Earth-fault Relay

SPAJ 110 C

Product Guide

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1MRS750351-MBG

Product Guide

Issued: April 1999
Status: Updated
Version: C/12.04.2006
Data subject to change without notice

Features

- Low-set neutral overcurrent stage with definite time or inverse time characteristic
- High-set neutral overcurrent stage with definite time characteristic
- Output relay functions to be freely configured
- Flexible adaptation to different types of application
- Serial interface for connecting the relay to a fibre-optic object bus and substation and network control systems
- Digital display of setting values, neutral current measured, memorized fault values and more
- Continuous self-supervision with auto-diagnostics of hardware and software
- Member of the SPACOM product family and ABB's Distribution Automation system
- CE marking according to the EC directive for EMC

Application

The earth-fault relay SPAJ 110 C is designed to be used for selective earth-fault protection, either primary or back-up protection, in solidly earthed or low-resistance earthed power systems.

The relay has two protection stages: a low-set overcurrent stage I_0> and a high-set overcurrent stage I_0>>. The low-set stage operates with definite-time characteristic or with inverse-time characteristic, while the high-set stage operates with definite time characteristic only. The earth-fault relay is used both as primary and back-up earth-fault protection relay for feeders, transformers, generators and motors. The relay can be configured to cooperate with a residual voltage relay used for blocking/deblocking the operation of the earth-fault relay.

Design

The earth-fault relay SPAJ 110 C is a secondary relay that is connected to the current transformers of the object to be protected. The earth-fault current can be measured either via a set of three phase current transformers in a residual current connection or a window-type core-balance current transformer. When a core-balance current transformer is used, it should be secured that the repeatability of the current transformer is sufficient also at high earth-fault currents. When an earth-fault occurs, the relay delivers an alarm signal, trips the circuit breaker or starts an external auto-reclose relay, depending on the application and the configuration of the relay.

When the energizing current exceeds the set start value I_0> of the low-set stage, the earth-fault relay starts. When, at definite time operation, the set operate time t> or, at IDMT operation, the calculated operate time t>, expires, the relay operates. In the same way the high-set stage starts once its set start value I_0>> is exceeded and, when the set operate time t>> expires, the relay operates.

The low-set stage of the earth-fault relay can be given either definite-time or inverse-time characteristic. At inverse time characteristic four inverse time curve sets with different steepness are available: Normal inverse, Very inverse, Extremely inverse and Long-time inverse. These curve sets comply with the BS 142 and IEC 255 standards.

The start signal from the earth-fault relay is received as contact function. The start signal can be used, for instance, for blocking cooperating protection relays.

The relay contains one optically isolated logic input for external incoming control signals, generally blocking signals.

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		25-27	25-26
Rated current I_n		1 A	5 A
Thermal withstand capability	continuously	4 A	20 A
	for 10 s	25 A	100 A
	for 1 s	100 A	500 A
Dynamic current withstand capability	Half-wave value	250 A	1250 A
Input impedance		<100 mΩ	<20 mΩ
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 ≤ 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)

