



Features

- Off-the-shelf generator protection relay for small and medium sized power generators
- Three-phase time overcurrent and short-circuit protection
- Single-stage overvoltage and undervoltage protection
- Three-phase, two-stage undervoltage 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
- 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.
- Member of the SPACOM product family and ABB's Substation Automation system
- CE marking according to the EC directive for EMC

Application

The SPAG 320 B and SPAG 320 C numerical generator protection relays are applied for the protection of small and medium sized power generators. The generator protection relays are mainly used for the protection of land-

based stand-by power generators provided with automatic switch-over and starting arrangements. Further, the relays are approved for use in marine and off-shore applications.

Design

The generator protection relays type SPAG 320 B and SPAG 320 C contain an overvoltage and undervoltage relay module type SPCU 1C1, an overcurrent relay module type SPCJ 3C3 and an undervoltage relay module type SPCU 3C15.

The relays provide high-set and low-set overcurrent protection, overvoltage and undervoltage protection and separately two-stage busbar overvoltage protection and supervision.

The first stage of the three-phase undervoltage relay module starts when one or several of the measured voltages fall below the set start level. The start of the second stage requires all three voltages falling below the set start level.

The undervoltage stages are automatically blocked, if the measured voltage suddenly falls below 0.2 times the rated value.

The generator protection relays type SPAG 320 are available in two main versions: type SPAG 320 B without serial communication capability and type SPAG 320 C, which includes a serial communication interface.

Data communication

The generator protection relay SPAG 320 C 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 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. The fault code indicates the type of the fault that has been detected.

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		$\leq 100 \text{ m}\Omega$	$\leq 20 \text{ m}\Omega$
Rated voltage U_n		100 V and 110 V	
Continuous voltage withstand		170 V	
Rated burden at U_n		$< 0.5 \text{ VA}$	
Rated frequency f_n , according to order		50 Hz or 60 Hz	

Table 2: Overvoltage and undervoltage relay module SPCU 1C1

Overvoltage stage $U>$	Start voltage $U>$		$0.8 \dots 1.6 \times U_n$	
	Start time, preset values		0.1 s, 1 s, 10 s or 60 s	
	Operate time $t>$ at definite time operation characteristic		0.05...10.0 s	
	Inverse time operation characteristic		Curve sets A and B	
	Time multiplier k at inverse time operation characteristic		0.05...1.0	
	Reset time, typically		50 ms	
	Drop-off/pick-up ratio, typically		0.97	
	Operation time accuracy	at definite time characteristic and start time accuracy		$\pm 2\%$ of set value or $\pm 25 \text{ ms}$
		at inverse time characteristic		$\pm 25 \text{ ms}$ or the inaccuracy appearing when the measured voltage varies $\pm 3\%$
	Operation accuracy			$\pm 3\%$ of set value
Undervoltage stage $U<$	Start voltage $U<$		$0.4 \dots 1.2 \times U_n$	
	Start time, preset values		0.1 s or 30 s	
	Operate time at definite time operation characteristic		1...100 s	
	Inverse time operation characteristic		Curve sets A and B	
	Time multiplier $k<$ at inverse time operation characteristic		0.1...1.0	
	Reset time, typically		60 ms	
	Drop-off/pick-up ratio, typically		1.03	
	Operation time accuracy	at definite time characteristic and start time accuracy		$\pm 2\%$ of set value or $\pm 25 \text{ ms}$
		at inverse time characteristic		$\pm 25 \text{ ms}$ or the inaccuracy appearing when the measured voltage varies $\pm 3\%$
	Operation accuracy			$\pm 3\%$ of set value

Technical data (cont'd)

Table 3: Overcurrent relay module SPCJ 3C3

Low-set overcurrent stage $I>$	Start current $I>$, setting range		$0.5...2.5 \times I_n$	
	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	$\pm 2\%$ of set value or ± 25 ms
			Class E at inverse time operation	5
Operation accuracy			$\pm 3\%$ of set value	
High-set overcurrent stage $I>>$	Start current $I>>$, setting range		$0.5...20 \times I_n$ 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			$\pm 2\%$ of set value or ± 25 ms
	Operation accuracy			$\pm 3\%$ of set value

