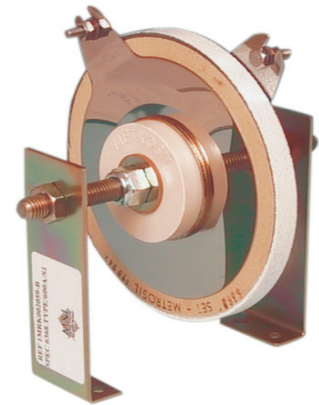


(SE 970162)



(xx03000049)

Features

- Primary side fault sensitivity down to 2-5% of main CT rating
- High speed operation, 10-20 ms
- Secure operation, not affected by CT saturation
- Trip or flag indication relay included

Application

The RADHD relay is used for providing a high speed restricted earth fault protection for transformers and reactors.

The relay is connected to a CT in the neutral point of the transformer and residually connected CT's in the phases. Applications are not limited by CT saturation for external or internal faults. The saturation voltage of the involved CT's must be at least twice the selected operating value of the RADHD relay and CT ratio correction can normally not be accepted. A non-linear resistor is used at the CT summation point to protect the CT's from high peak voltages during internal faults.

A short circuit current often contains a dc component that is larger in one phase than in the other two. In most cases this direct current, having a time constant of, for example, 10 to 300 ms, causes the current transformer to become saturated, which means that it is not capable of transforming correctly either the ac or the dc component. A restricted earth fault relay would therefore, if no special measures were taken, sense an "earth fault current" that does not exist on the primary side.

The RADHD relay therefore contains a filter circuit which will attenuate the dc component. Practical experience has shown that a relay setting, according to formula (1), is sufficient to secure correct relay operation even for the most extreme transient CT saturation.

U_s is calculated for the maximum fault-current using the formula:

$$U_s > I_2 r_2 \quad (1)$$

Observe also $U_s < \text{about } 1/2 U_k$ (2) where:

U_s = Operate voltage setting

I_2 = Secondary current at maximum through-fault current

r_2 = Sum of maximum secondary CT and lead resistance up to junction point

U_k = CT saturation voltage

Application (cont'd)

When an earth fault current occurs, a voltage is rapidly generated across the relay circuit. To prevent this voltage from becoming too high, the relay is connected in parallel with a voltage dependent resistor. The relay operates when the primary earth fault current, I_f , amounts to:

$$I_f > N(i_r + \Sigma i_m + i_{res}) \quad (3)$$

where:

N = Turns ratio of the current transformer

i_r = Relay operating current (normally 20 mA)

Σi_m = The sum of the magnetizing current at the operating voltage U_s for all current transformers involved

i_{res} = Current through the non-linear resistor at the voltage U_s , see Fig. 1.

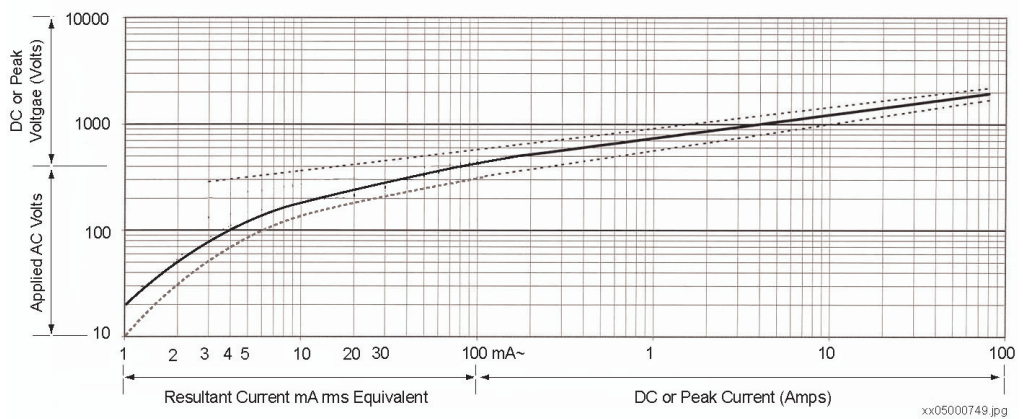


Fig. 1 Current voltage characteristics for the non-linear resistors. In the range 10-200 V, 50 Hz the maximum current is approx. 1-30 mA.