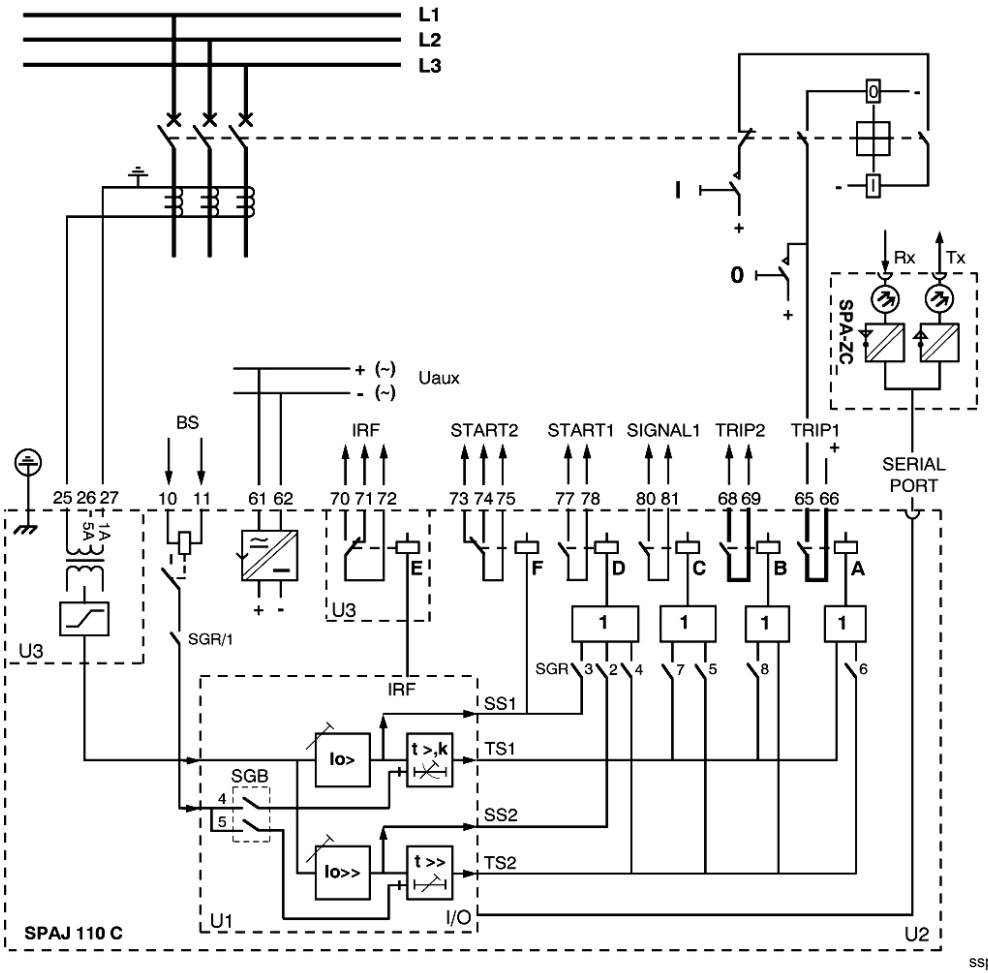
Table 4: Earth-fault relay module SPCJ 1C8

Low-set current stage I_0>	Start current I_0>, setting range			0.1…0.8 × I_n
	Start time, typically			60 ms
	Reset time, typically			60 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 60255-4 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 current stage I_0>>	Start current I_0>>			0.1…4.0 × I_n and ∞, infinite
	Start time, typically			50 ms
	Operate time t>>			0.05…100 s
	Reset time, typically			60 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 5: Tests and standards

Test voltages	Dielectric test voltage (IEC 60255-5)	2.0 kV, 50 Hz, 1 min
	Impulse test voltage (IEC 60255-5)	5 kV, 1.2/50 μs, 0.5 J
	Insulation resistance (IEC 60255-5)	>100 MΩ, 500 V dc
Interference tests	High-frequency (1 MHz) disturbance test (IEC 60255-22-1), common mode	2.5 kV
	High-frequency (1 MHz) disturbance test (IEC 60255-22-1), differential mode	1.0 kV
	Fast transients (IEC 60255-22-4, class III and IEC 61000-4-4), power supply inputs	4 kV, 5/50 ns
	Fast transients (IEC 60255-22-4, class III and IEC 61000-4-4), other inputs	2 kV, 5/50 ns
	Electrostatic discharge (IEC 60255-22-2 and IEC 61000-4-2), air discharge	8 kV
	Electrostatic discharge (IEC 60255-22-2 and IEC 61000-4-2), contact discharge	6 kV
Environmental conditions	Service temperature range	-10…+55°C
	Transport and storage temperature range (IEC 60068-2-8)	-40…+70°C
	Damp heat test (IEC 60068-2-3)	<95%, +40°C, 96 h
	Relative humidity (IEC 60068-2-30)	93…95%, +55°C, 6 cycles
	Degree of protection by enclosure when flush mounted	IP 54
	Weight	3 kg

