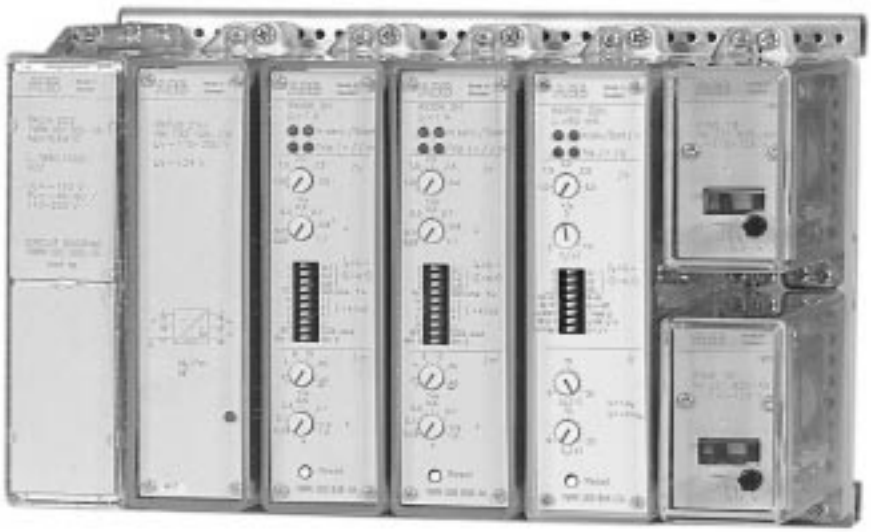
Time- and instantaneous overcurrent and earth fault line protection based on single phase elements

RACIK

1MRK 509 032-BEN
Page 1
Issued October 1999
Changed since February 1998
Data subject to change without notice



RACIK with test switch, DC/DC converter and two auxiliary trip relays.
Different casings are available.

Features

- Protection for short-circuits and earth-faults in unearthed, high-impedance earthed, low-impedance earthed or solidly earthed networks
- Two- or three- single phase time-overcurrent protection with start, delayed and instantaneous functions
- Low set stage with inverse time or definite time characteristics
- Instantaneous or definite time delayed high set stage
- Sensitive directional earth-fault protection for unearthed or high-impedance earthed systems
- Independent measuring elements with indications per phase
- Settable enable value of the residual voltage
- Manual or remote automatic reconnection of the characteristic angle for measuring of the resistive or capacitive component of the earth-fault current
- Built-in residual voltage protection for back-up
- Selective earth-fault protection for small residual currents in solidly earthed systems
- Micro-processor based relays with continuous settings for current operate values and time delays
- The protections are available with or without test switch and tripping relay

Application

The RACIK is available in several versions and is used to protect feeders in networks. It can also be used as back-up protections in transmission network.

Overcurrent protection
Two- or three-phase time-overcurrent relay is used as phase short-circuit protection in radial networks. The overcurrent protection function of RACIK is provided by the single phase time-overcurrent relay elements RXIDK 2H.

In the three-phase protection, both phase currents are always measured when a two-phase fault occurs. The relay operates even if one of the measuring circuits is faulty. Three phase elements are therefore more dependable than two phase elements. Compared to a summation type of three-phase measurement protection, that has a common measuring circuit, considerably greater reliability is achieved.

As there always will be fault current in at least one of the phases during short-circuit, it often is quite adequate to use two-phase protection for feeders.

RXIDK 2H has a low set stage with start and trip functions and a high set stage function. Several different time characteristics are available to achieve selective fault clearance. The high set stage can be set instantaneous or definitive-time delayed. The relay has also a fully isolated binary input. It can be programmed to enable or block the relay. As an alternative the binary input can raise the operate value of the low set stage with 40%. This function is called ”cold load” and facilitates restoration of distribution systems after outage.

In radially supplied networks, the start function can be used for blocking a blockable busbar protection. It can also be used for starting recorders, autoreclosing or signalling.

In meshed systems inverse time overcurrent protections which all have the same setting can be used as back-up protections.

In some applications it is necessary to use directional overcurrent relays. In these cases the protection RAPDK is recommended, see 1MRK 509 007-BEN.

Earth-fault protection
The earthing methods will influence the earth-fault current and therefore also the choice of the earth-fault protection. The system earthing can be either unearthed, high-impedance earthed, low-impedance earthed or solidly earthed.

Earth-fault protection in unearthed or high-impedance earthed systems
In unearthed or high-impedance earthed systems where the capacitive current from the protected line is large compared to the wanted operate value, directional residual current protections can be used for earth-fault protection. The relay uses the residual voltage as a polarizing quantity. The earth-fault protections contain RXPDK 22H as measuring relay with independent time delay. The relay has a characteristic angle $\alpha = 0°$ or $\alpha = -90°$. The angle is set either by a switch on the front side of the relay or by a binary input. Switching between $\alpha = 0°$ or $\alpha = -90°$ can thus be made externally via remote control or by means of a auxiliary contact in the disconnector of the neutral point earthing equipment. The relay has a high sensitivity and a setting range down to 3,7 mA.

In unearthed systems, the relay measures the capacitive current and the characteristic angle set to $\alpha = -90°$. In high-impedance earthed system with a neutral point resistor with or without a reactor in parallel the characteristic angle shall be set to $\alpha = 0°$ and the relay measures the resistive component of the earth-fault current.

The RXPDK 22H also measures the residual voltage. This function is used for enabling directional operation. It is also used as a back-up protection. By selecting different time delay based on the failure rate for the different feeders and the priority of critical loads it is possible to reduce the consequences in case of a back-up fault clearance.

Earth-fault protection in solidly earthed HV & EHV system
In solidly earthed systems the earth-fault currents can be of the same order of magnitude as the short-circuit currents. By measuring the residual current the non-directional RXIDK 2H can be used as simple alternative of earth-fault protections for radial feeders and as back-up protections. For pure RXIDK 2H 1-4 single phase element assemblies please see 1MRK 509 002-BEN.

Earth-faults with high fault resistance can be detected by measuring the residual current. This type of protection provides maximum sensitivity to earth-faults with additional resistance. It is often required to clear earth-fault with residual currents of magnitudes which are as low as 50-100 A.

A sensitive non-directional inverse time residual overcurrent protection is a suitable solution to get a selective protection in most cases. A logarithmic characteristic is generally the most suitable for the purpose of selectivity, since the time difference is constant for a given ratio between the currents. The combined definite and logarithmic inverse time characteristic available in the RXIDG 21H relay is designed to achieve optimum selectivity. The same type of inverse time-current characteristic should be used for all earth-fault overcurrent protections in the network. The selectivity is ensured when the largest infeed is less than 80% of the current on the faulty line. The settings for all objects shall be the same.