Design

The RADHD relay is available in 6 variants, all with 2 reconnectible operate values, U_{s1} and U_{s2} , and in 2 variants with operate value adjustable at a tapped resistor. The operate value, U_{s1} , is obtained when terminal 101:3B is connected to 107:13. The operate value U_{s2} is obtained when terminal 101:3B is connected to 107:18. When delivered, RADHD is connected for the operate value, U_{s1} . The basic version includes RTXP 18 test switch, RXTLA 1 rectifier module, RXTCA 1 capacitor module and RXID 1 overcurrent relay.

The RXID 1 is an instantaneous electromechanical overcurrent relay containing one heavy-duty and two medium-(trip)duty contacts (make contact). It has fixed operate value. The relay current-measuring circuit is fed through a short-circuiting connector RTXK so that the current transformer secondary circuit is automatically short-circuited when the relay is removed from the terminal base.

RADHD is available in variants with a trip relay RXME 18 with heavy duty contacts, or with a flag relay RXSF 1 with light-duty contacts.

Technical data

Operate voltage U_{s1}/U_{s2}		Maximum continuous voltage U_{s1}/U_{s2}	Approx. current at operation I_r
50 Hz	60 Hz		
10/15 V	10/15 V	34/60V	20 mA
20/30 V	19/29 V	74/82V	16 mA
40/50 V	38/48 V	99/106V	16 mA
70/100V	67/97 V	125/145V	16 mA
100-400 V	100-400 V	110% of U_s	75 mA

Rated frequency	50 or 60 Hz
Operate time (first trip contact)	10-20 ms
Auxiliary dc voltage	24, 48-55, 110-125, 220-250 V -20% to +10%
Permitted ambient temperature	-25 to +55°C
Insulation Tests Dielectric test, 50 Hz, 1 min: voltage circuits to contact circuits and earth current circuits to other circuits and earth	2,0 kV 2,5 kV

Contacts		RXID		RXSF 1	RXME
Number of contacts (terminals No.)		(1 make) (15-25)	+ 2 make	3 make	2 make
Max. system voltage dc/ac within a contact set	V	450/400		300/250	450/400
Current-carrying capacity (for already closed contact) 200 ms/1s continuously	A A	(90/50) (10)	90/50 5	90/50 5	55/30 6
Making and conducting capacity L/R > 10 ms, 200 ms/1 s		(30/20)	30/10	30/10	30/20
Breaking capacity ac P.F. > 0,1 max. 250 V	A	(30)	10	10	20
dc L/R < 40 ms max. 20 A at U_r	24 V A 48 V A 55 V A 110 V A 125 V A 220 V A 250 V A		- - 1 0,4 0,3 0,2 0,15	4 1,5 1,0 0,4 0,3 0,2 0,15	20 18 15 3 2,5 1 0,8

