Harmonic restraint earth fault or single-phase overcurrent protection

RAISB

1MRK 504 003-BEN
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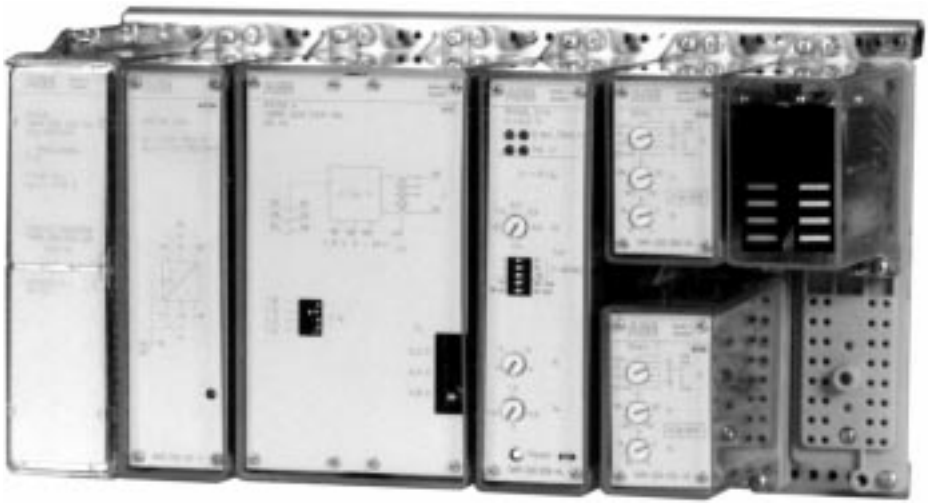

(SE970885)

Features

- Sensitive earth fault protection for solidly earthed networks
- Rated frequency 50 or 60 Hz
- 2nd harmonic restraint for stability at transformer inrush
- Operation blocked by 2nd harmonic component >20% of the fundamental current
- Operate current is settable 1-1,2-1,5-1,8 times a scale constant
- Scale constant is reconnectible 0,03-0,06-0,12 A or 0,2-0,4-0,8 A
- Operate time 50 - 70 ms at 3 x pick-up
- Reset ratio >90%
- Variants available with definite or inverse time delayed output

Application

The RAISB relay is above all intended as sensitive, delayed earth-fault protection for use in solidly earthed power systems. The most typical application is as a sensitive back-up protection in a transformer neutral or at a power line.

When a transformer is switched in and energized, a high inrush current usually appears. It can reach a peak value of several times the transformer's rated current, and it is gradually damped to a normal magnetizing current of some percent of rated current. The dampening is relatively slow, and the inrush current can last for several seconds. Normal current relays respond to this inrush current. In particular, earth current relays, which are sensitively set and/or have a short delay, run a risk of unwanted operation from this inrush current.

By applying a second harmonic restraint to the current relay, the possibility to apply sensitive protection with a short delay is very much improved. The restraint is arranged to prevent operation, when amount of second harmonic current component compared to the fundamental current passes a certain value. The transformer inrush current is heavily distored and has a high percentage of second harmonic, which prevents relay operation. The harmonic restraint unit RXISB 4 can be arranged to enable operation of another measuring relay, for instance RXIDK 2H with inverse time delay. In such cases RXISB 4 is set to operate at a lower current than the enabled relay.

Design

RAISB is available in a basic variant with definite time delay, flag indication and test switch, and in other variants in combinations with overcurrent inverse time relays or counter for elapsed time.The measuring relay RXISB 4 can also be delivered separately.

The basic variant of RAISB includes an RTXP 18 test switch, an RXTUG 21H dc-dc-converter, an RXISB 4 restraint over-current relay, an RXKL 1 time relay and an RXSF 1 flag relay.

The measuring relay RXISB 4 contains an input transformer, two circuit boards with circuits for operation and restraint, and an output relay with three make contacts.

The input transformer is reconnectible for three different scale constants. The fundamental frequency operate value is set with a selector switch on the front of the relay. The value is adjustable in four steps from 1,0 to 1,8 times the scale constants. The function of the relay is blocked by the restraining circuit for second harmonic current larger than 20% of the fundamental current.

The RXISB 4 relay is supplied with ±24V dc from an RXTUG 22H dc-dc-converter providing a galvanic separation from the auxiliary supply voltage (24...250 V). The converter has a green LED and a relay for signalling loss of dc supply. The time relay RXKL 1 is used for definite-time delay of the operation. The delay can be set between 20 ms and 99 h.

The flag relay RXSF 1 provides a red flag and three make contacts to indicate tripping.

