



## Features

- Supervision and protection relay primarily used for supervision of substation busbar voltages
- General-use voltage relay for applications requiring overvoltage or undervoltage supervision
- Optional disturbance recorder module used for verifying the correct operation of the protection relay and for analyzing network operation quantities
- Flexible selection of appropriate operational features in various applications
- Local numerical display of setting values, measured values, recorded fault values, auto-diagnostic fault codes, etc.
- Serial interface for two-way data communication with substation level equipment via fibre-optic bus
- Powerful software support for setting and monitoring of the relay via a portable computer
- Continuous self-supervision of relay hardware and software with autodiagnosis for enhanced system reliability and availability
- Robust aluminium relay case with an IP54 degree of protection by enclosure
- High immunity to electrical and electromagnetic interference
- Member of the SPACOM product family, ABB's Distribution Automation system and ABB's Panorama concept
- CE marking according to the EC directive for EMC

## Application

The voltage relay SPAU 330 C is intended for overvoltage and undervoltage supervision of the substation busbar phase-to-phase voltage and for supervision of the residual voltage of the distribution network. When fully equipped, the relay also incorporates a digital

disturbance recorder module. The relay can also be used in other applications requiring overvoltage or undervoltage protection/supervision, residual overvoltage supervision, or fault event recording e.g. for the protection of motors, capacitor banks, transformers, etc.

## Design

The voltage relay forms an integrated protection scheme which includes a residual overvoltage relay module, an overvoltage and undervoltage relay module and a disturbance recorder module. The relay is further provided with one control input for an external control signal such as a blocking signal. Further, the voltage relay is equipped with six output relays for CB control, signalling, etc.

### Residual overvoltage relay module SPCU 1C6

The residual overvoltage module incorporates two residual overvoltage stages, i.e. a low-set stage  $U_{0>}$  and a high-set stage  $U_{0>>}$ . Both stages have a definite time characteristic. The operation of both stages can be blocked by means of an external control signal. The high-set stage can be set out of function.

### Voltage relay module SPCU 3C14

The three-phase voltage relay module incorporates two protection stages, i.e. an overvoltage stage  $U_{>}$  and an undervoltage stage  $U_{<}$ . The overvoltage stage can be given definite time characteristic or inverse time characteristic whereas the undervoltage stage has a definite time characteristic. The undervoltage stage can be blocked by means of an external control signal. The operation of the undervoltage stage can be automatically blocked on loss of energizing voltage.

### Disturbance recorder module SPCR 8C27

The disturbance recorder continuously monitors the determined input signals. When the triggering conditions are fulfilled, a recording of max. 12 seconds is made, when all channels are used. Of the total length of the recording 0...100% may precede the triggering. The recording memory is divided into 0.5 seconds blocks. When the shortest possible recording time, i.e. 0.5 seconds, is used, there is enough memory for 24 consecutive recordings.

The recorder module also stores maximum and/or minimum values including time stamps of the analog signals measured.

The events to be recorded are separately selected in an event log mask. Any start-up of the recorder module and any event register

overflow situation are also recorded as events. The register also contains date and time stamps of the events recorded.

The recordings can be unloaded via the serial buses. The recordings can be erased, even before they have been unloaded, with a command via the serial buses or manually by means of the push-buttons on the front panel.

### Data communication

The relay is provided with a serial interface on the rear panel. By means of a bus connection module type SPA-ZC 17 or SPA-ZC 21 the relay can be connected to the fibre-optic SPA bus. The bus connection module type SPA-ZC 21 is powered from the host relay, whereas the bus connection module 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 relay is obtained from an internal plug-in type power supply module. Two auxiliary power module versions are available: type SPGU 240A1 for the supply voltage range 80...265 V ac/dc and type SPGU 48B2 for the supply voltage range 18...80 V dc. The power supply module forms the internal voltages required by the protection relay and the I/O module.

