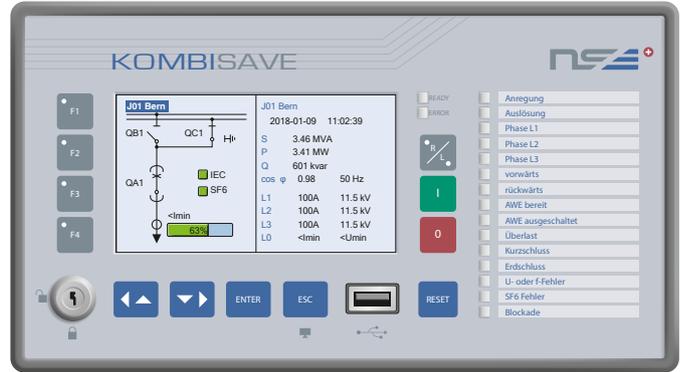
Moreover, the devices are supplied with the DIGICOM BASIC operating software. The software is used to parameterize and configure the devices. This includes the option to extend the software with functionalities, such as fault analysis. The software can also be used by multiple users if a multi-use license is purchased. You can find more information on appropriate operating and fault analysis software starting on page 64.

Easily create your order key yourself

See the table on the next few pages to create your order key.

You will find the order key on the second line of every table. You have the option to customize your product by using predefined options.
An order key consists of hardware and software options.

A complete order key in KOMBISAVE+ RN looks like the following:

1247154/X1/IU40/B2C1/RS/SE/50/00/00/00/00/00/00/00/AU

1247154/X **/IU40/B** **C** **/RS/** **/** **/00/00/00/00/00/00/00/**

G System automation/field control
A Additional communication protocol
4 Communication options
3 Binary inputs and outputs
1 Auxiliary power supply
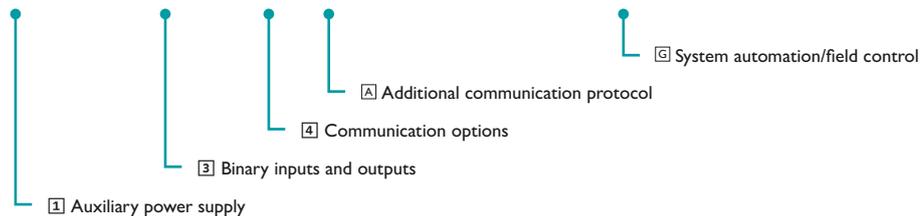
Defining the KOMBISAVE+ RN order key

Defining the hardware							
	CPU printed circuit board		**Auxiliary power supply** [1]		**Measuring transducer inputs**		**Binary inputs and outputs**** [3]
Order key >	1247154	/	Please select	/	I4U0	/	Please select	/
	2x binary inputs AC/DC* 6x binary outputs (2,500 VA/3 ms) 1x watchdog (2,500 VA/3 ms)		**X1** 24 V DC		4x current inputs (1 A/5 A*)		**B2C1** 20x binary DC inputs* 10x binary outputs (2,500 VA/6 ms)
			X2 48 V / 60 V / 110 V / 220 V DC / 230 V AC				**B2C2** 28x binary DC inputs* 10x binary outputs (2500 VA/6 ms)
							B2C3 20x binary DC inputs* 10x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)
							B3C1 12x binary DC inputs* 9x binary outputs (2500 VA/6 ms)
							B3C2 20x binary DC inputs* 9x binary outputs (2500 VA/6 ms)
							B3C3 12x binary DC inputs* 9x binary outputs (2,500 VA / 6 ms) 4x analog inputs (Pt 100)
							B4C1 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms)
							B4C2 20x binary DC inputs* 16x binary outputs (2500 VA/6 ms)
							B4C3 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)

* Switchable switching threshold
** Additional inputs and outputs on the CPU printed circuit board

Defining the device-specific software

Standard communication	Communication options [4]	Additional communication protocol [A]	Device-specific Software option [G]	System automation/field control [G]
RS /	Please select /	/	00/00/00/00/00/00/00 /	
1x serial electrical for IEC 60870-5-103 (RS-485)	**00** Without additional communication option	**00** None		**00** None
	RO 1x serial optical for IEC 60870-5-103 (ST male connector, 820 nm)	**50** IEC 61850		**AU** Options include
	EE 1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector)			
	EO 1x optical Ethernet e.g., for IEC 61850 (SC male connector, 1,300 nm)			
	SE 1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector)			
	SO 1x optical Ethernet switch, e.g., for IEC 61850 (2x LC male connector, 1,300 nm)			

1247154/X /IU40/B C /RS/ / /00/00/00/00/00/00/00/

- [1] Auxiliary power supply
- [3] Binary inputs and outputs
- [4] Communication options
- [A] Additional communication protocol
- [G] System automation/field control

Note

The DIGICOM BASIC operating software is delivered as standard with your product. There is also the option to purchase an extended version (see page 67).
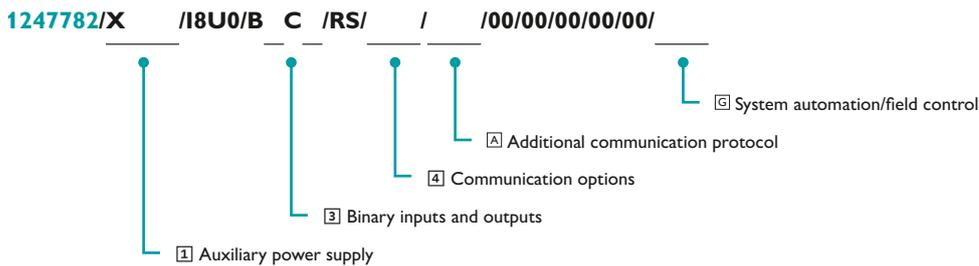
Defining the KOMBISAVE+ RF order key

Defining the hardware					
	[1]	[2]	[3]		[4]
CPU printed circuit board	**Auxiliary power supply**	**Measuring transducer inputs**	**Binary inputs and outputs***	**Standard communication**	**Communication options**
Order key > **1247778** /	**Please select** /	**Please select** /	**Please select** /	**RS** /	**Please select** /
2x binary inputs AC/DC* 6x binary outputs (2500 VA/3 ms) 1x watchdog (2,500 VA / 3 ms)	**X1** 24 V DC	**I4U4X** 4x current inputs (1 A/5 A*) 4x voltage inputs: (100 V/110 V/400 V*)	**B2C1** 20x binary inputs DC* 10x binary outputs (2500 VA/6 ms)	1x serial electrical for IEC 60870-5-103 (RS-485)	**00** Without additional communication option
	X2 48 V/60 V/ 110 V/ 220 V DC / 230 V AC	**I4U5X** 4x current inputs (1 A/5 A*) 5x voltage inputs: (100 V/110 V/400 V*)	**B2C2** 28x binary inputs DC* 10x binary outputs (2500 VA/6 ms)		**RO** 1x serial optical for IEC 60870-5-103 (ST male connector, 820 nm)
			B2C3 20x binary inputs DC* 10x binary outputs (2,500 VA/6 ms) 4x analog inputs (Pt 100)		**EE** 1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector)
			B3C1 12x binary inputs DC* 9x binary outputs (2500 VA/6 ms)		**EO** 1x optical Ethernet, e.g., for IEC 61850 (SC male connector, 1,300 nm)
			B3C2 20x binary inputs DC* 9x binary outputs (2500 VA/6 ms)		**SE** 1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector)
			B3C3 12x binary inputs DC* 9x binary outputs (2,500 VA / 6 ms) 4x analog inputs (Pt 100)		**SO** 1x optical Ethernet switch, e.g., for IEC 61850 (2x LC male connector, 1300 nm)
			B4C1 12x binary inputs DC* 16x binary outputs (2500 VA/6 ms)		
			B4C2 20x binary inputs DC* 16x binary outputs (2500 VA/6 ms)		
			B4C3 12x binary inputs DC* 16x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)		

* Switchable switching threshold
** Additional inputs and outputs on the CPU printed circuit board

Defining the device-specific software

[A] Additional communication protocol	[B] Synchroncheck	[C] Smart Grid protection	[D] Fault localization	[E] Distance protection	Device-specific software options	[G] System automation/field control
Please select /	Please select /	Please select /	Please select /	Please select /	00/00/00 /	Please select
00 None	**00** None	**00** None	**00** None	**00** None		**00** None
50 IEC 61850	**SY** Options include	**QU** Q-U contactor	**FO** Options include	**ZP** Options include		**AU** Options include
		FE Automatic frequency relief AFE/UFLA				
		QF Q-U contactor and automatic frequency relief AFE/UFLA				

1247778/X / /B C /RS/ / / / / / /

[G] System automation/field control

[E] Distance protection

[D] Fault localization

[C] Smart Grid protection

[B] Synchroncheck

[A] Additional communication protocol

[4] Communication options

[3] Binary inputs and outputs

[2] Measuring transducer inputs

[1] Auxiliary power supply

Note

The DIGICOM BASIC operating software is delivered as standard with your product. There is also the option to purchase an extended version (see page 67).

Determining the KOMBISAVE+ RQ order key

Defining the hardware			
CPU printed circuit board	[1] **Auxiliary power supply**	**Measuring transducer inputs**	[3] **Binary inputs and outputs****
1247782 /	**Please select** /	**I8U0** /	**Please select** /
2x binary inputs AC/DC* 6x binary outputs (2,500 VA/3 ms) 1x watchdog (2500 VA / 3 ms)	**X1** 24 V DC	8x current inputs (1 A/5 A*)	**B2C1** 20x binary DC inputs* 10x binary outputs (2500 VA/6 ms)
	X2 48 V / 60 V / 110 V / 220 V DC / 230 V AC		**B2C2** 28x binary DC inputs* 10x binary outputs (2500 VA/6 ms)
			B2C3 20x binary DC inputs* 10x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)
			B3C1 12x binary DC inputs* 9x binary outputs (2500 VA/6 ms)
			B3C2 20x binary DC inputs* 9x binary outputs (2500 VA/6 ms)
			B3C3 12x binary DC inputs* 9x binary outputs (2500 VA / 6 ms) 4x analog inputs (Pt 100)
			B4C1 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms)
			B4C2 20x binary DC inputs* 16x binary outputs (2500 VA/6 ms)
			B4C3 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)

* Switchable switching threshold
** Additional inputs and outputs on the CPU printed circuit board

Determining the KOMBISAVE+ RQ order key

Defining the hardware			
CPU printed circuit board	[1] **Auxiliary power supply**	**Measuring transducer inputs**	[3] **Binary inputs and outputs****
Order key > **1247782** /	**Please select** /	**I8U0** /	**Please select** /
2x binary inputs AC/DC* 6x binary outputs (2,500 VA/3 ms) 1x watchdog (2500 VA / 3 ms)	**X1** 24 V DC	8x current inputs (1 A/5 A*)	**B2C1** 20x binary DC inputs* 10x binary outputs (2500 VA/6 ms)
	X2 48 V / 60 V / 110 V / 220 V DC / 230 V AC		**B2C2** 28x binary DC inputs* 10x binary outputs (2500 VA/6 ms)
			B2C3 20x binary DC inputs* 10x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)
			B3C1 12x binary DC inputs* 9x binary outputs (2500 VA/6 ms)
			B3C2 20x binary DC inputs* 9x binary outputs (2500 VA/6 ms)
			B3C3 12x binary DC inputs* 9x binary outputs (2500 VA / 6 ms) 4x analog inputs (Pt 100)
			B4C1 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms)
			B4C2 20x binary DC inputs* 16x binary outputs (2500 VA/6 ms)
			B4C3 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)

* Switchable switching threshold
** Additional inputs and outputs on the CPU printed circuit board

Defining the device-specific software

Standard communication	Communication options [4]	Additional communication protocol [A]	Device-specific software options [G]	System automation/field control [G]
RS /	**Please select** /	**Please select** /	**00/00/00/00/00** /	**Please select**
1x serial electrical for IEC 60870-5-103 (RS-485)	**00** Without additional communication option	**00** None		**00** None
	RO 1x serial optical for IEC 60870-5-103 (ST male connector, 820 nm)	**50** IEC 61850		**AU** Options include
	EE 1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector)			
	EO 1x optical Ethernet, e.g., for IEC 61850 (SC male connector, 1,300 nm)			
	SE 1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector)			
	SO 1x optical Ethernet switch, e.g., for IEC 61850 (2x LC male connector, 1,300 nm)			

1247782/X   /I8U0/B C /RS/   /   /00/00/00/00/00/

- [G] System automation/field control
- [A] Additional communication protocol
- [4] Communication options
- [3] Binary inputs and outputs
- [1] Auxiliary power supply

Note

The DIGICOM BASIC operating software is delivered as standard with your product. There is also the option to purchase an extended version (see page 67).