The test switch RTXP 18 is a part of the COMBITEST system. By use of a test plug handle RTXH 18 connected to a test set, a complete secondary test of the protective relay can be done without any disconnections of cables. Besides the basic variant, the following variants are also available:

- RAISB with definite-time delay, and an RXTNI 21 counter (requires ac supply) to measure the elapsed time and RXSF 1 flag relay with yellow flag for starting and red flag for trip indications.
- RAISB with inverse-time current relays type RXIDK 2H or RXIDG 21H.

Technical data

Table 1: Energising quantities, rated values and limit

Quantity	Rated values
Rated frequency f_r	50 or 60 Hz
Scale range	0,03-0,216 A or 0,2-1,44 A
Operate value	Adjustable in steps 1,0, 1,2, 1,5 and 1,8 x scale constant I_S
Scale constant I_S	Reconnectible 0,03, 0,06 and 0,12 A or 0,2, 0,4 and 0,8 A
Reset ratio	> 90%
Degree of restraint (I2/I1)	Operation is blocked when the second harmonic component is > 20% of the fundamental current
Operate time	50 - 70 ms at I ≥ 3 x set operating value
Reset time	< 70 ms
Critical impulse time	Approx. 35 ms at I = 3 x set operating value
Graduation error	< 6% of set value
Overload capacity for relays with scale factor I_S=0,03 A I_S=0,06 A I_S=0,12 A I_S=0,2 A I_S=0,4 A I_S=0,8 A	Continuously / For 1 s 1,5 A / 40 A 4 A / 70 A 4 A / 70 A 10 A / 240 A 20 A / 350 A 20 A / 50 A
Auxiliary dc voltage EL	24-250 V dc, +10%, -20%
Power consumption: Current measuring circuit at I= I_S= 0,03 and 0,06 A 0,12 and 0,2 A 0,4 A 0,8 A Aux. voltage circuit	 < 1 mVA < 2 mVA 4 mVA 15 mVA < 10 W
Permitted ambient temperature	-20° C to +55° C

Table 2: Insulation test (IEC 255-

Dielectric test:	
Current circuits	2,5 kV 50 Hz, 1 min
Other circuits	2,0 kV 50 Hz, 1 min
Impulse voltage test	5,0 kV, 1,2/50 µs, 0,5 J

Technical data (cont'd)

Table 3: Electromagnetic compatibility test

Power frequency test (SS 436 15 03)	500 V, class PL 4
Fast transient test (SS 436 15 03)	4-8 kV, class PL 4
1 MHz burst test (IEC 255-22-1)	2,5 kV, class III
Electrostatic discharge (IEC 255-22-2)	8 kV, class III
Radiated electromagnetic field test (IEC 255-22-3)	10 V/m, 427 MHz
Fast transient test (IEC 255-22-4)	4 kV, class IV
Permissible interruption in auxiliary dc voltage (IEC 255-11) without unwanted operation without interrupting the operation	 2-200 ms 40 ms at 110 V dc 220 ms at 250 V dc

Table 4: Mechanical tests

Vibration test (IEC 255-21-1 Response test Endurance test	 0,035 mm/0,5 g, 10-150-10 Hz, Class I 1 g 10-150-10 Hz, 20 sweeps, Class 1
Shock tests (IEC 255-21-2) Response test Withstand test	 5 g, 11 ms, 3 pulses, Class 1 15 g, 11 ms, 3 pulses, Class 1
Bump test (IEC 255-21-2)	10 g, 16 ms, 1000 pulses, Class 1
Seismic tests (IEC 255-21-3) horizontal axis vertical axis	 1 g, 5-35-5 Hz, Class I 0,5 g, 5-35-5 Hz Class I

Table 5: Contact data of RXISB

Number of contacts	3 make contacts
Max. system voltage dc/ac	250/250 V
Current-carrying capacity 200 ms/1 s continuously	 90/50 A 5 A
Making and conducting capacity L/R > 10 ms 200 ms/1 s	 30/10 A
Breaking capacity for ac, PF >0,4, 220V dc, L/R <40 ms 48 V 110 V 220 V 250 V	 8,0 A 1,0 A 0,4 A 0,2 A 0,15 A

Contact data for time relay RXKL 1, time-overcurrent relays RXIDK 22H and RXIDG 21H, and flag relay RXSF 1 are given in the respective catalogue. See References.