Table 4: Undervoltage relay module SPCU 3C15

Undervoltage stage U<	Start voltage U<	0.4...1.2 × U _n		
	Start time, preset values	0.1 s, 1 s, 5 s or 30 s		
	Operate time at definite time operation characteristic	0.1...10.0 s		
	Time multiplier k< at inverse time operation characteristic	0.1...1.00		
	Reset time, typically	80 ms		
	Drop-off/pick-up ratio, typically	1.03		
	Operation time accuracy	at definite time characteristic and start time accuracy	±2% of set value or ±25 ms	
		at inverse time characteristic	±25 ms or the inaccuracy appearing when the measured voltage varies ±3%	
Operation accuracy	±3% of set value			
Undervoltage stage 3U<<	Start voltage 3U<<	0.1...1.2 × U _n		
	Start time, preset values	0.1 s or 1.0 s		
	Operate time at definite time operation characteristic	0.1...10.0 s		
	Reset time, typically	80 ms		
	Drop-off/pick-up ratio, typically	when the start value of the 3U<< stage ≥0.4	≤1.03	
		when the start value of the 3U<< stage <0.4	approx. 1.1	
	Operation time accuracy and start time accuracy	±2% of set value or ±25 ms		
	Operation accuracy	±3% of set value		

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 60255-5)	2 kV, 50 Hz, 1 min
	Impulse test voltage (IEC 60255-5)	5 kV, 1.2/50 μ s, 0.5 J
	High frequency interference test voltage (IEC 60255-6)	2.5 kV, 1 MHz
Environmental conditions	Specified ambient service temperature range	-10...+55°C
	Transport and storage temperature range (IEC60068-2-8)	-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 60068-2-3)	≤95% at 40°C for 56 days
	Degree of protection by enclosure of the relay case as per IEC 60529	IP 54
	Weight of the relay	5.5 kg