When energizing a solidly earthed power transformer, the residual inrush current can cause unwanted operation of the earth-fault overcurrent protection. RXIDG 21H is provided with a fully isolated binary input, which is programmed to either enable or block the relay when activated. A second harmonic restraint relay type RAISB can be connected to prevent unwanted operation at transformer energizing.

Design

The protection **RACIK** is designed in a number of variants for two- or three-phase overcurrent protections and/or earth-fault protection. It is built up based upon time overcurrent relay RXIDK 2H, RXIDG 21H and directional time overcurrent relay RXPDK 22H. Each protection is available with or without test switch RTXP 18, DC-DC converter RXTUG 22H or tripping relay RXME 18. With RXTUG 22H all requirements concerning disturbance emission and immunity with this protection assembly will be met.

All protections are built up by modules in the COMBIFLEX modular system mounted on apparatus bars. The connections to the protections are done by COMBIFLEX socket equipped leads. A short circuiting connector RTXK is mounted on the rear of the terminal base and will automatically short-circuit the current input when the relay is removed from its terminal base.

RXIDK 2H measuring relay

The time-overcurrent relay RXIDK 2H consists mainly of an input transformer for current adoption and isolation, filter circuits, digital-analog converter, microprocessor, HMI consisting of a programming switch and potentiometers for setting and LEDs for start, trip and in service indications, and three output relays, each with a change-over contact, for the start and trip functions of the low set stage and for the trip function of the high set stage respectively. The relay has also a binary input by which the operation can be enabled or blocked or the operate value of the low set stage increased by 40%.

RXIDG 21H measuring relay

The time-overcurrent relay RXIDG 21H consists mainly of an input transformer for current adoption and isolation, filter circuits, digital-analog converter, microprocessor, HMI consisting of a programming switch and potentiometers for setting and LEDs for start, trip and in service indications, and three output relays, each with a change-over contact, for the start and trip functions. The relay has also a binary input by which the operation can be enabled or blocked.

RXPDK 22H measuring relay

The directional time-overcurrent relay RXPDK 22H consists mainly of two input transformers for current and voltage adoption and isolation, filter circuits, digital-analog converter, microprocessor, HMI consisting of a programming switch and potentiometers for setting and LEDs for start, trip and in service indications, and three output relays, each with a change over contact, for the start and trip functions of the directional stage and for trip function of the over- or under-voltage function. The relay has also two binary inputs for remote resetting of LED indications and for changing the characteristic angle from 0° to -90° or vice versa.

Technical data

Time-overcurrent relay RXIDK 2H

Table 1: Current input

Rated current I_r	1 A or 5 A
Scale constant I_s	(0,1 0,2 0,4 1,0) x I_r
Setting ranges 1 A Variant I > I>> 5 A Variant I > I>>	 0,075-3,25 A 0,1-40 A 0,375-16,25 A 0,5-200 A
Effective current range	(0,75-65) x I_s
Rated frequency f_r Frequency characteristics	50-60 Hz Filter options: 50-60 Hz flat, (standard variant) see Fig. 1
Power consumption 1 A variant $I = I_s = 0,1$ A $I = I_s = 1$ A 5 A variant $I = I_s = 0,5$ A $I = I_s = 5$ A	 0,5 mVA 50 mVA 1 mVA 100 mVA
Overload capacity for 1 A variant continuously 5 A variant continuously 1 A variant during 1 s 5 A variant during 1 s	 6 A 20 A 100 A 350 A

Table 2: Current functions, standard variant

Current function	Low set stage I>	High set stage I>>
Setting range	(0,75-3,25) x I_s	(1-40) x I_s and ∞
Operate time, typical I = 0 = > 1,3 x I > I = 0 = > 3 x I > I = 0 = > 10 x I >	 35 ms 25 ms 20 ms	
Reset time, typical I = 1,3 = > 0 x I > I = 3 = > 0 x I > I = 10 = > 0 x I >	 25 ms 35 ms 45 ms	
Consistency of operate value	< 0,5%	
Reset ratio (typical) Consistency	95% < 1,5%	
"Cold load" activated	Operate value increases 40%	N.A
Transient over-reach L/R = 10, 50 and 100 ms	< 5%	
Overshoot time	< 20 ms	
Recovery time at I = 3 x I>	< 40 ms	
Frequency dependence within frequency range 47,5 - 63,0 Hz	< 2,5%	
Operate value at 150 Hz	App. 1,5 x set op. value	
Influence of harmonics 100 / 120 Hz, 10% 150 / 180 Hz, 20% 250 / 300 Hz, 20%	 < 3% < 6% < 4%	
Temperature dependence within range -5°C to +55°C	< 2%	

Table 3: Time function

Time function	Low set stage I>			High set stage I>>
Time delay	Inverse and definite time (Normal, Very, Extremely, Long time and RI inverse time)			Definite time
Setting range Definite time Inverse time	 0,05-8,1 s k = 0,05-1,1			 0,03-1,0 s –
Accuracy Definite time Inverse time	 1% and ±10 ms NI, VI, EI and LI NI, VI, EI and LI NI, VI, EI and LI NI, VI, EI and LI RI	 2 x op. value 5 x op. value 10 x op. value 20 x op. value 1,0 x op. value 1,3 x op. value 1,5 x op. value 10 x op. value 20 x op. value	 12,5% and ±30 ms 7,5% and ±30 ms 5% and ±30 ms 5% and ±30 ms 12,5% and ±30 ms 12,5% and ±30 ms 5% and ±30 ms 5% and ±30 ms 5% and ±30 ms	 1% and ±10 ms
Consistency	< 0,5%			< 0,5%

Technical data(cont'd)

Table 4: Filter options, deviation from technical data for RXIDK 2H, standard variant