Determining the KOMBISAVE+ RL order key

Defining the hardware							
CPU printed circuit board	[1] Auxiliary power supply	[2] Measuring transducer inputs	Standard communication	[3] Binary inputs and outputs**	Standard communication	[4] Communication options	
Order key > 1247779 /	Please select /	Please select /	W2 /	Please select /	RS /	Please select /	
2x binary inputs AC/DC* 6x binary outputs (2500 VA/3 ms) 1x watchdog (2500 VA/3 ms)	**X1** 24 V DC	**I4U0** 4x current inputs (1 A/5 A*)	1x Pro-tection inter-face INTER-SAVE	**B2C1** 20x binary DC inputs* 10x binary outputs (2500 VA/6 ms)	1x serial electrical for IEC 60870-5-103 (RS-485)	**00** None	
	X2 48 V/60 V/110 V/220 V DC/230 V AC	**I4U5X** 8x current inputs (1 A/5 A*) 8x voltage inputs: (100 V/110 V/400 V*)		**B2C2** 28x binary DC inputs* 10x binary outputs (2500 VA/6 ms)		**RO** 1x serial optical for IEC 60870-5-103 (ST male connector, 820 nm)	
				B2C3 20x binary DC inputs* 10x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)		**EE** 1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector)	
				B3C1 12x binary DC inputs* 9x binary outputs (2500 VA/6 ms)		**EO** 1x optical Ethernet, e.g., for IEC 61850 (SC male connector, 1300 nm)	
				B3C2 20x binary DC inputs* 9x binary outputs (2500 VA/6 ms)		**SE** 1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector)	
				B3C3 12x binary DC inputs* 9x binary outputs (2500 VA / 6 ms) 4x analog inputs (Pt 100)		**SO** 1x optical Ether-net switch, e.g., for IEC 61850 (2x LC male connector, 1,300 nm)	
				B4C1 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms)			
				B4C2 20x binary DC inputs* 16x binary outputs (2500 VA/6 ms)			
				B4C3 12x binary DC inputs* 16x binary outputs (2500 VA/6 ms) 4x analog inputs (Pt 100)			

* Switchable switching threshold
** Additional inputs and outputs on the CPU printed circuit board

Defining the device-specific software							Defining accessories	
A Additional communication protocol	**B** Synchroncheck	**C** Smart Grid protection	**D** Fault localization	**E** Distance protection	**F** Differential protection	**G** System automation/field control	**5** Optical communication module in Push-in technology (max. 2 modules can be selected; modules can be assembled individually)	
Please select /	Please select /	Please select /	Please select /	Please select /	Please select /	Please select /	Please select /	Please select
00 None	**00** None	**00** None	**00** None	**00** None	**00** None	**00** None	**00** Without communication modules	
50 IEC 61850	**SY** Options include	**QU** Q-U contactor	**FO** Options include	**ZP** Options include	**LD** Line differential protection	**AU** Options include	**SFP-MM2X** 1x multimode 1,310 nm LC-Dup 2 km (with doubled selection 2x multimode 1,310 nm LC-Dup 2 km)	
		FE Automatic frequency relief AFE/UFLA			**LT** Line differential protection with transformer in the protected area		**SFP-SM15** 1x singlemode 1310 nm LC-Dup 15 km (with doubled selection 2x singlemode 1310 nm LC-Dup 15 km)	
		QF Q-U contactor and automatic frequency relief AFE/UFLA					**SFP-SM40** 1x singlemode 1310 nm LC-Dup 40 km (with doubled selection 2x singlemode 1310 nm LC-Dup 40 km)	
							SFP-SM80 1x singlemode 1,550 nm LC-Dup 80 km (with doubled selection 2x singlemode 1,550 nm LC-Dup 80 km)	

1247779/X / /W2/B C /RS/ / / / / / / / / /

- **5** 2. Optical communication module
- **5** 1. Optical communication module
- **G** System automation/field control
- **F** Differential protection
- **E** Distance protection
- **D** Fault localization
- **C** Smart Grid protection
- **B** Synchroncheck
- **A** Additional communication protocol
- **4** Communication options
- **3** Binary inputs and outputs
- **2** Measuring transducer inputs
- **1** Auxiliary power supply

Note

The DIGICOM BASIC operating software is delivered as standard with your product. There is the option to purchase an extended version (see Page 67).

Transformer current-supplied mains protection with POWERSAVE

POWERSAVE is a compact and powerful protective and control device with a full range of protective, control, and measurement functions. Thanks to the optionally integrated power management system for the direct triggering of the circuit breaker by the protective device, this device solution operates independently of a stable external power supply. The combination of energy management and distance protection functions makes the device absolutely essential as blackout protection.

Device versions

With the two design variants and numerous options, the POWERSAVE product family is suitable for many applications.

Application examples

The extensive functions and the various applications are clearly brought into context.

Communication options

The protective relays can communicate via a wide variety of protocols and interfaces.
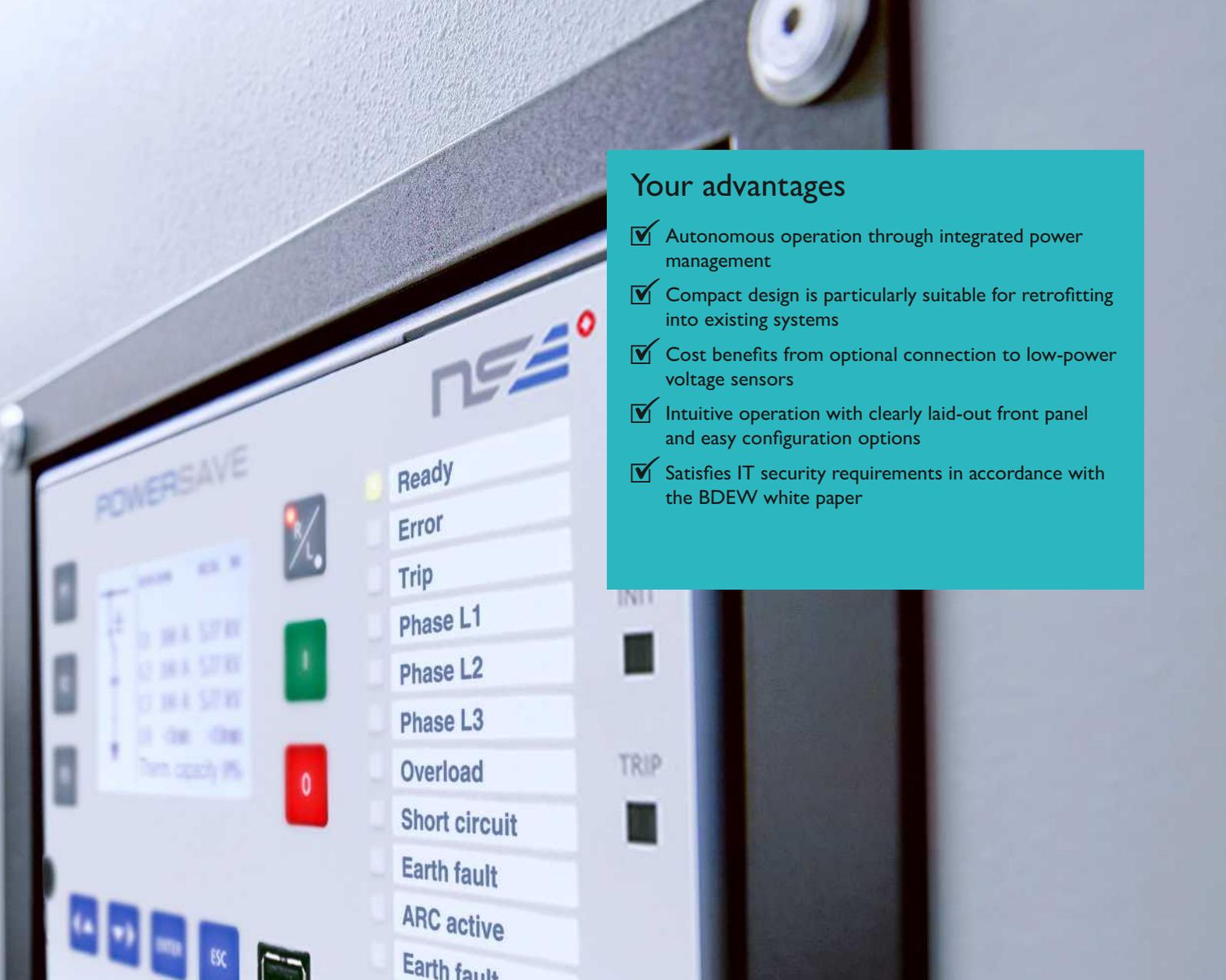
Your advantages

☑ Autonomous operation through integrated power management

☑ Compact design is particularly suitable for retrofitting into existing systems

☑ Cost benefits from optional connection to low-power voltage sensors

☑ Intuitive operation with clearly laid-out front panel and easy configuration options

☑ Satisfies IT security requirements in accordance with the BDEW white paper

Structural descriptions

The modular product family is available in various assembly options.

Technical data/order key

Define your product with all relevant order information or in our online configurator.

DIGICOM operating software

Learn more about the settings and evaluations of the protective relay with the DIGICOM operating software.

Device versions of POWERSAVE

1 POWERSAVE+ RN

Simple overcurrent and motor protection with field control and optional power management

Efficient protection of industrial and power generation systems

2 POWERSAVE+ RF

Feeder protection with distance protection, ground fault detection with field control, and optional power management

Compact field control device for complex applications in switching devices

Special features of the POWERSAVE device family
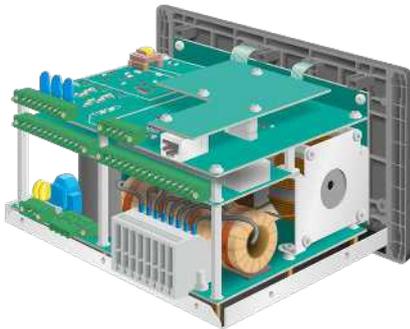
Maximum system availability thanks to blackout protection
Optional power management with an energy block and transformer power supply enables system operation independent of external power supply.
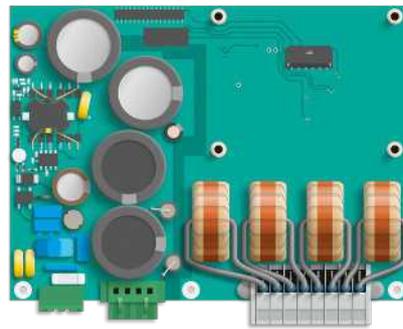
Optional energy blocky
With an energy storage device, connected circuit breakers can be switched more than two days after a power supply failure (at least two triggers). An additional energy storage device provides the auxiliary signals for the power supply. An integrated capacitor allows the system to be maintained for at least 30 seconds.
It can be combined with a transformer power supply.
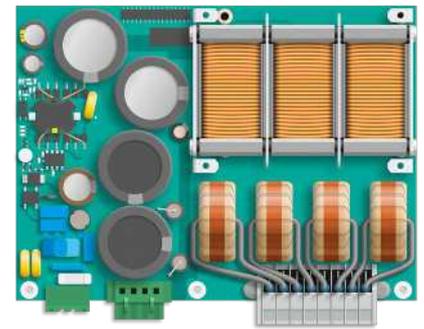
Optional transformer power supply
The optional transformer power supply also enables further system operation even when the primary power supply has failed.
In this case, the optional energy storage device is charged by the transformer power supply.

			⒈ **RN**	⒉ **RF**
Properties of the versions				
Protective functions		General	49I&II, 50N/51N, 50P/51P, 68	32N, 47, 49I&II, 50N/51N, 50P/51P, 59N, 67, 67N, 67NIEF, 68
		Motor protection	14, 37, 46, 50M	14, 37, 46, 48, 50M
		Distance protection (only with software option ZP)		21FL, 21N, 21P
		Smart Grid (only with software options QU, FE, or QF)		27/59, 81O/U, QU, UFLA
Protective functions			50SOTF, 50BF, 74TC, 79, 85, 86,	50BF, 50SOTF, 60, 74TC, 79, 85, 86, MCS31
Measurement		Number of current transformers	4	4
		Number of voltage transformers		4 or 5
		Measured values	3I, I0, 3I/15 min, Ith	3I, I0, 3I/15min, Ith, 3ULE, 3ULL, U0, PQS, f, cosφ, R/X, km/miles
Standard properties of POWERSAVE				
Integrated power management – Energy storage – Transformer power supply			24 V DC at 3 J and 300 V DC at 50 J with an availability of three autonomous circuit breaker trips during 48 hrs. without recharging via auxiliary power or transformer current Transformer power supply from 0.2xIn, system start <100 ms	
Controller			Standard: CB, XCBR, LOC, CILO (key switch) Extended (only with software option AU): DCC, CBT, CBAY, CILO (locking logic), directed control via HMI	
Message and status indicator / front panel			Standard: Predefined measured value tables, freely configurable LEDs Extended (only with software option AU): User-specific measured value and status tables	
Programmable logic (only with software option AU)			Integrated PLC	
Communication options			Standard: USB, IEC 60870-5-103 Extendable: IEC 61850	
Formats			XML, COMTRADE, XRIO, MMS, (Fast) GOOSE	

Application examples of POWERSAVE

Typical application with a POWERSAVE RF

The RF version is a multi-functional feeder protection device with ground fault detection and field control as well as optional power management. The device can be used in simple star or ring networks and in complex meshed networks with isolated, compensated, rigidly grounded, or low-resistance grounded star point. In addition to the standard current protection functions, the protective device is used with voltage and frequency functions and the optional distance protection (full scheme) for complete protection of feeders. The device covers all ground fault protective functions of the above-listed supply system configurations. As in all versions, additional monitoring and measuring functions are also implemented alongside the purely protective functions. In addition to the communication option implemented as standard via IEC 60870-5-103, IEC 61850 can also be used by selecting the appropriate software function.

The optional fault locator and the automatic frequency reduction round off the protection package. The device can also take over the entire field control. The optionally integrated programmable logic allows the functions to be adapted to specific requirements, such as additional special locking, automatic switching, etc.

Compact field control device for complex applications in switching devices
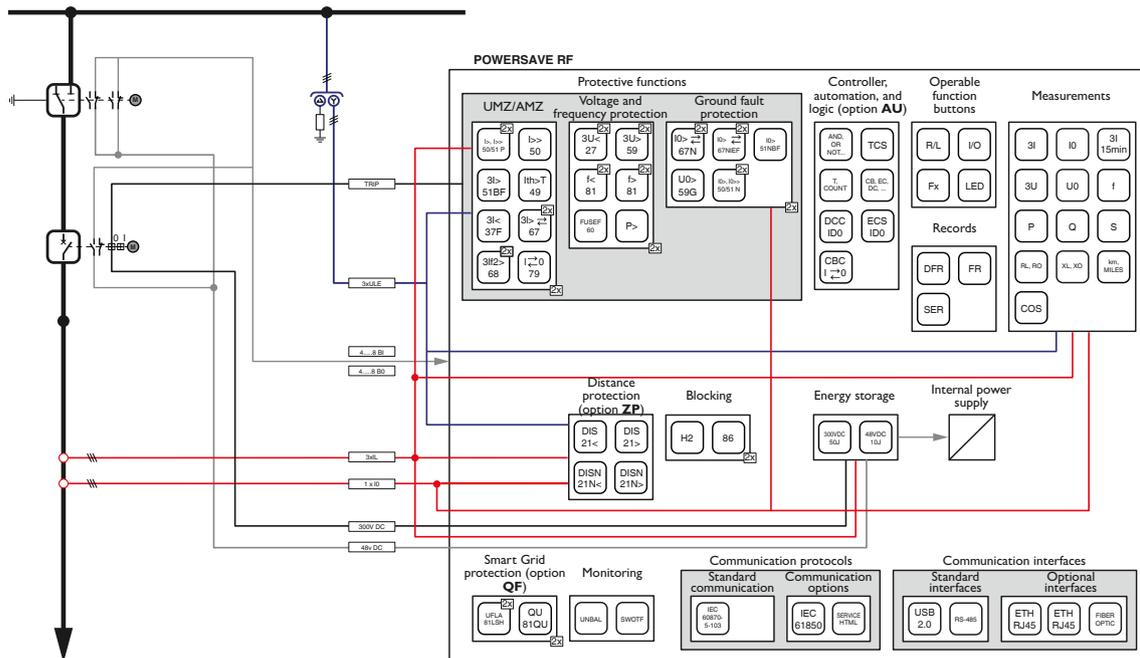
Smart Grid configuration with POWERSAVE RF

The application example shows how to use the device version for the feed-in management of distributed power generation plants. Protection at the feeders and at the grid connection point is covered by the POWERSAVE RF.

