Generator protection relay SPAG 332 C

1MRS 750416-MBG
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Features

- Off-the-shelf generator protection relay for land-based and marine power plant applications
- Two-stage overvoltage protection and reverse power protection
- Three-phase time overcurrent and short-circuit protection
- Two-stage directional earth-fault protection
- Compact and robust mechanical design in an aluminium case to IP 54
- Local man-machine communication via push-buttons and digital displays on the front panels of the relay modules
- With or without serial interface for connecting the relay to higher-level data acquisition systems, local or remote control systems or other host systems via optical fibres
- Local operation indication via LED indicators with memory function and via the digital display
- High immunity to electrical and electromagnetic interference
- Continuous self-supervision of relay hardware and software for enhanced system reliability and availability
- Auto-diagnostic fault indication to facilitate fault location and repair
- Powerful software support for parameterization of the relay and for reading and recording measured values, events, etc.
- CE marking according to the EC directive for EMC

Application

The SPAG 332 B and SPAG 332 C numerical generator protection relays are applied for the protection of small and medium sized power generators and their prime movers. The generator protection unit is used in small hydropower plants, thermal power stations and other stationary power plants. Further, the relays are approved for use in marine and offshore applications. The generator protection relays SPAG 332 B and SPAG 332 C are often used in association with several directly connected generators operating in parallel on the same busbar system.

Design

The generator protection relays SPAG 332 B and SPAG 332 C contain an overvoltage and reverse power relay module type SPCP 3C2, an overcurrent relay module type SPCJ 3C3 and a directional earth-fault relay module type SPCS 3C4.

The relays are used for the protection of generators requiring reverse power protection, high-set and low-set overvoltage protection, high-set and low-set overcurrent protection and directional earth-fault protection.

The reverse power protection mainly protects the prime mover of the generator by preventing the generator from motoring.

The low-set stage of the overcurrent protection acts as time overcurrent protection and it can be given either definite time or inverse time characteristic.

The stator earth-fault protection is based on the use of a directional earth-fault module.

The generator protection relays type SPAG 332 are available in two main versions: type SPAG 332 B without serial communication capability and type SPAG 332 C, which includes a serial communication interface.

Data communication

The generator protection relay is provided with a serial interface on the rear panel. By means of a bus connection module type SPA-ZC 21 or SPA-ZC 17 the generator protection relay can be connected to the fibre-optic SPA bus. The bus connection module SPA-ZC 21 is powered from the host relay, whereas the bus connection module type SPA-ZC 17 is provided with a built-in power unit, which can be fed from an external secured power source. The relay communicates with higher-level data acquisition and control systems over the SPA bus.

Self-supervision

The relay incorporates a sophisticated self-supervision system with auto-diagnosis, which increases the availability of the relay and the reliability of the system. The self-supervision system continuously monitors the hardware and the software of the relay. The system also supervises the operation of the auxiliary supply module and the voltages generated by the module.

When a permanent internal relay fault is detected, the IRF indicator on the relay front panel is lit. At the same time the output relay of the self-supervision system operates and a fault message is transmitted to the higher-level system over the serial bus. Further, in most fault situations, a fault code is shown in the display of the protection relay module.

Auxiliary supply voltage

The auxiliary supply of the generator protection relays is obtained via an internal plug-in type power module. Two power supply module types are available: type SPGU 240A1 for ac or dc supply within the input voltage range 80…265 V and type SPGU 48B2 for dc supply within the input voltage range 18…80 V. The power supply module forms the internal voltages required by the protection relay modules and the I/O module. The operation of the power module is continuously supervised.

