

# Transient measuring directional relay and earth-fault protection RXPG



(RXPG\_4.eps)

## Features

### Relay

- Transient measuring directional earth fault relay for resonant earthed systems
- Correct directional measuring without use of a neutral point resistor
- Bidirectional design with separate start functions for earth faults on the line side and the busbar side
- Settable enable value, 10-30 V neutral point voltage
- Built-in timers
- Three design variants with logics and outputs adapted for different applications
- Variant A for indication and signal
- Variant B for trip and with built-in backup neutral point voltage relay
- Variant C as variant B but with one shot delayed auto-reclosing

### Earth-fault protection

- Directional earth fault protections for resonant earthed systems with or without use of a neutral point resistor
- Independent time delay
- Different tripping and indication variants available
- Test switch included

# Application

Directional earth-fault protections are used when selectivity is required, e.g. due to parallel lines, meshed networks or networks being supplied from a number of directions.

They are also normally required in radial fed systems to get selective operation.

RXPG 4 is a transient measuring directional earth fault relay which determines the direction to an earth fault based on the short-term transient build-up in the beginning of the earth fault. Thus, no resistance is required in the neutral point of the system. This improves the possibility of discovering high-impedance earth fault, for example at a broken conductor.

RXPG 4 is available in three variants, all with the same measuring features but with logics and outputs adapted for different applications.

Variant A has start functions for indicating earth faults on the line side and the busbar side respectively. The relay is intended to be used as earth fault protection when no immediate tripping but only indication of the faulty line is required.

Variant B has in addition to the start functions two settable time functions. One for selective tripping at earth fault on the line side and the other for back-up tripping at neutral point voltage. The relay is intended to be used as earth fault protection when selective tripping of the faulty line is required.

Variant C has in addition to start- and time functions according to variant B even autoreclosing for one shot with dead-time settable 30-90 s. The relay is intended to be used as earth fault protection when selective tripping of the faulty line and auto-reclosing of the line is required.

The functions of the different variants are shown in their terminal diagrams.

Earth-fault protections based on relay RXPG 4 are used as directional earth-fault protections in resonant earthed systems with or without neutral point resistors both in radial fed networks and in meshed networks.

# Design

The earth-fault protections are available in six different designs. All contain a test switch RXTP 18 and a transient measuring directional relay RXPG 4 of variant A, B or C. Protections containing relays of variant B or C have one or two auxiliary relays RXME 1 respectively. In protections for auxiliary voltages other than 48 and 110 V dc are also a dc-dc converter RXTUG 22H included.

The ordering table lists all the variants and the module layouts next to the diagrams show the content for some variants.

All current and voltage input and trip functions are routed through the test switch which provides both relay isolation and correct sequencing of trip and input circuits, during a test.

The directional operation of RXPG is based on the polarities of the current and voltage transients in the earth-fault moment.

The RXPG 4 relay consists mainly of two input transformers, for the adaptation of current and voltage to the measuring

circuits, and of three printed board assemblies (PBA's). The PBA's are equipped with setting devices and circuits for filtering, level and directional measuring, delay, logic and amplification as well as two, three or four output relays. The output relays are intended for the start, time-lag (trip) and reclosing functions. In the front there are two yellow LED's for indication of the start function for earth fault on the line side (LS) alternatively the busbar side (BS), as well as a red LED for time-lag operation (LS). The red LED locks itself and is reset electrically or with a push button in the front.

RXPG 4 is in principle plug-in compatible with the relays RXPE 40 and RXPF 4.

A short-circuiting connector type RTXK is supplied with all relay modules. This connector is mounted on the rear of the terminal base (not supplied with individual relays) and automatically short-circuits the current transformer secondary circuit when the relay is removed from the terminal base. The relays occupies four seats (4U 12C).