Our devices are certified according to VDE-AR-N 4110 and VDE-AR-N 4120 for typical applications in the field of regenerative power generation in the medium and high-voltage range. Here, the protective functions focus on the voltage and frequency functions as well as the Q-U protection.

Like with all variants in the device family, here there is also the option for the device to take over field control. The optionally integrated programmable logic allows the functional adaptation to the respective application. Direct communication to a control system or a higher-level automation system can be achieved by IEC 61870-5-103 or optionally by selecting the appropriate software function IEC 61850 Ed. 1/Ed. 2.

Protection for wind turbine generators
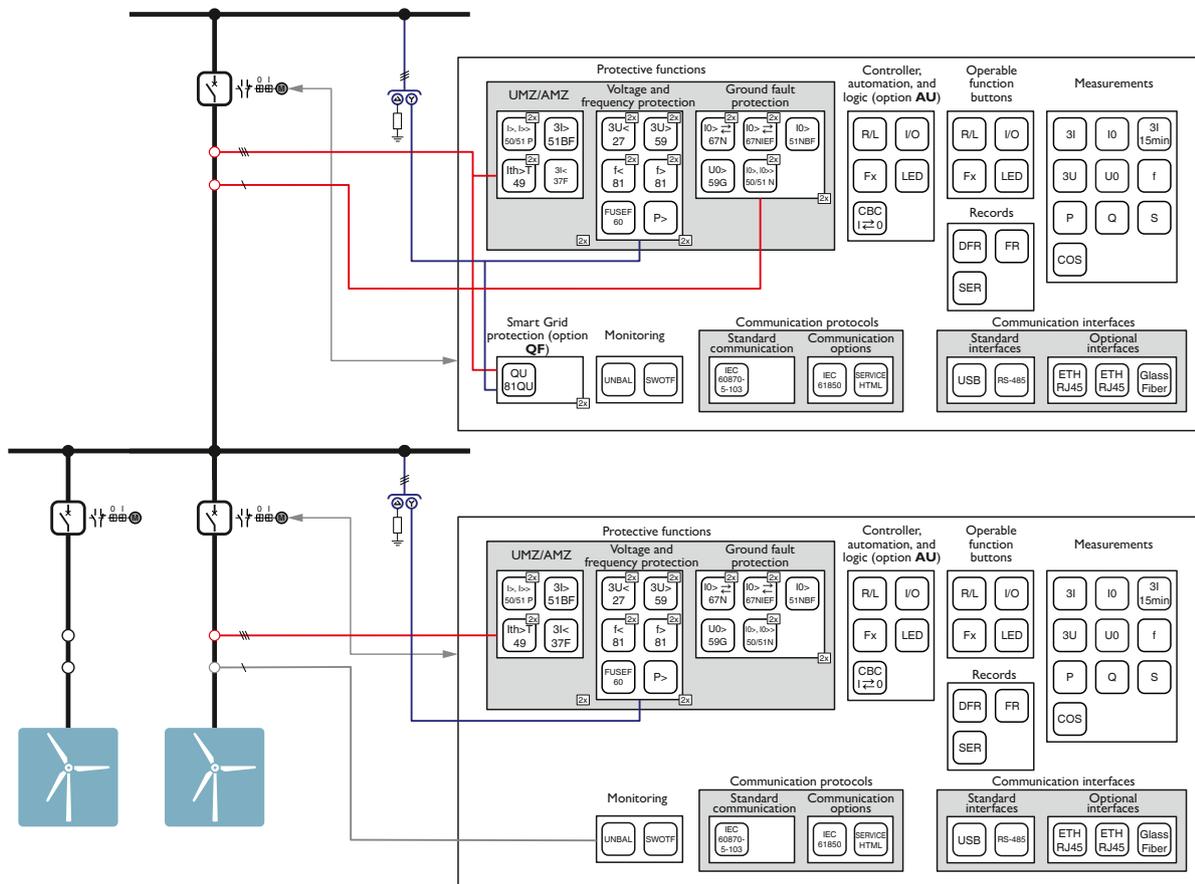
Communication options of POWERSAVE

Standard communication with IEC 60870-5-103

The POWERSAVE RF has a serial electrical interface for communication via IEC 60870-5-103 as standard. The POWERSAVE RN can optionally be extended by a serial electrical interface. In addition to the RS-485 connection, there is an alternative option to communicate via an optical interface. The optical interface is suitable for ST male connectors and fiber-optic cables of 820 nm.

Programming is done using XCFG files via the USB front interface.

Status, events,
COMTRADE

Control room

Remote control technology

System automation

IRIG, GPS
Time synchronization

IEC 60870-5-103
Standard: electrical
Optional: optical

USB
XML and COMTRADE files

IED service

IT security

With regard to cybersecurity, our protective device families have been developed under consideration of the BDEW white paper. The aim is to increase IT security in systems in the energy sector against unwanted internal and external attacks.
Examples of central elements in this context are role-based access control and protective mechanisms at the communication interfaces. This includes both the management of user roles and rights (RBAC) and the recording of security-relevant events. Moreover, it prevents the installation of third-party software.

To verify data, files are signed using SHA-256 and 3072-bit RSA keys, e.g., for update and patch management. For particularly high data security, user files are stored encrypted with AES-256 independently of the configuration file and encrypted with TLS during data transmission via the Ethernet interface.

Further information is available at:
https://phoe.co/fM2JT1

Secure access

Data check with SHA-256 and 3072-bit RSA

Data encryption with AES-256

Role-based access control (RBAC)

Protective and control device

Communication option IEC 61850

In addition to communication via IEC 60870-5-103, it is also possible to communicate via IEC 61850. All versions of the POWERSAVE device family are optionally available with IEC 61850 Ed. 1/Ed. 2. The associated physical connections can be selected as an electrical Ethernet interface via RJ45 or optical Ethernet with a 1300 nm SC male connector. The Ethernet port can also be used as a dedicated service interface with

DIGICOM.
Options with electrical or optical switches can also be selected to implement the necessary redundancy concepts. By using SFP modules, the desired variants can be specified when ordering.
All devices with the IEC 61850 option support MMS and GOOSE functionalities (FAST GOOSE and SLOW GOOSE). All of the existing Ethernet interfaces can be used as service interfaces with the

DIGICOM operating software. Programming is done using xcfg file files via the USB front interface or Ethernet service interface. Moreover, transmissions of COMTRADE files for fault analysis is also possible.

Status, events, COMTRADE

Control room

Remote control technology

System automation

IRIG, GPS
Time synchronization

IEC 61850 (electrical or optical)
MMS, GOOSE

DIGICOM via Ethernet

Electrical

USB
XML and COMTRADE files

IED service
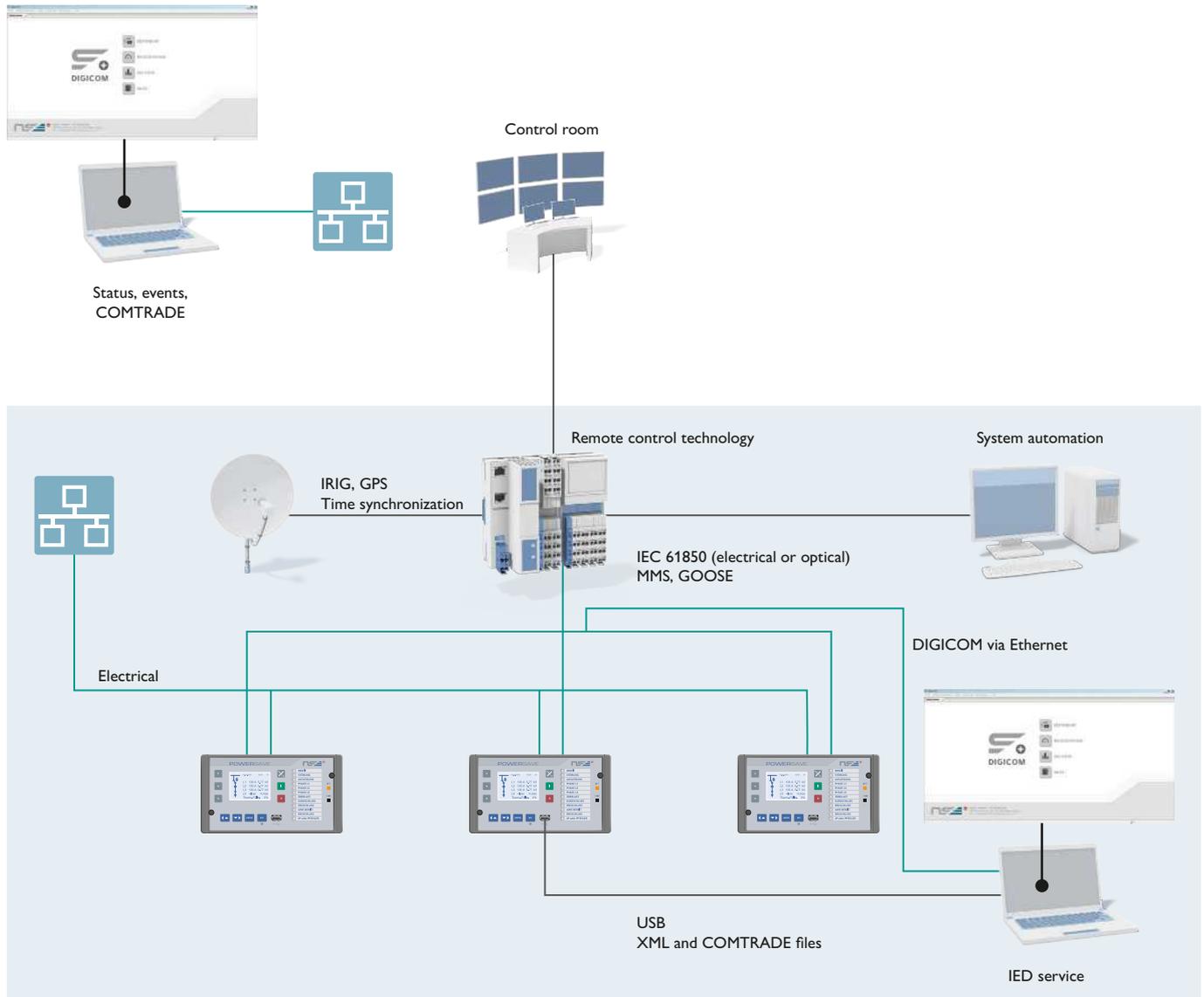
Redundancy concepts with IEC 61850

For IEC 61850 applications, the POWERSAVE device family offers various redundancy concepts: Parallel Redundancy Protocol (PRP), High-availability Seamless Redundancy (HSR), and Rapid Spanning Tree Protocol (RSTP). With PRP, parallel transmission to two redundant networks takes place so that continuous operation is possible in the event of a fault. In this procedure, data is neither lost nor transmitted with a delay. The DAN functionality (Double Attached Node) is achieved with an integrated switch. By using SFP modules, the functionality can be implemented both electrically and optically with various FO options.

HSR allows the parallel transmission of the data in both ring parts. This means that there is no downtime if there is a malfunction of components within the ring. Non-redundant devices are connected via a redundancy box (Red Box). With RSTP, transmission happens in the ring, which is virtually "open" at one point. Here, there are short downtimes if one component of the ring has a malfunction. Switching to a new topology is done automatically.

Station automation

PRP/HSR
Red Box

IRIG,-B GPS
Time synchronization

LAN A

LAN B

PRP/HSR
Red Box

PRP/HSR Red Box

HSR

IED service

PRP/HSR
Ethernet switch

PRP/HSR
Ethernet switch

Electrical or optical RSTP

DAN   DAN   DAN   DAN

Structural descriptions of POWERSAVE

Dimensional drawing of the structural version (type S) in mm

Front view

Side view

Drilling template for the fixing bracket
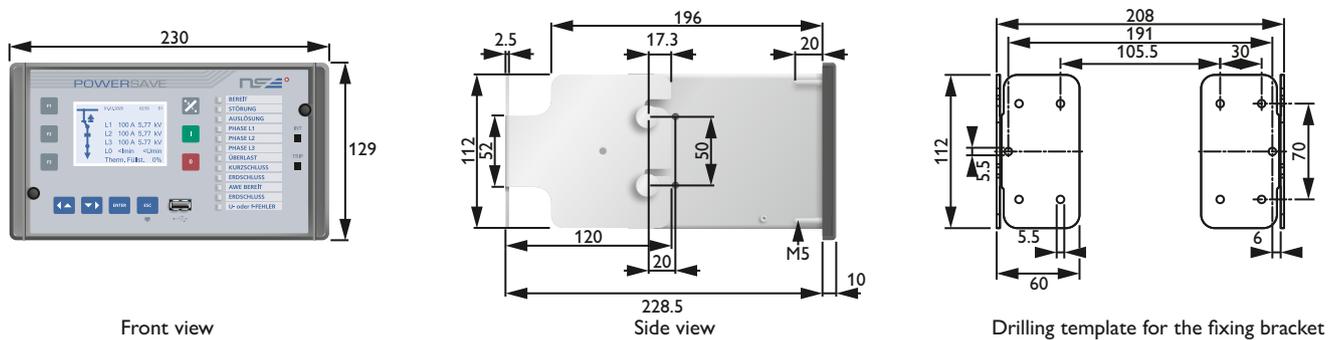
Dimensional drawing of the installed version (type S) in mm