	Filter options		
	50-60 Hz, sharp	**150-180 Hz, sharp**	**40-2000 Hz, flat**
Operate time (typical) I = 0 = > 1,3 x op. value I = 0 = > 2 x op. value I = 0 = > 10 x op. value	 65 ms 55 ms 35 ms	 45 ms 35 ms 25 ms	 35 ms 25 ms 20 ms
Reset time (typical) I = 1,3 = > 0 x op. value I = 2 = > 0 x op. value I = 10 = > 0 x op. value	 40 ms 50 ms 100 ms	 30 ms 35 ms 55 ms	 20 ms 25 ms 50 ms
Reset ratio (typical)	95%		
Recovery time at I = 3 x op. value	< 65 ms	< 45 ms	< 40 ms
Overshoot time	< 35 ms	< 25 ms	< 20 ms
Transient over-reach L/R = 10, 50 and 100 ms	< 2%	< 2%	< 20%
Frequency dependence within frequency range ±5%	< 12%	< 20%	–
Influence of harmonics 50, 60 Hz, 100% 100, 120 Hz, 100% 150, 180 Hz, 100% 250, 300 Hz, 100%	 – < 2% < 2% < 2%	 < 1% < 4% – < 2%	 – – –

See also technical data common for RXIDK 2H, RXIDG 21H and RXPDK 22H

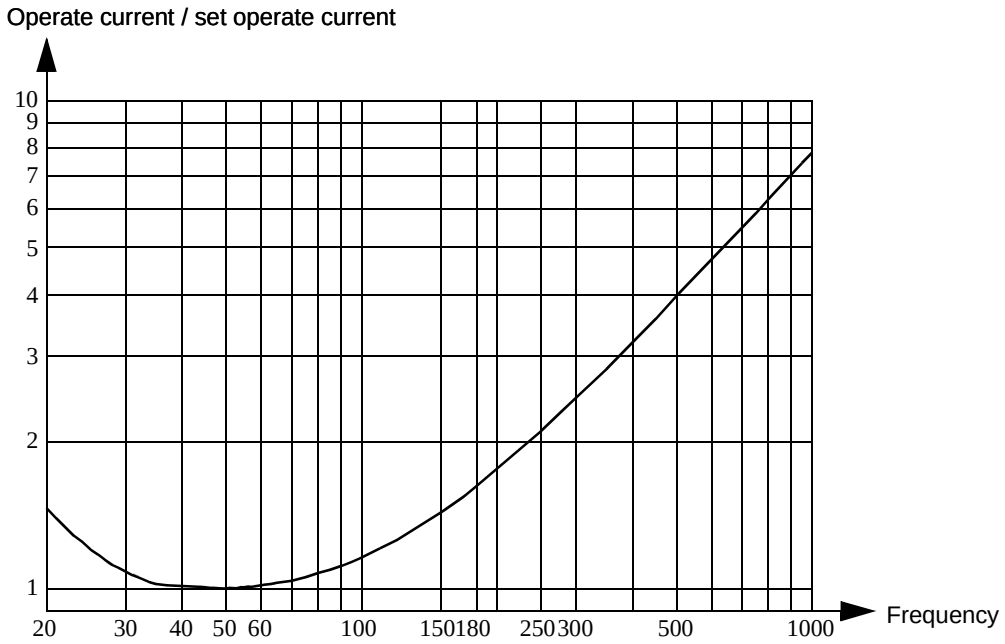


Fig. 1 Typical frequency characteristic for RXIDK 50-60 Hz, standard, valid for $I \leq 65 \times I_s$
(There is risk for contact chattering with frequency ≤ 30 Hz)

Time-overcurrent relay RXIDG 21H

Table 5: Current input

Rated current I_r	0,2 A
Scale constant I_s Scale range I_a I >	20, 40, 80 and 200 mA 15-650 mA 15mA-2,60 A
Effective current range	(0,75-100) x I_s
Rated frequency f_r Frequency characteristic Frequency range	50-60 Hz See Fig. 2 40-1000 Hz
Power consumption $I = I_s$ = 20 mA $I = I_s$ = 40 mA $I = I_s$ = 80 mA $I = I_s$ = 200 mA	 0,03 mVA 0,1 mVA 0,3 mVA 1,2 mVA
Overload capacity at Is = 20/40/80/200 mA - continuously - during 1 s	 2/4/4/4 A 20/40/80/80 A

Table 6: Start function

Operate value, I >	K x I_a
Constant K	1-4
Basic current setting I_a	(0,75-3,25) x I_s
Operate time, typical I = 0 = > 1,3 x I > I = 0 = > 3 x I > I = 0 = > 20 x I>	35 ms 25 ms 20 ms
Reset time, typical I = 1,3 = > 0 x I > I = 3 = > 0 x I > I = 20 = > 0 x I >	25 ms 35 ms 55 ms
Consistency of operate value	< 0,5%
Reset ratio (typical) Consistency	95% < 1,5%
Transient over-reach L/R = 10, 50 and 100 ms	< 5%
Overshoot time	< 20 ms
Recovery time atI = 3 x I>	< 40 ms
Frequency dependence within frequency range 50 Hz, ±5% frequency range 60 Hz, ±5%	 < 0,5% < 1,0%
Operate value at 150 Hz	Approx. 1,5 x set op. value
Influence of harmonics 100 / 120 Hz, 10% 150 / 180 Hz, 20% 250 / 300 Hz, 20%	 < 3% < 6% < 4%
Temperature dependence within range -5°C to +55°C	 < 2%

Technical data (cont'd)

Table 7: Time function

Time delay	Inverse time and definite time
Operate time for inverse time, Inv Accuracy	Formula: $t = 5{,}8 - 1{,}35 \times \ln I/I_a$, at $t > t_0$, see Fig. 3. Overall: ±100 ms
Setting range for definite time, Def.time Accuracy	t_0 = 1,0-2,0 s Overall: ±50 ms

See also technical data common for RXIDK 2H, RXIDG 21H and RXPDK 22HTechnical data (cont'd)

