



(SE970136)



(SE970128)

### Features

- Two- or three-phase directional overcurrent protection for cables and overhead lines
- Directional earth fault protection for isolated, high impedance or solidly earthed networks
- Independent measuring elements with indications per phase
- Test switch, start and trip indication
- Micro-processor based directional time-overcurrent relays with continuous settings for current operate values and time delays
- Extremely inverse
- Long time inverse
- RI-Inverse
- Definite time delay settable 50 ms-8,1 s
- Alternative version where it is possible to change the directional function to be non-directional

#### RXPDK 21H relay

- Voltage-polarized with voltage memory
- Characteristic angle settable  $-120^\circ$  to  $+120^\circ$
- Two variants with wide setting ranges:
  - Low set directional stage 0,075 to 3,25 A or 0,375 to 16,2 A
  - High set nondirectional stage 0,1 to 40 A or 0,5 to 200 A and  $\infty$
- Low set stage programmable for the following time characteristics:
  - Normal inverse
  - Very inverse

#### RXPDK 22H relay

- Directional voltage-polarized earth fault relay for isolated or high impedance earthed systems
- Two variants with wide setting ranges: 3,75 to 162 mA or 15,0 to 650 mA, with settable definite time delay 60 ms-10 s
- Settable enable value, 5-30 V neutral point voltage
- Manual or remote automatic reconnection of the characteristic angle  $\alpha$  for measuring of the resistive or capacitive component of the earth fault current
- Settable uni- or bidirectional function
- Separate built-in over- or undervoltage protection function. Can for example be used as a neutral point overvoltage protection

**RXPDK 23H relay**

- Voltage-polarized with high sensitivity for earth fault protection in solidly earthed systems
- Two variants with wide setting ranges:
  - Low set directional stage 0,075 to 3,25 A or 0,375 to 16,2 A
  - High set nondirectional stage 0,1 to 40 A or 0,5 to 200 A and  $\infty$
- Low set stage programmable for the following time characteristics:
  - Normal inverse
  - Very inverse
  - Extremely inverse
  - Definite time delay settable 50 ms - 8,1 s
- High set stage definite time delay, settable 30 ms -10 s.

**Application**

Directional relay assemblies are used for overcurrent or earth fault protection when selectivity is required, e.g. due to parallel lines meshed networks or networks being supplied from a number of directions.

**Directional overcurrent protection**

The assemblies for phase-overcurrent protection contain RXPDK 21H as directional relay. The function can be independently (definite) or dependently (inverse) time delayed. Three-phase assemblies are used primarily when extra dependability is required against two-phase short-circuits.

The RXPDK 21H relay has a settable characteristic angle of  $-120^\circ$  to  $+120^\circ$  and can thus be used for these applications. When used as directional overcurrent phase-fault protection, the current input is energized from one phase and the voltage input from the line to line voltage between the other two phases (cross-polarization).

A voltage memory is used to get correct directional operations in case of three phase faults and low voltages to the relay.

**Earth fault protection in solidly earthed systems**

The assemblies for earth fault protection in solidly earthed networks contain the RXPDK 23H directional relay with independently set time delay.

In this application it is not possible to use a voltage memory method to decide the direction because there is no zero-sequence voltage before the fault has occurred. Therefore RXPDK 23H has a sensitive directional measuring and will give a correct operation if the input voltage is more than 0,5 V.

In systems with low zero-sequence voltage values, the directional measuring properties of a directional relay may be influenced by

harmonics in the voltage. The RXPDK relay is provided with a filter for suppression of third harmonics.

**Earth fault protection in high impedance earthed systems**

In isolated and in high impedance earthed systems where the capacitive current from the protected line is large compared to the set operate value, directional relay assemblies are used for earth fault protection.

These assemblies contain RXPDK 22H as measuring relay with independent time delay. The relay has a characteristic angle of  $\alpha=0^\circ$  or  $90^\circ$  leading, which is set either by a switch on the front side of the relay or by binary input 1. Reconnections between  $0^\circ$  and  $90^\circ$  leading can thus be made externally via remote control or by means of an auxiliary contact in the disconnecter of the neutral point earthing equipment.

RXPDK 22H set for  $\alpha=0^\circ$  is used in networks with resistance earthed neutral point with or without arc suppression coil. The relay is connected so that it operates for a resistive earth fault current in the direction from the busbar out towards the fault point. With the relay set for bidirectional function it operates for a resistive earth current in both directions.

RXPDK 22H set for  $\alpha=90^\circ$  leading is used in networks with an isolated neutral point to measure the capacitive earth fault current. The relay is connected to operate for a capacitive earth fault current in the direction from the fault point inwards to the busbar.

The RXPDK 22H also measures the neutral point voltage. This function is used for enabling directional operation, and as back-up protection for delayed tripping when the earth fault current does not reach the set value.

## Design

The directional time-overcurrent relay assemblies with RXPDK are available in several variants for single-phase (earth fault), two-phase and three-phase protection with different output circuitries.

A short circuiting connector, type RTXK, is delivered with each current relay. In assemblies this connector is mounted on the rear of the terminal base and will automatically short-circuit the current input when the relay is removed from the terminal base.

The RXPDK relay requires a separate dc-dc converter for auxiliary supply ( $\pm 24$  V). One RXTUG converter can supply up to nine relays.

### Note:

When the RXPDK relay or the dc-dc converter is plugged into or withdrawn from a terminal base, the auxiliary voltage supply must be interrupted. Neither is it allowed to open wiring on plus or minus supply with unit in service.

### RXPDK 21H measuring relay

The directional time-overcurrent relay, type RXPDK 21H, is a static microprocessor based relay. The relay consists mainly of two input transformers, one for current and one for voltage, filter circuits, microprocessor, HMI, LEDs for indications of relay in service, start and trip of low set (directional) stage and trip of high set stage, and three output units which provide separate change-over contacts for start of low set stage and trip of low set and high set stages. The relay is also equipped with two binary inputs, one for blocking of the directional time delayed low set stage and the other for reset of LEDs. The relay is equipped with a filter for third harmonics suppression.

Start and low set operate values are set on the scale marked  $I_{\alpha>}$  on the front of the relay.

The relay operates when  $I \times \cos(\varphi - \alpha) \geq I_{\text{set}}$ . The characteristic angle,  $\alpha$ , positive when  $I$  lags  $U$ , is settable between  $-12^\circ$  to  $+12^\circ$  or  $-120^\circ$  to  $+120^\circ$ .

When the input voltage  $U$  drops below 5 V the voltage memory is activated. The phase angle is frozen after 100 ms and resets when the start function resets.

When  $U = 0$  before the overcurrent start e.g. at switching on a line, the relay will operate as follows:

- $U < 5$  V: non-directional operation
- $U > 5$  V: non-directional operating during the first 200 ms and then directional operation

The RXPDK 21H is available in an alternative version. In this version it is possible to change the directional function to be non-directional. This setting is done by one of the dip-switches on the front. The setting range of the characteristic angle  $\alpha$  is still  $-120^\circ$  to  $+120^\circ$  but the scale  $-12^\circ$  to  $+12^\circ$  is not available in this alternative version. The input voltage has of course no influence on the overcurrent function when the relay is set to be non-directional.