Front view

Side view

Cutout and drilling template for front installation
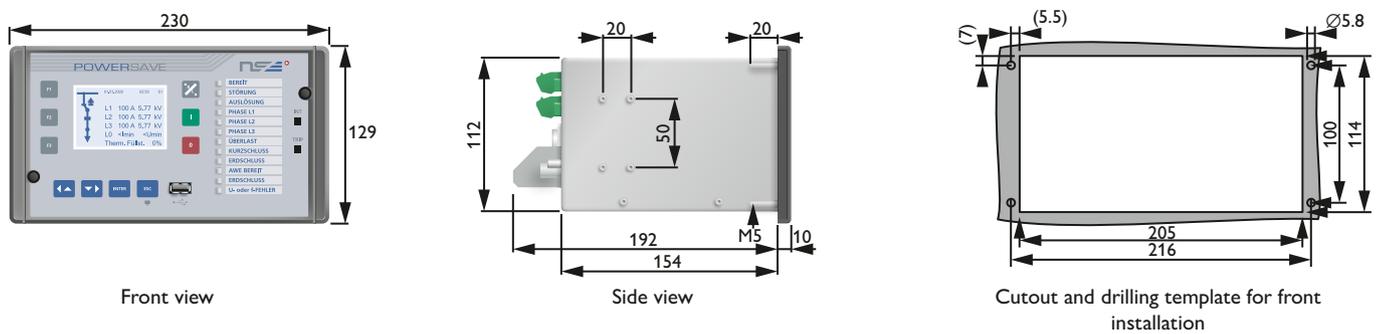
Dimensional drawing of the structural version for RN1 or DIGISAVE retrofit projects (type R*) in mm

Front view

Side view

Drilling template for the fixing bracket
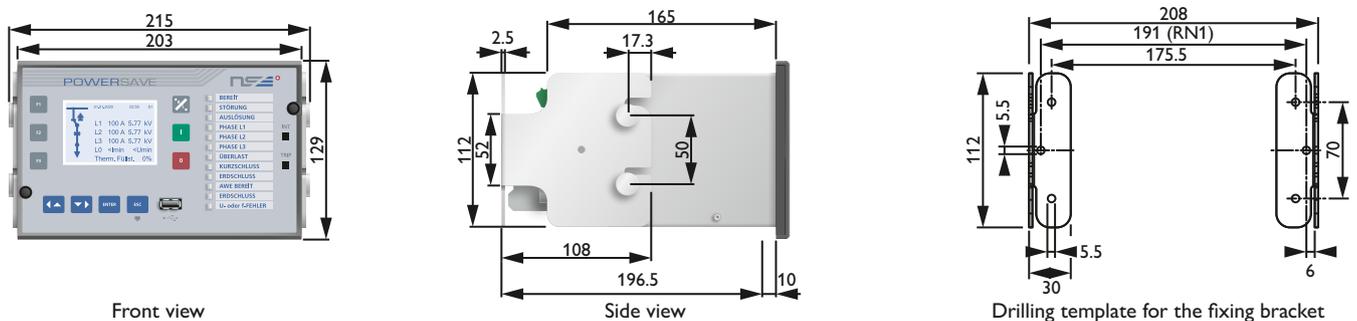
* Type R can also be used for direct installation in a 19" 3HE rack. For details, please see the manual.

Use FAME to design energy switching devices and interfaces that are easy to service

Regular testing of digital protection relays requires efficient and simple test connections in the switching device on site to ensure the safety of the system and the test personnel. The innovative, modular FAME plug-in test system is used to perform these tests in the field of network protection technology for medium-voltage and high-voltage switching devices in a time and cost-optimal manner.
The modular system makes it possible to define standardized test plug-in test sockets in practical applications and to define optimum test options for each protective device.

[i] **Web code:** #2353

Easy and safe measurement and testing processes with the FAME plug-in test system

Front side of the POWERSAVE device family

Energy-saving, mono-color 3" TFT display to display system graphics with controller and measured value tables. Additional sides can be configured user-specifically.

Button to switch between remote and local with status LED

3 freely-parameterizable function keys

2 mechanical switching signals (excitation/triggering)

12 freely configurable LEDs (tri-colored)

4 navigation keys for simple operation

USB service interface and supply for the protective computer

2 buttons to switch switchable equipment on and off
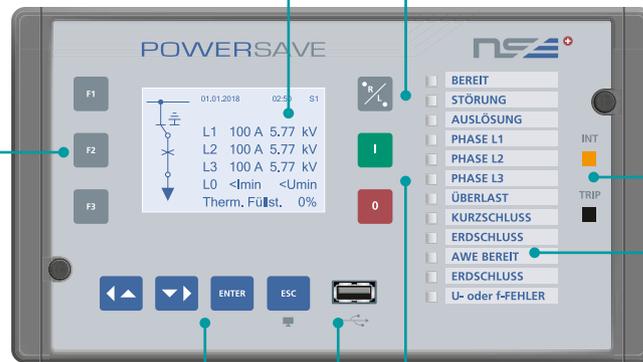
Example rear side of a POWERSAVE RF device version

Voltage converter connections (X7)

Standard communication interface via RS-485 electric for IEC 60870-5-103 or remote configuration (X8)

Extendable communication interface: e.g., electrical Ethernet for IEC 61850 (RJ45 connector)

Binary inputs (X5)

Binary outputs (X6)

RJ45 Ethernet service interface (X4)

Grounding with grounding strap (X3)

Auxiliary current supply (X1)

Energy block connection (X2)

Short-circuiting CT connections (X3)
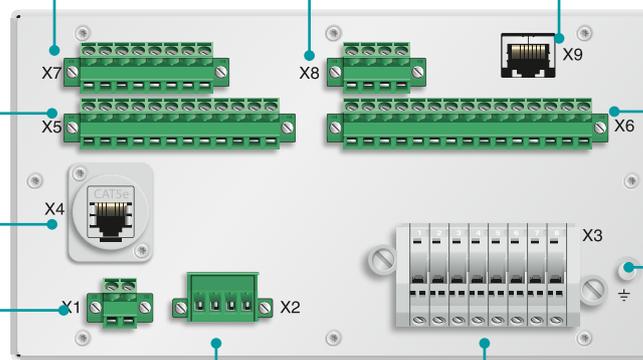
Structural descriptions of POWERSAVE

Example technical connection diagram

POWERSAVE RF: 1248589/X2/I4U4/P1/BI8BO8/RE/EE/S and
POWERSAVE RF: 1248589/X2/I4S3/P1/BI8BO8/RE/EE/S

Our sales department will gladly help you with device-specific
connection diagrams.

Energy storage

Energy storage for message signals**
Charging voltage: 24 V DC
Energy content: 3 J bei 24 V DC
Capacity: 10 mF
Charging time for the back-up capacitor:
4 minutes

Energy storage for the trigger circuit*
Charging voltage: 20 … 320 V DC
(can be configured via software)
Energy content: 50 J at 300 V DC
Charging time at 300 V DC: 90 s (with
auxiliary current supply)

Power supply (X2)

44 V DC … 250 V DC
50 V AC … 275 V AC, 50/60 Hz

Current transformer

Current transformer inputs (I4**)
4x current inputs: 1 A / 5 A
(can be switched via using software)

Transformer power supply***

Minimal supply current:
All phases 0.2 In, one phase 0.5 In
Short-circuit detection according to ZUKS:
<70 ms (system time)
Primary transformer load at In: < 2.0 V

Standard communication interfaces (RE)

Serial electrical for IEC 60870-5-103 (RS-485)
and electrical Ethernet as a service
interface (RJ45)

Power supply

1.1	
1.2	UH
E	

Energy storage

Supply	
2.1	II
2.2	24 V DC
2.3	II
2.4	300 V DC

Voltage transformer

7.1	U1
7.2	
7.3	U2
7.4	
7.5	U3
7.6	
7.7	U0
7.8	

Current transformer

1 A or 5 A

3.1	I1
3.2	
3.3	I2
3.4	
3.5	I3
3.6	
3.7	I0
3.8	

Feed converter for transformer power supply

Current I1	I1
Current I2	I2
Current I3	I3

Standard communication interface

RS-485
IEC 60870-5-103

8.1	
8.2	

Standard communication interface

Electrical Ethernet RJ45
IEC 61850
Service interface
Parameterization

1	
2	
3	
6	

---

*   An appropriate ballast can be used to control low-energy coils (pulse shaper).
**   Do not use 24 V DC auxiliary voltage output to trip circuit breakers.
*** In the case of pure converter current operation, the automation system interfaces are switched off.

Voltage transformer

Voltage transformer inputs (**U4)
4x voltage inputs: 100/110/400 V AC
(can be switched via software)

Voltage sensors

Voltage transformer inputs (**S3)
3x sensor inputs: max. 3.25 V
in accordance with IEC 61869
(can be configured via software

Binary inputs/outputs (BI8BO8)

8 binary inputs
20 ... 60 / 80 ... 250 V AC/DC
(switching threshold can be selected via software)
Integrated contact cleaning
(contact cleaning system/contact fritting)
Stability against capac. interference signals
according to VDE directive

8 binary outputs
Nominal voltage: 250 V AC or 30 V DC
2x 8 A @250 V AC continuous
(contacts doubled), 2x 2,000 VA,
2x 8 A @30 V DC continuous
(contacts doubled), 2x 240 W
Response time: Standard max. 8 ms

Extendable communication interface (EE)

Electrical Ethernet,
e.g., for IEC 61850 (RJ45)

Technical data of POWERSAVE

Properties	ANSI	Descriptions	IEC 61850	Versions	
				RN	RF
Protective functions					
General	27/59	Three-phase undervoltage and surge protection	PTOV PTUV		●
	32N	Wattmetrically directed ground-fault protection based on zero system variables	PSDE		●
	47	Voltage asymmetry protection	PTOV		●
	49 I & II	Three-phase thermal overload protection with one or two thermal images (two-stage, e.g., for motors, cables, dry-type and oil transformers)	PTTR	●	●
	50HS	Three-phase undirected high current protection	PTOC	●	●
	50N/51N	Undirected ground-fault protection (two-phase, IEC DT, IEC VI, IEC EI, IEC LTI)	PTOC	●	●
	50P/51P	Three-phase undirected overcurrent protection and high current protection (two-stage, IEC DT, IEC NI, IEC VI, IEC EI)	PTOC	●	●
	59N	Residual voltage protection	PTOV		●
	67	Three-phase directed overcurrent protection and high current protection	PTOC		●
	67N	Directed ground-fault protection	PTOC		●
	67NIEF	Directed ground-fault protection for transient and intermittent grounding faults	PTEF		●
	67NIEF	Directed ground fault protection based on zero-system energy	PTEF		●
	67NIEF	Directed wiper relay	PTEF		●
	68	Three-phase inrush stabilization	PHAR	●	●
	81O/81U	Frequency protection	PTOF, PTUF		●
Motor protection	14	Rotor blocking protection for motors	PZSU	●	●
	37	Undervoltage protection	PTUC	●	●
	46	Unbalanced load protection	PTOC	●	●
	48	Start-up time limitation for motors	PMSS		●
	50M	Load jump protection	PTOC	●	●
Distance protection	21FL	Fault locator (only with software option FO)	RFLO		(●)
	21N, 21P	Current excitation, under-impedance excitation with load suppression, U/I excitation (only with software option ZP)	PTOC, PSCH		(●)
		Polygonal distance protection for phase-phase and phase-ground and integrated directed/undirected end-time protection (only with software option ZP)	PDIS		(●)
Smart Grid	81LSH	Multi-stage load shedding at underfrequency with active power direction (automatic frequency relief) UFLA (only with software option FE)	PFRQ		(●)
	QU	Q-U protection (reactive power undervoltage protection) (only with software option QU)	–		(●)

Properties	ANSI	Descriptions	IEC 61850	Versions	
				RN	RF
Protective functions					
Tolerances	-	Typical excitation times (15 ... 25 ms (sub cycle I>>> : 10 ms))	-	●	●
	-	Shutoff upon short circuit from transformer current and three-phase I> = 1.0In, excitation UMZ I> , t>=0.01 s (90 ms)	-	●	●
	-	Excitation tolerance (<2.5%)	-	●	●
	-	Relative time tolerance (<1%)	-	●	●
	-	Time tolerance of directed functions (Excitation: ~25 ms, trigger: ~32 ms)	-	●	●
	-	Fault location tolerance (<1% @ cable length, @ U/Usc >5 % and 30°<j<90°)	-	●	●
	-	Time tolerance for distance protection (excitation ~27 ms, trigger ~37 ms From transformer current in the first zone Z1: ~100 ms)	-	●	●
	-	Frequency protection time tolerance (excitation: ~80 … 120 ms)	-	●	●
Protective functions					
	47	Rotary field direction monitoring	MMXU		●
	50BF	Circuit breaker failure protection	RBRF	●	●
	50SOTF	Three-phase short-circuit switch-on protection	PIOC	●	●
	60	Automatic voltage transformer case	RFUF		●
	74TC	Circuit trip monitoring (only with software option AU)	SCBR	(●)	(●)
	79	Automatic restart (ARE) 1/3 pos.	RREC	●	●
	85	Signal comparison	PSCH	●	●
		Busbar protection with H2 logic	PSCH	●	●
	86	Restart inhibit	PSCH	●	●
	LAL	Carrying circuit	PSCH	●	●
	MCS31	Circuit monitoring (transformer monitoring)	MMXU	●	●
	VTFF	Voltage circuit monitoring	-		●
	-	Ground fault error – pulse localization	PSDE	●	●
	-	Monitoring the supply voltage	NZBAT	●	●

