



SG-50 KOMBISAVE

Combined protection



Precision actuation and triggering

The SG-50 KOMBISAVE is a numeric protection and control device for use in medium voltage distribution systems, industry and uncoupling protection at decentralised generators. The modular separation of the protection and control functions means economic benefits in plant management are attained.

It is in protection technology in particular that we attach the greatest of importance to quality and longevity. In addition to greater precision, the idea of simple and reliable configuration (familiar from the established telecontrol systems of the series 5) are also deployed in the SG-50 KOMBISAVE. Self-explanatory menu navigation means that manuals are broadly redundant.

Typical fields of use

- Definite/inverse time-delay overcurrent protection, simple or directional
- Power protection with optional automatic reclosing
- Transformer protection with thermal dual body map
- Machinery protection, rotor blocking protection
- Earth fault protection with intermitting EF detection
- Protection of decentralised generation plants (QU protection)
- Busbar protection with H2 logic
- Reserve protection in HV networks

SG-50 KOMBISAVE short profile

Combi protection with precision function in tailor-made designs with variable transformer configuration and selective protection functions. Large colour display with configuration options on site, function and control data, maintenance and key-operated switch, 11-colour LED with freely definable marking. 14 binary inputs, 14 relays, 2 auxiliary voltages, RS-485 interface with IEC 60870-5-103 protective equipment coupling.

Optional: 26 inputs, U-input 400 V AC no VT, serial FO protective coupling, IEC 60870-5-104 control centre coupling, IEC 61850, logic function and plant automation. Protection modules: Synchrocheck, QU protection, fault location, polygonal distance protection, surge guard, parallel power protection, MHO circuit characteristics

Performance & quality

Integration into networks

In addition to the high level of functionality whilst retaining simple operation, major significance is attached to the integration capability of the protection technology into intelligent networks. As combination protective equipment, network control can be realised directly or via diverse telecontrol and substation automation capabilities.

The selective protective equipment coupling filters relevant process points for analysis in power system control. Fault records can be automatically read by the series5 remote terminal unit from the protective equipment. The remote terminal unit logs the fault records in the Comtrade format and makes them available for analysis in different ways.

The high level of flexibility of the SG-50 KOMBISAVE means it can be deployed for an array of applications.

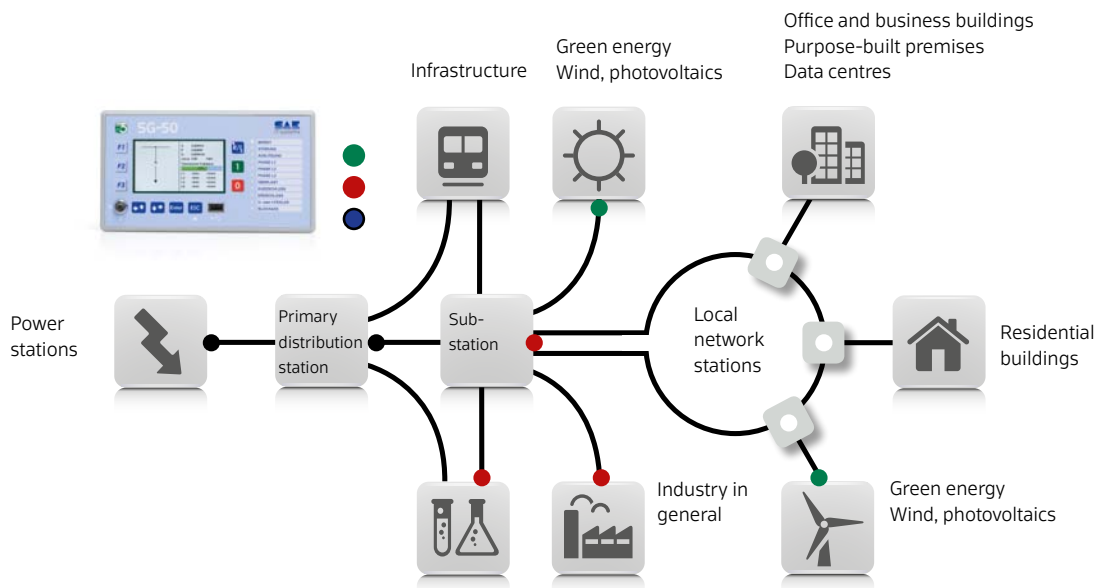
Configuration

The large colour display with intuitive keypad and freely programmable function buttons enable simple configuration of the system. Comprehensive parameter records are generated on a PC using a configuration tool and loaded into the system over a USB port. Parameter records and fault records can also be transferred via a memory stick. The optional DIGICOM-advanced PC software provides comprehensive analysis of the fault records.