Diagrams

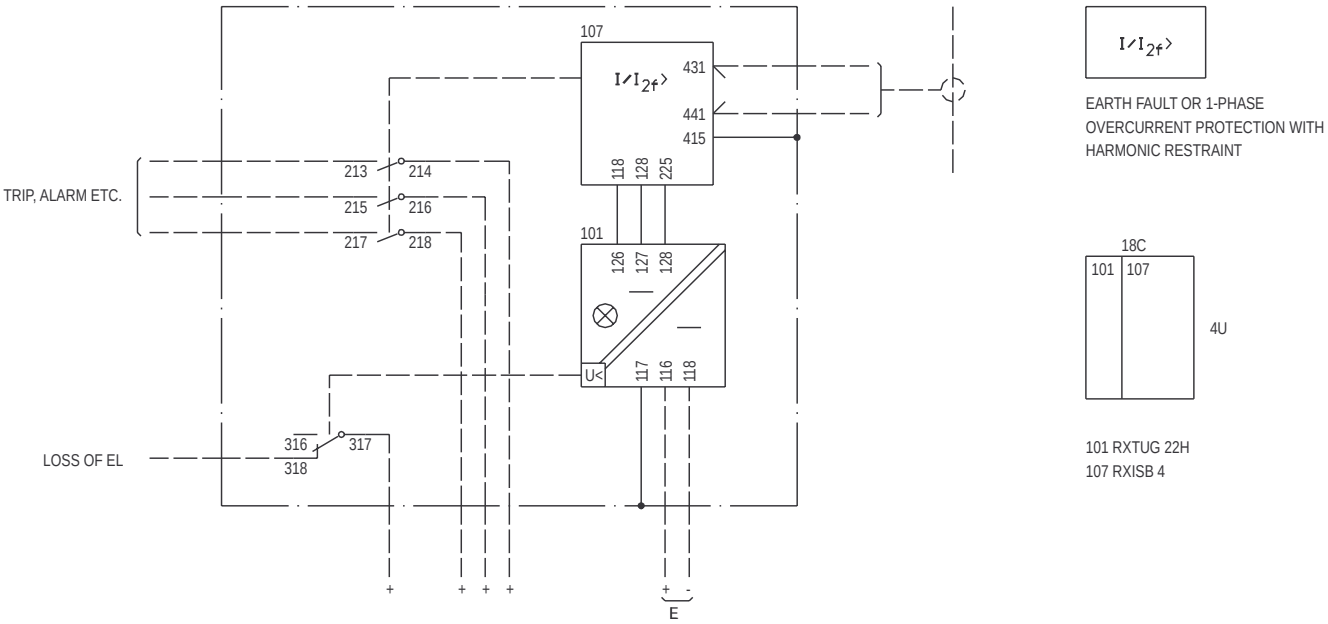

Fig. 1 Circuit diagram 1MRK 000 052-AB for RXISB 4 with RXTUG 22H

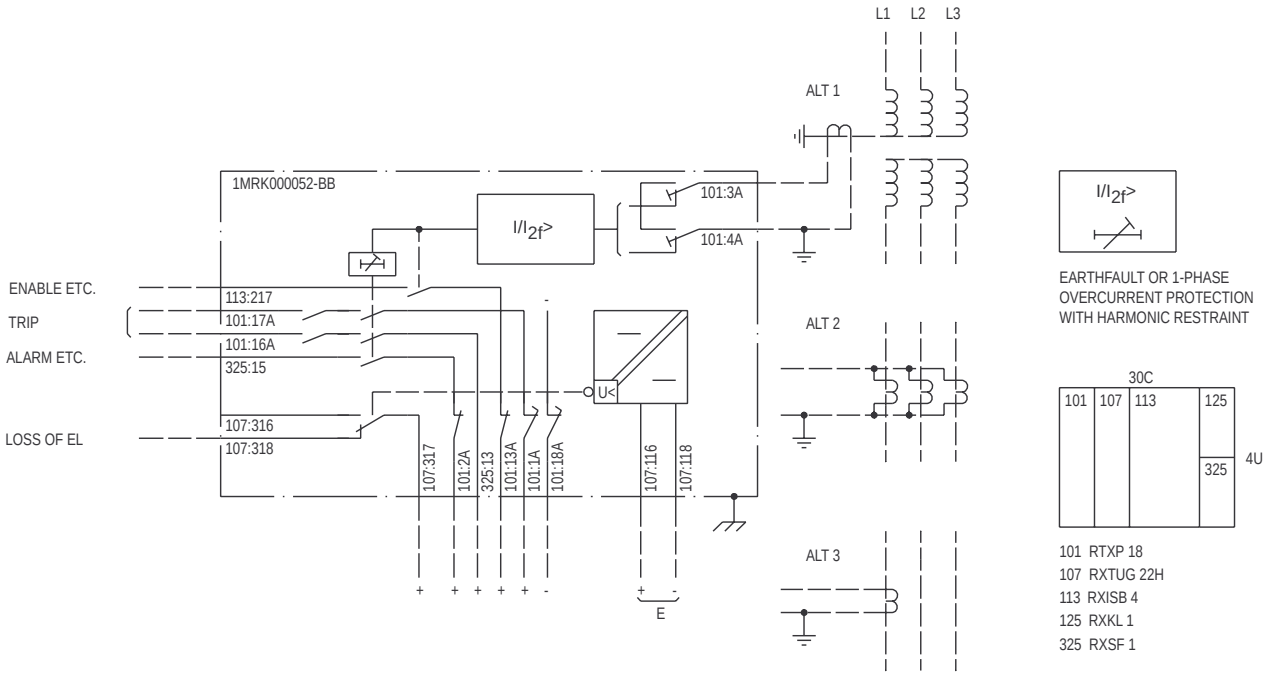

Fig. 2 Terminal diagram 1MRK 000 052-BBA, RAISB basic variant

Diagrams (cont'd)