## Technical data

**Table 1: Energizing inputs**

Terminals	13-14, 16-17, 19-20, 28-29	13-15, 16-18, 19-21, 28-30
Rated voltage $U_n$	100 V	110 V
Continuous voltage withstand	$2.0 \times U_n$	
Burden at rated voltage	<0.5 VA	
Rated frequency $f_n$ , according to order	50 Hz or 60 Hz	

**Table 2: Output contact ratings**

Type of contact		Tripping	Signalling
Terminals		65-66	67-68-69, 70-71-72, 73-74-75, 76-77-78, 79-80-81
Rated voltage		250 V ac/dc	
Thermal withstand capability	Carry continuously	5 A	5 A
	Make and carry for 0.5 s	30 A	10 A
	Make and carry for 3 s	15 A	8 A
Breaking capacity for dc, when the control/ signalling circuit time constant $L/R \leq 40$ ms, at the control voltages	220 V dc	1 A	0.15 A
	110 V dc	3 A	0.25 A
	48 V dc	5 A	1 A
Contact material		AgCdO <sub>2</sub>	

**Table 3: Control input, communication and power supply**

External control input	Terminals		10-11
	Control voltage level		18...265 V dc or 80...265 V ac
	Power consumption when input activated		2...20 mA
Data communication	Transmission mode		Fibre optic serial bus
	Data code		ASCII
	Selectable data transfer rates		300, 1200, 2400, 4800 or 9600 Bd
	Fibre optic bus connection module, powered from the host relay	for plastic fibre cables	SPA-ZC 21BB
		for glass fibre cables	SPA-ZC 21MM
	Fibre optic bus connection module with a built-in power supply unit	for plastic fibre cables	SPA-ZC 17BB
		for glass fibre cables	SPA-ZC 17MM
Auxiliary supply modules	Power supply and I/O modules and voltage ranges	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

**Technical data (cont'd)**
**Table 4: Residual overvoltage relay module SPCU 1C6**

Low-set overvoltage stage $U_{0>}$	Start voltage $U_{0>}$		2...100% of $U_n$
	Start time, typically		70 ms
	Operate time $t_{>}$		0.05...100 s
	Reset time, typically		100 ms
	Drop-off/pick-up ratio, typically		0.96
	Operate time accuracy		$\pm 2\%$ of set value or $\pm 40$ ms
	Operation accuracy	10...100% of $U_n$	$\pm 3\%$ of set value
2...20% of $U_n$		$\pm 5\%$ of set value	
High-set overvoltage stage $U_{0>>}$	Start voltage $U_{0>>}$		2...80% of $U_n$ and $\infty$ , infinite
	Start time, typically		70 ms
	Operate time $t_{>>}$		0.05...100 s
	Reset time, typically		100 ms
	Drop-off/pick-up ratio, typically		0.96
	Operate time accuracy		$\pm 2\%$ of set value or $\pm 25$ ms
	Operation accuracy	10...80% of $U_n$	$\pm 3\%$ of set value
		2...16% of $U_n$	$\pm 5\%$ of set value

**Table 5: Overvoltage and undervoltage relay module SPCU 3C14**

Overvoltage stage $U_{>}$	Start voltage $U_{>}$		$0.8...1.6 \times U_n$
	Start time, preset values		0.1 s or 30 s
	Operate time at definite time operation characteristic		0.05...100 s
	Time multiplier $k_{>}$ at inverse time operation characteristic		0.05...1.00
	Reset time, typically		60 ms
	Drop-off/pick-up ratio, typically		0.97
	Operate time accuracy	at definite time characteristic and start time accuracy	±2% of set value or ±25 ms
		at inverse time mode of operation	±25 ms or accuracy obtained at a ±3% variation of the input voltage
	Operation accuracy		±3% of set value
Undervoltage stage $U_{<}$	Start voltage $U_{<}$		$0.4...1.2 \times U_n$
	Start time, preset values		0.1 s or 30 s
	Operate time at definite time operation characteristic		1...120 s
	Reset time, typically		60 ms
	Reset ratio, typically		1.03
	Operation time accuracy and start time accuracy		±2% of set value or ±25 ms
	Operation accuracy		±3% of set value

