



Features

- Combined overvoltage and undervoltage protection relay
- Single-phase definite time or inverse time overvoltage stage
- Single-phase definite time or inverse time undervoltage stage
- Control input for blocking the function of the undervoltage stage by means of an external control signal
- Automatic blocking of the undervoltage stage on loss of energizing voltage
- Fully field-configurable output relay functions
- Flexible matching of the relay to the intended protection application
- Numerical display of setting values, measured values, recorded fault values, indications, etc.
- Serial interface for bus connection module and fibre-optic substation bus
- Continuous self-supervision of relay hardware and software for enhanced system reliability and availability
- Auto-diagnostic fault indication to facilitate repair of an internal relay fault
- Powerful software support for parameterization and supervision of relays

Application

The voltage relay SPAU 121 C is intended to be used for overvoltage and undervoltage protection and supervision in distribution substations. Generally the relay measures the phase-to-phase voltage of the system.

The overvoltage stage and the undervoltage stage can be given definite time characteristic or inverse time characteristic.

An external control signal can be used to block the operation of the undervoltage stage.

The relay forms a whole including overvoltage stage, undervoltage stage as well as flexible trip and alarm functions.

Design

The combined overvoltage and undervoltage relay SPAU 121 C is a secondary relay that is connected to the voltage transformers of the object to be protected. The relay generally measures the phase-to-phase voltage of the system. On operation the relay trips the circuit-breaker and/or provides an alarm signal, in accordance with the configuration of the relay.

When the phase-to-phase voltage exceeds the set start value $U_{>}$ of the overvoltage stage, the overvoltage stage starts and generates a start signal SS1. When, at definite time mode of operation, the set operate time $t_{>}$ or, at inverse time mode of operation, the calculated operate time $t_{>}$, has expired, the overvoltage stage delivers a trip signal TS1. In the same way the undervoltage stage starts and generates a start signal SS2, when the value measured goes below the start value $U_{<}$, and when the set operate time $t_{<}$ has expired, the undervoltage stage operates by generating a trip signal TS2.

The undervoltage stage can be given definite time characteristic or inverse time characteristic. The inverse time characteristic includes two sets of curves, named A and B.

The undervoltage stage can also be given definite time characteristic or inverse time characteristic. When inverse time characteristic is selected one curve named C is available.

Operation of the undervoltage stage can be blocked by applying a control signal BS to the external opto-isolated control input of the relay.

The overvoltage and undervoltage relay is provided with two output relays for tripping and four output relays for signalling. One of the signalling relays is dedicated for the self-supervision system of the relay.

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 the self-supervision system detects a permanent internal relay fault, 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 SPTU 240S1 for the supply voltage range 80...265 V ac/dc and type SPTU 48S1 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	13-15
Rated voltage U_n	100 V	110 V
Continuous withstand	$2 \times U_n$	$2 \times U_n$
Power consumption at rated voltage U_n	<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, 68-69	70-71-72, 73-74-75, 77-78, 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 ₂	

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	SPTU 240S1	80...265 V ac/dc	
		SPTU 48S1	18...80 V dc	
	Power consumption	under quiescent conditions	~4 W	
		under operating conditions	~6 W	

Technical data (cont'd)

Table 4: Overvoltage and undervoltage relay module SPCU 1C1

Overvoltage stage U>	Start voltage U>		$0.8...1.6 \times U_n$	
	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 ± 25 ms
		at inverse time characteristic		± 25 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<		$0.4...1.2 \times U_n$	
	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 ± 25 ms
		at inverse time characteristic		± 25 ms or the inaccuracy appearing when the measured voltage varies $\pm 3\%$
	Operation accuracy		$\pm 3\%$ of set value	

Table 5: 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 μ s, 0.5 J
	Insulation resistance (IEC 255-5)	>100 M Ω , 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
	Environmental conditions	Service temperature range
	Transport and storage temperature range (IEC 68-2-8)	-40...+70°C
	Damp heat test (IEC 68-2-3)	<95%, +40°C, 96 h
	Relative humidity (IEC 68-2-30)	93...95%, +55°C, 6 cycles
	Degree of protection by enclosure when panel mounted	IP 54
	Weight	3 kg