Technical data of POWERSAVE

Properties	ANSI	Descriptions	IEC 61850	Versions RN	Versions RF
Measurement					
Analog inputs	-	Current transformer variant 00, KO: Nominal current 1 A/5 A, 50 Hz, measuring range: 0.01…64xIn, <0.2 VA	-	4	4
	-	Current transformer variants P1 P2 W1 W5 nominal current 1A: (S<3 VA) or 5 A: (S<5 VA) @ 50 Hz, measuring range: 0.01…64xIn	-	4	4
	-	Voltage transformer: Nominal voltage 100/110/400(230) V, 50 Hz, measuring range 0.05…440 V AC; <0.2 VA	-	–	3 / 4
	-	Sensor inputs for resistive voltage transformers max. 3.25 V, Un = 1 V	-	–	3
Current	3I	Three-phase current indicator (I_{L1}, I_{L2}, I_{L3})	MMXU	●	●
	I0	Ground current	MMXU	●	●
	Ith	Thermal level	-	●	●
Voltage	3ULE	Three-phase voltage indicator LE (U_{L1E}, U_{L2E}, U_{L3E})	MMXU		●
	3ULL	Three-phase voltage indicator LL (U_{L1L2}, U_{L2L3}, U_{L3L1})	MMXU		●
	U0	Residual voltage	MMXU		●
Frequency	f	Frequency	MMXU		●
Power	cosφ	Power factor	MMXU		●
	PQS	Real power, reactive power, apparent power	MMXU		●
Other	3I /15 min	Slave pointer, three-phase, 15 min	MMXU	●	●
	F	Load profile	MSAT	●	●
	km/miles	Fault location (only with software option FO)	MMXU		(●)
	R/X	Impedances RLL, RLE, XLL, XLE (only with software option ZP)	MMXU		(●)
Controller					
	I↔O CB	Circuit breaker controller with graphical position indicator (only with software option AU)	XCBR, CSWI	(●)	(●)
	I↔O DCC	Control of disconnect and ground-fault switch with graphical position indicator (only with software option AU)	XSWI, CSWI	(●)	(●)
	I↔O CBT	Trolley control with graphical position indicator (only with software option AU)	XSWI, CSWI	(●)	(●)
	I↔O	Controller with locking logic (only with software option AU)	CILO	(●)	(●)
	CBAY	Field control (only with software option AU)	CBAY	(●)	(●)
	R/L	Local and remote switching (only with software option AU)	LOC	(●)	(●)

Properties	ANSI	Descriptions	IEC 61850	Versions	
				RN	RF
Message and status indicator on the front panel					
	-	Standard measured value tables and freely configurable LEDs	–	●	●
	-	Extensive measured value and status tables	–	●	●
	-	Energy-saving high-resolution monochrome 3" graphic display	–	●	●
	-	Three user-specific configurable function keys	–	●	●
	-	Two displays (mechanical position indicator)	–	●	●
	-	Button for onsite/remote switching	–	●	●
	-	Direct control buttons	–	●	●
	-	12 tri-colored LEDs	–	●	●
	-	USB interface for communication to the PC or direct USB stick access	–	●	●
Programmable logic					
	RS	RS flip flops (only with software option AU)	GAPC	(●)	(●)
	TOF/TON	On and off time delay (only with software option AU)	GAPC	(●)	(●)
	UDCNT	Forward/reverse counters (only with software option AU)	FCNT	(●)	(●)
	-	Single-point information	GGIO	●	●
	-	Double-point information	GGIO	●	●
	-	AND, OR, NOT, XOR, CONSTANT (only with software option AU)	–	(●)	(●)
Communication options					
Standard communication	-	1x serial electrical for IEC 60870-5-103 (RS-485) (only with hardware option RS)	–	(●)	●
	-	XML parameterization via USB	–	●	●
Communication options	-	1x electrical Ethernet for service interfaces via DIGICOM (RJ45 connector) (only with hardware option EX)	-	(●)	
	-	1x serial electrical for IEC 60870-5-103 (only with hardware option RE) 1x electrical Ethernet for service interfaces via DIGICOM (RJ45 connector)	–	(●)	(●)
	-	1x serial optical IEC 60870-5-103 (ST male connector, 820 nm) (only with hardware option RO)	–	(●)	(●)
	-	1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector) (only with EE hardware option)	–	(●)	(●)
	-	1x optical Ethernet, e.g., for IEC 61850 (SC male connector, 1,300 nm) (only with EO hardware option)	-	(●)	(●)
		1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector) (only with hardware option SE)	–	(●)	(●)
		1x optical Ethernet switch, e.g., for IEC 61850 (2x LC male connector, 1300 nm) (only with hardware option SO)	–	(●)	(●)
	-	IEC 61850 (only with EE, EO, SE, or SO hardware option and software option 50): - Specification IEC 61850-6, 7-1, 7-2, 7-3, 7-4, 8-1 - Protocol IEC 61850-8-1 block 1, 2, 2+, 4, 4+, 5, 6, 9ab, 12abcd, 13, 14 - Receiver for 32 fast binary signals/locking mechanisms/individual notifications - Transmitter of 32 fast binary signals/locking mechanisms/individual notifications - Transmitter of 100 measured values/status signals - IEC 61850 MMS and GOOSE	–	(●)	(●)
Formats					
Event and malfunction data	DFR	Malfunction data recording (COMTRADE standard)	RDRE	●	●
	SER	Event lists	RSER	●	●

Technical data of POWERSAVE

Properties	ANSI	Descriptions	IEC 61850	Versions	
				RN	RF
Other hardware					
Mounting type	-	Size 19"/2, 3 RU for construction and installation (type S only with hardware option S)	-	(●)	(●)
	-	Size 19"/2, rack installation and RN1 construction offset (type R only with hardware option R)	-	(●)	(●)
	-	Microprocessor arm 1x or 2x (for IEC 61850)	-	●	●
	-	Energy storage for malfunction data and events: POWERCAP <7T	-	●	●
	-	Binary inputs 20…60 / 80…250 V AC/DC with integrated contact cleaning system, max. 220 nF line capacity	-	4 / 8	4 / 8
	-	Binary outputs 2 x 8 A@250 V AC (2 x 2,000 VA) and 2 x 8 A@30 V DC (2 x 240 W), two contacts parallel internally; 8 ms (varies based on design)	-	4 / 8 / 12	4 / 8 / 12
Auxiliary voltage	-	22…28 V DC, P<10 VA (only with hardware option X1), buffer time without power management >50 ms, buffer time with power management >30 s (with hardware options KO, P1, P5, W1, W5)	-	(●)	(●)
	-	50…275 V AC, 44…250 V DC, P<10 VA (only with hardware option X2), buffer time without power management >50 ms, buffer time with power management >30 s (with hardware options KO, P1, P5, W1, W5)	-	(●)	(●)
Power management	-	System start <90 ms, regular checks (every 7 days), charging from mains voltage <40 s	-	●	●
	-	20 to 320 V DC / 50 J with charging from auxiliary energy or converter, charge lasts for <48 h, automatic cyclic monitoring of charging from auxiliary voltage in t<40 s, charging from three-phase current transformer supply at In>0.5 In, t<330 s (only with hardware options K0, P1, P5)	-	(●)	(●)
	-	24 V DC / 9 J with charging from auxiliary energy or converter, charge lasts for <48 h, automatic cyclic monitoring of charging from auxiliary voltage in t<120 s, charging from three-phase current transformer supply at In>0.5In, t<275s (only with K0, P1, P5 hardware options)	-	(●)	(●)
	-	System hold on failure of auxiliary supply and three-phase measured current <0.18In, <30 s (from charged state) (only with K0, P1, P5 hardware options)	-	(●)	(●)
	-	System hold on failure of auxiliary supply (from 3x 0.2Im) and energy hold energy blocks >3x 0.3In: continuous (only with P1, P5 hardware options)	-	(●)	(●)
	-	Transformer power supply for protection and energy block, current transformer <2.5 VA (1 A), <2.0 VA (5 A) (only for P1, P5, W1, W5 hardware options)	-	(●)	(●)

Properties	Standards	Tests
Electrical tests		
Standards	IEC 60255-1 IEEE Std C37.9.0/.1/.2 UL 508 VDE 0435	
Dielectric test	Type check	5 kV, 1.2/50 ms, 0.5 J
	Series check	2.5 kV, 50 Hz, 1 min.
Electromagnetic compatibility	IEC 60255-26	Replacement for IEC 60255-22-1, -2, -3, -4
	EN 61000-6-2	
	VDE 0345 Part 301 and 110	
Noise emission of housing	IEC CISPR 11	30 MHz … 1000 MHz
Auxiliary power supply malfunction message	IEC CISPR 22	150 kHz … 30 MHz

Properties	Standards	Tests
Electrical tests		
Irradiation with HF field frequency run	IEC 61000-4-3	10 V/m, 80 MHz … 1,000 MHz and 1,400 MHz … 2,700 MHz, run 80% AM, 1 kHz
Irradiation with HF field individual frequencies	IEC 61000-4-3	10 V/m, 80, 160, 380, 450, 900, 1,850, 2,150 MHz, 80 % AM, 1kHz, duration 10 s
Electrostatic discharge	IEC 61000-4-2	6 kV contact, 15 kV air
Rapid transient disturbance variables/bursts	IEC 61000-4-4	Communication: 2 kV 5/50 ns, 5 kHz, both polarities Other connections: 4 kV, 5/50 ns, 5 kHz, both polarities
Energy-rich surge voltages	IEC 61000-4-5	Pulse: 1.2/50 ms Auxiliary voltage conductor to ground: 4 kV, 10 Ω, 9 µF Conductor to conductor: 2 kV, 0 Ω, 18 µF Communication: Conductor to ground: 4 kV, 0 Ω, 0 µF Other connections: Conductor to ground: 4 kV, 40 Ω, 0.5 µF Conductor to conductor: 2 kV, 40 Ω, 0.5 µF
Conducted HF, AM	IEC 61000-4-6	Communication: 10 V; 150 kHz…80 MHz; 80% AM, 1 kHz Other connections: 20 V; 150 kHz…80 MHz; 80% AM, 1 kHz
Operating frequency magnetic field	IEC 61000-4-8	30 A/m continuous; 300 A/m for 1 s … 3 s
Slowly attenuated oscillating waves	IEC 61000-4-18	Communication: CM: 1 kV at 1 MHz, 200 Ω Other connections: DM: 1 kV; CM: 2.5 kV at 1 kHz and 1 MHz, 200 Ω
Operating frequency	IEC 61000-4-16	Binary inputs: Zone A; DM: 150 V, 100 Ohm, 0.1 mF; CM: 300 V, 220 Ω, 0.47 µF
Voltage fluctuations and flicker	IEC 61000-4-11	In the entire indicated auxiliary voltage range
	IEC 61000-4-29	
Immunity for the functional ground connection	IEC 61000-4-6	150 kHz … 80 MHz 10 V, 150 Ω, 80% AM
	IEC 61000-4-4	Burst: 4 kV, zone A
Shocks and vibrations		
Standards	IEC 60255-21	
Sinusoidal oscillation	IEC 60255-21-1	5…8 Hz; ±7.5 mm amplitude
	IEC 60068-2-6	8 … 150 Hz; 20 m/s^2 acceleration, frequency hub 1 octave/min, 20 periods in 3 axes orthogonal to each other
Shock	IEC 60255-21-2	Half-wave, acceleration 150 m/s^2, 11 ms duration of each vibration in both directions on all axes
	IEC 60068-2-27	
Sinusoidal vibrations during earthquakes	IEC 60255-21-3	Horizontal: 1 … 8 Hz, ±3.5 mm amplitude
	IEC 60068-3-3	Vertical: 1 … 8 H z, ±1.5 mm amplitude horizontal @ 1g: 8 … 35 Hz Vertical @ 5 m/s^2: 8 … 35 Hz Frequency hub 1 octave/min, 1 period on all axes
Half-wave sinusoidal vibrations during earthquakes	IEC 60255-21-3	Acceleration 100 m/s^2, 16 ms duration every 1,000. Vibration in all directions
	IEC 60068-3-3	
Vibration and duration of shaking during transport	IEC 60255-21-1	Half-wave, acceleration 150 m/s^2, 11 ms duration of each vibration in both directions on all axes
	IEC 60068-2-6	
Climatic ambient conditions		
Standard	IEC 60255-1	Operating temperature: -10°C ... +55°C Storage temperature: -25°C ... +55°C Transport temperature: -25°C ... +70°C
	IEC 60068-2-17	Test conditions over 16 hours: -25°C ... +85°C Temporarily permissible for 96 hours with possibly impaired display during operation from +55°C: -20°C ... +70°C
	Humidity	Annual average < 75%, condensation/ice formation not permissible Monthly average < 95% at max. +40°C, condensation/ice formation not permissible
	Installation altitude	<3,000 m above sea level

POWERSAVE order key

Configure your protective relay directly in the online configurator

Configure and order your protective relay online at any time. To do so, simply enter the web code into the search field on our website.

Alternatively, you can put your individual order key together on the following pages.

| i | **Web code:** #2274

1. Defining the hardware

The POWERSAVE device family is divided into two customizable basic designs (see overview on Page 41). The variants thus contain different hardware adaptations and device-specific equipment options. Depending on the basic version, you can determine your individual protective and control device by using a predefined selection of hardware options. The options listed on the right are used here as an overview.

1 Auxiliary power supply

2 Measuring transducer inputs (current and voltage transformer)

3 Binary inputs and outputs

4 Communication options

5 Power management

6 Mounting type
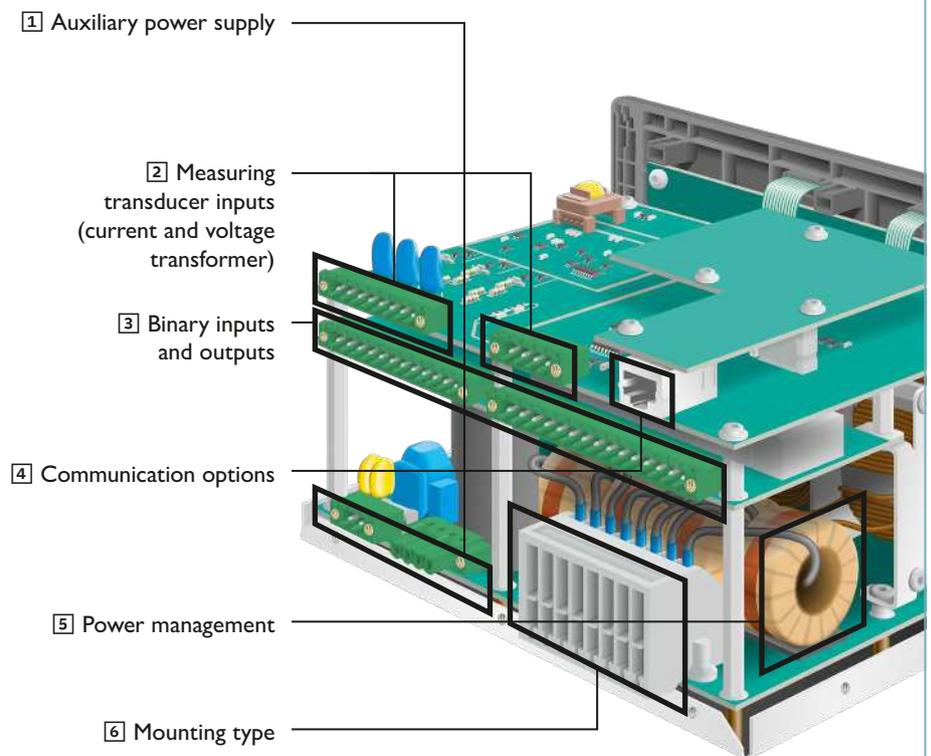
2. Defining the device-specific software (see pages 61, 63)

The devices are supplied with a predefined range of functions as standard. Depending on the hardware specification, you can select additional software functions. The device-specific software functions A–E can be selected on pages 61 and 63.