The start function output is energized immediately after the measured value exceeds the set start level. For definite-time delayed operation the low set stage output operates after the set time delay. For inverse-time operation, the operate time will depend of the time setting (constant  $k$ ) and by how much the measured current magnitude exceeds the start current level setting ( $I>$ ).

The high set stage operates instantaneously when the measured value exceeds the set value.

### RXPDK 22H measuring relay

The directional time-overcurrent relay, type RXPDK 22H, is a static microprocessor based relay. It consists mainly of two input transformers, filter circuits, microprocessor, HMI, LEDs for indications of relay in service, start and trip of directional stage and trip of neutral point voltage, and three output units which provide separate change-over contacts for start and trip of directional stage and trip of voltage stage. The relay is also equipped with two binary inputs, one for change of characteristic angle between  $0^\circ$  and  $90^\circ$  leading and the other for reset of LEDs. The relay is equipped with a filter for third harmonics suppression.

Start and low set operate values are set on the scale marked  $I_{\alpha>}$  on the front of the relay.

The relay operates when  $I \times \cos(\varphi - \alpha) \geq I_{\text{set}}$  and  $U_N \geq U>$ . The characteristic angle,  $\alpha$ , is settable  $0^\circ$  or  $-90^\circ$ . The relay can also be pro-

grammed for uni- or bidirectional function, and the characteristic angle is set with the programming switch on the front of the relay.

The start function output is energized immediately after the measured value exceeds the set start level.

The definite-time delayed function operates after the set time delay has expired.

The neutral point voltage stage operates after the measured voltage level exceeds the set level and after the set time delay.

**RXPDK 23H measuring relay**

The directional time-overcurrent relay, type RXPDK 23H, is a static microprocessor based relay. It consists mainly of two input transformers, filter circuits, microprocessor, HMI, LEDs for indications of relay in service, start and trip of directional stage and trip of high set stage, and three output units which provide separate change-over contacts for start and trip of directional stage and trip of high set stage. The relay is also equipped with two binary inputs, one for blocking or enabling the trip functions and the other for reset of LEDs. The relay is equipped with a filter for third harmonics suppression.

Start and low set operate values are set on the scale marked  $I_{\alpha >}$  on the front of the relay. The directional stage operates when  $I \geq I_{set}$  and  $140^\circ \geq \varphi \geq 0^\circ$ . The phase angle is positive when I lags U. The relay has a sensitive directional measuring and will give correct directional operation if the input voltage is more than 0.5 V.

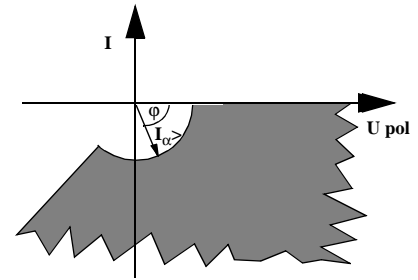


Fig. 1 Function characteristic for the RXPDK 23H  $I_{\alpha >}$  function

The start function output is energized immediately after the measured value exceeds the set start level. The definite-time delayed functions operates after the set time delay. For inverse-time operation, the operate time will depend of the time setting (constant k) and by how much the measured current magnitude exceeds the start current level setting ( $I >$ ).

**Technical data**

**Directional time-overcurrent relay RXPDK 21H**

**Table 1: Voltage and current inputs**

Rated voltage $U_r$	120 V
Rated current $I_r$	1 A or 5 A
Scale constant $I_s$	(0,1 0,2 0,4 and 1,0) x $I_r$
Scale range 1 A Variant $I_{\alpha >}$ $I >>$ 5 A Variant $I_{\alpha >}$ $I >>$	0,075-3,25 A 0,1-40 A 0,375-16,25 A 0,5-200 A
Effective voltage range U	5-200 V
Effective current range	(0,75-65) x $I_s$

**Table 1: Voltage and current inputs**

Rated frequency $f_r$	50-60 Hz
Operating frequency range	45-66 Hz
Power consumption for: $U = U_r$	0,25 VA
1 A variant $I = I_s = 0,1$ A	0,5 mVA
$I = I_s = 1$ A	50 mVA
5 A variant $I = I_s = 0,5$ A	1,5 mVA
$I = I_s = 5$ A	100 mVA
Overload capacity voltage: continuously	250 V
during 10 s	300 V
Overload capacity current:	
1 A variant continuously	4 A
5 A variant continuously	20 A
1 A variant during 1 s	100 A
5 A variant during 1 s	350 A

**Table 2: Current functions**

Current functions	Low set stage $I_{\alpha>}$	High set stage $I_{>>}$
Setting range	$(0,75-3,25) \times I_s$	$(1,0-40) \times I_s$ and $\infty$
Binary input 1 "block" Active signal on binary input 1, blocks the time delayed $I_{\alpha>}$	Directional function	
Angle $\varphi$ between U and I	Positive if I lags U	–
Setting range for characteristic angle $\alpha$	$-120^\circ$ to $+120^\circ$ or $-12^\circ$ to $+12^\circ$ Alt. version only $-120^\circ$ to $+120^\circ$	–
Operate condition $I_{\alpha>}$	$I \times \cos(\varphi - \alpha) \geq \text{set } I_{\alpha>}$	–
Voltage memory	When the input voltage U drops below 5 V the voltage memory is activated. The phase angle is freezed after 100 ms and resets when the start function resets. When U = 0 before the overcurrent start e.g. at switching on a line, the relay will operate as follows: - U < 5 V: non-directional operation - U > 5 V: non-directional operation during the first 200 ms and then directional operation	
Operate time at $\varphi = \alpha$ , typical	dir. at $\varphi = \alpha$ alt. version non directional	
$I = 0 \Rightarrow 3 \times I_{\alpha>}$	90 ms	40 ms
$I = 0 \Rightarrow 10 \times I_{\alpha>}$	85 ms	30 ms
Reset time at $\varphi = \alpha$ , typical		
$I = 3 \Rightarrow 0 \times I_{\alpha>}$	40 ms	
$I = 10 \Rightarrow 0 \times I_{\alpha>}$	55 ms	
Consistency of the op. value	< 2% at $\varphi = \alpha$	< 2%
Accuracy for characteristic angle $\alpha$ :		
$0-40 \times I_s$	< 3°	
$40-100 \times I_s$	< 5°	
Reset ratio (typical)	90%	
Transient over-reach L/R=10, 50 and 100 ms	< 5 %	

Technical data (cont'd)

**Table 2: Current functions**

Current functions	Low set stage $I_{\alpha >}$	High set stage $I_{>>}$
Overshoot time	< 55 ms	< 20 ms
Recovery time at $I = 3 \times I_{\alpha >}$	< 50 ms	
Frequency dependence 45-65 Hz	< $\pm 5\%$	
Influence of harmonics in:	Angle dependence	Current dependence
U 100 / 120 Hz, 20%	< 3°	—
150 / 180 Hz, 100%	< 5°	—
250 / 300 Hz, 100%	< 4°	—
I 100 / 120 Hz, 20%	< 4°	< 3%
150 / 180 Hz, 10%	< 6°	< 3%
150 / 180 Hz, 20%	< 10°	< 4%
250 / 300 Hz, 20%	< 7°	< 3%