Block diagram

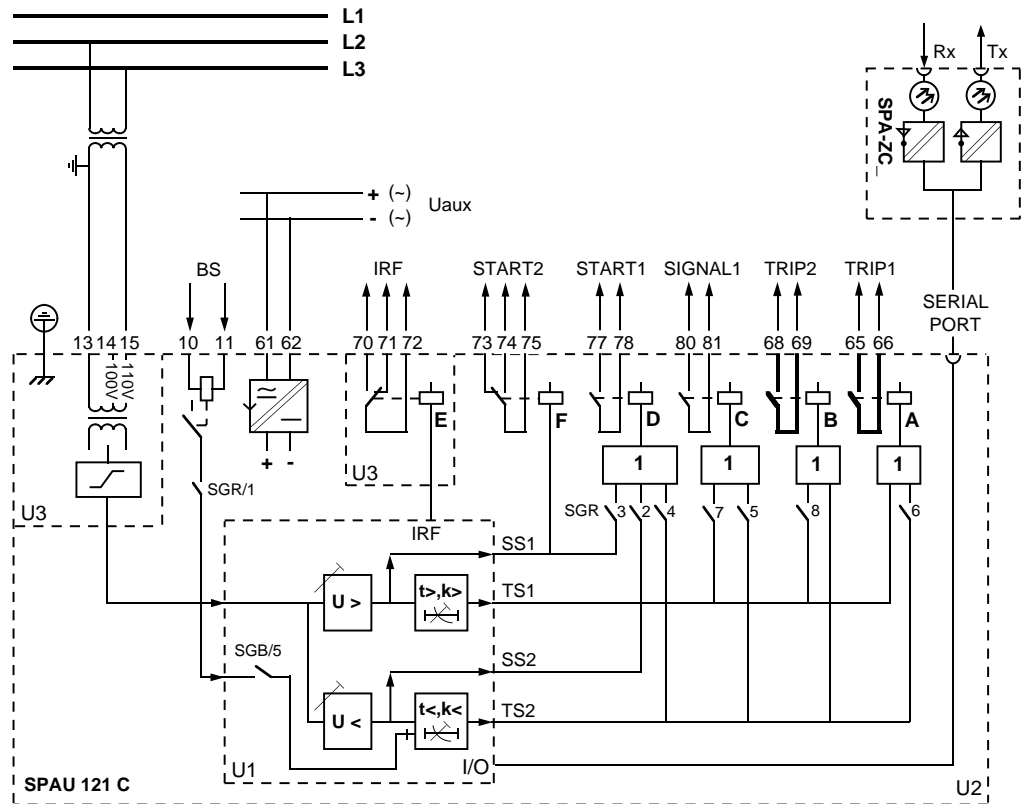


Fig. 1 Block diagram and sample connection diagram

Mounting and dimensions

Flush mounting

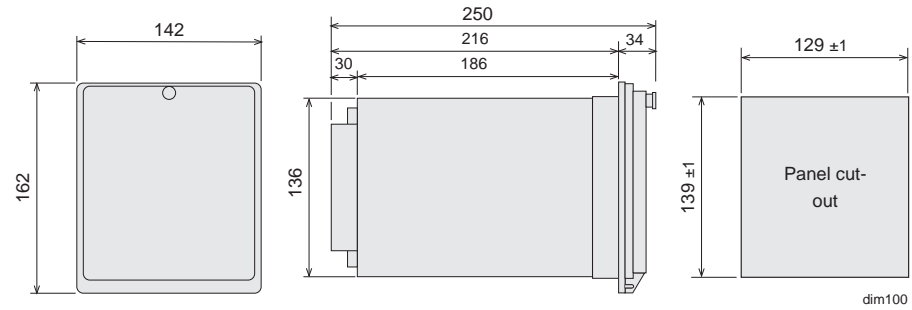


Fig. 2 Flush-mounting relay case (dimensions in mm)