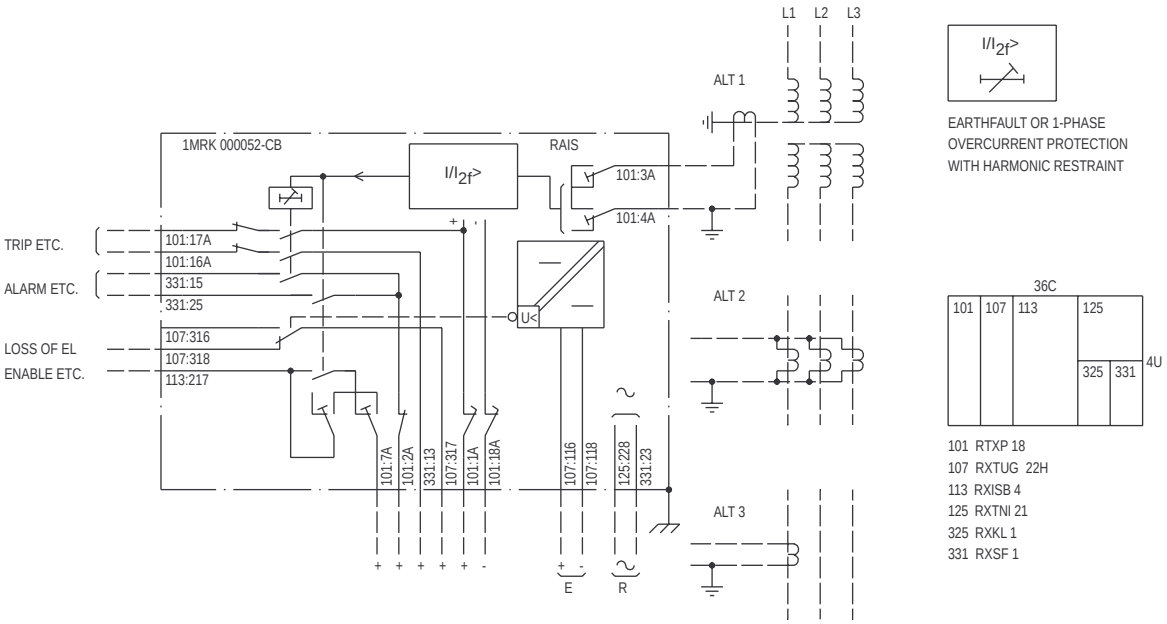

Fig. 3 Terminal diagram 1MRK 000 052-CBA, RAISB with RXTNI 21

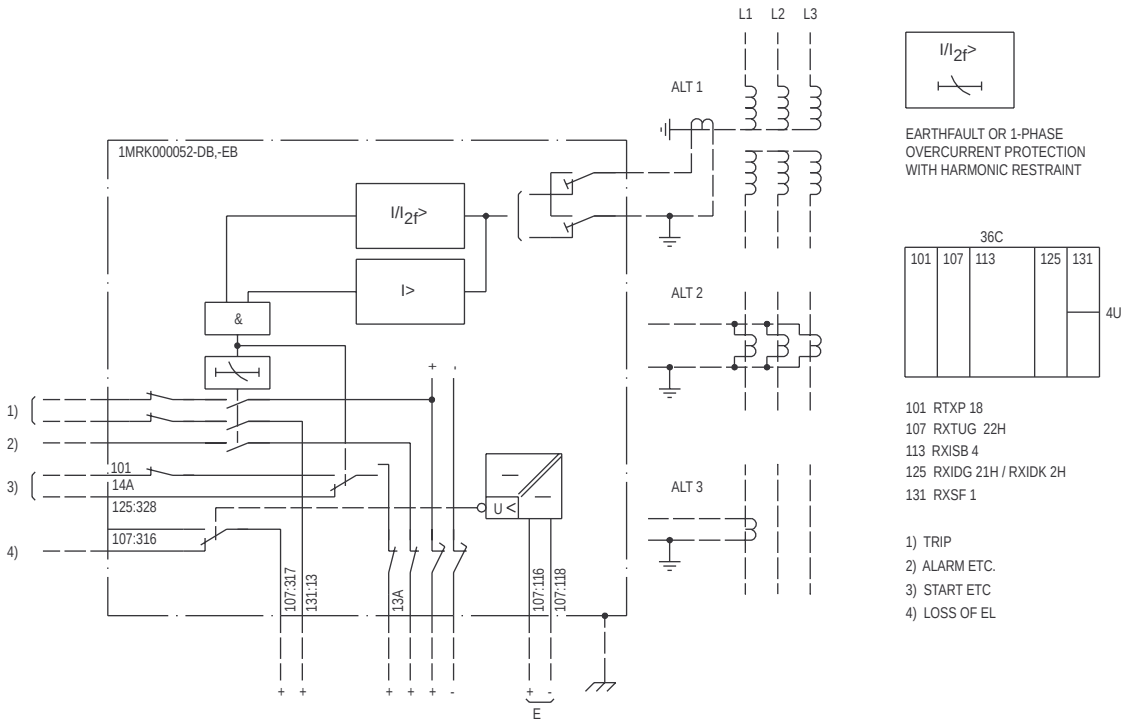

Fig. 4 Terminal diagram 1MRK 000 052-DBA, RAISB with RXIDK 2H or RXIDG 21H

Ordering

Specify:

- Quantity
- Ordering No. from the ordering table
- Auxiliary voltage RL; 110 or 220 V ac
- Code A,D
- (for separately delivered RXISB 4 a ±24 V supply from a dc/dc converter RXTUG 22H is required)
- Desired wording on the lower half of the test switch face plate max. 13 lines with 14 characters per line.

Mounting and connection:
RAISB is delivered on apparatus bars. For additional mounting, a case for 19" rack or panel mounting is required.

For information on COMBIFLEX, accessories and mounting systems, see References.

Ordering table

Variant	Dimensions	Weight	Circuit/ Terminal diagram	Ordering No.
RAISB basic variant	4U 30C	4,3 kg	1MRK 000 052-BB / 1MRK 000 052-BBA	1MRK 000 052-BA
RAISB with RXTNI 21	4U 36 C	4,9 kg	1MRK 000 052-CB / 1MRK 000 052-CBA	1MRK 000 052-CA
RAISB with RXIDG 21H	4U 36 C	4,8 kg	1MRK 000 052-DB / 1MRK 000 052-DBA	1MRK 000 052-DA