**Table 3: Time function**

Time function	Low set stage $I_{\alpha >}$
Time delay	Inverse and definite time (Normal, Very, Extremely, Long time and RI inverse time)
Setting range	Definite time Inverse time
	0,05-8,1 s $k = 0,05-1,1$
Accuracy	The tolerances for inverse and definite time delay are calculated under the condition that the current before operation is higher than $0,4 \times I_s$ , otherwise add 20-30 ms.
	Definite time Inverse time
	1% and $\pm 50$ ms
	NI, VI, EI and LI 2 x op. value 12,5% and $\pm 30$ ms
	NI, VI, EI and LI 5 x op. value 7,5% and $\pm 30$ ms
	NI, VI, EI and LI 10 x op. value 5% and $\pm 30$ ms
	NI, VI and LI 20 x op. value 5% and $\pm 30$ ms
	EI 20 x op. value 5% and +80 -30 ms
	RI 1,0 x op. value 12,5% and $\pm 30$ ms
	1,3 x op. value 12,5% and $\pm 30$ ms
	1,5 x op. value 5% and $\pm 30$ ms
	10 x op. value 5% and $\pm 30$ ms
	20 x op. value 5% and $\pm 30$ ms
Consistency	< 0,5%

See also technical data common for RXPDK 21H, RXPDK 22H and RXPDK 23H

**Directional time-overcurrent relay RXPDK 22H**

**Table 4: Voltage and current inputs**

Rated voltage $U_r$	120 V
Rated current $I_r$	50 mA or 200 mA
Scale constant $I_s$	$(0,1 \ 0,2 \ 0,4 \ \text{and} \ 1,0) \times I_r$
Scale range	
50 mA variant $I_{\alpha >}$	3,75 - 160 mA
200 mA variant $I_{\alpha >}$	15 - 650 mA
Effective voltage range U	5-200 V
Effective current range	$(0,75-100) \times I_s$

**Table 4: Voltage and current inputs**

Rated frequency $f_r$	50-60 Hz
Operating frequency range	45-66 Hz
Power consumption for $U = U_r$ 50 mA variant $I = I_s = 5$ mA $I = I_s = 50$ mA 200 mA variant $I = I_s = 20$ mA $I = I_s = 200$ mA	0,25 VA 0,05 mVA 1 mVA 0,1 mVA 1,5 mVA
Overload capacity voltage: continuously during 10 s Overload capacity current: continuously 50 mA variant $I_s = 5/10/20/50$ mA 200 mA variant $I_s = 20/40/80/200$ mA during 1 s 50 mA variant 200 mA variant	250 V 300 V  0,5/1/1/1 A 2/4/4/4 A  5 A 20 A

**Table 5: Start function**

<b>Current function</b>	<b>Stage I&gt;</b>			
Setting range I>	$(0,75-3,25) \times I_s$			
Angle between U and I, $\varphi$	Positive if I lags U			
Settable characteristic angle $\alpha$	0° or -90° Uni- or Bi directional			
Operate conditions for I>, at selected program (U>, I $\alpha$ >) and (U enbl I) (U>, I $\alpha$ >) and (I indep U) (U<, I>) and (U enbl I) (U<, I>) and (I indep U)	I x cos ( $\varphi-\alpha$ ) $\geq$ set I> and U $\geq$ set U> I x cos ( $\varphi-\alpha$ ) $\geq$ set I> and U $\geq$ 5 V I $\geq$ set I> and U $\leq$ set U< I $\geq$ set I>			
Logic for phase memory low voltage phase memory low voltage timeout	Ignores angle changes when U < 5 V Blocks start function 1s after U has decreased to < 5 V			
Binary input 1 "α-selection" Active signal on binary input 1,	Changes the characteristic angle $\alpha$ from 0° to -90° or -90° to 0°			
Accuracy for characteristic angle $\alpha$ 1 to 8 x set op. value 8 to 25 x set op. value 25 to 100 x set op. value	$I_s = 0,1 \times I_r$ < 5,5° < 2,5° < 1,5°	$I_s = 0,2 \times I_r$ < 3,0° < 2,0° < 1,5°	$I_s = 0,4 \times I_r$ < 2,0° < 2,5° < 2,0°	$I_s = 1,0 \times I_r$ < 3,0° < 2,5° < 2,0°
Operate time at $\varphi = \alpha$ , typical I = 0 => 3 x I> I = 0 => 10 x I>	Directional function 85 ms 80 ms		Non-directional function 20 ms 15 ms	
Reset time at $\varphi = \alpha$ , typical I = 3 => 0 x I> I = 10 => 0 x I>	Directional function 30 ms 40 ms		Non-directional function 30 ms 40 ms	
Consistency of the op. value	< 3% at $\varphi=\alpha$		< 2%	
Reset ratio (typical)	90%			
Transient over-reach L/R=10, 50 and 100 ms	< 3 %		< 4%	
Overshoot time	< 50 ms		< 20 ms	

Technical data (cont'd)

**Table 5: Start function**

Current function	Stage I>	
Recovery time at $I = 3 \times I_{\alpha}$	< 50 ms	
Frequency dependence 45-65 Hz	<± 5%	< 3%
Influence of harmonics in: Voltage circuit 100 / 120 Hz, 30% 150 / 180 Hz, 50% 150 / 180 Hz, 100% 250 / 300 Hz, 30%  Current circuit 100 / 120 Hz, 5% 150 / 180 Hz, 10% 150 / 180 Hz, 20% 150 / 180 Hz, 30% 250 / 300 Hz, 20% 250 / 300 Hz, 30%	Angle dependence < 2° < 5° < 7° < 2°  < 2° < 6° < 9° < 12° < 7° < 11°	Current dependence – – – –  < 3% < 3% < 7% < 7% < 4% < 6%

**Table 6: Voltage function**

Selected function U> or U<	U>	U<
Setting range U	$U = U_s = (5-30) V$	$U = 4 \times U_s = (5-120) V$
Operate time Over-voltage (typical) U = 0 => 1,1 x op. value U = 0,9 => 1,1 x op. value Under-voltage (typical) U = 2,0 => 0,9 x op. value U = 1,1 => 0,9 x op. value	60 ms 45 ms – –	– – 60 ms 45 ms
Reset time Over-voltage (typical) U = 1,1 => 0,9 x op. value U = 1,1 => 0 x op. value Under-voltage (typical) U = 0,9 => 1,1 x op. value U = 0,9 => 2,0 x op. value	60 ms 35 ms – –	– – 60 ms 35 ms
Consistency of the op. value	< 2%	
Reset ratio, (typical)	90%	110%
Overshoot time	< 40 ms	
Recovery time Over-voltage U= 0 => 1,1 x op. value Under-voltage U= 2,0 => 0,9 x op. value	< 55 ms –	– < 55 ms
Frequency dependence 45-55 Hz 54-65 Hz	< 2% < 4%	
Influence of harmonics in: Voltage circuit 100 / 120 Hz, 30% 150 / 180 Hz, 50% 150 / 180 Hz, 100% 250 / 300 Hz, 30%	Voltage dependence < 4% < 2% < 5% < 2%	