Block diagram



sspaj110

Fig. 1 Block diagram and sample connection diagram

Mounting and dimensions

Flush mounting

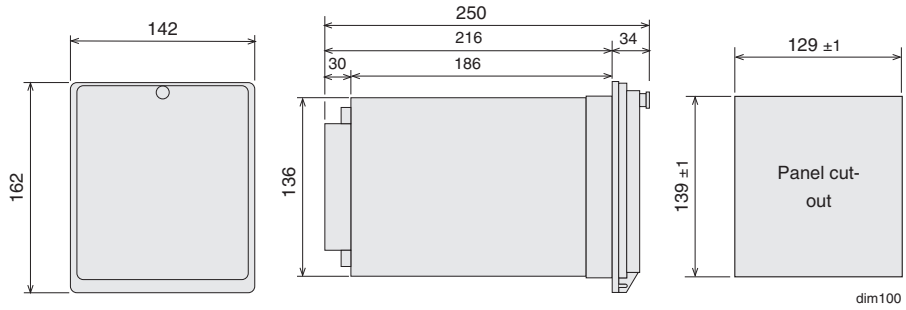
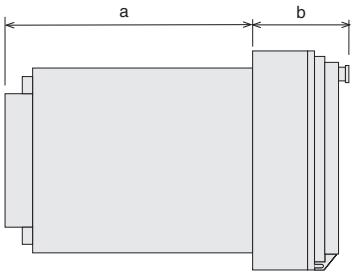


Fig. 2 Flush-mounting relay case (dimensions in mm)

Semi-flush mounting



Raising frame	a	b
SPA-ZX 111	176	74
SPA-ZX 112	136	114
SPA-ZX 113	96	154

SFM100_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 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.

SPA-ZX104
SPA-ZX105
SPA-ZX106

SPA-ZX110
SPA-ZX115

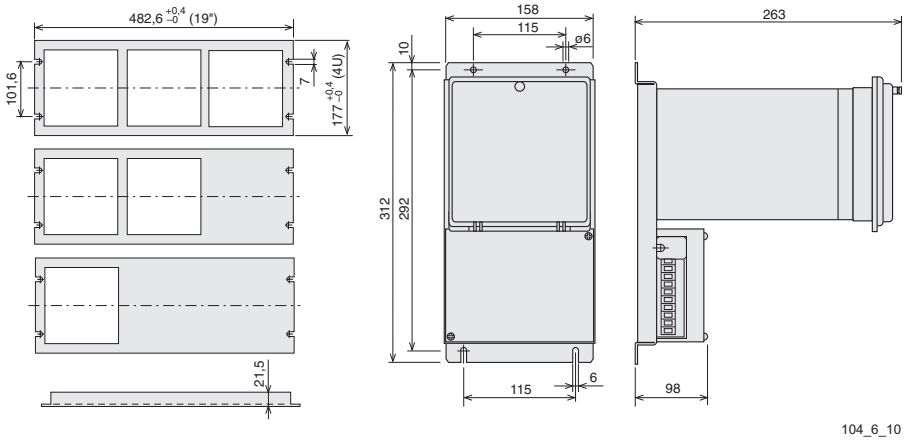


Fig. 4 Mounting cabinets and frames as well as projecting mounting (dimensions in mm)

Ordering

When ordering, please specify:

Ordering information	Ordering example
1. Type designation and quantity	SPAJ 110 C, 5 pieces
2. Order number	RS 421 010-AA
3. Rated values	I_n=5 A, f_n=50 Hz
4. Auxiliary voltage	U_{aux} =110 V dc
5. Accessories	-
6. Special requirements	-

Order numbers

Earth-fault relay SPAJ 110 C without test adapter	RS 421 010-AA, CA, DA, FA
Earth-fault relay SPAJ 110 C including test adapter RTXP 18	RS 421 210-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

Manual “Earth-fault relay SPAJ 110 C”	1MRS 750801-MUM EN

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