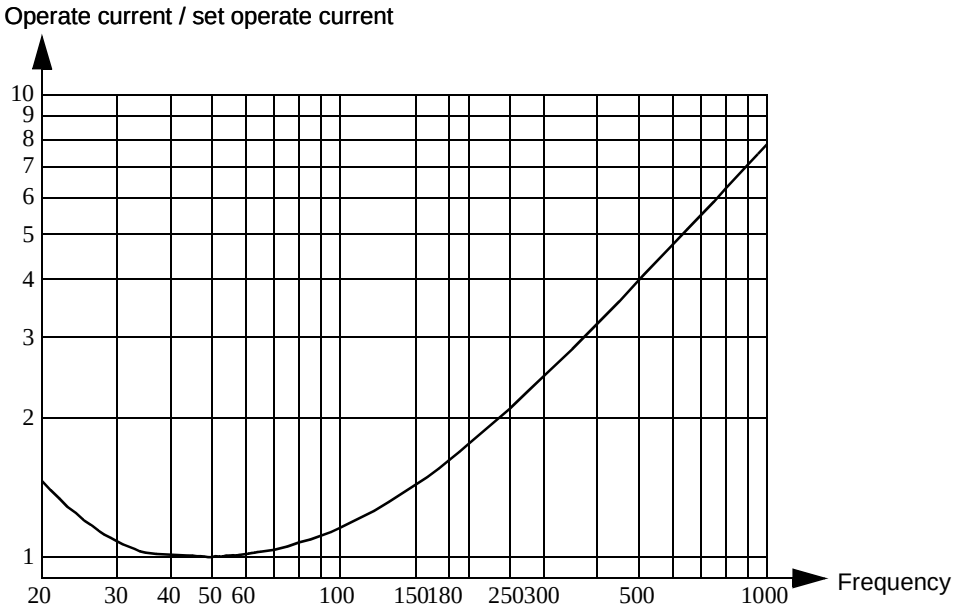


Fig. 2 Typical frequency characteristic for RXIDG 50-60 Hz, valid for valid for $I \leq 100 \times I_s$
(There is risk for contact chattering with frequency ≤ 30 Hz)

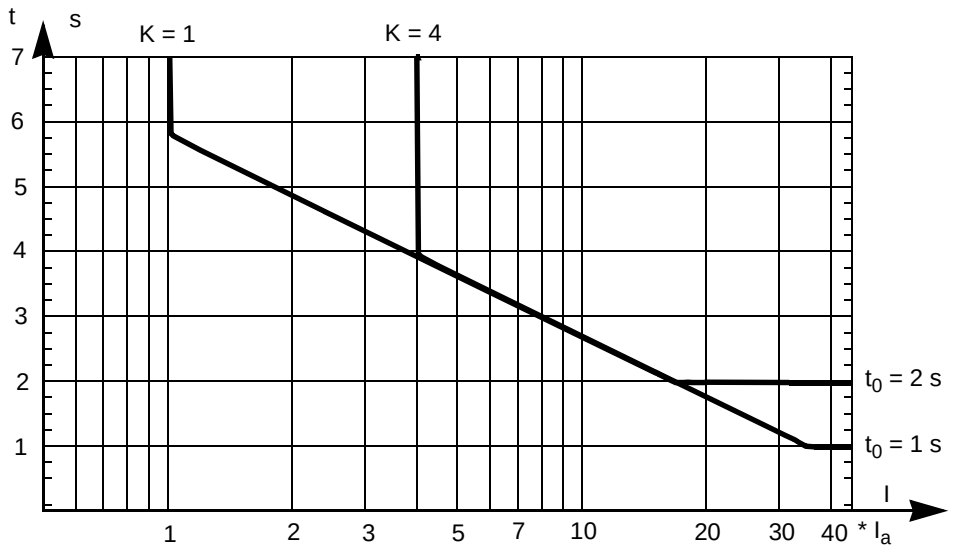


Fig. 3 RXIDG logarthmic inverse characteristic with definite minimum time.

Directional time-overcurrent relay RXPDK 22H

Table 8: 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 and 1,0) x I_r
Setting ranges 50 mA Variant $I_\alpha >$ 200 mA Variant $I_\alpha >$	 3,75 - 160 mA 15 - 650 mA
Effective voltage range U	5-200 V
Effective current range	(0,75-100) x I_s
Rated frequency f_r Operating frequency range	50-60 Hz 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 9: Start function

Current function	**Stage I>**			
Setting range I >	(0,75-3,25) x I_s			
Angle between U and I, φ	Positive if I lags U			
Settable characteristic angle α	0° or -90°			
Operate conditions for I >, at selected program (U>, I_α>) and (U x I) (U>, I_α>) and (I indep U) (U<, I >) and (U enbl I) (U<, I >) and (I indep U)	 I x cos (φ-α) ≥ set I > and U ≥ set U> I x cos (φ-α) ≥ set I > and U ≥ 5 V I ≥ set I > and U ≤ set U< I ≥ set I >			
Logic for phase memory - low voltage phase memory - low voltage time out	 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 α from 0 x ° to -90° or -90° to 0°			
Accuracy for characteristic angle α 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 x I_r < 5,5° < 2,5° < 1,5°	I_s = 0,2 x I_r < 3,0° < 2,0° < 1,5°	I_s = 0,4 x I_r < 2,0° < 2,5° < 2,0°	I_s = 1,0 x I_r < 3,0° < 2,5° < 2,0°
Operate time at φ = α, 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 φ = α, 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 φ = α		< 2%	
Reset ratio (typical)	90%			
Transient over-reach L/R=10, 50 and 100 ms	< 3%		< 4%	
Overshoot time	< 50 ms		< 20 ms	
Recovery time at I = 3 x I_α>	< 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, 180% 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% 30%	Angle dependence < 2° < 5° < 7° < 2° < 2° < 6° < 9° < 12° < 7° < 11°		Current dependence – – – – < 3% < 3% < 7% < 7% < 4% < 6%	

Table 10: 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	60 ms	–
	U = 0,9 = > 1,1 x op. value	45 ms	–
	Under-voltage (typical)		
	U = 2,0 = > 0,9 x op. value	–	60 ms
	U = 1,1 = > 0,9 x op. value	–	45 ms
Reset time	Over-voltage (typical)		
	U = 1,1 = > 0,9 x op. value	60 ms	–
	U = 1,1 = > 0 x op. value	35 ms	–
	Under-voltage (typical)		
	U = 0,9 = > 1,1 x op. value	–	60 ms
	U = 0,9 = > 2,0 x op. value	–	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	< 55 ms	–
Under-voltage	U= 2,0 = > 0,9 x op. value	–	< 55 ms
Frequency dependence	45-55 Hz	< ±2%	
	54-65 Hz	< ±4%	
Influence of harmonics in:		Voltage dependence	
Voltage circuit	100 / 120 Hz, 30%	< 4%	
	150 / 180 Hz, 50%	< 2%	
	150 / 180 Hz, 100%	< 5%	
	250 / 300 Hz, 30%	< 2%	

Table 11: Time function

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

See also technical data common for RXIDK 2H, RXIDG 21H and RXPDK 22H

Technical data (cont'd)