**Table 7: Time function**

Function	Stage I>	Stage U> or U<
Time delay	Definite time	
Setting range for definite time Accuracy Consistency	$t_I = 0-10 s$ 1% and ±50 ms < 0,5%	$t_U = 0-20 s$ 1% and ±50 ms <0,5%

See also technical data common for RXPDK 21H, RXPDK 22H and RXPDK 23H

## Directional time-overcurrent relay RXPDK 23H

**Table 8: Voltage and current inputs**

Rated voltage $U_r$	120 V
Rated current $I_r$	1 A or 5 A
Scale constant $I_s$	1 A variant 5 A variant
	0,1, 0,2, 0,4 and 1,0 A 0,5, 1, 2, and 5 A
Scale range	
1 A Variant	$I_{\alpha} >$ $I >>$
	0,075-3,25 A 0,1-40 A
5 A Variant	$I_{\alpha} >$ $I >>$
	0,375-16,25 A 0,5-200 A
Effective voltage range U	0,5-500 V
Effective current range	$(0,75-90) \times I_s$
Rated frequency $f_r$	50-60 Hz
Operating frequency range	45-66 Hz
Power consumption for: U = 120 V	0,5 mVA
1 A variant	$I = I_s = 0,1$ A $I = I_s = 1$ A
	0,3 mVA 25 mVA
5 A variant	$I = I_s = 0,5$ A $I = I_s = 5$ A
	1,5 mVA 100 mVA
Overload capacity voltage:	
	continuously
	during 10 s
	during 1 s
	250 V 300 V 500 V
Overload capacity current:	
1 A variant	continuously
5 A variant	continuously
1 A variant	during 1 s
5 A variant	during 1 s
	4 A 20 A 100 A 350 A

**Table 9: Current functions**

Current functions	Low set stage $I_{\alpha} >$	High set stage $I >>$
Setting range	$(0,75-3,25) \times I_s$	$(1,0-40) \times I_s$ and •
Binary inputs Active signal on binary input 1 Active signal on binary input 2	Blocks or enables the trip functions Reset LEDs	
Angle $\varphi$ between U and I	Positive if I lags U	–
Operate condition $I_{\alpha} >$	$140^\circ \geq \varphi \geq 0^\circ$ AND $I \geq \text{set } I_{\alpha} >$	–
Minimum polarizing voltage	0,5 V	
Operate time at $\varphi = \alpha$ , typical $I = 0 \Rightarrow 3 \times I_{\alpha} >$ $I = 0 \Rightarrow 10 \times I_{\alpha} >$	75ms 70ms	35 ms 30 ms
Reset time at $\varphi = \alpha$ , typical $I = 3 \Rightarrow 0 \times I_{\alpha} >$ $I = 10 \Rightarrow 0 \times I_{\alpha} >$	55 ms 65 ms	50 ms 60 ms
Consistency of the op. value	< 2% at $\varphi = \alpha$	< 2%
Reset ratio (typical)	90%	90%
Transient over-reach L/R=10, 50 and 100 ms	< 5%	< 5%

Technical data (cont'd)

**Table 9: Current functions**

Current functions	Low set stage I <sub>α&gt;</sub>	High set stage I>>
Overshoot time	< 60 ms	< 35 ms
Recovery time at I = 3 x I <sub>α&gt;</sub>	< 35 ms	< 30 ms
Frequency dependence 45-65 Hz	< ±5%	
Influence of harmonics in: Voltage circuit 100 / 120 Hz, 30% 150 / 180 Hz, 100% 150 / 180 Hz, 200% 250 / 300 Hz, 200%  Current circuit 100 / 120 Hz, 10% 150 / 180 Hz, 10% 250 / 300 Hz, 20%	Angle dependence  < 2° < 8° < 15° < 5°  < 2° < 5° < 6°	Current dependence      < 3% < 4% < 3%

**Table 10: Time functions**

Time function	Low set stage I <sub>α&gt;</sub>	High set stage I>>
Time delay	Inverse and definite time (Normal, Very and Extremely inverse time)	-
Setting range Definite time Inverse time	0,05-8,1 s k = 0,05-1,1	0,03 - 10 s -
Accuracy Definite time  Inverse time	1% and ±50 ms  NI, VI and EI 2 x op. value 12,5% and ±30 ms NI, VI and EI 5 x op. value 7,5% and ±30 ms NI, VI and EI 10 x op. value 5% and ±30 ms VI and EI 20 x op. value 5% and ±30 ms	-
Consistency	< 0,5%	

See also technical data common for RXPDK 21H, RXPDK 22H and RXPDK 23H

**Technical data common for RXPDK 21H, RXPDK 22H and RXPDK 23H**

**Table 11: Auxiliary DC voltage supply**

Auxiliary voltage EL for RXTUG 22H Auxiliary voltage to the relay	24-250 V DC, ±20% ±24 V (from RXTUG 22H)
Power consumption at RXTUG 22H input 24-250 V before operation after operation without RXTUG 22H ±24 V before operation after operation	Max. 6,5 W Max. 7,5 W  Max. 3,0 W Max. 4,0 W

**Table 12: Binary input**

Binary input voltage RL	48-60 V and 110-220 V DC, -20% to +10%
Power consumption 48-60 V 110-220 V	Max. 0,3 W Max. 1,5 W

**Table 13: Output relays**

Contacts	3 change-over
Maximum system voltage	250 V AC / DC.
Current carrying capacity continuous during 1 s	5 A 15 A
Making capacity at inductive load with L/R >10 ms during 200 ms during 1 s	30 A 10 A
Breaking capacity AC, max. 250 V, cos φ > 0,4 DC, with L/R < 40 mS	8 A 1 A 0,4 A 0,2 A 0,15 A
110 V 220 V 250 V	

**Table 14: Electromagnetic compatibility (EMC), immunity tests**

All tests are done together with the DC/DC-converter, RXTUG 22H

Test	Severity	Standard
Surge immunity	1 and 2 kV, normal service 2 and 4 kV, destructive test	IEC 61000-4-5, class 3 IEC 61000-4-5, class 4
AC injection	500 V, AC	SS 436 15 03, PL 4
Power frequency field immunity	1000 A/m	IEC 61000-4-8
1 MHz burst	2,5 kV	IEC 60255-22-1, class 3
Spark	4-8 kV	SS 436 15 03, PL 4
Fast transient	4 kV	IEC 60255-22-4, class 4
Electrostatic discharge In normal service with cover on	8 kv (contact) 15 kv (air) 8 kv, indirect application	IEC 60255-22-2, class 4 IEC 60255-22-2, class 4 IEC 61000-4-2, class 4
Radiated electromagnetic field	10 V/m, 26-1000 MHz	IEC 61000-4-3, Level 3
Conducted electromagnetic	10 V, 0,15-80 MHz	IEC 61000-4-3, Level 3
Interruptions in auxiliary voltage 110 VDC, no resetting for interruptions	2-200 ms < 40 ms	IEC 60255-11