# Technical data

**Table 1: RXPG 4**

Rated voltage $U_n$	110 V
Rated frequency $f_n$	50 Hz
Auxiliary voltage EL	48 or 110 V dc
Voltage RL	48 or 110 V dc
<b>Operate values:</b>	
Transient current	Settable 3-15 or 10-50 mA 200 Hz
Transient voltage	2,1 V 200 Hz
Neutral point voltage	Settable 10-30 V 50 Hz
Resetting ratio	> 90%
<b>Operate times:</b>	
Directional measuring	< 2 ms
Start operation	130 ms
Time lag I >	Settable 1-5 s
Time lag U >	Settable 2-10 s
Reclosing	1 shot with dead-time settable 30-90 s
<b>Power consumption:</b>	
Current circuit	0,03 mVA at I = lowest scale value
Voltage circuit	0,5 VA
Auxiliary voltage EL	< 4 W
Voltage RL	< 0,2 W per circuit
<b>Overload capacity:</b>	
Current circuit	
3-15 mA	1 A continuously, 25 A in 1 s
10-50 mA	3 A continuously, 75 A in 1 s
Voltage circuit	140 V continuously
Permitted range in %, EL and RL	80-110% of rated voltage
Permitted ambient temperature	-25 °C to +55 °C
<b>Insulation tests:</b>	
Dielectric test	
current circuit	50 Hz, 2 kV, 1 min
other circuit	50 Hz, 2 kV, 1 min
Impulse voltage test	1,2/50 $\mu$ s, 5 kV, 0,5 J

**Table 1: RXPG 4**

<b>Disturbance tests:</b>		
Power frequency test	50 Hz, 0,5 kV, 2 min	
Fast transient test	4-8 kV, 2 min	
1 MHz burst test	2,5 kV, 2 s	
Dimensions	4U 12C modules	
Weight	1,4 kg	
<b>Contact data:</b>	<b>Time-lag</b>	<b>Start and reclosing</b>
Highest system voltage ac or dc	250 V	250 V
Current carrying capacity		
continuously	4 A	5 A
during 1 sec	10 A	15 A
Making and conducting capacity		
during 200 ms, L/R > 10 ms	20 A	30 A
during 1 sec L/R > 10 ms	10 A	15 A
Breaking capacity		
ac $\cos \phi > 0,4$	5 A	8 A
dc L/R > 40 ms		
48 V	0,5 A	1 A
110 V	0,2 A	0,4 A
220 V	0,1 A	0,2 A

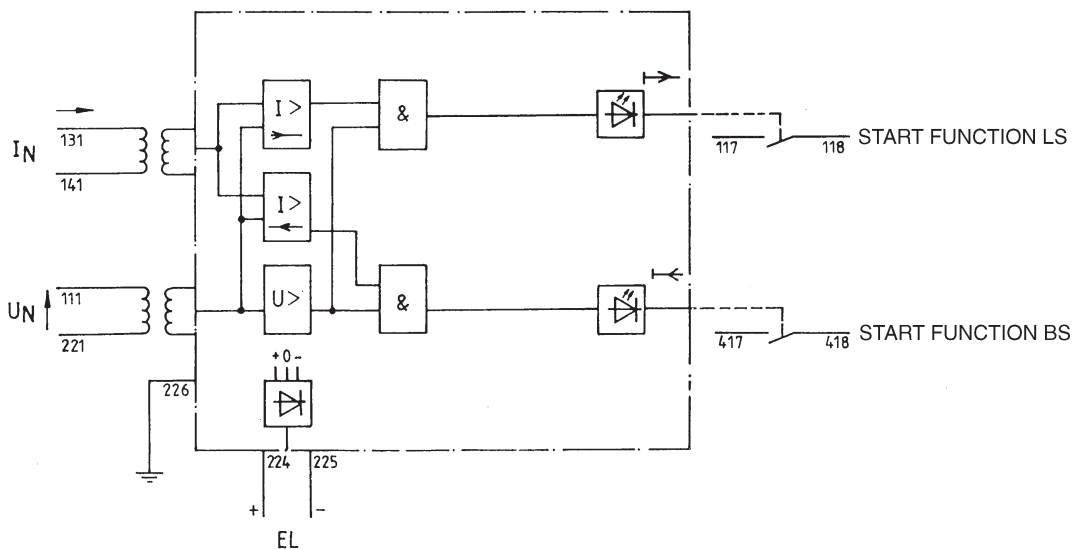
**Table 2: Relay assembly**

Current setting range	3-15 mA, 10-50 mA
Rated ac voltage	110 V, 50 Hz
Enable voltage setting range	10-30 V
Time delay, setting range	1-5 s (I >), 2-10 s (U >)
<b>Auxiliary voltage and power consumption:</b>	
24-36 V dc	10 <sup>1)</sup> W
48 V dc	5 W
48-60 V dc	11 <sup>1)</sup> W
110 V dc	6 W
110-250 V dc	11 <sup>1)</sup> W