Block diagram

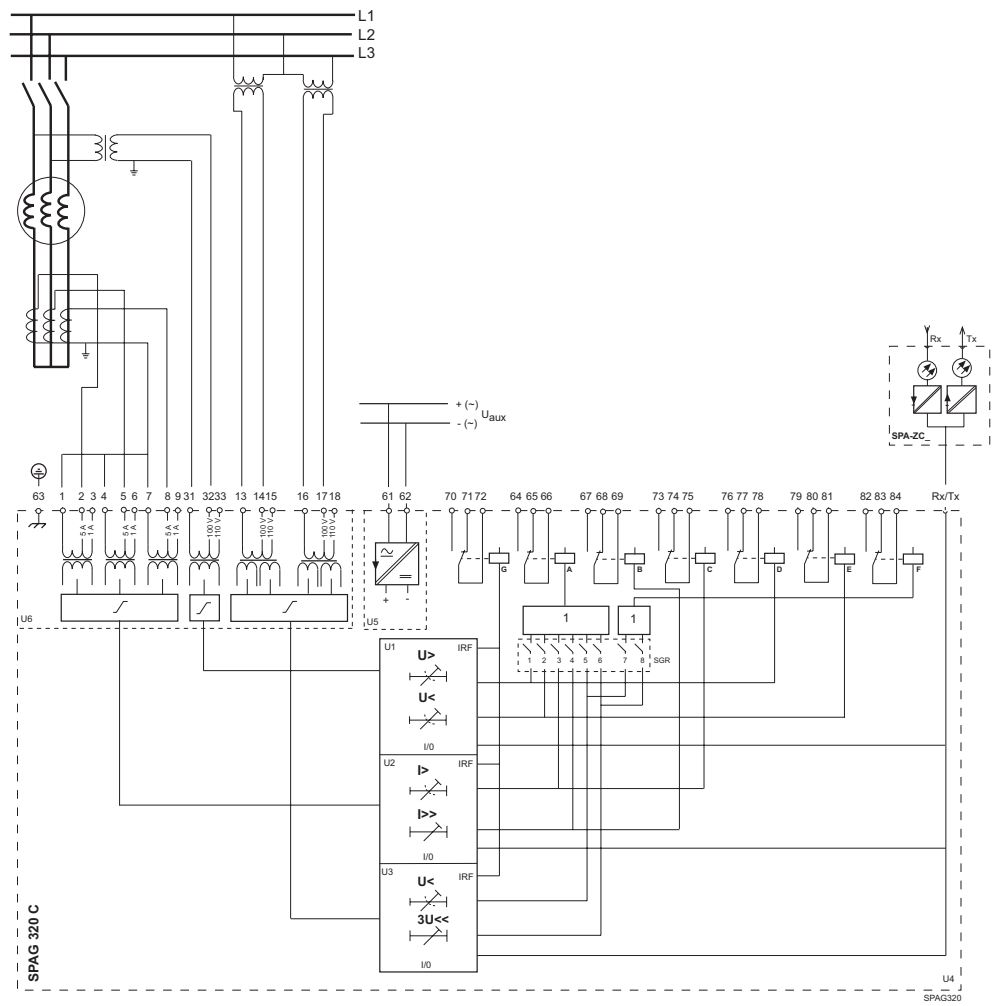


Fig. 1 Block diagram and sample connection diagram

Mounting and dimensions

Flush mounting

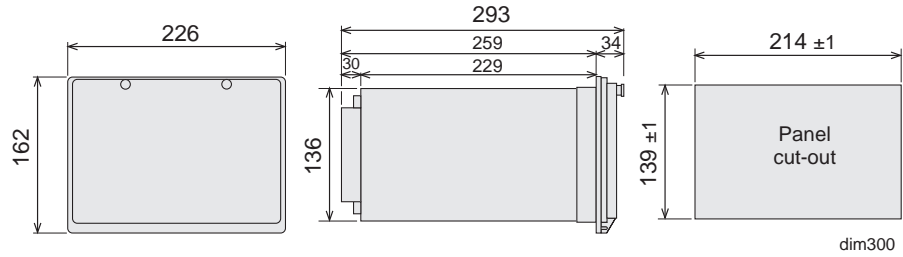
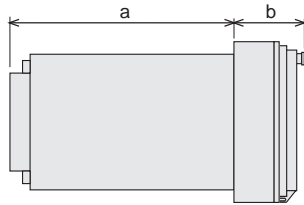


Fig. 2 Flush-mounting relay case (dimensions in mm)

Semi-flush mounting



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

SFM300_1

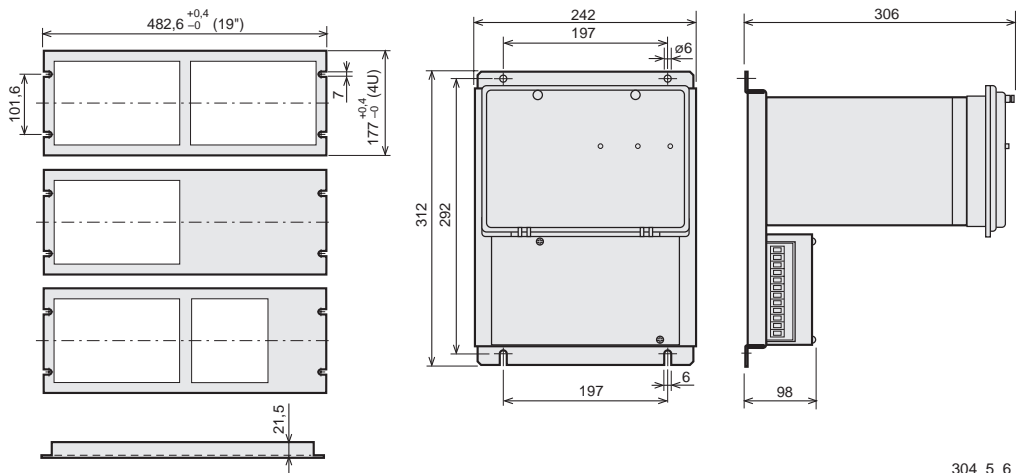
Fig. 3 Semi-flush mounting relay case (dimensions in mm)

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.

SPA-ZX304
SPA-ZX305
SPA-ZX201

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



304_5_6

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 320 B, 5 pieces
2. Order number	RS 643 010-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 320	
SPAG 320 B, version without serial interface	RS 643 010-AA, CA, DA, FA
SPAG 320 C, version with serial interface	RS 643 011-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 $U_{aux} = 80\dots265$ V ac/dc
	CA equals $f_n = 50$ Hz and $U_{aux} = 18\dots80$ V dc
	DA equals $f_n = 60$ Hz and $U_{aux} = 80\dots265$ V ac/dc
	FA equals $f_n = 60$ Hz and $U_{aux} = 18\dots80$ V dc

Generator protection relays SPAG 320 with test adapter RTXP 18	
SPAG 320 B, version without serial interface	RS 643 210-AA, CA, DA, FA
SPAG 320 C, version with serial interface	RS 643 211-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 $U_{aux} = 80\dots265$ V ac/dc
	CA equals $f_n = 50$ Hz and $U_{aux} = 18\dots80$ V dc
	DA equals $f_n = 60$ Hz and $U_{aux} = 80\dots265$ V ac/dc
	FA equals $f_n = 60$ Hz and $U_{aux} = 18\dots80$ V dc

References**Additional information**

Brochure "Generator protection relays"	1MRS 750194-MDS EN
Manual "Generator protection relay SPAG 320"	34 SPAG 2 EN1



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