Software

The concept here is also aligned towards tailor-made solutions and intuitive operation:

- DIGICOM-basic:
Base settings of protection parameters
- DIGICOM-advanced:
 - + Online view of device status,
 - + Measurement centre,
 - + Service- and test functions,
 - + Fault record analysis with DIGIVIEW



Potential application areas

- | | |
|----------------------------|---|
| ● Power station protection | Thermal unit protection |
| ● Substation protection | Protection with integrated station automation |
| ● Measurement stations | Protected with directional earth protection |
| ● Industry | Protection for closely-meshed networks, poss. EF protection |
| ● Generation | Network uncoupling: QU protection |
| ○ Secondary distribution | Autonomous protection, no battery supply |

Operation

Simple, intelligible, flexible

The much-praised approach of broadly self-explanatory menu navigation has also been provided for on the SG-50 KOMBISAVE, making manuals and expert knowledge redundant during operation.

All information and parameters can be read on the large display and be entered from the keyboard. Configuration from a PC is not an absolute requirement for simple applications. For more complex applications and more efficient configuration, there is of course also the ability to connect the SG-50 KOMBISAVE combi protective equipment to a PC over a USB port and to operate it with the DIGICOM software.

A USB memory stick can be used to easily load parameter records onto the SG-50 KOMBISAVE without using a PC. Similarly, records of events and network faults can be read via memory stick and later be analysed by the network protection engineer from the comfort of his or her office. The additional option of operation over the communication interfaces offers a maximum level of flexibility.

Integrated operator panel

The SG-50 KOMBISAVE is operated on site from a clearly structured, easily understandable operator panel on the front of the device.

- 1 Fully graphic, high-resolution TFT display: Dynamic plant visualisation makes it easier to gain an overview of the plant status. Clearly legible text fields indicate at a glance the important measured values.
- 2 11 freely programmable, three-coloured LEDs for status and warning indications: These LEDs can be set individually to red, green or orange, and be assigned to any functions (static and flashing). Push-in strips can easily be used to label the LEDs.
- 3 Four conveniently positioned navigation buttons for operation of the device.
- 4 Separate button for switching between "Remote control (R)" and "Local operation (L)". Two orange LEDs signal the current operating mode.
- 5 Two separate control buttons are used to activate plant equipment.
- 6 Three separate function buttons: These buttons can be assigned to frequently used functions, such as accessing a particular menu.
- 7 Mechanical key-operated switch for interlocking switching operations for example during maintenance.



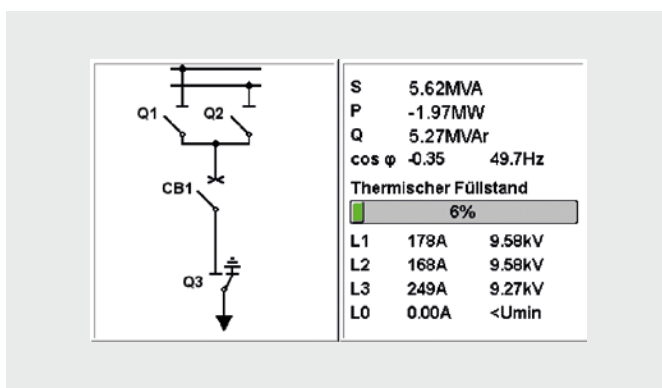
SG-50 KOMBISAVE with standard plant visualisation

Control

Plant visualisation

The design of an installation and the equipment deployed therein can be shown graphically. The acquisition of equipment states via SG-50 KOMBISAVE inputs enables the dynamic visualisation of the current status of the real installation. In addition, clearly legible text fields indicate at a glance the most important measured values.