RAISB with RXIDK 2H	4U 36C	4,8 kg	1MRK 000 052-EB / 1MRK 000 052-DBA	1MRK 000 052-EA

Overcurrent relays with inverse characteristics

Type	Scale range	Overload capacity	Article No.	Code
RXIDG 21H	0,015-0,65 A	2/4 A	1MRK 000 839-AA	None
RXIDK 2H	0,015-0,65 A	2/4 A	1MRK 000 838-FA	☐A11
RXIDK 2H	0,075-3,25 A	4 A	1MRK 000 838-AA	☐A1

Measuring relay in RAISB

Type	Frequency	Scale range	Article No.	Code
RXISB 4	50 Hz	0,03-0,216 A	1MRK 000 034-AA	☐D1
RXISB 4	50 Hz	0,2-1,44 A	1MRK 000 034-BA	☐D2
RXISB 4	60 Hz	0,03-0,216 A	1MRK 000 034-CA	☐D3
RXISB 4	60 Hz	0,2-1,44 A	1MRK 000 034-DA	☐D4

References

Time relay RXKL 1	1MRK 508 002-BEN
Flag relay RXSF 1	1MRK 508 015-BEN
Time over-current relays RXIDK 2H and RXIDG 21H	1MRK 509 002-BEN
Test system COMBITEST	1MRK 512 001-BEN
DC-DC converter RXTUG 22H	1MRK 513 001-BEN
COMBIFLEX connection and installation components	1MRK 513 003-BEN
Relay mounting systems	1MRK 514 001-BEN
Dimensions	1MRK 514 004-BEN
COMBIFLEX modular identification system	1MRK 514 005-BEN
Counter RXTNI 21	B03-9232

Manufacturer

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