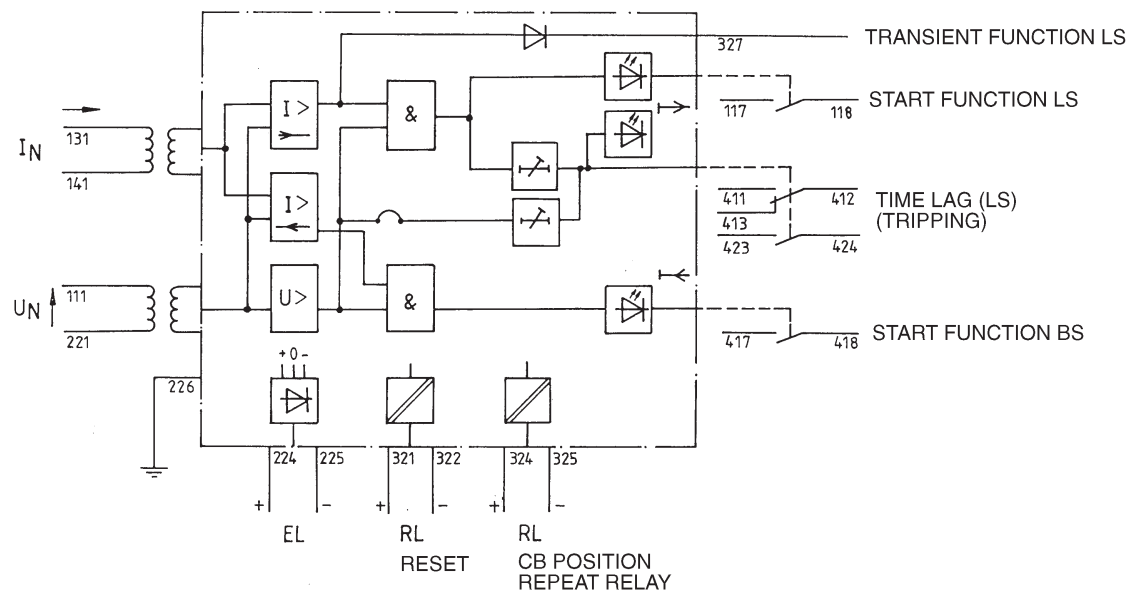
<sup>1)</sup> dc/dc converter RXTUG 22 H is included

# Diagrams

Figure 1: Terminal diagram for RXPG 4, variant A



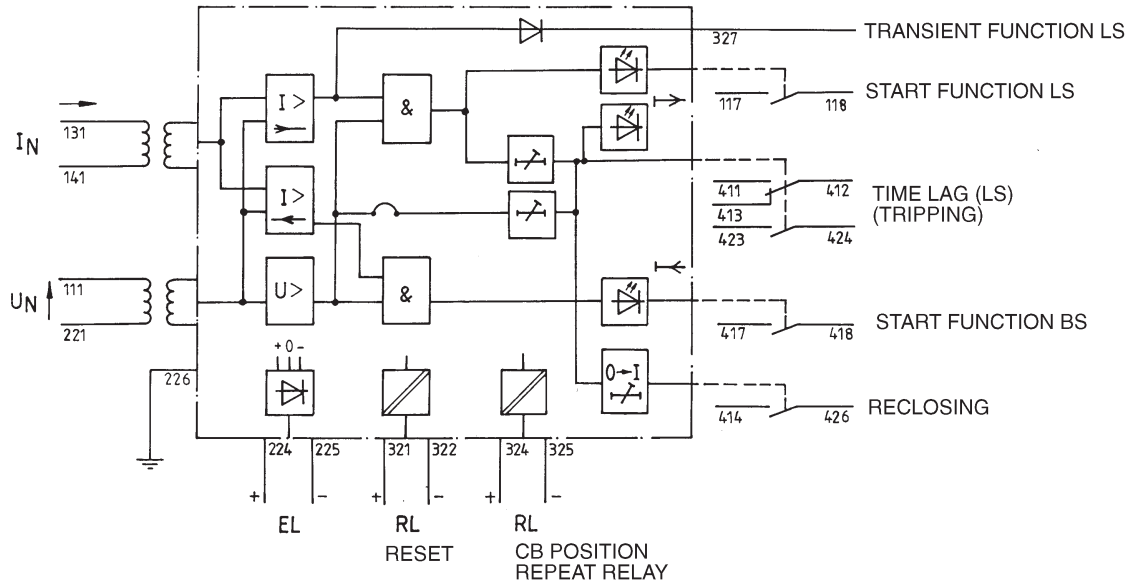
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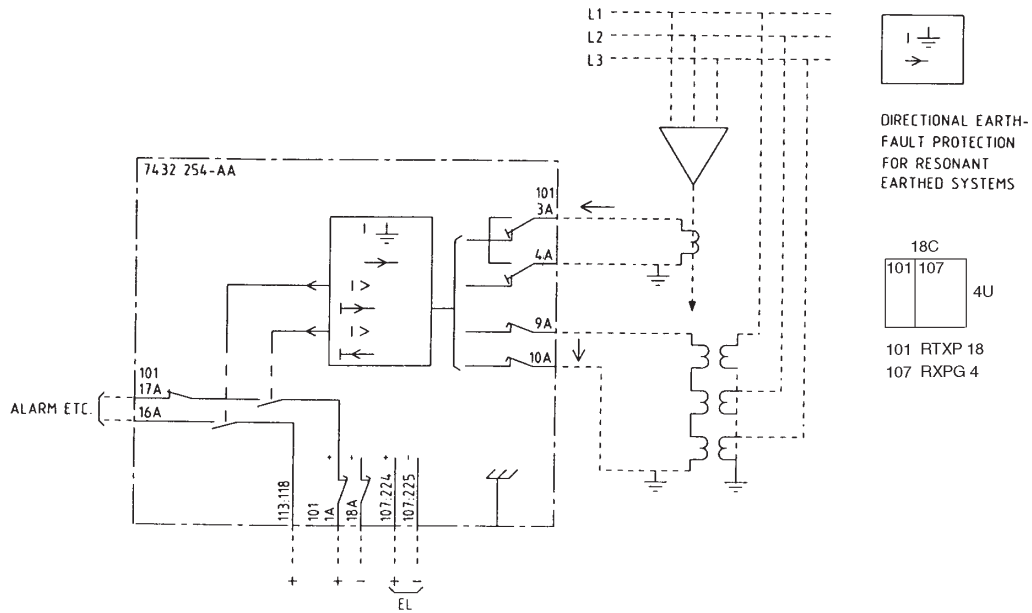
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Figure 2: Terminal diagram for RXPG 4, variant B