The graphic plant visualisation and the measured value display can be configured easily from the DIGICOM-PC software.



Plant visualisation and measured value view

Equipment control

Existing equipment can be controlled from the SG-50 KOMBISAVE if it is connected to the outputs.

Control is either from:

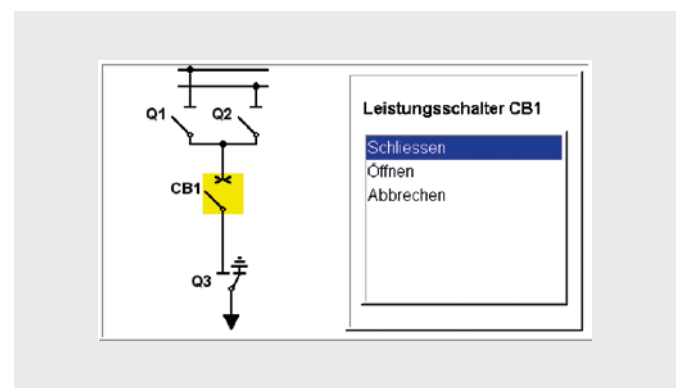
- The integrated control panel
- The binary inputs
- The control centre (network interfaces)

Switching sovereignty

The switching sovereignty can be granted via binary inputs or the control centre. To guarantee safety, an R/L button can be used to disable the remote control capability (L) and to suppress every control command by a key-operated switch. Local control is provided via the four navigation buttons on the operator panel in conjunction with plant visualisation. Two function buttons, "I" and "O", enable safe and efficient operation of selected equipment.

An example of control using the navigation buttons is shown below with a circuit breaker:

- 1 The "Control" menu is selected with the arrow buttons and enabled with "Enter".
- 2 The arrow buttons are used to select the circuit breaker in the visualisation system. Relevant supplementary information is shown in the text field.
- 3 "Enter" is used to confirm the selection - available control actions are displayed.
- 4 The required control action "Close" is selected with the arrow buttons and confirmed with "Enter". The circuit breaker is closed after a password is entered.



Control of a circuit breaker

Logic functionality

The integrated, comprehensive and easily understandable logic functionality enables new functions to be set up for automation of the switching station. This means diverse signals of the protective functions, the operator panel, the binary inputs and outputs and control centre and virtual equipment signals (for outgoing line visualisation, equipment control) can be linked together. Various function blocks are available for linking, including:

- Logic gates
- Counters
- Timing relays
- Memory

Configuration of the logic is simple from the DIGICOM PC software. Understandability and simple operation are features of the autonomous concept for logic input and logic processing in the SG-50 KOMBISAVE. Comprehensive data interchange is provided with modern, up-to-date standards.

Communication

Protocols

Modern supervisory control centre systems use various protocols for data interchange. Direct integration of protocols in the protective equipment enables seamless connection of the SG-50 KOMBISAVE to the substation automation of various manufacturers.

IEC 60870-5-103

IEC 60870-5-103 is a standard for the transmission of protection data and fault records. The support of IEC 60870-5-103 via the EIA/RS-485 interface is included as default.

IEC 60870-5-104

IEC 60870-5-104 is a standard for integration into telecontrol and substation automation.

Transmission over Ethernet links (TCP/IP) is available with Ethernet interface as an option.

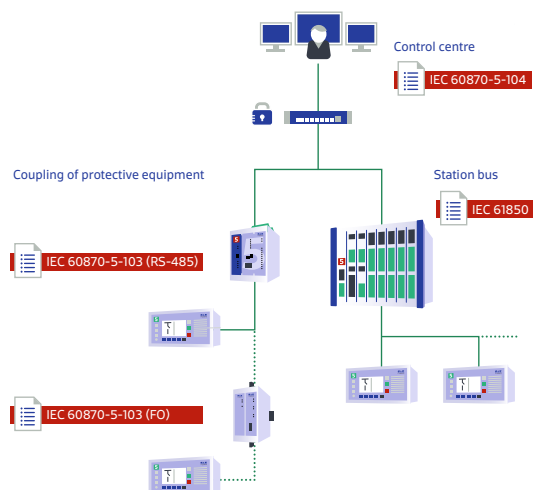
IEC 61850

IEC 61850 is a general transmission protocol for station automation for protection technology and supervisory control centres in electrical switching stations for mid and high voltage technology.