Technical data

Table 1: Energizing inputs

Rated current I_n		1 A	5 A
Thermal current withstand	continuously	4 A	20 A
	for 10 s	20 A	100 A
	for 1 s	100 A	500 A
Dynamic current withstand capability	Half-wave value	250 A	1250 A
Input circuit impedance		≤100 mΩ	≤20 mΩ
Rated voltage U_n		100 V and 110 V	
Continuous voltage withstand		170 V	
Rated burden at U_n		<0.5 VA	
Rated frequency f_n, according to order		50 Hz or 60 Hz	

Table 2: Overvoltage and reverse power relay module SPCP 3C2

Overvoltage stage U>	Start voltage U>, setting range		0.80…1.60 × U_n
	Start time, typically		100 ms
	Operate time		0.10…10.0 s
	Reset time, typically		80 ms
	Setting accuracy		±1%
	Drop-off/pick-up ratio, typically		0.96
	Operation time accuracy		±2% or ±25 ms
	Operation accuracy		±3% of set value
Overvoltage stage U>>	Start voltage U>>, setting range		1.3 × U_n, 1.4 × U_n, 1.5 × U_n or 1.6 × U_n
	Start time, typically		100 ms
	Operate time		0.1 s, 0.3 s, 0.6 s or 1.0 s
	Reset time, typically		80 ms
	Setting accuracy		±1%
	Drop-off/pick-up ratio, typically		0.96
	Operation time accuracy		±2% or ±25 ms
	Operation accuracy		±3% of set value
Reverse power stage P<–	Setting range		-2.0…-20.0% of P_n
	Start time, typically		200 ms
	Operate time		1.00…100 s
	Reset time, typically		200 ms
	Setting accuracy		±1%
	Drop-off/pick-up ratio, typically	when the setting P<–/P_n < 5%	0.85
		when the setting P<–/P_n ≥ 5%	0.95
	Operation time accuracy		±2% or ±40 ms
	Operation accuracy		±5% of the maximum value of the setting range when I ≤ I_n

Technical data (cont'd)

Table 3: Overcurrent relay module SPCJ 3C3

Low-set overcurrent stage I>	Start current I>, setting range			0.5…2.5 × I_n
	Start time, typically			70 ms
	Reset time, typically			60 ms
	Retardation time			<30 ms
	Drop-off/pick-up ratio, typically			0.96
	Selectable modes of operation	Definite time characteristic	Operate time t>	0.05…100 s
		Inverse definite minimum time (IDMT) characteristic	Curve sets acc. to IEC 255-4 and BS 142	Normal inverse Very inverse Extremely inverse Long-time inverse
			Time multiplier k	0.05…1.00
	Operation time accuracy		Definite time operation characteristic	±2% of set value or ±25 ms
			Class E at inverse time operation	5
	Operation accuracy			±3% of set value
High-set overcurrent stage I>>	Start current I>>, setting range			0.5…20 × I_n and ∞, infinite
	Start time, typically			40 ms
	Operate time t>>			0.04…100 s
	Reset time, typically			60 ms
	Retardation time			<30 ms
	Drop-off/pick-up ratio, typically			0.96
	Operation time accuracy			±2% of set value or ±25 ms
	Operation accuracy			±3% of set value

Table 4: Directional neutral overcurrent relay module SPCS 3C4

Low-set neutral overcurrent stage Iφ>	Start current Iφ>	1.0…10.0% of I_n
	Start time	60…150 ms
	Operation characteristic	I_0sinφ or I_0cosφ
	Operate time t>	0.1…10.0 s
	Reset time, typically	120 ms
	Drop-off/pick-up ratio, typically	0.90
	Operation time accuracy	±2% of set value or ±50 ms
	Operation accuracy	±3% of maximum set value of stage Iφ> + inaccuracy caused by ±1° phase displacement
High-set neutral overcurrent stage Iφ>>	Start current Iφ>>	1.0…40.0% of I_n and ∞, infinite
	Start time	60…150 ms
	Operation characteristic	±I_0sinφ or ±I_0cosφ
	Operate time t>>	0.1…1.0 s
	Reset time, typically	120 ms
	Drop-off/pick-up ratio, typically	0.90
	Operate time accuracy	±2% of set value or ±50 ms
	Operation accuracy	±3% of maximum set value of stage Iφ>> + inaccuracy caused by ±1° phase displacement
Residual voltage U_0	Start voltage U_0>, fixed values	2%, 5%, 10% or 20% of U_n