**Table 15: Electromagnetic compatibility (EMC), emission tests**

Test	Severity	Standard
Conducted	0,15-30 MHz, class A	EN 50081- 2
Radiated emission	30-1000 MHz, class A	EN 50081- 2

**Table 16: Insulation tests**

Test	Severity	Standard
Dielectric Circuit to circuit and circuit to earth Over open contact	2,0 kV AC, 1 min 1,0 kV AC, 1 min	IEC 60255-5
Impulse voltage	5 kV, 1,2/50 μs, 0,5 J	IEC 60255-5
Insulation resistance	> 100 MΩ at 500 V DC	IEC 60255-5

Technical data (cont'd)

**Table 17: Mechanical tests**

Test	Severity	Standard
Vibration	Response: 2,0 g, 10-150-10 Hz Endurance: 1,0 g, 10-150-10 Hz, 20 sweeps	IEC 60255-21-1, class 2 IEC 60255-21-1, class 1
Shock	Response: 5 g, 11 ms, 3 pulses Withstand: 15 g, 11 ms, 3 pulses	IEC 60255-21-2, class 1
Bump	Withstand: 10 g, 16 ms, 1000 pulses	IEC 60255-21-2, class 1
Seismic	X axis: 3,0 g, 1-35-1 Hz Y axis: 3,0 g, 1-35-1 Hz Z axis: 2,0 g, 1-35-1 Hz	IEC 60255-21-3, class 2, extended (Method A)

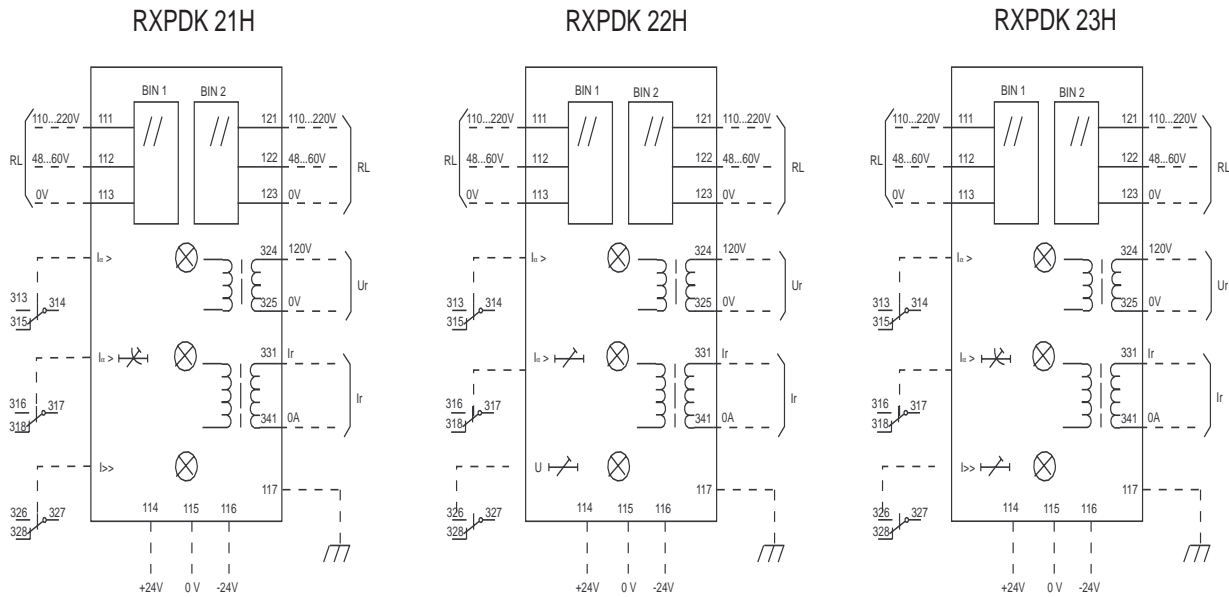
**Table 18: Temperature range**

Storage	-20 °C to +70 °C
Permitted temperature range	-5 °C to +55 °C

**Table 19: Weight and dimensions**

Equipment	Weight	Height	Width
RXPDK 21H without RXTUG 22H	0,7 kg	4U	6C
RXPDK 22H without RXTUG 22H	0,7 kg	4U	6C
RXPDK 23H without RXTUG 22H	0,7 kg	4U	6C

## Diagrams



(96000275)