Figure 3: Terminal diagram for RXPG 4, variant C



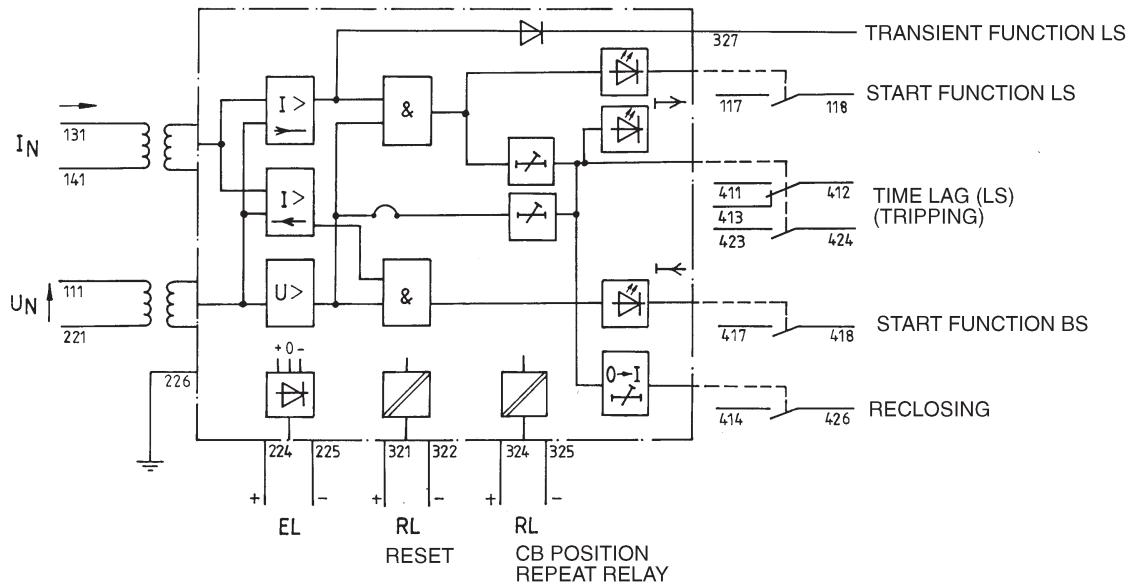
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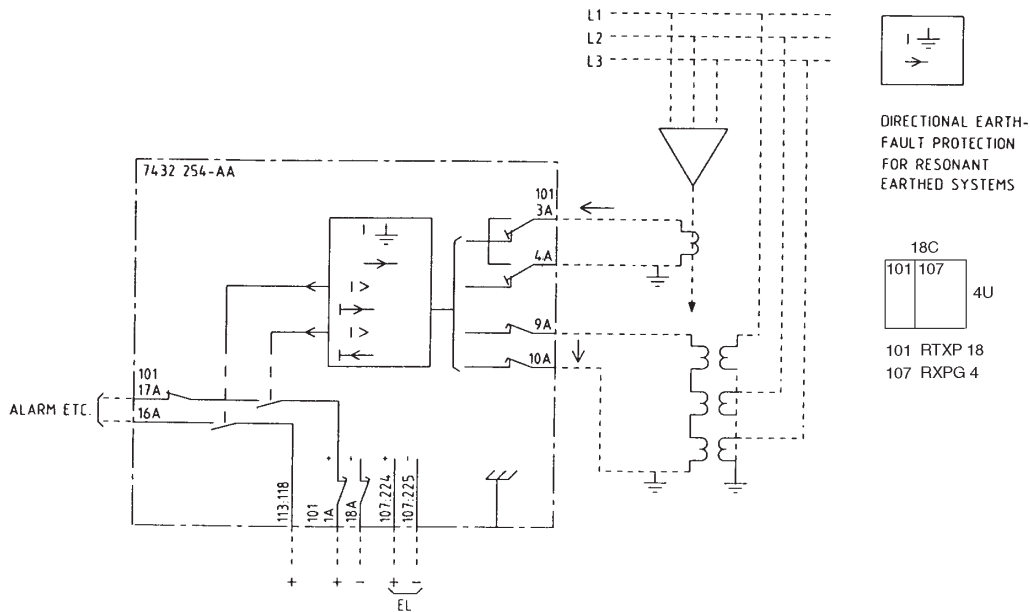
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Figure 4: Terminal diagram 7432 254-AAA