Table 5: Auxiliary supply modules

Type of module	Input voltage range	SPGU 240A1	80…265 V ac/dc
		SPGU 48B2	18…80 V dc
	Power consumption	under quiescent conditions	~10 W
		under operating conditions	~15 W

Table 6: Output contact ratings

Rated voltage		250 V ac/dc
Thermal withstand capability	Carry continuously	5 A
	Make and carry for 0.5 s	10 A
Breaking capacity for dc, when the control circuit time constant L/R ≤ 40 ms, at the control voltage levels	220 V dc	0.15 A
	110 V dc	0.25 A
	48 V dc	1 A
Contact interval		64-65-66, 67-68-69, 70-71-72, 73-74-75, 76-77-78, 79-80-81

Technical data (cont'd)

Table 7: Data communication

Applies to relays with the final letter C in the type designation		
Transmission mode		Fibre-optic serial bus
Data code		ASCII
Data transfer rate, selectable		4800 or 9600 Bd
Electrical/optical bus connection module powered from the host relay	for plastic core cables	SPA-ZC 21BB
	for glass fibre cables	SPA-ZC 21MM
Electrical/optical bus connection module powered from the host relay or from an external power source	for plastic core cables	SPA-ZC 17BB
	for glass fibre cables	SPA-ZC 17MM

Table 8: Tests and standards

Test voltages	Insulation test voltage (IEC 255-5)	2 kV, 50 Hz, 1 min
	Impulse test voltage (IEC 255-5)	5 kV, 1.2/50 μs, 0.5 J
	High frequency interference test voltage (IEC 255-6)	2.5 kV, 1 MHz
Environmental conditions	Specified ambient service temperature range	-10…+55°C
	Transport and storage temperature range (IEC 68-2-8)	-40…+70°C
	Temperature influence on the operation values of the relay over the specified ambient service temperature range	<0.2%/°C
	Long term damp heat withstand (IEC 68-2-3)	≤95% at 40°C for 56 days
	Degree of protection by enclosure of the relay caseas per IEC 529	IP 54
	Weight of the relay	5.5 kg