Technical data common for RXIDK 2H and RXIDG 21H and RXPDK 22H

Table 12: Auxiliary DC voltage supply

Measuring relays	**RXIDK 2H**		**RXIDG 21H**	**RXPDK 22H**
	Standard	**Other filters**		
Auxiliary voltage EL for RXTUG 22H Auxiliary voltage to the relay	24-250 V DC, ±20% ±24 V (from RXTUG 22H)			
Power consumption 24-250 V before operation after operation without RXTUG 22H ±24 V before operation after operation	 Max. 4,5 W Max. 6,0 W Max. 1,3 W Max. 3,0 W	 Max. 5,5 W Max. 6,5 W Max. 2,0 W Max. 3,0 W	 Max. 4,5 W Max. 6,0 W Max. 1,3 W Max. 3,0 W	 Max. 6,5 W Max. 7,5 W Max. 3,0 W Max. 4,0 W

Table 13: 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 14: 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, 48 V 110 V 220 V 250 V	 8 A 1 A 0,4 A 0,2 A 0,15 A

Table 15: Electromagnetic disturbance tests
All tests are done together with the DC/DC-converter, RXTUG 22H

Test	Severity	Standard
Surge immunity test	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 test	500 V, AC	SS 436 15 03, PL 4
Power frequency field immunity test	1000 A/m	IEC 61000-4-8
1 MHz burst test	2,5 kV	IEC 60255-22-1, class 3
Spark test	4-8 kV	SS 436 15 03, PL 4
Fast transient test	4 kV	IEC 60255-22-4, class 4
Electrostatic discharge test - 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 test	10 V/m, 26-1000 MHz	IEC 61000-4-3, Level 3
Conducted electromagnetic test	10 V, 0,15-80 MHz	IEC 61000-4-6, Level 3
Interruptions in auxiliary voltage 110 VDC, no resetting for interruptions	2-200 ms < 40 ms	IEC 60255-11

Table 16: Electromagnetic 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 17: Insulation tests

Test	Severity	Standard
Dielectric test - current circuit - other circuits - over open contact	 2,5 kV AC, 1 min 2,0 kV AC, 1 min 1,0 kV AC, 1 min	IEC 60255-5
Impulse voltage test	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 18: Mechanical tests

Test	Severity		Standard
Vibration	Response: Endurance:	2,0 g, 10-150-10 Hz 1,0 g, 10-150-10 Hz, 20 sweeps	IEC 255-21-1, class 2 IEC 255-21-1, class 1
Shock	Response: Withstand:	5g, 11 ms, 3 pulses 15 g, 11 ms, 3 pulses	IEC 255-21-2, class 1
Bump	Withstand:	10 g, 16 ms, 1000 pulses	IEC 255-21-2, class 1
Seismic	X axis: Y axis: Z axis:	3,0 g, 1-35-1 Hz 3,0 g, 1-35-1 Hz 2,0 g, 1-35-1 Hz	IEC 255-21-3, class 2, extended (Method A)

Table 19: Temperature range

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

Table 20: Weight and dimensions

Equipment		Weight	Height	Width
RXIDK 2H	without RXTUG 22H	0,7 kg	4U	6C
RXIDG 21H	without RXTUG 22H	0,7 kg	4U	6C
RXPDK 22H	without RXTUG 22H	0,7 kg	4U	6C