**Table 6: Disturbance recorder module SPCR 8C27**

Input channels	Number of input channels		8 analog channels 8 binary channels
	Sampling frequency per channel		500 Hz (default)
	Resolution of A/D converters		11 bit
	Time difference between sampling of adjacent input channels		250 $\mu$ s (default)
Recording memory	Recording capacity	1 MB SRAM	Max. 24 recordings Max. 224 blocks
		4 MB SRAM	Max. 26 recordings Max. 992 blocks
		1 block equals	0.5 s (= 250 data samples)/channels
Analog channels	Measuring ranges	Phase-to-phase voltages; analog channels 1...3	0... $2.5 \times U_n$ or 0... $21 \times U_n$
		Phase-to-phase voltages; analog channels 1...3	0... $2 \times I_n$ or 0... $20 \times I_n$
		Residual voltage; analog channel 7	0...102% of $U_n$
		Residual voltage (neutral current); analog channel 8	0...20% of $I_n$ or 0...102% of $I_n$
	Measuring accuracy of samples, value > $0.2 \times$ range, $f = 0...60$ Hz		$\pm 2.5\%$ or better
Data communication	Data code		ASCII
	Serial port		SPA bus connector of host relay RS 232 connector on front panel

**Technical data (cont'd)**
**Table 7: Tests and standards**

Test voltages	Dielectric test voltage (IEC 255-5)	2.0 kV, 50 Hz, 1 min
	Impulse test voltage (IEC 255-5)	5 kV, 1.2/50 $\mu$ s, 0.5 J
	Insulation resistance (IEC 255-5)	>100 M $\Omega$ , 500 V dc
Interference tests	High-frequency (1 MHz) disturbance test (IEC 255-22-1), common mode	2.5 kV
	High-frequency (1 MHz) disturbance test (IEC 255-22-1), differential mode	1.0 kV
	Fast transients (IEC 255-22-4, class III and IEC 801-4, level 4), power supply inputs	4 kV, 5/50 ns
	Fast transients (IEC 255-22-4, class III and IEC 801-4, level 4), other inputs	2 kV, 5/50 ns
	Electrostatic discharge (IEC 255-22-2 and IEC 801-2, class III), air discharge	8 kV
	Electrostatic discharge (IEC 255-22-2 and IEC 801-2, class III), contact discharge	6 kV
	RF electromagnetic field test (IEC 1000-4-3 and ENV 50140)	10 V/m, f = 80...1000 MHz
	Conducted RF disturbance test (IEC 1000-4-6 and ENV 50141)	10 V, f = 150 kHz...80 MHz
Environmental conditions	Service temperature range	-10...+55°C
	Transport and storage temperature range (IEC 68-2-8)	-40...+70°C
	Damp heat test (IEC 68-2-30)	<95%, +55°C, 6 cycles
	Degree of protection by enclosure when panel mounted	IP 54
	Weight	~5.5 kg