Fig. 2 Terminal diagram RXPDK 21H

Fig. 3 Terminal diagram RXPDK 22H

Fig. 4 Terminal diagram RXPDK 23H

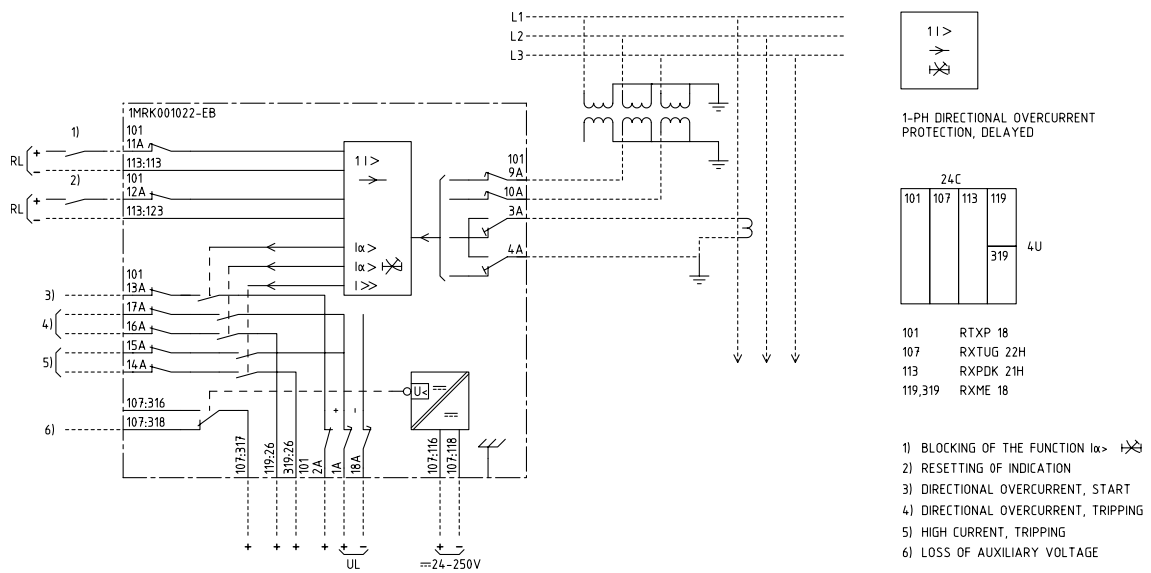


Fig. 5 Terminal diagram 1MRK 001 022-EBA

## Diagrams (cont'd)

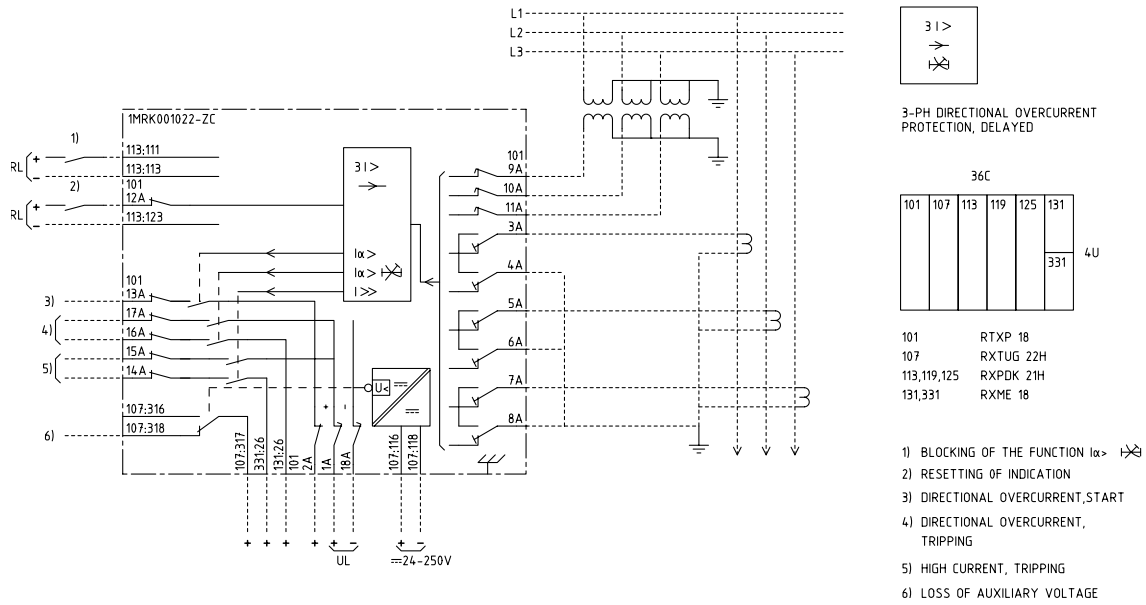


Fig. 6 Terminal diagram 1MRK 001 022-ZCA

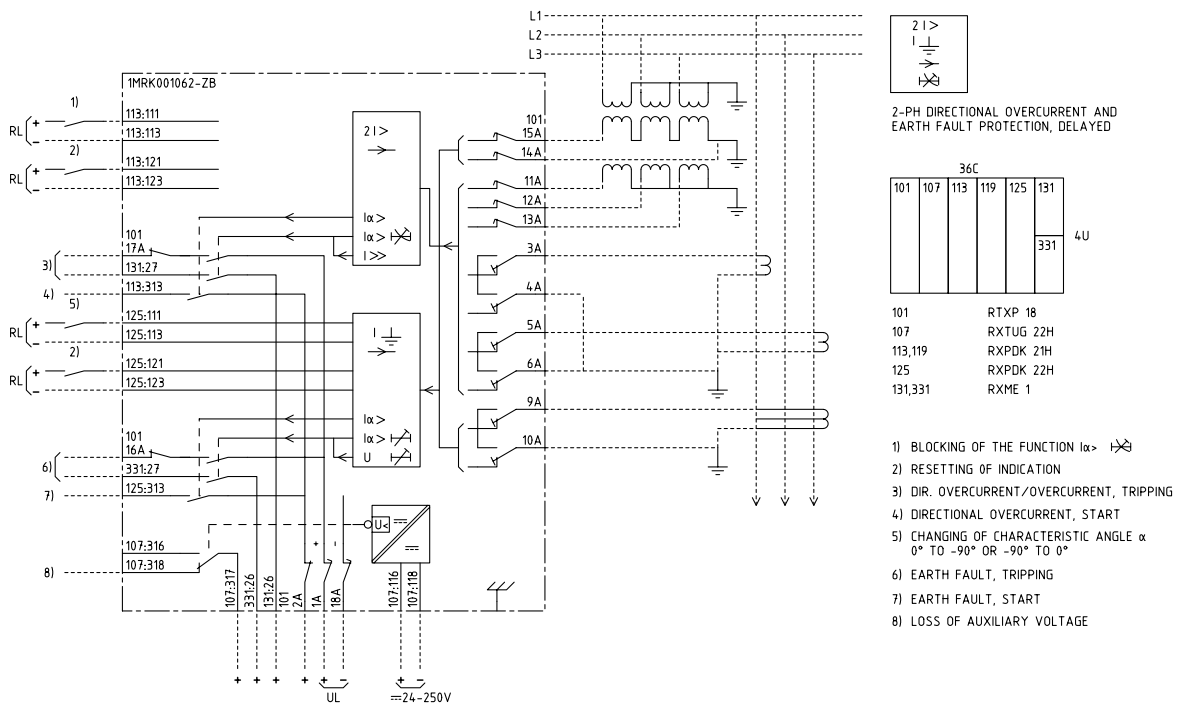


Fig. 7 Terminal diagram 1MRK 001 062-ZBA

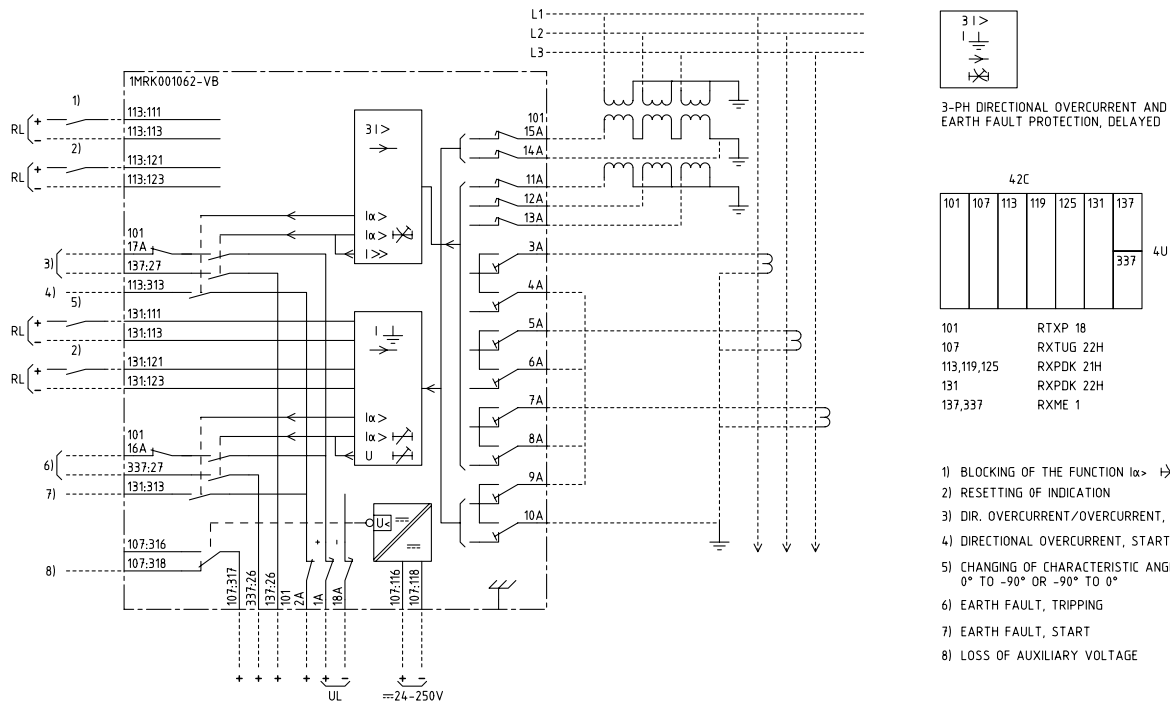