Diagrams

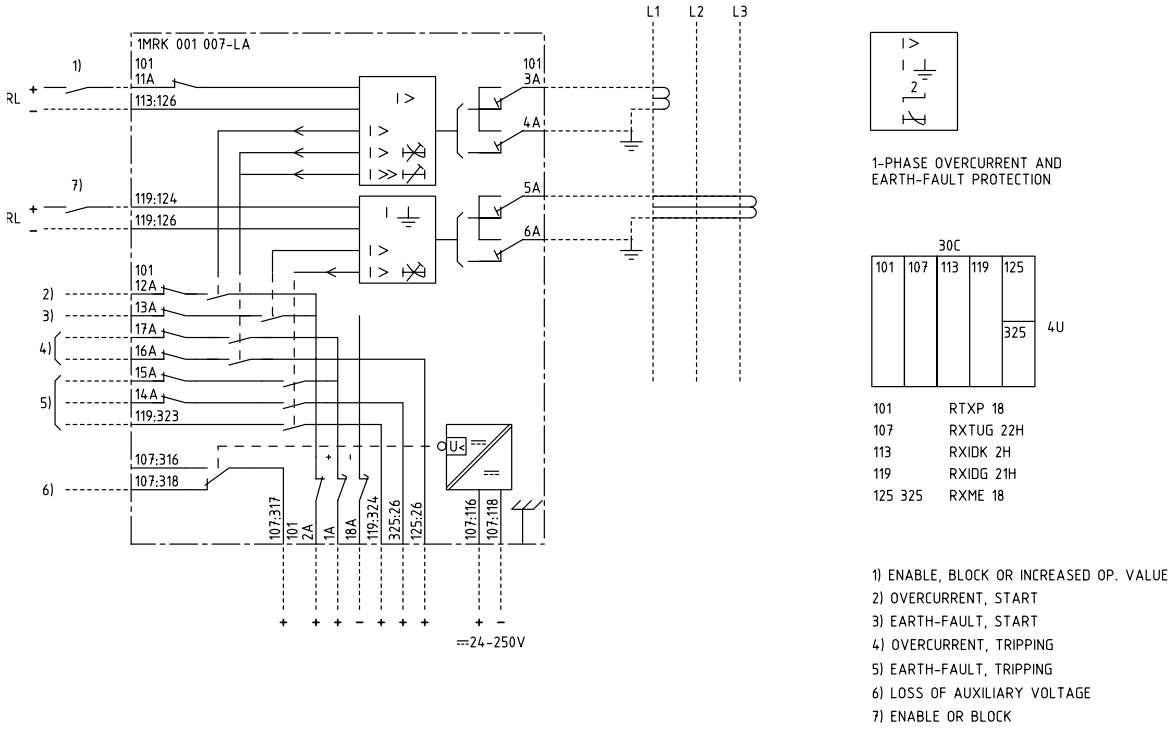


Fig. 4 Terminal diagram 1MRK 001 007-LAA

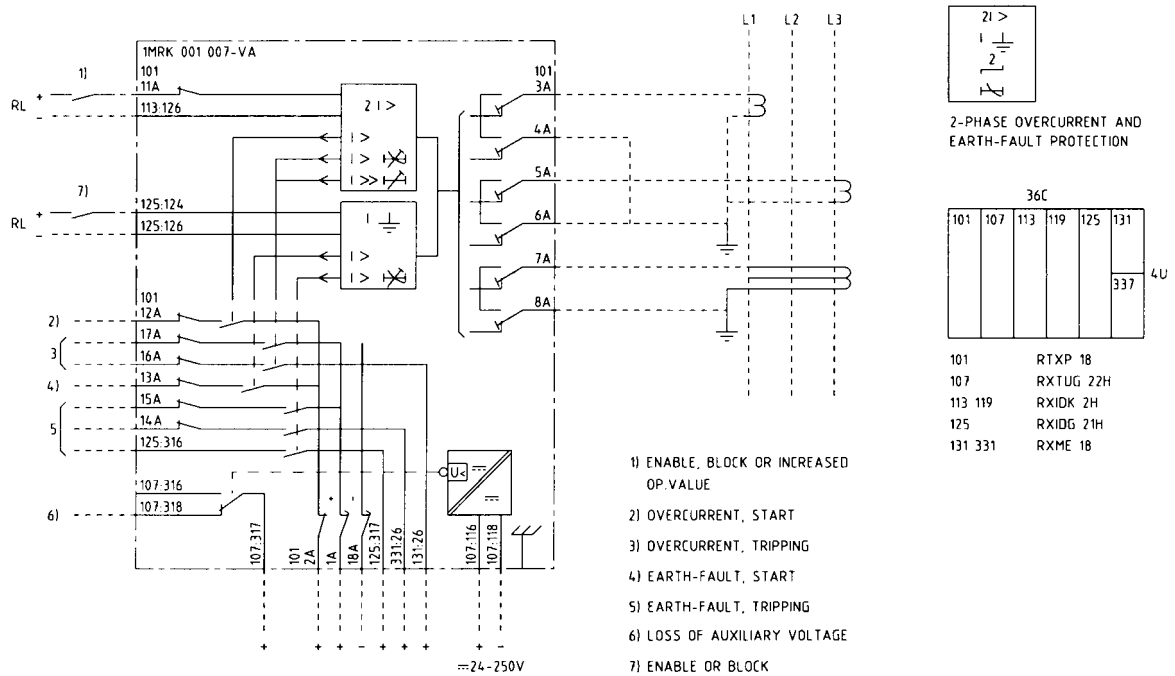


Fig. 5 Terminal diagram 1MRK 001 007-VAA

Diagrams (cont'd)