### Block diagram

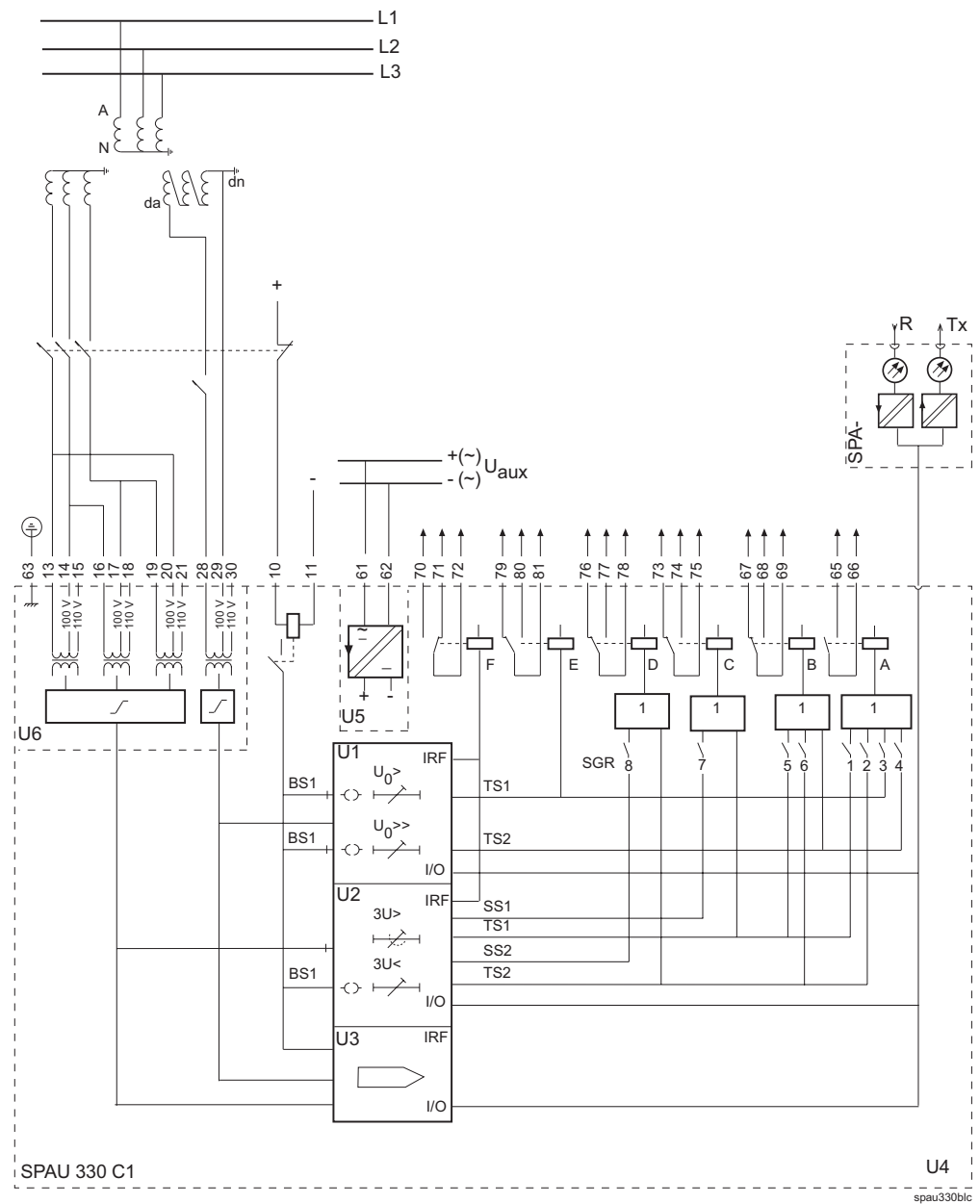


Fig. 1 Block diagram and sample connection diagram

Mounting and dimensions

Flush mounting

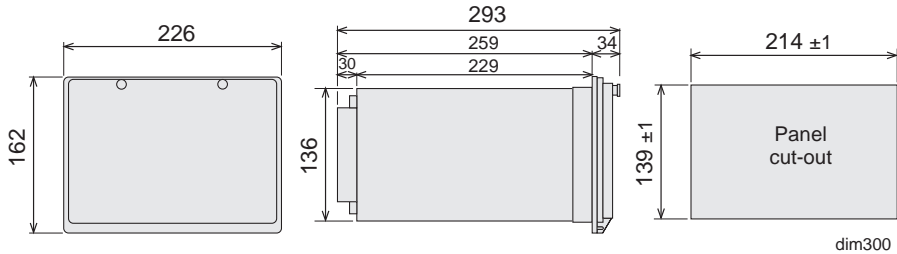


Fig. 2 Flush-mounting relay case (dimensions in mm)