Some of the definitions in IEC 61850:

- General specifications for switching stations
- Information for functions and equipment
- Information exchange for protection, monitoring, control and measurement
- IEC 61850-8-1; block 1, 2, 5, 6, 9ab, 12ad, 13, 14

Electrical or optical Ethernet links (TCP/IP) are used for transmission.



Possible structure of a communication network

Product selection

The SG-50 KOMBISAVE is available tailor-made in many combinations:

Hardware

It starts with the selection of the auxiliary voltage for supply and actuation:

- V1** 16 to 160 V DC
- V2** 120 to 250 V DC/90 to 250 V AC

Then the necessary transformer configuration is determined with the protective function required:

- I2U0** two current transformers CT (1 / 5 A), no voltage converter VT
- I4U0** four CT (1 / 5 A), no voltage converter VT
- I4U1** four CT (1 / 5 A), one VT (100/110 V AC)
- I4U4** four CT (1 / 5 A), four VT (100/110 V AC)
- I4U4X** four CT (1 / 5 A), four VT (100/110/400 V AC)
- I8U0X** eight CT (1 / 5 A), no voltage converter VT from 1Q16

Status and control signals I/O are always configured:

- B114B014** 14 binary inputs, 14 outputs/relays
- B126B014** 26 binary inputs (2*DC/AC, 24*DC), 14 outputs/relays (2 high speed)

Then there is the interface required:

- RS** EIA/RS-485 with IEC 60870-5-103: default
- RO** EIA/RS-485 via fibre optics:
- EE** Ethernet over RJ-45:
- EO** Ethernet over ST fibre optics:
- WS** System interface (input for RTD-temp-box) from 1Q16

Software options

Please note that some functions are only available with certain hardware / transformer configurations.

- 04** Communication with IEC60870-5-104: requires EE/EO
- 50** Communication with IEC61850: requires EE/EO
- SY** Synchron-check: requires I4U4
- QU** QU protection: requires I4U4
- UL** Underfrequency load shed UFLS requires I4U4
- FO** Fault location: requires I4U4
- ZP** Polygonal distance protection: requires I4U4
- PE** Surge guard: requires I4U4, ZP
- PA** Parallel power compensation: requires I4U4, ZP
- MO** MHO circuit characteristics: requires I4U4, ZP
- LD** Line differential protection from 1Q16 requires I4U4
- TF** Differential protection for transformers from 1Q16 requires I8U0
- AU** Customer-specific plant automation

Accessories

- User manual: Deliverables in digital format
- Customer-specific push-in strips. LED labelling: Deliverables
- DIGICOM-basic configuration software: Deliverables
- USB cable for connection to PC, 2m, type A-A
- Assembly set, surface mounting with brackets and button bolts
- DIGICOM-advanced (fault record analysis...)

SG-50 KOMBISAVE functional scope

Select here the options for the combination of protective functions and the transformer configuration required:

- I2 = two current transformers
I4 = four current transformers (e.g. I_{L1} , I_{L2} , I_{L3} , I_{L0})
U0 = no voltage converter
U1 = one voltage converter
U4 = four voltage converters (e.g. U_{L1} , U_{L2} , U_{L3} , U_0)

Measured values and displays

	I2U0	I4U0	I4U1	I4U4
LED (three-coloured, freely programmable, static, flashing)	11	11	11	11
Illuminated graphical TFT colour display	●	●	●	●
Network fault: Current (and voltage) per phase, KS duration, binary inputs/outputs, date/time	●	●	●	●
Event list with 1000 events, fault data recording max. 8 s	●	●	●	●
I_{L1} , I_{L2} , I_{L3} , I_{L0} , I_{15} min average, thermal Fill level	●	●	●	●
U_0 , U_{L1} , U_{L2} , U_{L3} , U_{L12} , U_{L23} , U_{L31} , f:				●
P, Q, S, $\cos \phi$, R/X, R0/X0, km/miles:				●