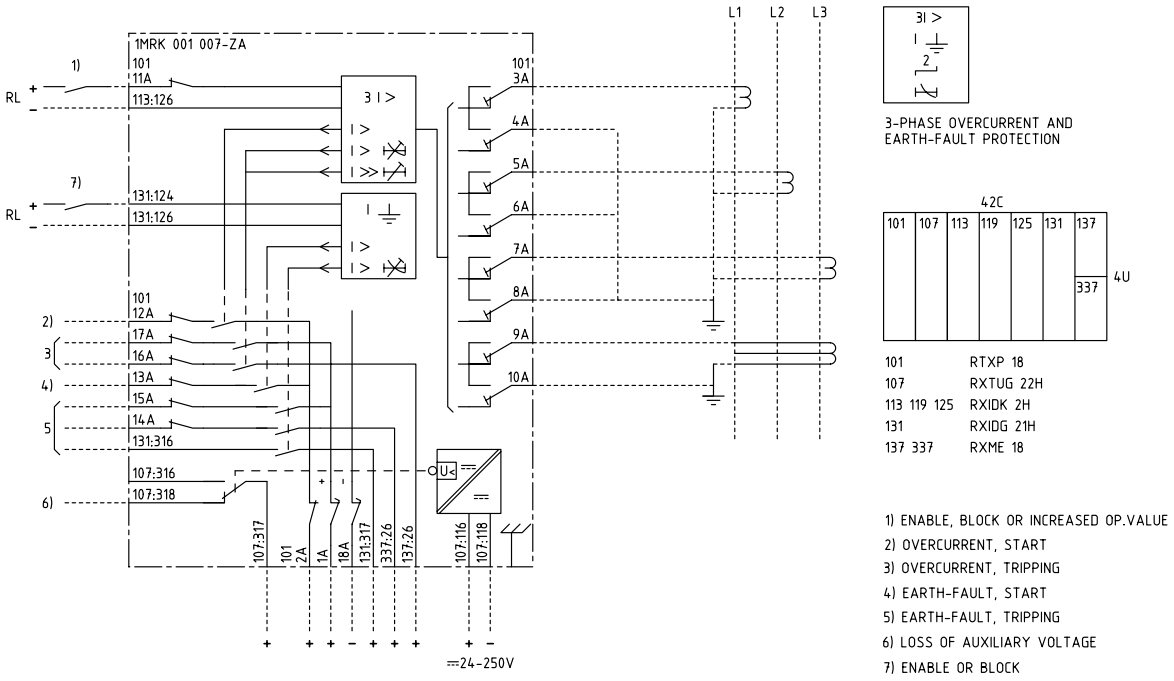


Fig. 6 Terminal diagram 1MRK 001 007-ZAA

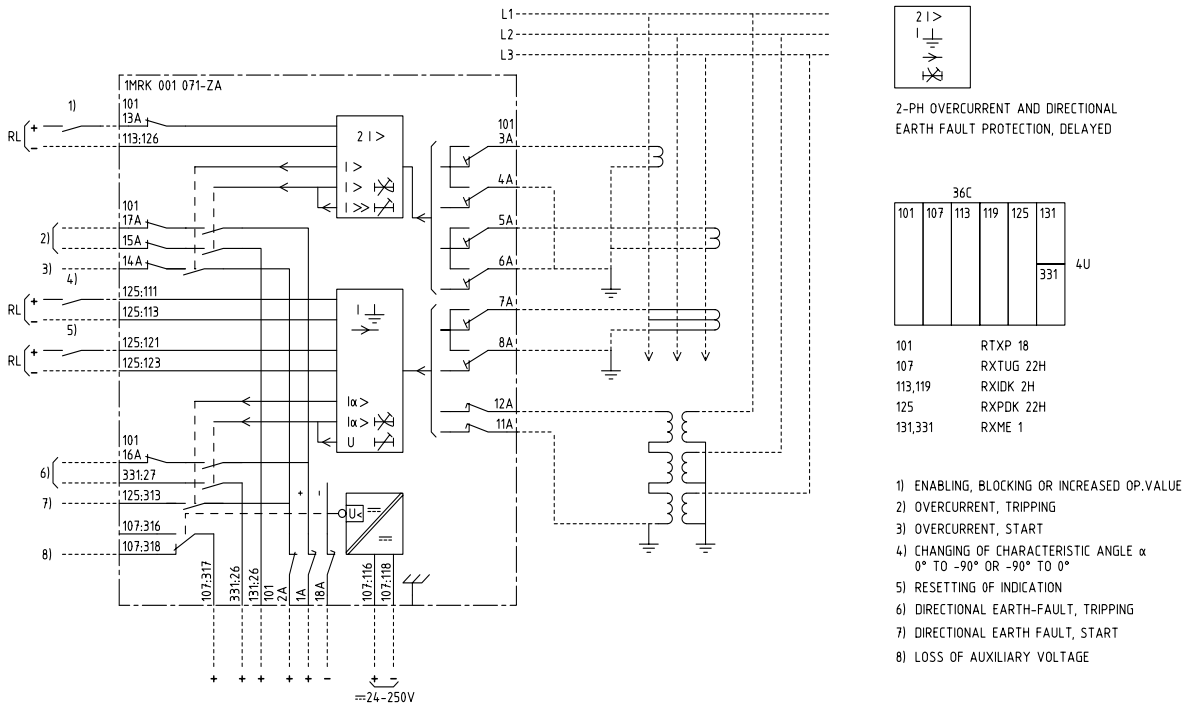


Fig. 7 Terminal diagram 1MRK 001 071-ZAA

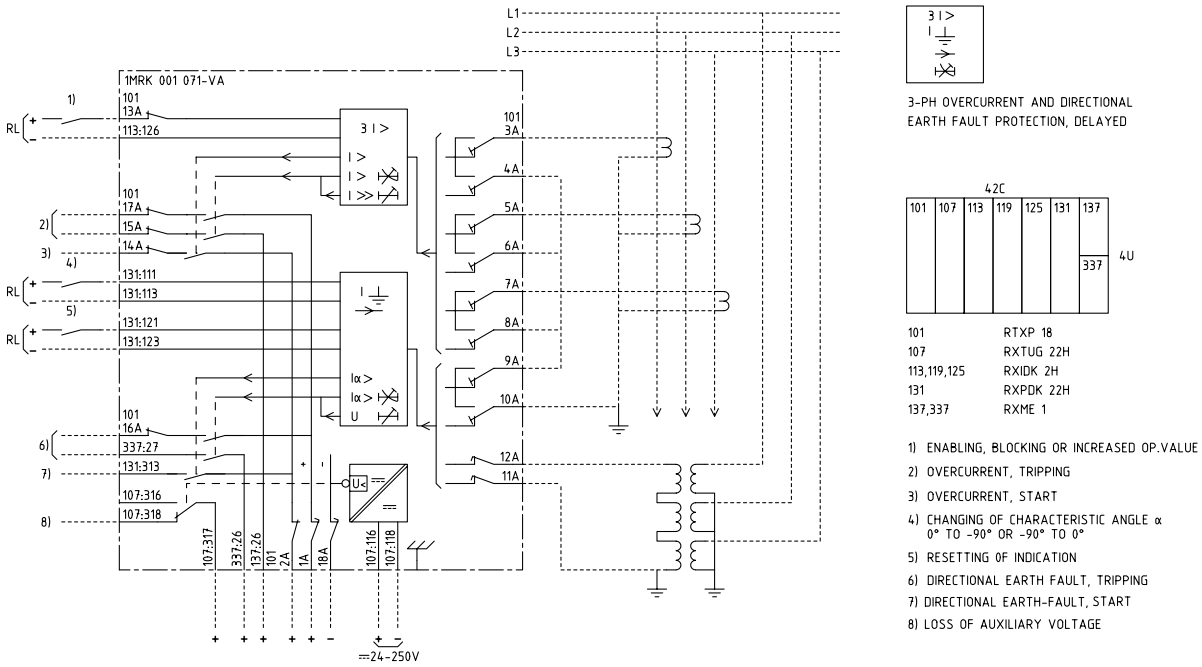
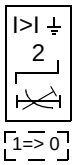


Fig. 8 Terminal diagram 1MRK 001 071-VAA

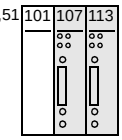
Protection assemblies

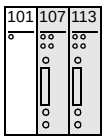
RACIK is available in the following variants:

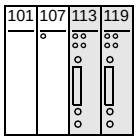
RACIK 2 Single-phase overcurrent and earth fault-protection

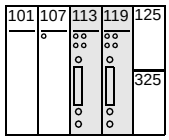


50,51



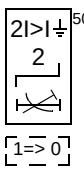




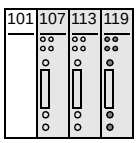


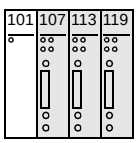
101	RTXP 18		101	RXTUG 22H		101	RTXP 18		101	RTXP 18	
107	RXIDK 2H		107	RXIDK 2H		107	RXTUG 22H		107	RXTUG 22H	
113	RXIDG 21H		113	RXIDG 21H		113	RXIDK 2H		113	RXIDK 2H	
						119	RXIDG 21H		119	RXIDG 21H	
									125	RXME 18	
									325	RXME 18	
Order No.		Circuit diagram	Order No.		Circuit diagram	Order No.		Circuit diagram	Order No.		Circuit diagram
1MRK 001 006-GA		1MRK 001 007-GA	1MRK 001 006-HA		1MRK 001 007-HA	1MRK 001 006-KA		1MRK 001 007-KA	1MRK 001 006-LA		1MRK 001 007-LA

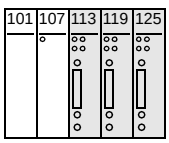
RACIK 3 Two-phase and earth fault protection