Block diagram

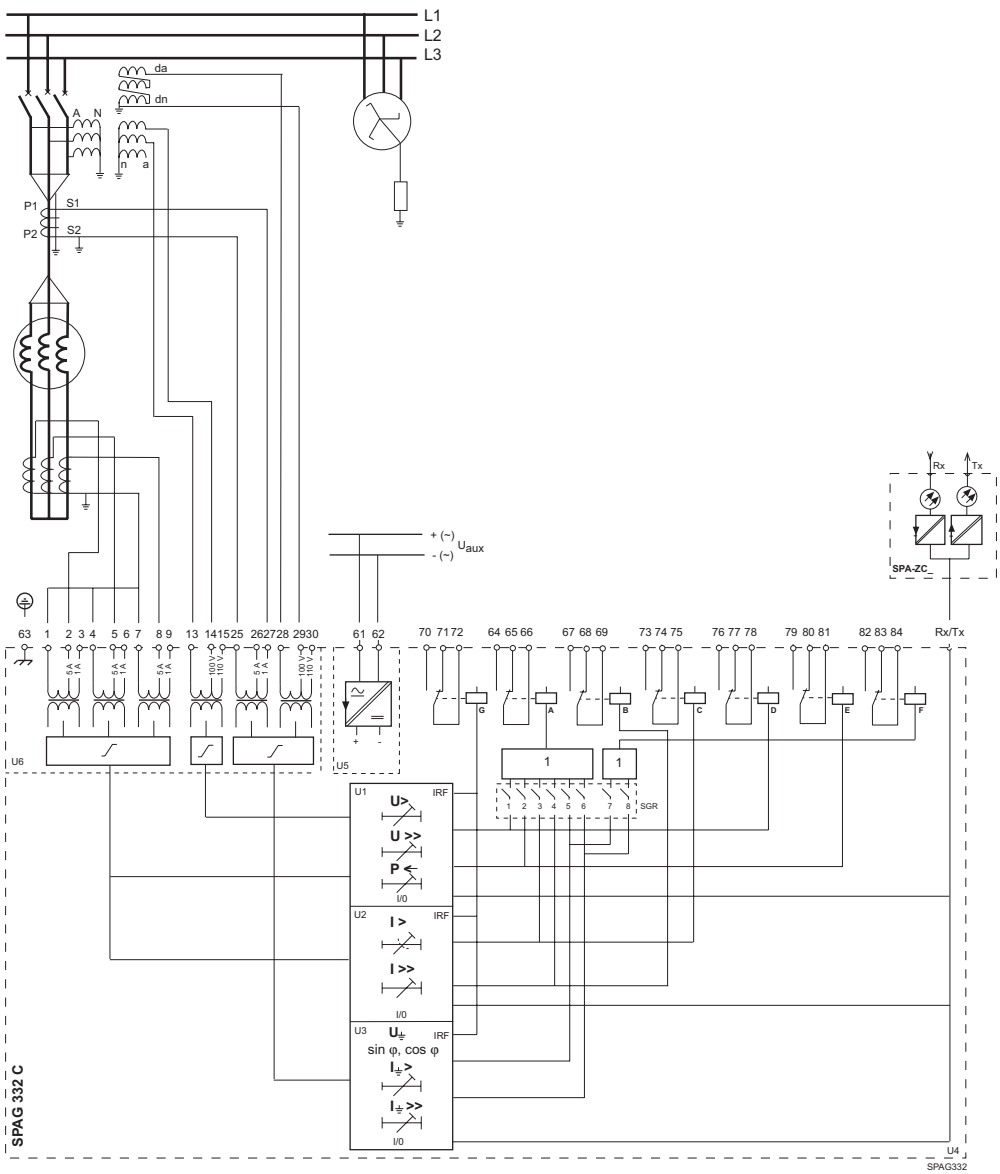


Fig. 1 Block diagram and sample connection diagram

Mounting and dimensions

Flush mounting

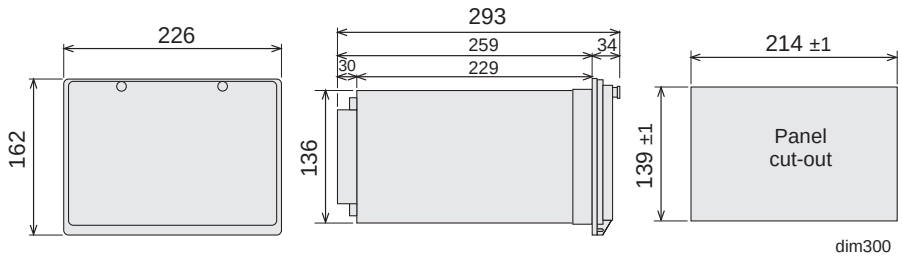
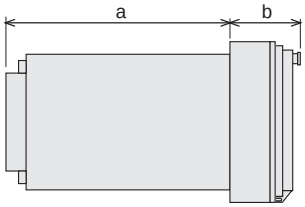


Fig. 2 Flush-mounting relay case (dimensions in mm)

Semi-flush mounting



Raising frame	a	b
SPA-ZX 301	219	74
SPA-ZX 302	179	114
SPA-ZX 303	139	154

SFM300_1

Fig. 3 Semi-flush mounting relay case (dimensions in mm)

Mounting in 19 inch cabinets and frames

An ancillary mounting plate, height 4U (~177 mm), is recommended to be used when the protection relays are to be mounted in 19 inch frames or cabinets. The ancillary mounting plate type SPA-ZX 304 accommodates two size 300 relays and type SPA-ZX 305 one size 300 relay.