Semi-flush mounting

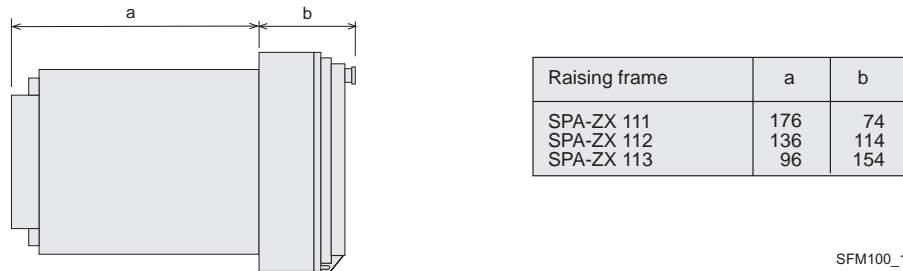


Fig. 3 Semi-flush mounting relay case (dimensions in mm)

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 104 accommodates three relays, type SPA-ZX 105 two relays and type SPA-ZX 106 one relay.

Projecting mounting

When projecting mounting is preferred, a relay case type SPA-ZX 110 is used. The relay case for projecting mounting is provided with front connectors.

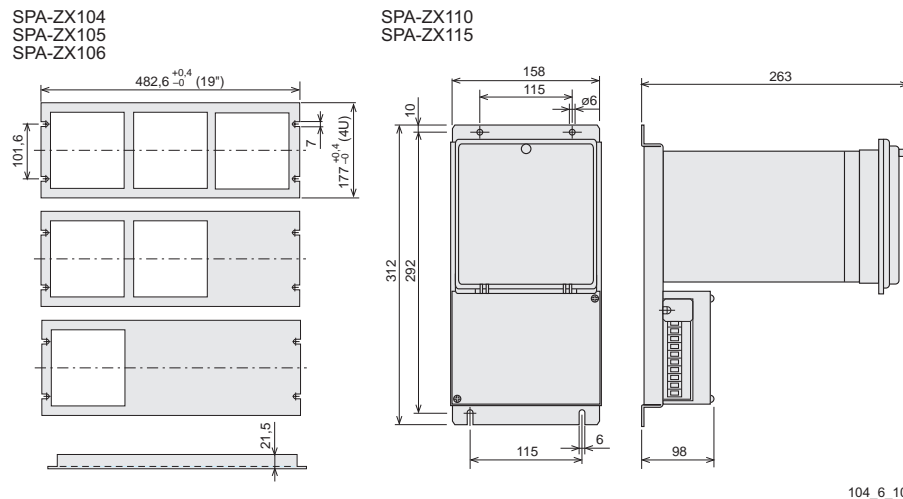


Fig. 4 Mounting cabinets and frames as well as projecting mounting (dimensions in mm)

104_6_10

Ordering

When ordering, please specify:

Ordering information	Ordering example
1. Type designation and quantity	SPAU 121 C, 5 pieces
2. Order number	RS 612 002-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

Combined overvoltage and undervoltage relay SPAU 121 C without test adapter	RS 612 002-AA, CA, DA, FA
Combined overvoltage and undervoltage relay SPAU 121 C including test adapter RXP 18	RS 612 202-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 $U_{aux} = 80 \dots 265 \text{ V ac/dc}$
	CA equals $f_n = 50 \text{ Hz}$ and $U_{aux} = 18 \dots 80 \text{ V dc}$
	DA equals $f_n = 60 \text{ Hz}$ and $U_{aux} = 80 \dots 265 \text{ V ac/dc}$
	FA equals $f_n = 60 \text{ Hz}$ and $U_{aux} = 18 \dots 80 \text{ V dc}$

References

Additional information

Brochure "Voltage and current measuring relays"	1MRS 750270-MDS EN
Manual "Combined overvoltage and undervoltage relay SPAU 121 C"	1MRS 750608-MUM EN



ABB Substation Automation Oy

P.O. Box 699

FIN-65101 Vaasa

Finland

Telephone: +358 10 224 000

Fax: +358 10 224 1094