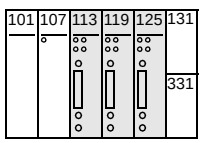


50,51



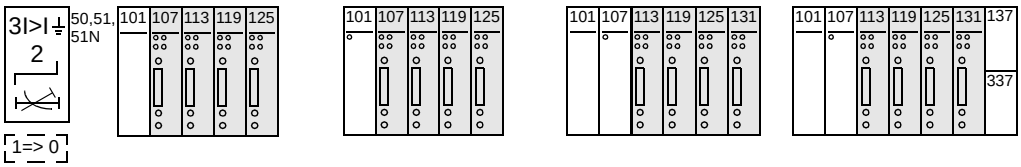






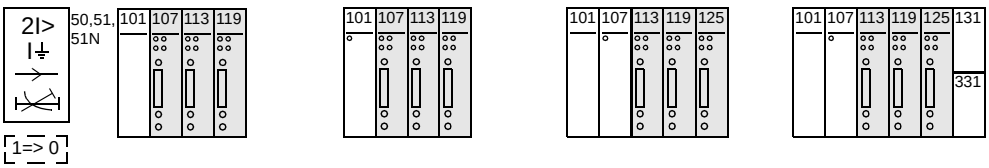
101	RTXP 18		101	RXTUG 22H		101	RTXP 18		101	RTXP 18	
107	RXIDK 2H		107	RXIDK 2H		107	RXTUG 22H		107	RXTUG 22H	
113	RXIDK 2H		113	RXIDK 2H		113	RXIDK 2H		113	RXIDK 2H	
119	RXIDG 21H		119	RXIDG 21H		119	RXIDK 2H		119	RXIDK 2H	
						125	RXIDG 21H		125	RXIDG 21H	
									131	RXME 18	
									331	RXME 18	
Order No.		Circuit diagram	Order No.		Circuit diagram	Order No.		Circuit diagram	Order No.		Circuit diagram
1MRK 001 006-SA		1MRK 001 007-SA	1MRK 001 006-TA		1MRK 001 007-TA	1MRK 001 006-UA		1MRK 001 007-UA	1MRK 001 006-VA		1MRK 001 007-VA

RACIK 4 Three-phase overcurrent and earth fault protection



101	RTXP 18	101	RXTUG 22H	101	RTXP 18	101	RTXP 18
107	RXIDK 2H	107	RXIDK 2H	107	RXTUG 22H	107	RXTUG 22H
113	RXIDK 2H	113	RXIDK 2H	113	RXIDK 2H	113	RXIDK 2H
119	RXIDK 2H	119	RXIDK 2H	119	RXIDK 2H	119	RXIDK 2H
125	RXIDG 21H	125	RXIDG 21H	125	RXIDK 2H	125	RXIDK 2H
				131	RXIDG 21H	131	RXIDG 21H
						337	RXME 18
						337	RXME 18
Order No.	Circuit diagram	Order No.	Circuit diagram	Order No.	Circuit diagram	Order No.	Circuit diagram
1MRK 001 006-NA	1MRK 001 007-NA	1MRK 001 006-YA	1MRK 001 007-YA	1MRK 001 006-PA	1MRK 001 007-PA	1MRK 001 006-ZA	1MRK 001 007-ZA

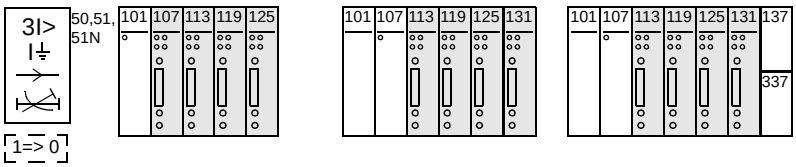
RACIK 223 Two-phase overcurrent and directional earth fault protection for high impedance earthed systems



101	RTXP 18	101	RXTUG 22H	101	RTXP 18	101	RTXP 18
107	RXIDK 2H	107	RXIDK 2H	107	RXTUG 22H	107	RXTUG 22H
113	RXIDK 2H	113	RXIDK 2H	113	RXIDK 2H	113	RXIDK 2H
119	RXPDK 22H	119	RXPDK 22H	119	RXIDK 2H	119	RXIDK 2H
				125	RXPDK 22H	125	RXPDK 22H
						131	RXME 18
						331	RXME 18
Order No.	Circuit diagram	Order No.	Circuit diagram	Order No.	Circuit diagram	Order No.	Circuit diagram
1MRK 001 070-NA	1MRK 001 071-NA	1MRK 001 070-YA	1MRK 001 071-YA	1MRK 001 070-PA	1MRK 001 071-PA	1MRK 001 070-ZA	1MRK 001 071-ZA

Protection assemblies (cont'd)

RACIK 224 Three-phase overcurrent and directional earth fault protection for high impedance earthed systems



101	RXTUG 22H		101	RTXP 18		101	RTXP 18	
107	RXIDK 2H		107	RXTUG 22H		107	RXTUG 22H	
113	RXIDK 2H		113	RXIDK 2H		113	RXIDK 2H	
119	RXIDK 2H		119	RXIDK 2H		119	RXIDK 2H	
125	RXPDK 22H		125	RXIDK 2H		125	RXIDK 2H	
			131	RXPDK 22H		131	RXPDK 22H	
						137	RXME 18	
						337	RXME 18	
Order No.		Circuit diagram	Order No.		Circuit diagram	Order No.		Circuit diagram
1MRK 001 070-TA		1MRK 001 071-TA	1MRK 001 070-UA		1MRK 001 071-UA	1MRK 001 070-VA		1MRK 001 071-VA

Mounting alternatives

All protection can be delivered in the following alternatives:

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

Ordering

Specify RACIK Protections

- 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

Overcurrent relay

Type	Rated current Ir	Filter	Article No.	Code for phase	Code for earth fault
RXIDK 2H	1 A	50-60 Hz (standard)	1MRK 000 838-AA	☐A1	
RXIDK 2H	5 A	50-60 Hz (standard)	1MRK 000 838-HA	☐A6	
RXPDK 22H	0,05 A	50-60 Hz (standard)	1MRK 000 844-CA		☐C3
RXPDK 22H	0,2 A	50-60 Hz (standard)	1MRK 000 844-DA		☐C4
RXIDG 2H	0,2 A	50-60 Hz (standard)	1MRK 000 839-AA		

Auxiliary voltage
For included auxiliary relays

	Code
24 V dc	☐H5
48-55 V dc	☐H6
110-125 V dc	☐H7
220-250 V dc	☐H8

Mounting

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

References

Auxiliary relays	1MRK 508 015-BEN
Time-overcurrent relays RXIDK 2H/RAIDK	1MRK 509 002-BEN
Directional time-overcurrent relays RXPDK/RAPDK	1MRK 509 007-BEN
Connection and installation components in COMBIFLEX	1MRK 513 003-BEN
Relay accessories COMBIFLEX	1MRK 513 004-BEN
Test systems COMBITEST	1MRK 512 001-BEN
User's Guide Phase overcurrent and earth-fault protections, type RAIDK, RAIDG, RAPDK and RACIK	1MRK 509 031-UEN

Manufacturer

ABB Automation Products AB
Substation Automation Division
SE-721 59 Västerås
Sweden
Tel: +46 (0) 21 342000
Fax: +46 (0) 21 146918