Fig. 8 Terminal diagram 1MRK 001 062-VBA

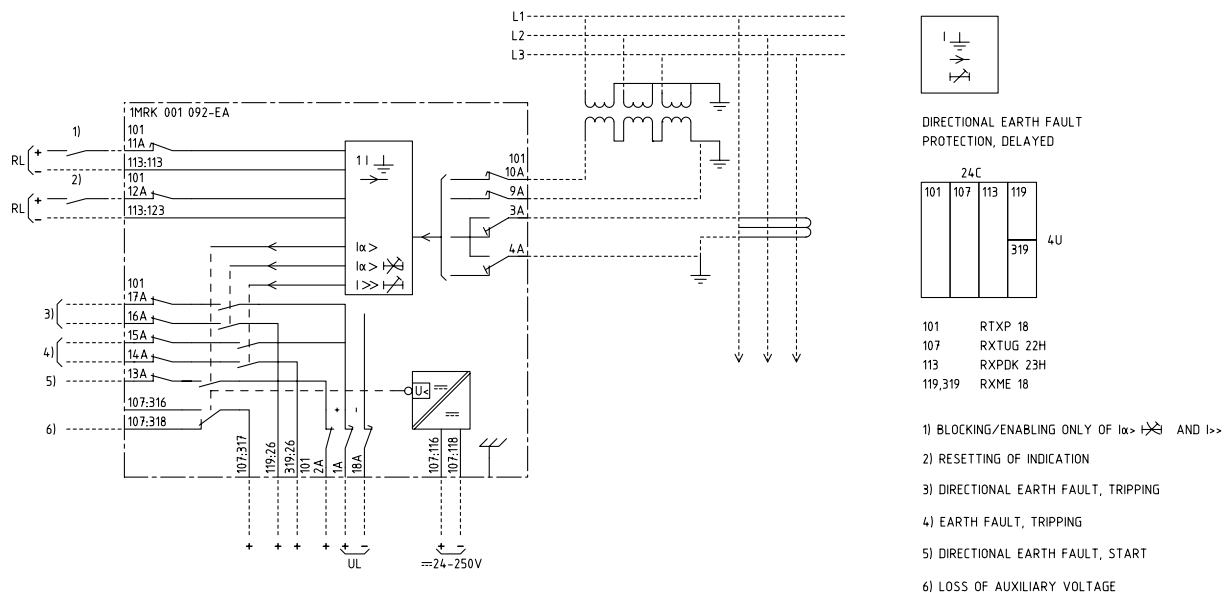


Fig. 9 Terminal diagram 1MRK 001 092-EAA

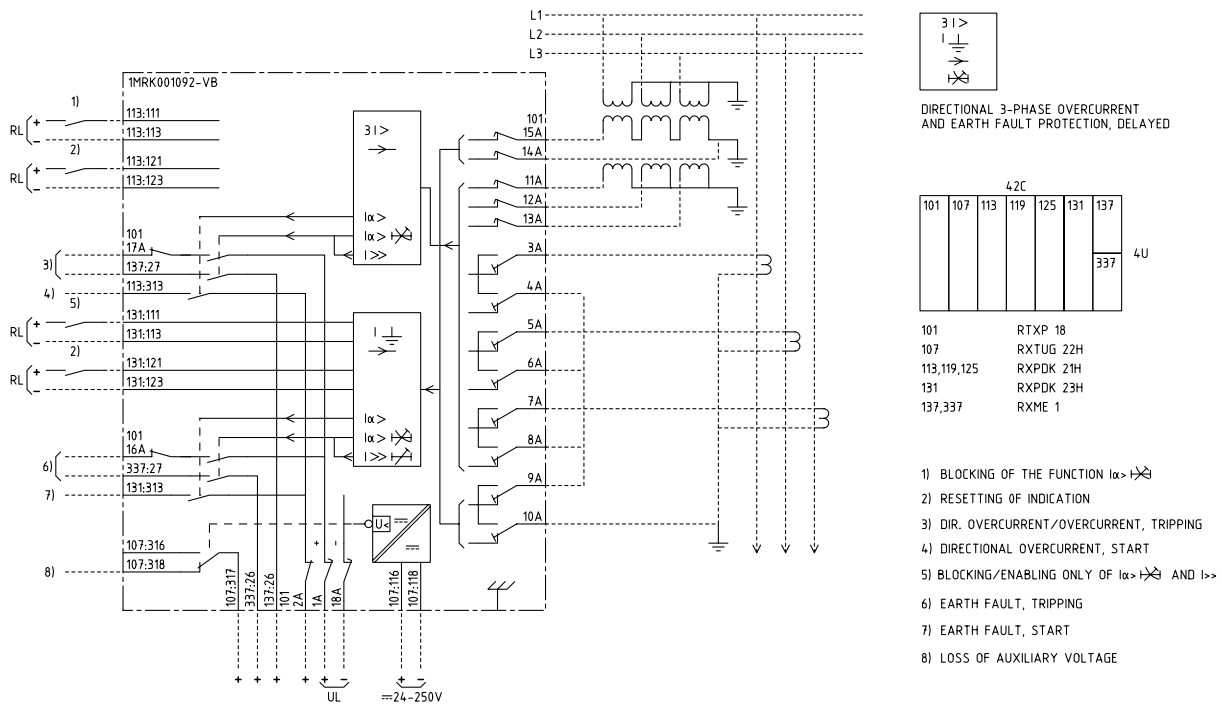
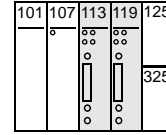
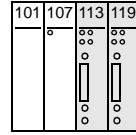
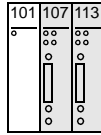
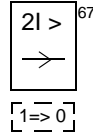


Fig. 10 Terminal diagram 1MRK 001 092-VBA



Protection assemblies (cont'd)