Figure 5: Terminal diagram 7432 255-AAA



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Figure 6: Terminal diagram 7432 256-BAA



# Ordering

Specify:

- Quantity
- Ordering No. according to ordering tables for earth-fault protection and/or for RXPG 4
- Current scale
- Auxiliary dc voltage, EL, RL
- Desired wording on the lower half of the test switch face plate max. 13 lines with 14 characters per line.

## Installation

RXPG is a plug-in relay occupying four COMBIFLEX relay seats (4U 12C). The relay is mounted on separately ordered terminal bases. These are then installed in equipment frames or on apparatus bars also to be mounted in equipment frame.

### Ordering table for earth-fault protection

Tripping relay	Start function	Time function	Autore-closer	DC/DC converter	Ordering No.	Circuit/Terminal diagram	Modular size	Weight
–	X	–	–	–	RK 651 131-AA	7432 254-AAA <sup>1)</sup>	4U 18C	2,5 kg
–	X	–	–	X	RK 651 131-BA	7432 254-BAA	4U 24C	3 kg
X	X	X	–	–	RK 651 132-AA	7432 255-AAA <sup>1)</sup>	4U 24C	3 kg
X	X	X	–	X	RK 651 132-BA	7432 255-BAA	4U 30C	4 kg
X	X	X	X	–	RK 651 133-AA	7432 256-AAA	4U 24C	3,5 kg
X	X	X	X	X	RK 651 133-BA	7432 256-BAA <sup>1)</sup>	4U 30C	4 kg

1) Diagram shown in this document. Other diagrams available on request.

### Ordering table for RXPG4

Variant	Terminal diagram	Auxiliary dc Voltage EL	Ordering No.	
			3-15 mA	10-50 mA
A	Fig. 1	48 V	RK 521 002-AA	RK 521 002-BA
		110 V	RK 521 003-AA	RK 521 003-BA
B	Fig. 2	48 V	RK 521 004-AA	RK 521 004-BA
		110 V	RK 521 005-AA	RK 521 005-BA
C	Fig. 3	48 V	RK 521 006-AA	RK 521 006-BA
		110 V	RK 521 007-AA	RK 521 007-BA

# References

Auxiliary, signal and tripping relays	1MRK 508 015-BEN
Time relay RXKL 1	1MRK 509 012-BEN
DC-DC converter RXTUG 22 H	1MRK 513 001-BEN
COMBIFLEX	1MRK 513 003-BEN
COMBITEST	1MRK 512 001-BEN
Directional check and secondary testing	RK 651-105E



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