A Additional communication protocol
B Smart Grid protection
C Fault localization
D Distance protection
E System automation/field control

Moreover, the devices are supplied with the DIGICOM BASIC operating software. The software is used to parameterize and configure the devices. There is the option to extend the software with functionalities, such as fault analysis. The software can also be used by multiple users if a multi-use license is purchased. You can find more information on appropriate operating and fault analysis software starting on page 64.

Easily create your order key yourself

See the table on the next few pages to create your order key.

You will find the order key on the second line of every table. You have the option to customize your product by using predefined options. An order key consists of both hardware and software options.

A complete order key in POWERSAVE RN looks like the following:

1248590/X1/I4U0/K0/BI4BO4/RS/SE/S/50/00/00/00/00/00/AU

1248590/X /I4U0/ /BI BO / / / / /00/00/00/00/00/

E System automation/field control
A Additional communication protocol
6 Mounting type
4 Communication options
3 Binary inputs and outputs
5 Power management
1 Auxiliary power supply
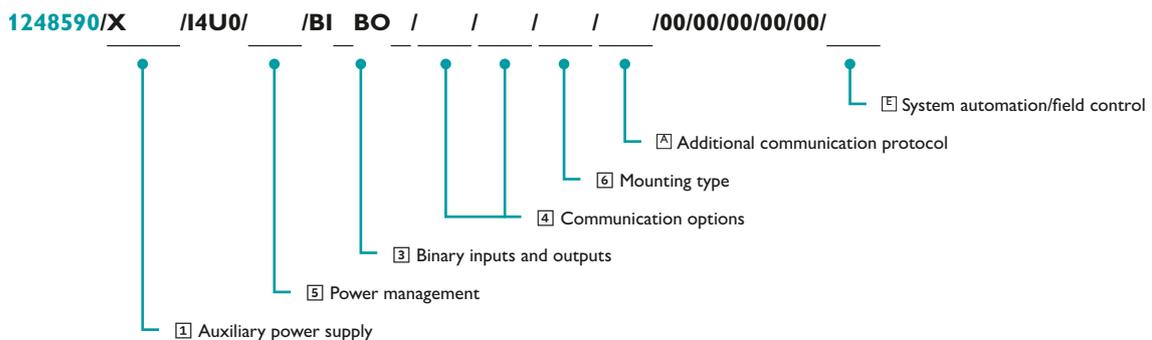
Determining the POWERSAVE RN order key

Defining the hardware				
	[1] Auxiliary power supply	[2] Measuring transducer inputs	[5] Power management	[3] Binary inputs and outputs**
Order key > **1248590** / POWERSAVE RN	**Please select** /	**I4U0** /	**Please select** /	**Please select** /
	X1 24 V DC	4x current inputs (1 A / 5 A* for variants without transformer power supply; automatically short-circuiting)	**00** 0x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	**BI4BO4** 4x binary inputs DC* 4x binary outputs (2000 VA/8 ms)
	X2 48 V / 60 V / 110 V / 220 V DC / 230 V AC		**K0** 1x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	**BI8BO8** 8x binary inputs DC* 8x binary outputs (2000 VA/8 ms)
			W1 0x energy storage (300 V DC/50 J and 48 V DC/9 J) 1x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	**BI4BO12** 4x binary inputs DC* 12x binary outputs (2000 VA/8 ms)
			W5 0x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 1x three-phase transformer power supply (In = 5 A)	
			P1 1x energy storage (300 V DC/50 J and 48 V DC/9 J) 1x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	
			P5 1x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 1x three-phase transformer power supply (In = 5 A)	

* Switchable switching threshold
** Additional inputs and outputs on the CPU printed circuit board

	Communication options [4]		Mounting type [6]	Additional communication protocol [A]	Device-specific software options	System automation/field control [E]
Defining the device-specific software						
Please select /	Please select /	Please select /	Please select /	00/00/00/00/00 /		Please select
00 None	**00** None	**S** Size 19"/2; 3 RU for construction and installation (type S)	**00** None		**00** None
RS 1x serial electrical for IEC 60870-5-103 (RS-485)	**RO** 1x serial optical for IEC 60870-5-103 (ST male connector, 820 nm)	**R** Size 19"/2; rack installation and RN1 construction offset (type R)	**50** IEC 61850		**AU** Options include
EX 1x electrical Ethernet as service interface via DIGICOM (RJ45 connector)	**EE** 1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector)				
RE 1x serial electrical for IEC 60870-5-103 (RS-485) 1x electrical Ethernet as service interface via DIGICOM (RJ45 connector)	**EO** 1x optical Ethernet, e.g., for IEC 61850 (SC male connector, 1,300 nm)				
	SE 1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector)				
	SO 1x optical Ethernet switch, e.g. for IEC 61850 (2x LC male connector, 1,300 nm)				

1248590/X /I4U0/ /BI BO / / / / /00/00/00/00/00/

[E] System automation/ field control
[A] Additional communication protocol
[6] Mounting type
[4] Communication options
[3] Binary inputs and outputs
[5] Power management
[1] Auxiliary power supply

Note

The DIGICOM BASIC operating software is delivered as standard with your product. There is the option to purchase an extended version (see Page 67).

Determining the POWERSAVE RF order key

	POWERSAVE RF	Auxiliary power supply [1]	Measuring transducer inputs [2]	Power management [5]	Binary inputs and outputs** [3]
Order key >	**1248589** /	Please select /	Please select /	Please select /	Please select /
		X1 24 V DC	**I4U3** 4x current inputs* 3x voltage inputs (100 V/ 110 V/400 V)*	**00** 0x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	**BI4BO4** 4x binary inputs DC* 4x binary outputs (2000 VA/8 ms)
		X2 48 V/60 V/110 V/ 220 V DC/ 230 V AC	**I4S3** 4x current inputs* 3x voltage inputs (100 V/ 110 V/400 V)	**K0** 1x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	**BI8BO8** 8x binary inputs DC* 8x binary outputs (2000 VA/8 ms)
			I4U4 4x current inputs* 4x voltage inputs (100 V/ 110 V/400 V)	**W1** 0x energy storage (300 V DC/50 J and 48 V DC/9 J) 1x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	**BI4BO12** 4x binary inputs DC* 12x binary outputs (2000 VA/8 ms)
				W5 0x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 1x three-phase transformer power supply (In = 5 A)	
				P1 1x energy storage (300 V DC/50 J and 48 V DC/9 J) 1x three-phase transformer power supply (In = 1 A) 0x three-phase transformer power supply (In = 5 A)	
				P5 1x energy storage (300 V DC/50 J and 48 V DC/9 J) 0x three-phase transformer power supply (In = 1 A) 1x three-phase transformer power supply (In = 5 A)	

Defining the hardware

* 1 A/5 A switchable switching thresholds for variants without a transformer power supply; automatically short-circuiting
** Additional inputs and outputs on the CPU printed circuit board

		Defining the device-specific software					
[4] Communication options		[6] Mounting type	[A] Additional communication protocol	[B] Smart Grid protection	[C] Fault localization	[D] Distance protection	[E] System automation/field control
Please select /	Please select /	Please select /	Please select /	Please select /	Please select /	Please select /	Please select
RS 1x serial electrical for IEC 60870-5-103 (RS-485)	**00** None	**S** Size 19"/2; 3 RU for construction and installation (type S)	**00** None	**00** None	**00** None	**00** None	**00** None
RE 1x serial electrical for IEC 60870-5-103 (RS-485) 1x electrical Ethernet as service interface via DIGICOM (RJ45 connector)	**RO** 1x serial optical for IEC 60870-5-103 (ST male connector, 820 nm)	**R** Size 19"/2; rack installation and RN1 construction offset (type R)	**50** IEC 61850	**QU** Q-U contactor	**FO** Options include	**ZP** Options include	**AU** Options include
	EE 1x electrical Ethernet, e.g., for IEC 61850 (RJ45 connector)			**FE** Automatic frequency relief AFE/UFLA			
	EO 1x optical Ethernet, e.g., for IEC 61850 (SC male connector, 1,300 nm)			**QF** Q-U contactor and automatic frequency relief AFE/UFLA			
	SE 1x electrical Ethernet switch, e.g., for IEC 61850 (2x RJ45 connector)						
	SO 1x optical Ethernet switch, e.g., for IEC 61850 (2x LC male connector, 1,300 nm)						

1248589/X / / /BI BO /R / / / / / / /

[1] Auxiliary power supply
[2] Measuring transducer inputs
[5] Power management
[3] Binary inputs and outputs
[4] Communication options
[6] Mounting type
[A] Additional communication protocol
[B] Smart Grid protection
[C] Fault localization
[D] Distance protection
[E] System automation/field control

Note

The DIGICOM BASIC operating software is delivered as standard with your product. There is the option to purchase an extended version (see Page 67).

Configure the protective relay easily and analyze data

In principle, the DIGICOM operating software configures the protective relay and the documents the configuration data.

Depending on the version of the operating software, additional functionalities are available to the user, such as the graphical evaluation of fault data.

Firmware updates can be performed via USB or service interface using the operating software.

Your advantages

☑ A uniform operating software for all protective devices

☑ Intuitive parameterization and operation of devices

☑ Efficient operation thanks to integrated help function

☑ Portable software for use without installation

Software overview

Get to know the various design variants and simply download the free basic version.

Intuitive operation

DIGICOM enables intuitive configuration of the protective relay including system automation and fault data analysis.

Software overview

DIGICOM – an operating software for all protective devices

DIGICOM is the operating software for standard configuration and parameterization of the protective relay families KOMBISAVE+ and POWERSAVE. Alternatively, the protective relays can be adjusted directly on the device on site.

A local help function allows direct access to the latest function and device manuals. In addition to the basic device settings, extensive automation functions such as locking, blockades, etc. can also be programmed. The system automation for controlling an outgoing feeder and its visualization in the display can be configured with a logic and graphics editor.

The current device status can be viewed online via the operating software. Measured values and the states of the binary inputs and outputs are visualized, for example. In addition, DIGICOM enables extensive test functions and the installation of firmware updates.

Automation system

Protective device

USB stick

Laptop
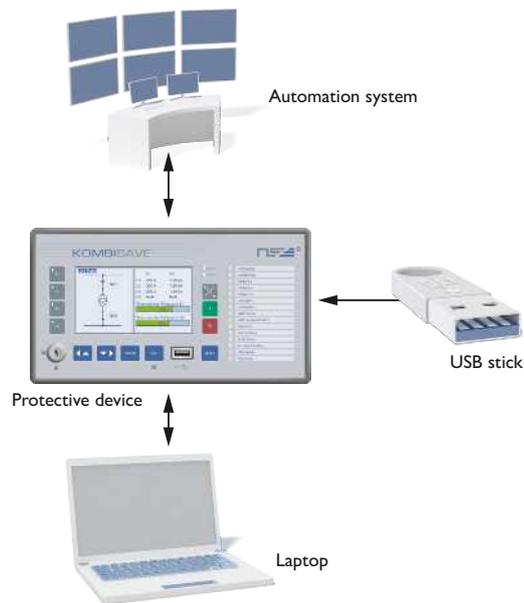
Secure access to your protective device (additional information on IT security can be found on pages 15 and 45)
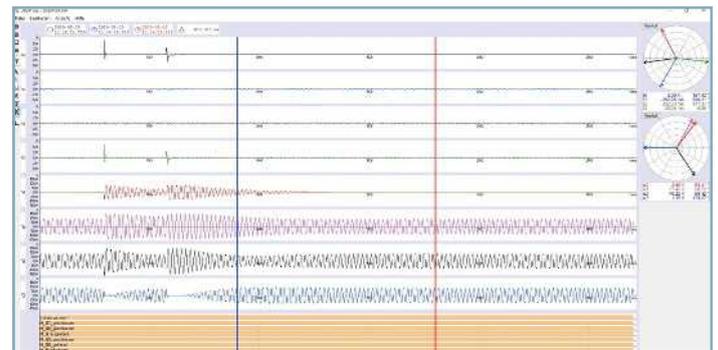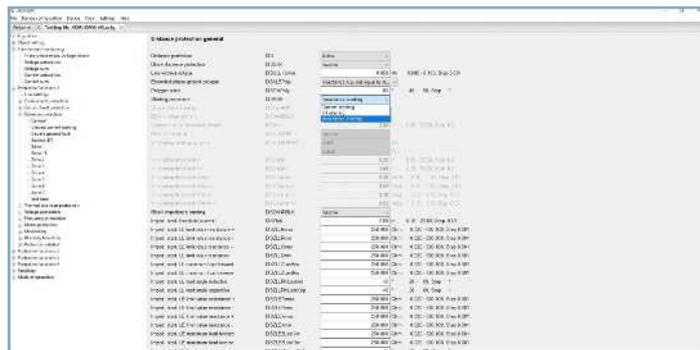
Parameterization of protective and control functions with DIGICOM BASIC

The basic DIGICOM BASIC version allows full parameterization of the protection and control functions of the protective relays. The configuration files are readable, comparable, customizable, and reloadable from the protective devices. The help function in the software provides all the current device and function user manuals locally to ensure seamless operation.