Semi-flush mounting



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

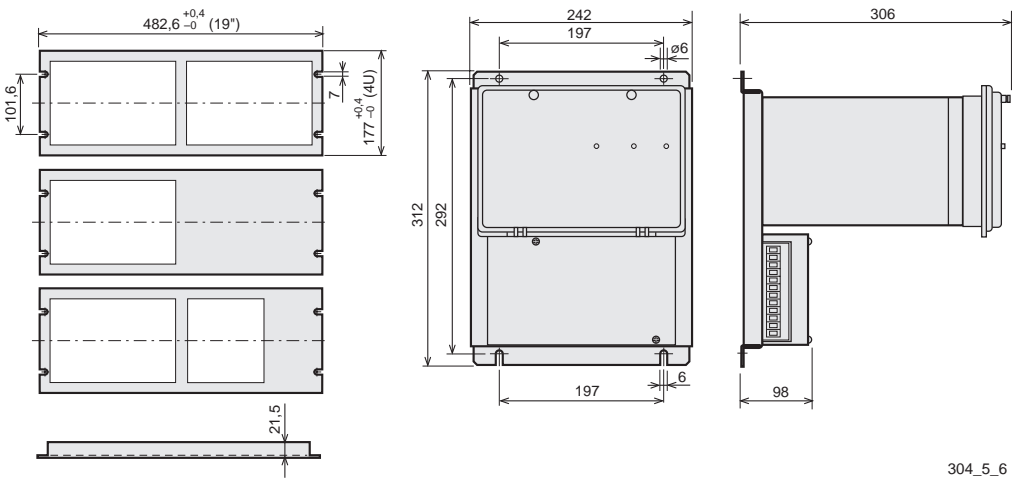


Fig. 4 Mounting cabinets and frames as well as projecting mounting (dimensions in mm)



## Ordering

### When ordering, please specify:

Ordering information	Ordering example
1. Type designation and quantity	SPAU 330 C, 5 pieces
2. Order number	RS 613 020-AA
3. Rated values	$U_n=110\text{ V}$ , $f_n=50\text{ Hz}$
4. Auxiliary voltage	$U_{aux}=110\text{ V dc}$
5. Accessories	-
6. Special requirements	-

### Order numbers

Voltage relays SPAU 330 C_	
SPAU 330 C complete	RS 613 020-AA, CA, DA, FA
SPAU 330 C1, incl. modules SPCU 1C6 and SPCU 3C14	RS 613 021-AA, CA, DA, FA
SPAU 330 C2, incl. modules SPCU 1C6 and SPCR 8C27	RS 613 022-AA, CA, DA, FA
SPAU 330 C3, incl. module SPCU 1C6	RS 613 023-AA, CA, DA, FA
SPAU 330 C4, incl. modules SPCU 3C14 and SPCR 8C27	RS 613 024-AA, CA, DA, FA
SPAU 330 C5, incl. module SPCU 3C14	RS 613 025-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 $f_n = 50\text{ Hz}$ and $U_{aux} = 80...265\text{ V ac/d}$
	CA equals $f_n = 50\text{ Hz}$ and $U_{aux} = 18...80\text{ V dc}$
	DA equals $f_n = 60\text{ Hz}$ and $U_{aux} = 80...265\text{ V ac/dc}$
	FA equals $f_n = 60\text{ Hz}$ and $U_{aux} = 18...80\text{ V dc}$

Voltage relays SPAU 330 C_ including a test adapter type RTXP18	
SPAU 330 C complete	RS 613 220- AA, CA, DA, FA
SPAU 330 C1, incl. modules SPCU 1C6 and SPCU 3C14	RS 613 221- AA, CA, DA, FA
SPAU 330 C2, incl. modules SPCU 1C6 and SPCR 8C27	RS 613 222- AA, CA, DA, FA
SPAU 330 C3, incl. module SPCU 1C6	RS 613 223- AA, CA, DA, FA
SPAU 330 C4, incl. modules SPCU 3C14 and SPCR 8C27	RS 613 224- AA, CA, DA, FA
SPAU 330 C5, incl. module SPCU 3C14	RS 613 225- 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 $f_n = 50\text{ Hz}$ and $U_{aux} = 80...265\text{ V ac/d}$
	CA equals $f_n = 50\text{ Hz}$ and $U_{aux} = 18...80\text{ V dc}$
	DA equals $f_n = 60\text{ Hz}$ and $U_{aux} = 80...265\text{ V ac/dc}$
	FA equals $f_n = 60\text{ Hz}$ and $U_{aux} = 18...80\text{ V dc}$

## References

### Additional information

Colour brochure "Voltage relays SPAU 300 Series"	1MRS 750326-MDS EN
User's manual and technical description "Overvoltage, undervoltage and residual voltage relay SPAU 330 C"	1MRS 750508-MUM EN



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