Protection functions

ANSI	IEC	Description	I2U0	I4U0	I4U1	I4U4
		Parameter records	2	2	4	4
50/51	I>, I>>	overcurrent; two-stage, IOC and TOC selectable	●	●	●	●
50N/51N	IE>, IE>>	earth current; two-stage, IOC and TOC selectable		●	●	●
49 & 49II	δ >	thermal overload; two body map for oil transformers, motors, lines, etc.	●	●	●	●
37	I<	Undercurrent protection	●	●	●	●
48		Start-up time monitoring	●	●	●	●
66/86		Re-start inhibits	●	●	●	●
14		Rotor blocking protection	●	●	●	●
51M		Load step protection	●	●	●	●
46	I2>	Out-of-balance protection		●	●	●
50BF		Switch fail protection	●	●	●	●
79	ARC	Automatic reclosing	●	●	●	●
68		Inrush protection	●	●	●	●
50		Short-circuit switch-on protection	●	●	●	●
85		Busbar protection to H2	●	●	●	●
74TC	TC	Trigger circuit monitoring	●	●	●	●
67N	IE ger>, IE ger>>	Dual directional earth connection; for insulated, compensated and fixed networks			●	●
67Ns	IEE >, IEE >>	Dual directional intermitting earth connection; for isolated and compensated network			●	●
67	Iger>, Iger>>	Dual directional short-circuit protection; two-stage				●
27/59	V<, V>	Undervoltage/surge protection; both two-stage				●
81U/81O	f<, f>	Under/over-frequency protection; both two-stage				●
47	V2>	Rotary field monitoring				●
	QV	QU/QV protection (optional)				(●)
21FL		Fault locator (optional)				(●)
25		Synchro-check (optional)				(●)
81LSH		Under frequency load shed UFLS (optional)				(●)
	Z<	Current, UI, under-impedance excitation for distance protection				(●)
21, 21N	Z	Polygonal multi-stage distance protection with 7 zones in forward/backward direction and managed zone Z1B				(●)
21, 21N	Z	MHO circuit characteristics for distance protection				(●)
		Parallel power compensation for distance protection				(●)
		Surge guard for distance protection				(●)

Technical data

Auxiliary source

DC supply V1

Function range	16...160 V DC, <5 W
Network failure bridging	50 ms

AC/DC supply

Function range	V2 120 to 250 V DC/90 to 250 V AC, <5 VA
Network failure bridging	50 ms

Measurement inputs

Nominal frequency f_N	50 or 60 Hz
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Current inputs

Nominal current I_N	I_1, I_2, I_3, I_0 1 A and 5 A changeable via software
Consumption per phase for I_N	< 0.2 VA
Accuracy for I_N	< 0.5%
$2...40 \times I_N$	< 3%
$40...100 \times I_N$	< 10%
Capacity	4 x I_N
continual	Thermal 100 x I_N Dynamic 250 x I_N

Voltage inputs

Nominal voltage V_N	$U_1, U_2, U_3, U_0/U_x$ 100 V / 110 V AC changeable via software
Consumption per phase	< 0.2 VA
Accuracy $0.25...2 \times V_N$	< 0.5%
Capacity	$2 \times V_N$ continual

Binary inputs and outputs

Binary inputs BI14	14 inputs, 19 to 250 V AC/DC, < 2 mA
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Binary inputs BI26	2 inputs, 19 to 250 V AC/DC, < 2 mA 24 inputs 24-60 V DC /70-250 V DC, < 2 mA
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Binary outputs BO14	14 relays, 250 V AC/DC, 2 high speed < 3 ms
Permitted switched current	8 A @ 240 V AC, resistive 8 A @ 30 V DC, resistive 0.4 A @ 110 V DC, resistive
Limiting making capacity	2000 VA
Switch principle	normally open contact

Constructive features

Enclosure	steel plate, 1.5 mm, zinc-plated, IP51
Dimensions, installation	230×129×200 mm (W×H×T)
Dimensions, assembly	230×129×244 mm
Weight	approx. 3.5 kg