**RAPDK 212 Two-phase directional time-overcurrent protection**



101 RXTUG 22H  
107 RXPDK 21H  
113 RXPDK 21H

101 RTXP 18  
107 RXTUG 22H  
113 RXPDK 21H  
119 RXPDK 21H

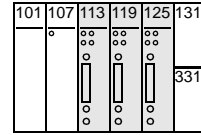
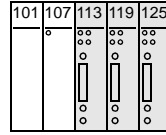
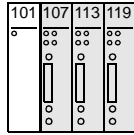
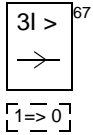
101 RTXP 18  
107 RXTUG 22H  
113 RXPDK 21H  
119 RXPDK 21H  
125 RXME 18  
325 RXME 18

Order No.	Circuit diagram
1MRK 001 021-HB	1MRK 001 022-HB

Order No.	Circuit diagram
1MRK 001 021-KB	1MRK 001 022-KB

Order No.	Circuit diagram
1MRK 001 021-LB	1MRK 001 022-LB

**RAPDK 213, 223, 233 Three-phase directional time-overcurrent and two-phase directional time-overcurrent and earth-fault protection**



101 RXTUG 22H  
107 RXPDK 21H  
113 RXPDK 21H  
119 RXPDK 22H or 23H

101 RTXP 18  
107 RXTUG 22H  
113 RXPDK 21H  
119 RXPDK 21H  
125 RXPDK 22H or 23H

101 RTXP 18  
107 RXTUG 22H  
113 RXPDK 21H  
119 RXPDK 21H  
125 RXPDK 22H or 23H  
131 RXME 18  
331 RXME 18

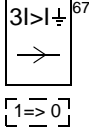
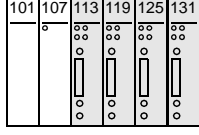
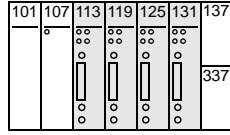
Order No.	Circuit diagram
1MRK 001 021-YC	1MRK 001 022-YC
1MRK 001 061-YB	1MRK 001 062-YB
1MRK 001 091-YB	1MRK 001 092-YB

Order No.	Circuit diagram
1MRK 001 021-PC	1MRK 001 022-PC
1MRK 001 061-PB	1MRK 001 062-PB
1MRK 001 091-PB	1MRK 001 092-PB

Order No.	Circuit diagram
1MRK 001 021-ZC	1MRK 001 022-ZC
1MRK 001 061-ZB	1MRK 001 062-ZB
1MRK 001 091-ZB	1MRK 001 092-ZB

3I > with RXPDK 21H  
2I > I<sub>φ</sub> with RXPDK 22H  
2I > I<sub>φ</sub> with RXPDK 23H

**RAPDK 224, 234 Three-phase directional overcurrent and earth fault protection**

		
	<p>101 RTXP 18                  107 RXTUG 22H                  113 RXPDK 21H                  119 RXPDK 21H                  125 RXPDK 21H                  131 RXPDK 22H or 23H</p>	<p>101 RTXP 18                  107 RXTUG 22H                  113 RXPDK 21H                  119 RXPDK 21H                  125 RXPDK 21H                  131 RXPDK 22H or 23H                  337 RXME 18                  337 RXME 18</p>
	<p>Order No.      Circuit diagram</p>	<p>Order No.      Circuit diagram</p>
<p>3I&gt;I_ with RXPDK 22H</p>	<p>1MRK      1MRK                  001 061-UB    001 062-UB</p>	<p>1MRK      1MRK                  001 061-VB    001 062-VB</p>
<p>3I&gt;I_ with RXPDK 23H</p>	<p>001 091-UB    001 092-UB</p>	<p>001 091-VB    001 092-VB</p>

**Mounting alternatives**

All assemblies can be delivered in the following mounting alternatives:

- on apparatus bars (standard)
- in equipment frame
- in RHGS
- in RHGX

**Ordering**

Specify RAPDK (Protection):

- Quantity
- Ordering number
- Code A, C, H, M
- Desired wording on the lower half of the test switch face plate max. 13 lines with 14 characters per line.

Specify RXPDK 21H, RXPDK 22H and RXPDK 23H (Loose Relay):

- Quantity
- Ordering number

**Directional overcurrent relay**

Type	Rated current	Article No.	Code Phase	Code Earth fault
RXPDK 21H	1 A	1MRK 000 844-AB	<input type="checkbox"/> A1	<input type="checkbox"/> C1
RXPDK 21H	5 A	1MRK 000 844-BB	<input type="checkbox"/> A2	<input type="checkbox"/> C2
RXPDK 22H	0,05 A	1MRK 000 844-CA	<input type="checkbox"/> A3	<input type="checkbox"/> C3
RXPDK 22H	0,2 A	1MRK 000 844-DA	<input type="checkbox"/> A4	<input type="checkbox"/> C4
RXPDK 23H	1 A	1MRK 000 844-EA	<input type="checkbox"/> A1	<input type="checkbox"/> C1
RXPDK 23H	5 A	1MRK 000 844-FA	<input type="checkbox"/> A2	<input type="checkbox"/> C2
RXPDK 21H	1 A (alt. version)	1MRK 000 844-KA	<input type="checkbox"/> A5	<input type="checkbox"/> C5
RXPDK 21H	5 A (alt. version)	1MRK 000 844-LA	<input type="checkbox"/> A6	<input type="checkbox"/> C6

**Auxiliary voltage**

For included auxiliary relays

	Code
24 V DC	<input type="checkbox"/> H5
48-55 V DC	<input type="checkbox"/> H6
110-125 V DC	<input type="checkbox"/> H7
220-250 V DC	<input type="checkbox"/> H8

**Mounting**

Mounting alternatives	Size	Article No.	Code
Apparatus bars			<input type="checkbox"/> M10
Equipment frame without door	4U 19"	1MRK 000 137-GA	<input type="checkbox"/> M11
Equipment frame with door	4U 19"	1MRK 000 137-KA	<input type="checkbox"/> M12
RHGX 4	4U 12C	RK 927 001-AB	<input type="checkbox"/> M71
RHGX 8	4U 24C	RK 927 002-AB	<input type="checkbox"/> M72
RHGX 12	4U 36C	RK 927 003-AB	<input type="checkbox"/> M73
RHGX 20	4U 60C	RK 927 004-AB	<input type="checkbox"/> M74
RHGS 30	6U x 1/1 19" rack	1MRK 000 315-A	<input type="checkbox"/> M81
RHGS 12	6U x 1/2 19" rack	1MRK 000 315-B	<input type="checkbox"/> M82
RHGS 6	6U x 1/4 19" rack	1MRK 000 315-C	<input type="checkbox"/> M83

**References**

Connection and installation components in COMBIFLEX	1MRK 513 003-BEN
Relay accessories COMBIFLEX	1MRK 513 004-BEN
Test system COMBITEST	1MRK 512 001-BEN
User's Guide RXPDK	1MRK 509 007-UEN

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**Manufacturer**

**ABB Automation Products AB**  
Substation Automation Division  
S-721 59 Västerås  
Sweden  
Tel: +46 21 342000  
Fax: +46 21 146918