Projecting mounting

When projecting mounting is preferred, a relay case type SPA-ZX 306 is used. The relay case for projecting mounting is provided with front connectors.

SPA-ZX304
SPA-ZX305
SPA-ZX201

SPA-ZX306
SPA-ZX307
SPA-ZX317
SPA-ZX318

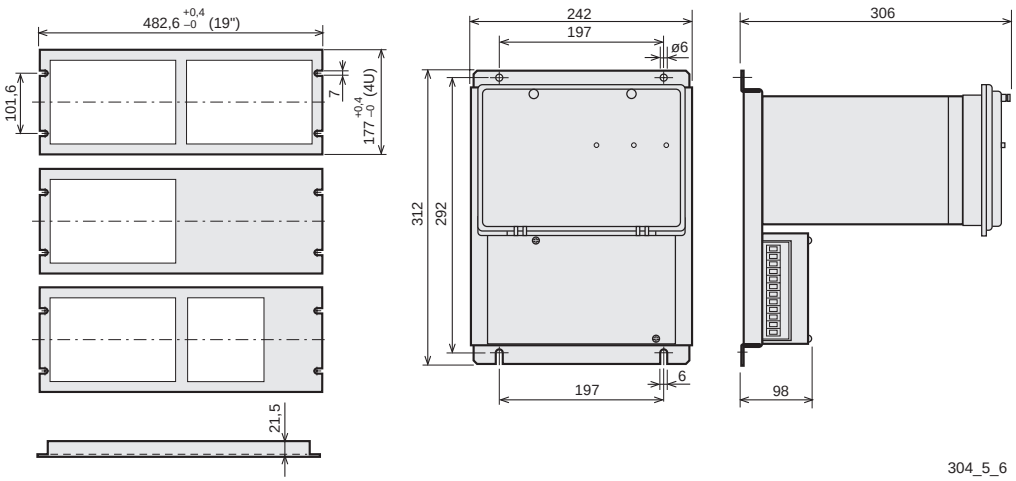


Fig. 4 Mounting cabinets and frames as well as projecting mounting (dimensions in mm)

Ordering

When ordering, please specify:

Ordering information	Ordering example
1. Type designation and quantity	SPAG 332 B, 5 pieces
2. Order number	RS 643 040-AA
3. Rated values	I_n=5 A, U_n=110 V, f_n=50 Hz
4. Auxiliary voltage	U_{aux} =110 V dc
5. Accessories	-
6. Special requirements	-

Order numbers

Generator protection relays SPAG 332	
SPAG 332 B, version without serial interface	RS 643 040-AA, CA, DA, FA
SPAG 332 C, version with serial interface	RS 643 041-AA, CA, DA, FA
The last two letters of the order number indicate the rated frequency f_n and the auxiliary voltage U_{aux} of the relay as follows:	AA equals f_n = 50 Hz and U_{aux} = 80…265 V ac/dc
	CA equals f_n = 50 Hz and U_{aux} = 18…80 V dc
	DA equals f_n = 60 Hz and U_{aux} = 80…265 V ac/dc
	FA equals f_n = 60 Hz and U_{aux} = 18…80 V dc

Generator protection relays SPAG 332 with test adapter RTXP 18	
SPAG 332 B, version without serial interface	RS 643 240-AA, CA, DA, FA
SPAG 332 C, version with serial interface	RS 643 241-AA, CA, DA, FA
The last two letters of the order number indicate the rated frequency f_n and the auxiliary voltage U_{aux} of the relay as follows:	AA equals f_n = 50 Hz and U_{aux} = 80…265 V ac/dc
	CA equals f_n = 50 Hz and U_{aux} = 18…80 V dc
	DA equals f_n = 60 Hz and U_{aux} = 80…265 V ac/dc
	FA equals f_n = 60 Hz and U_{aux} = 18…80 V dc

References

Additional information

Brochure “Generator protection relays”	1MRS 750194-MDS EN
Manual “Generator protection relay SPAG 332”	34 SPAG 5 EN1

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