Additional device status, test, and service functions with DIGICOM ADVANCED

The DIGICOM ADVANCED extension includes many additional functionalities. The extensions extend the range of functions, above all with regard to the device status and test functions. In the process, the current measured values and the status information of all binary inputs and outputs are available in the operating software. Moreover, the events lists and fault data can be viewed and saved locally. The test and service functions are used for example to test parallel and serial interfaces. The integrated analysis tool DIGIVIEW allows the analysis of fault data. The extension is available as a single-user license by USB dongle and as a multi-user license via corporate license files.
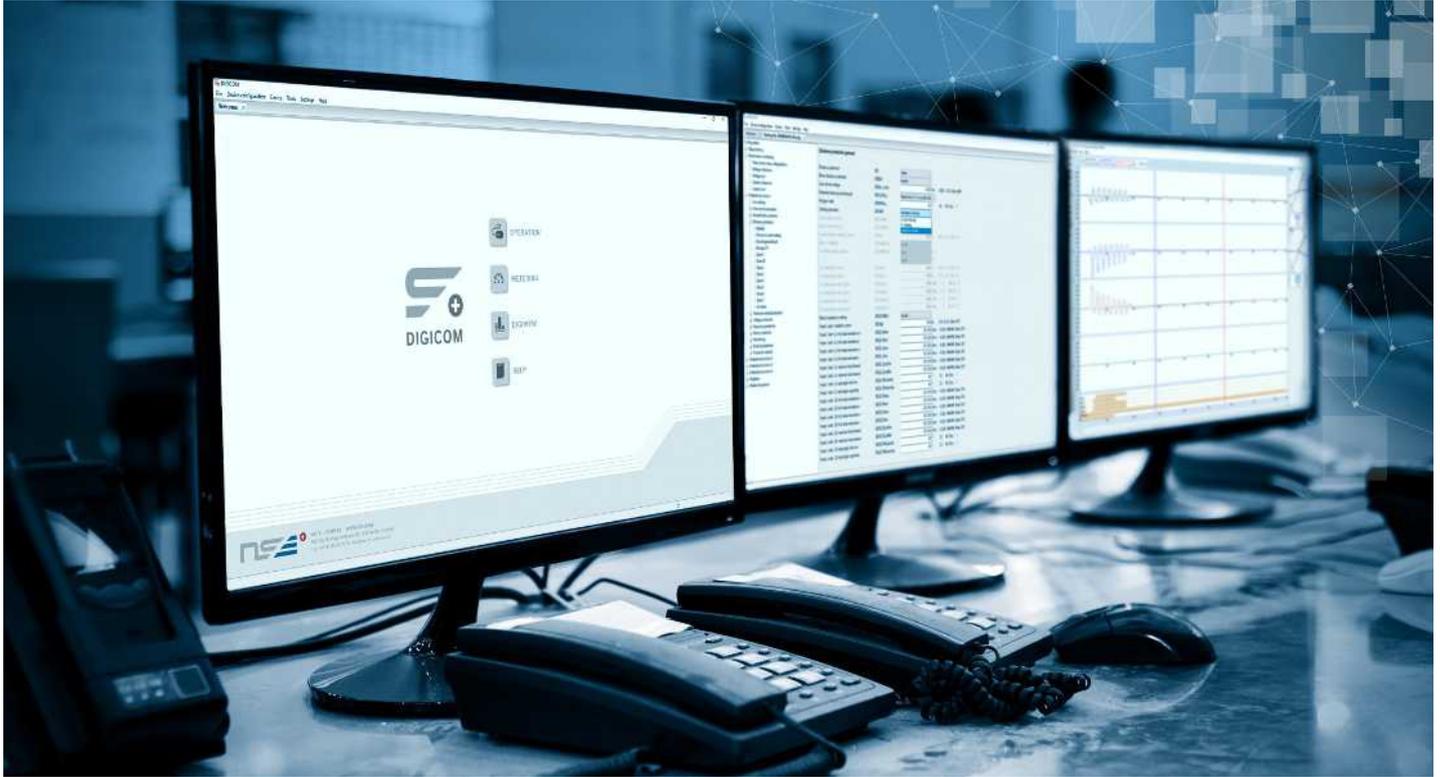
Functions	DIGICOM		
	BASIC	**ADVANCED**	**ADVANCED MULTIUSER**
Complete creation of the configuration files including programmable logic and system automation	✓	✓	✓
Reading out device data	✓	✓	✓
Comparison of configuration files	✓	✓	✓
Uploading the configuration files to the protective device	✓	✓	✓
Password management	✓	✓	✓
Language selection (DE, EN, FR, IT)	✓	✓	✓
Integrated help function, function manual, and device manuals	✓	✓	✓
Reading out event lists		✓	✓
Display of the measured values and status indicators in the measurement center (online file)		✓	✓
Graphic visualization of the DIST/DIFF characteristic curves (only for devices with software option ZP)		✓	✓
Test functions (activation of the binary outputs, LEDs, IEC 60870-5-103, thermal decay)		✓	✓
Readout and graphic analysis of the COMTRADE fault data in DIGIVIEW		✓	✓
Firmware update		✓	✓
Multi-user license			✓
Item number	1270480	1270482	1270484

Download the DIGICOM BASIC software free of charge

DIGICOM is the operating software for initial device setup and for adjustments in later operation. For optimal decision-making, you can get a first impression of the software in advance.

The basic version DIGICOM BASIC is available as a free download on our website. You won't need an existing test device to get an initial impression.
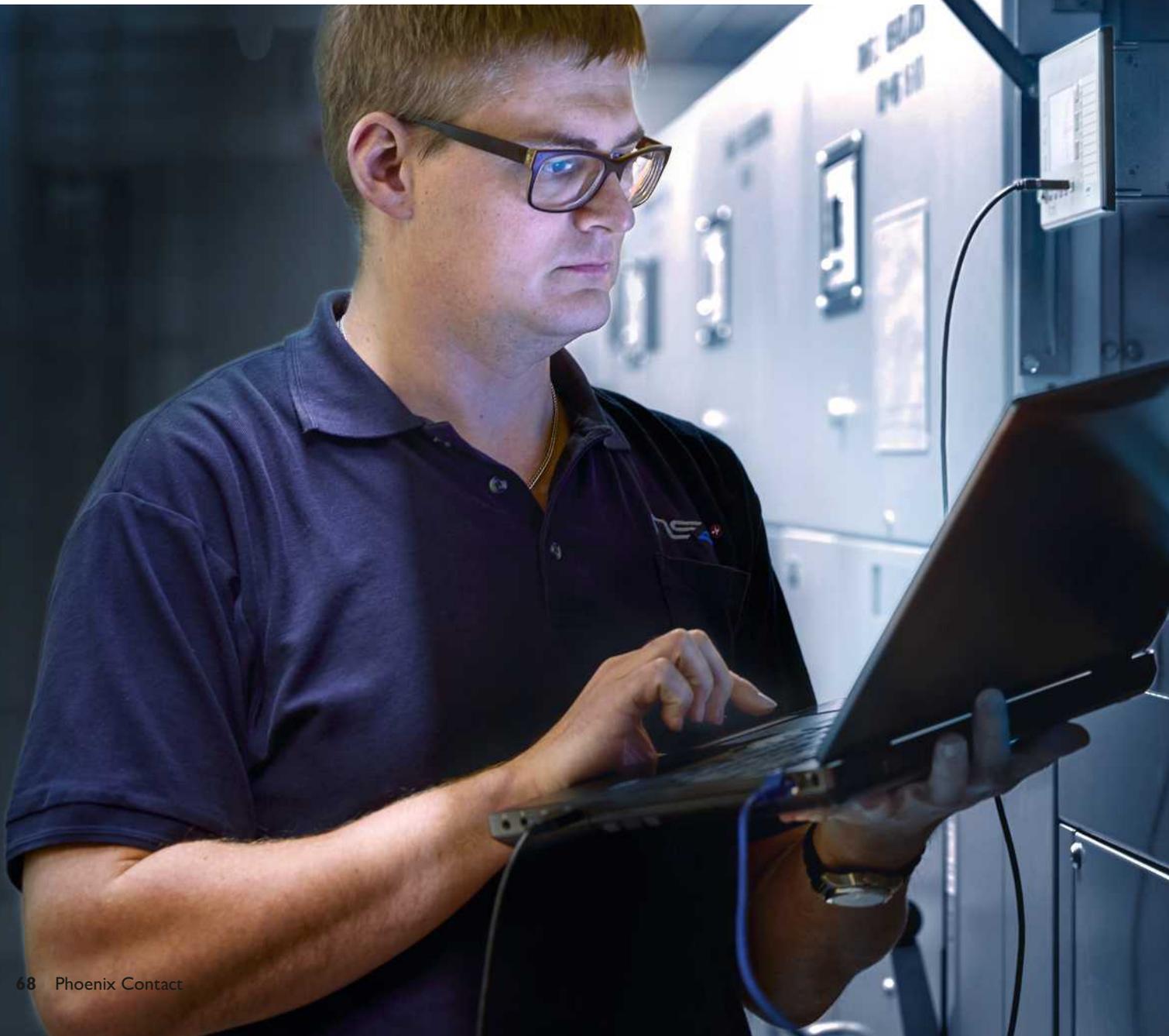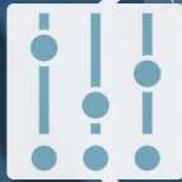
Download the software easily and free of charge

Optimum mains protection requires not only reliable and particularly robust hardware, but also intuitive operation of the components and support during commissioning and later operation.

You can simply download the DIGICOM BASIC operating software free of charge and get your first impressions of how to use it. All the basic version functions can be used without installing the actual software. For a detailed description of this, please refer to the user manual and information within the software itself.

Web code: #2274
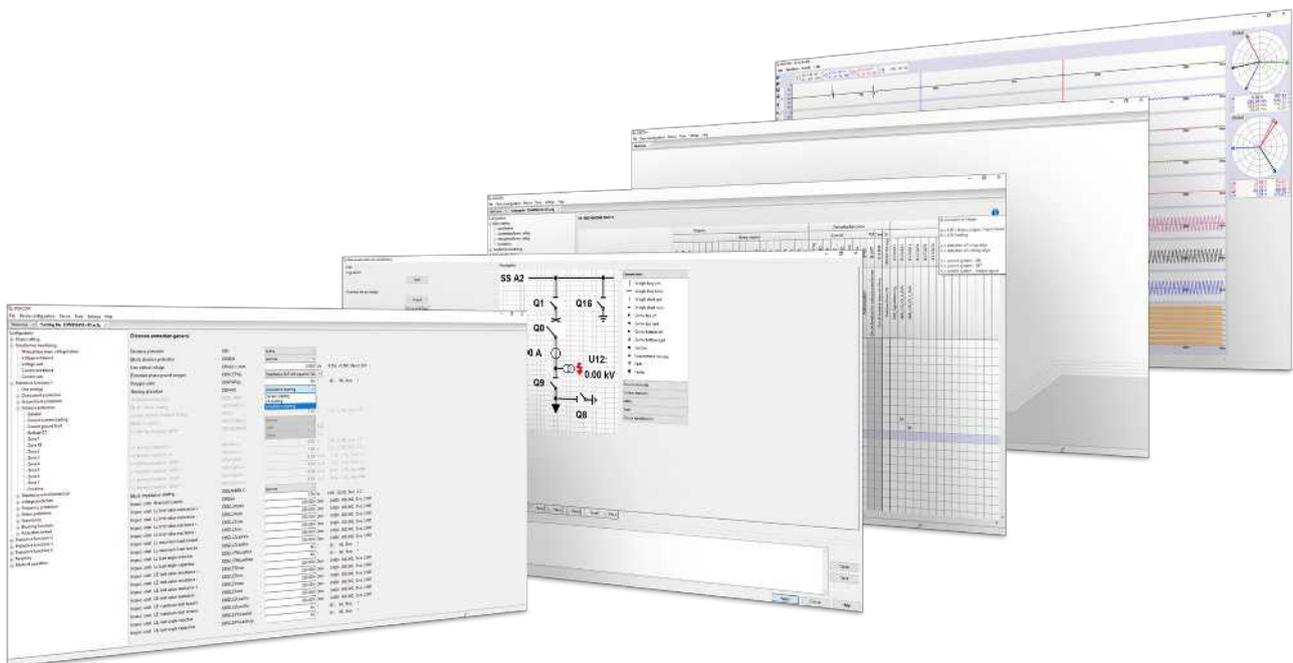
Intuitive operating software with extensive functions

Comprehensive functions with intuitive operation

The DIGICOM operating software enables fast and self-explanatory use due to a clear display.

The software provides support for configuring the device and guides along the extensive protection settings from system automation all the way to the evaluation of the available data.

To do this, DIGICOM uses an integrated graphic and logic editor and the optional analysis program DIGIVIEW.
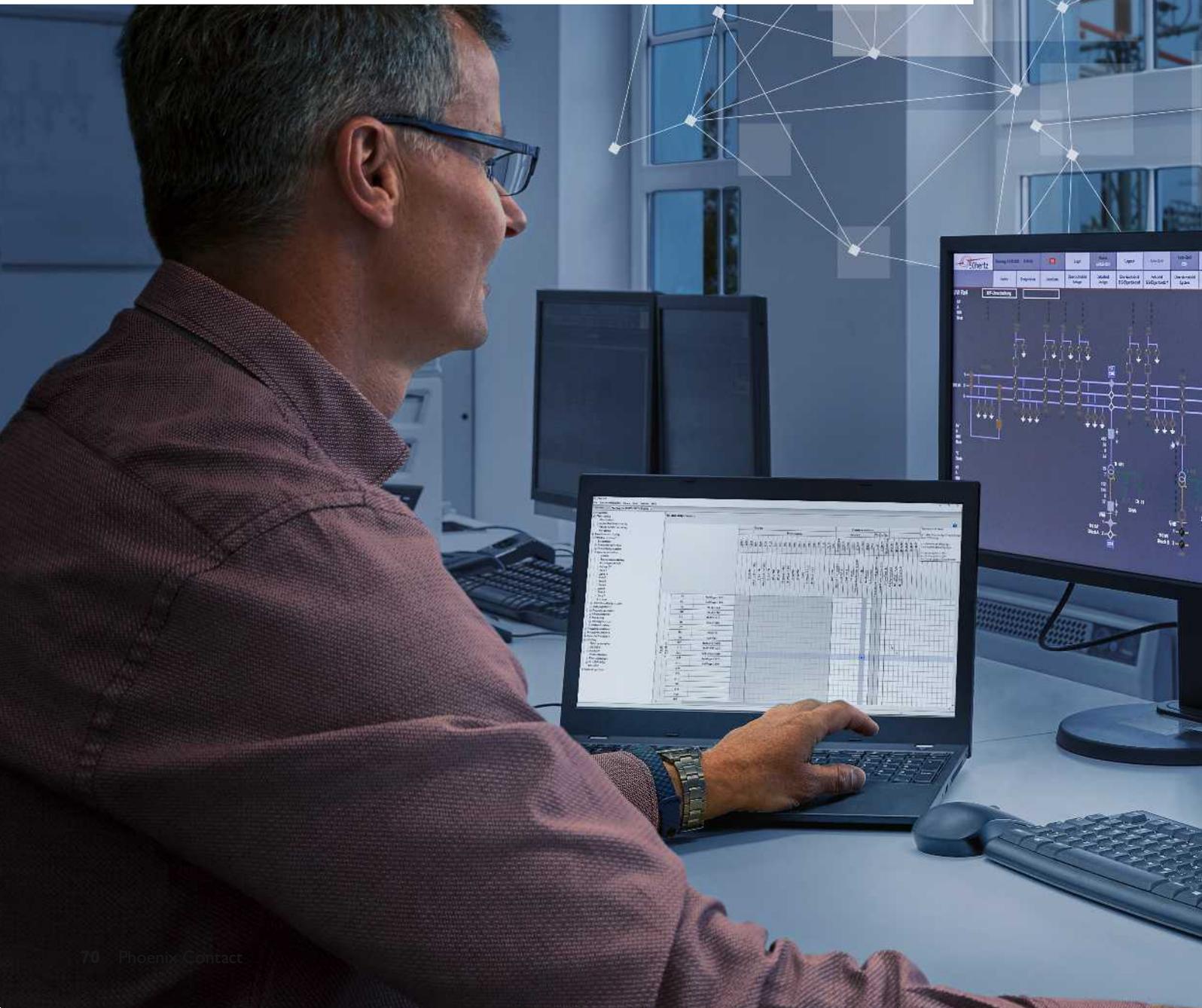
Device parameterization