Terminals & connections

Current/voltage converter	Plug-in terminals, fuseable, 35 A/250 VAC
Binary signals	Plug-in terminals, fuseable, 2.5 mm ²
Supply	Plug-in terminals, fuseable, 2.5 mm ²
USB	USB type A
EIA/RS-485 electrical	Plug-in terminals, fuseable, 2.5 mm ²
Ethernet electrical	RJ45, TIA-568
Ethernet optical	ST connector, 1300 nm, max. 1.5 km

Standards/tests

Basic product standard	IEC 60255
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Insulation test

Voltage test (routine test)	IEC 60255-5 2.5 kV (EFF), 50 Hz, 1 min
Voltage test (type approval)	5 kV (peak), 1.2/50 ms, 0.5 J

EMC testing (type approval)

IEC 60255-4 and -22, IEC 61000-4	
High-frequency testing	IEC 60255-22-1: 2.5 kV (peak), 1 MHz
Electrostatic discharge	8 kV contact, 15 kV air discharge
Radiation in HF field	10 V/m, 80 MHz to 2.7 GHz
Fast transient interference	4 kV, 5/50 ns, 5 kHz,
Burst:	IEC 60255-22-4 and IEC 60255-4-4: Burst length 15 ms, repetition rate 300 ms
High-energy surge voltages	pulse 1.2/50 μ s
Surge:	IEC 61000-4-5
Conducted HF	IEC 61000-4-6: 10 V, 150 kHz to 80 MHz
Magnetic field	IEC 61000-4-8: 30 A/m continual, 300 A/m 3 s

Mechanical strength (type approval)

Standards	IEC 255-21-1, IEC 255-21-2, IEC 255-21-3, DIN IEC 68-2-6
Earthquake resistance	Nominal frequency: 1...35 Hz Crossover frequency: 8...9 Hz Horizontal: 3.5 mm; 10 m/s ² Vertical: 1.5 mm; 5 m/s ²
Vibration loading	10...150 Hz; 0.075 mm; 1 g
Surge follow-up load	Ea: 11 ms; 15 g, Eb: 16 ms; 10 g

Ambient conditions (type approval)

Standards	IEC 60255-6
Operating temperature	-10° C to +55° C
Storage temperature	-25° C to +55° C
Transport temperature	-25° C to +70° C
Relative humidity	annual average: 75%, no condensation 95% at max. 40° C for 30 days



SG-50 KOMBISAVE product variants

Suggestions from the array of variations

Single IOC protector

- Single line protection with control
- Auxiliary voltage 48 V DC
- Communication IEC 60870-5-103/RS-485

SG-50-V1-I2U0-RS

Single IOC protector with EF

- Single line or motor protector with control (lines, transformer, motors)
- Auxiliary voltage 240 V AC
- Communication IEC 60870-5-103/RS-485

SG-50-V2-I4U0-RS

Cost-effective distribution network protector

- IOC, directional EF,
- complex motor protection
- Auxiliary voltage 60 V DC
- Communication IEC 60870-5-103/RS-485

SG-50-V1-I4U1-RS

Directional IOC/EF protector

- Directional IOC, directional EF, U<>, f<>, complex motor protection
- Auxiliary voltage 60 V DC
- Communication IEC 60870-5-103/RS-485
- optional with synchro-check, fault location extendible

SG-50-V1-I4U4-RS

QU/QV protection

- Reactive power undervoltage protection
- Communication IEC 60870-5-103/RS-485
- Distance protection optionally extendible

SG-50-V1-I4U4-RS-QU

Distance protection

- Directional IOC, directional EF, U<>, f<>
- Distance protection
- Auxiliary voltage 48 V DC
- Communication IEC 61850 FO
- optional with MHO surge guard extendible

SG-50-V1-I4U4-RS-EO-50-ZP

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The guard5 series is developed and manufactured with precision in line with our principle of supplying the highest quality and reliability. The products are not commodity goods and provision is made for customer requirements provided they are permitted by the technology.

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SAE IT-systems GmbH & Co. KG
Im Gewerbegebiet Pesch 14
50767 Cologne, Germany
Phone: +49 (0)221/59808-0
Fax: +49 (0)221/59808-60
info@sae-it.de
www.sae-it.de