Clear user interface for configuration

The DIGICOM operating software enables a fast and simple device parameterization. The configuration file is either created from scratch or read out from an already-configured unit. The menu navigation of the configuration files is structured in a user-friendly tree structure. This enables clear, step-by-step device parameterization. The selection of the individual sub-points automatically displays the configurable parameters. The software automatically grays out the parameters that cannot be changed due to previously made settings. The field-tested process makes programming the device easy for the user.
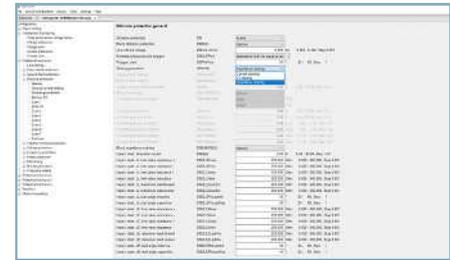
A structured menu navigation and logical links between selection fields makes operation easier

Parameterizing the interfaces for primary technology

In the object adjustment section, the connections of conventional current and voltage transformers are set. With the POWERSAVE protective relay family, the settings for connected sensors are entered depending on the hardware variant. In the case of converter parameterization, this includes, for example, the connection direction, primary values, circuitry, rated currents and voltages, and the star point treatment.

The transformer monitoring section establishes how the connected transformers are monitored. Monitoring functions such

as measurement voltage failure, current and voltage imbalance, and current and voltage sum can be configured here. Activating the monitoring or protection functions automatically makes the associated data points available in the communication protocol, logic, and I/O matrix.

Simple data transfer from connected transformers and sensors

Protective functions and peripheral devices can be programmed as needed

In the field of protective functions, DIGICOM provides the option to set up up to four different parameter records. These parameter records include the same selection options of protective functions respectively and can be adjusted independently of one another. In addition to the protection functions, operation support functions for monitoring, signal transmission, or AWE can also be found in each parameter record. The parameter records can be switched by using the function buttons on the front panel. The settings in the peripherals section include various themes. In this area, parameters

are defined which are used to control the primary technology, the station automation, and the connection to the remote control technology or which affect the display. The integrated graphics and logic editor and the E/A matrix are tools for engineering the system automation. Parameters to define communication via IEC 61850 or IEC 60870-5-103 are also defined in this section.

Flexible operation due to freely programmable function buttons

System automation and engineering

Visualization and system logic

The visualization of the control panel on the device display and the programmable system logic are edited with the graphic and logic editor. The editor is a part of the DIGICOM BASIC operating software. The system automation is defined with the logic editor.

The visualization for the device display is created graphically in the editor and linked to the programmable logic. The logic files can be exported, imported, and edited directly from the editor. This enables re-use of templates on other devices. The combination of logic file and visualization results in control of the switching devices field.

The editor is used to define the display on the device display as needed or with predefined tables. The left half of the display shows the system topology with all switching elements. On the right half, all measured or calculated measured values can be shown, for example. Static and dynamic text blocks, information from device detection, or virtual LEDs can likewise be shown.
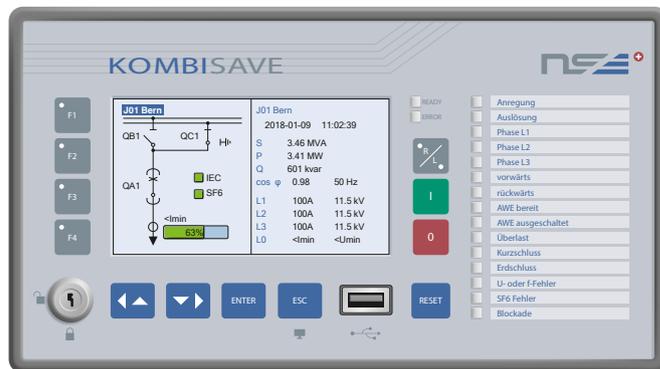
Control systems intuitively via the front panel

Working with the logic editor

The logic editor offers a wide range of options for system automation. The logics enable tasks such as extending of protection functions, executing switching sequences, or automatic grid changeovers. The software library supplied provides RS flip flops, counters, timers, and Boolean logic. The switching elements specified by the primary technology can also be taken from there. These logical switching elements ensure, for example, that the switching position is correctly shown on the display and transmitted to the automation system. The link between logic editor and I/O matrix is made via logic inputs and logic outputs. The designations of the inputs and outputs are automatically taken over during import into the I/O matrix and linked to the desired signals. The circuit diagrams can be hierarchically structured with the editor. This enables a clear display of the system information and re-use of standardized templates.
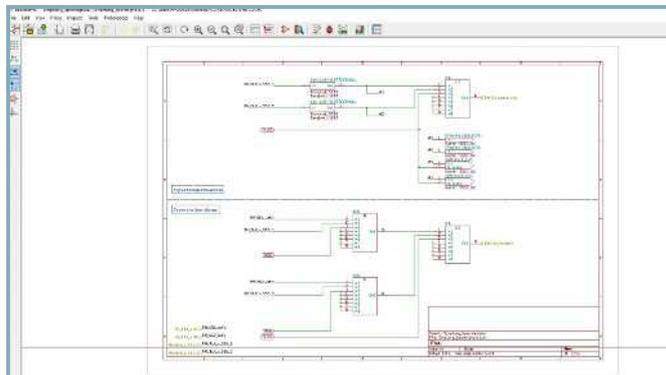
Create clear analog logics

Test functions and fault data analysis

Support for commissioning with integrated test functions

In addition to the parameterization and configuration of the protective relay, the software also allows you to run test functions. This is necessary during tasks such as commissioning tests and maintenance work, or when rectifying faults.

In addition to activating the binary inputs and outputs, you can also adjust the test of the excitation signal. Moreover, there is the option to check the functionality of the LEDs and the screen.
A thermal level can be specified for the thermal image. This simulates the pre-heating of the protected equipment, such as a motor.

The communication function via IEC 60870-5-103 can be tested using DIGICOM. Since not all data points can be tested by direct testing, signals such as device faults and warnings can be stimulated as individual data points, for example. This can be easily carried out with the support of the DIGICOM test function.

Display of status and measured values

Analysis of fault data with DIGIVIEW

For optimal analysis of fault data, the supplied DIGIVIEW analysis program can be used to display COMTRADE files. DIGIVIEW is a universal tool in which fault data records can be displayed and evaluated clearly. The program supports COMTRADE files in accordance with IEEE C37.111.1999.

The measured analog values are show as u(t) and i(t). These are used to calculate and display additional values such as RMS values. In addition to analog values and binary traces, it is possible to display current and voltage values in vector diagrams.
Fourier transformations are used to determine the proportions of the harmonics, calculate their percentages, and display them in the program. This makes it easier to assess transient processes in transformers, for example.
The analog or binary values to be displayed are selected in the configuration. The settings for the vector diagrams, the fault data time point, the trigger time point, and the device designation can also be adjusted here.
This makes it possible to synchronize incident records to a common point in time for comparisons or due to invalid time stamps.
DIGIVIEW supports the display of primary and secondary values and allows subsequent modification of the primary and secondary ratios of the transformers. The areas shown can be scaled in size. The appropriate magnification enables detailed data analysis. A modified fault record can be saved with a new file name and also
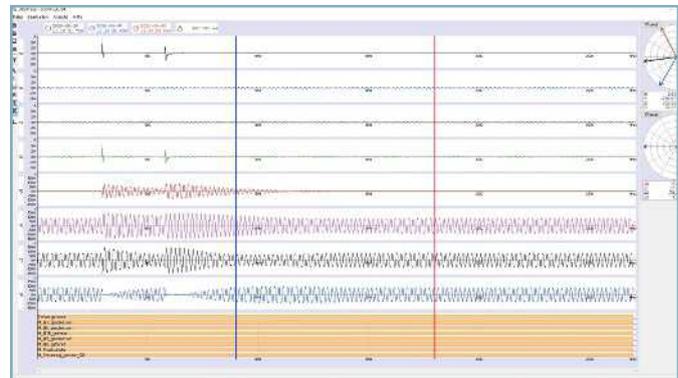
Display of analog signals and binary values

printed. DIGIVIEW is part of the DIGICOM ADVANCED operating software package, for which a corresponding license is required.

Intelligently combined

Error warning systems

Our electronic display and notification systems are used to process and visualize information. They are available with 8, 16, 24, or 40 notification displays. Optionally, they also allow data transmission to a control room by means of standardized communication protocols.

[i] **Web code:** #2356

Protective relays for mains protection

The comprehensive portfolio of protective relays ensures reliable grid availability in the voltage range from 10 kV to 110 kV. The devices are therefore perfect for use in substations and at feed-in points to the public power supply as well as in industrial power distribution applications.

[i] **Web code:** #2274

Industrial communication

The aim of industrial communication is the reliable transmission of data from the field through to the control level. Consistent solutions with Industrial Ethernet, state-of-the-art wireless technologies, and cybersecurity increase the availability and security of the networked systems here. Network protocols and fi eldbus systems such as PROFINET, OPC UA, PROFIBUS, and INTERBUS ensure efficient communication.
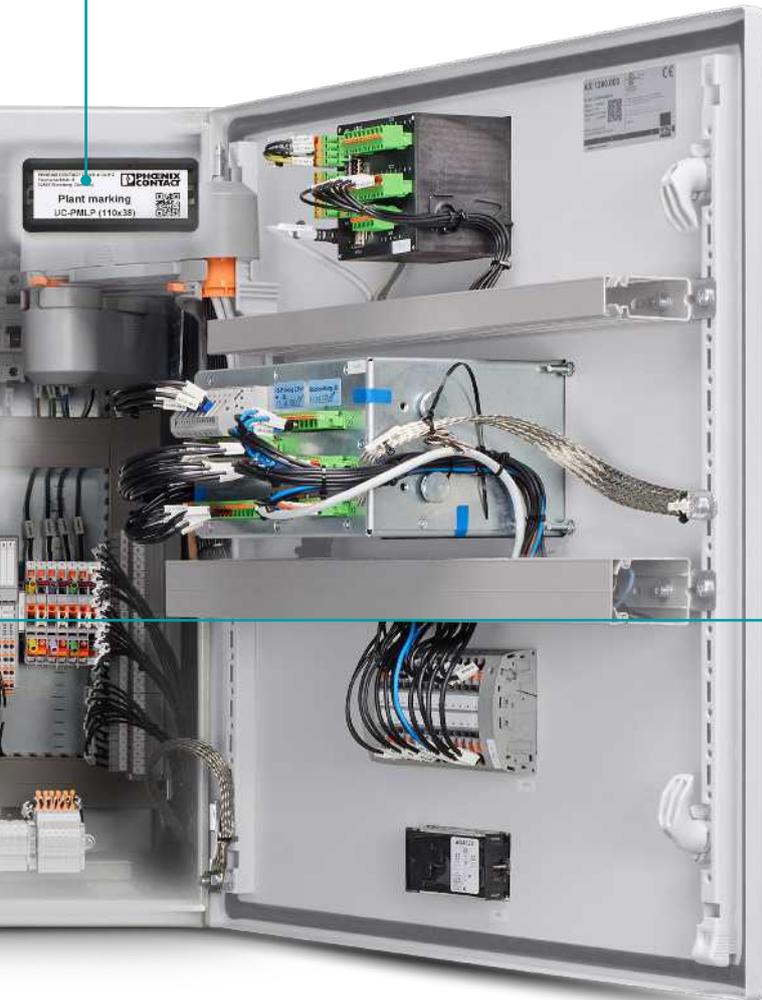
[i] **Web code:** #0936

Marking and labeling

A consistent plant marking system forms the basis for efficient maintenance, repairs and troubleshooting in substations. We offer consistent and comprehensive system solutions for this purpose: from marking material through marking systems to software – all from a single source.

ⓘ Web code: #0575

Remote terminal unit (RTU)

The smartRTU technology platform is a modular, easy-to-configure remote terminal solution for various fields of application. As a telecontrol or automation system in power grids, it features predefined functions and easy configuration.

ⓘ Web code: #2359

Protect, monitor, and control electrical grids

Transmission grid and distribution grid operators are constantly modernizing and developing their grids. With our comprehensive service portfolio, we help grid operators in the digitalization and optimal adaptation and development of their equipment. The focus is on security of supply, based on high-availability and technically mature products and solutions. We provide you with support from the planning phase to implementation.

Plug-in test systems for protection technology and control engineering

Protective devices for high-voltage current transformers are tested regularly. The modular, preconfigured FAME plugs and terminal strips offer all switching actions for safe protective testing, enabling time-saving measuring and testing processes.

ⓘ Web code: #0131

Open communication with customers and partners worldwide

Phoenix Contact is a global market leader based in Germany. We are known for producing forward-thinking products and solutions for the comprehensive electrification, networking, and automation of all sectors of the economy and infrastructure. With a global network, we maintain close relationships with our customers, something we believe is essential for our common success.

You can find your local partner at

phoenixcontact.com

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