Diagrams

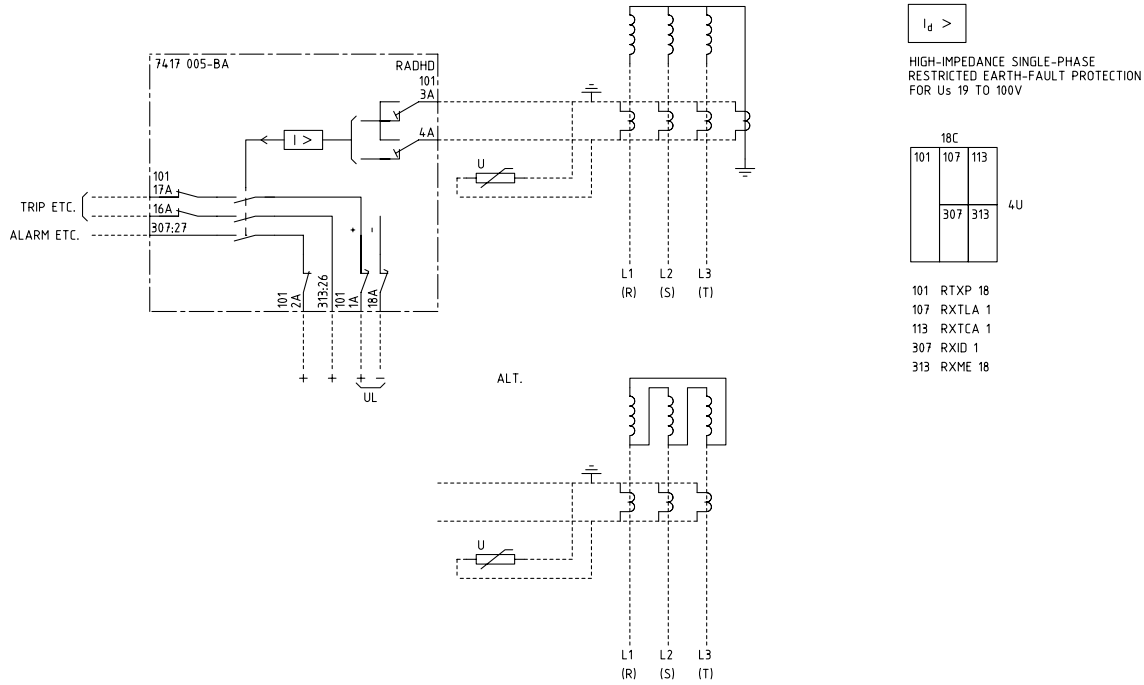


Fig. 2 Terminal diagram No. 7417 005-BAA

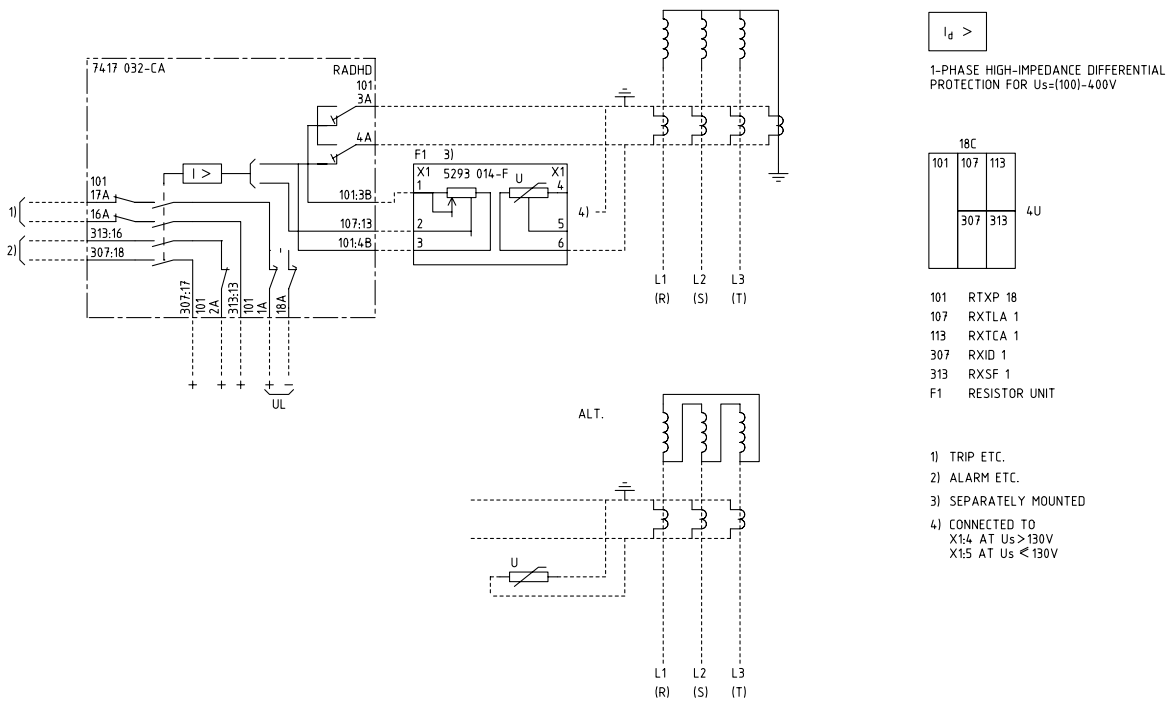


Fig. 3 Terminal diagram No. 7417 032-CAA

Ordering

Specify:

- Quantity
- Ordering No.
- Rated frequency
- Auxiliary dc voltage
- Operate value, U_s
- Ordering No., non-linear resistor
- Desired wording on the lower half of the test switch face plate max. 13 lines with 14 characters per line.

Mounting:

- RADHD is provided on apparatus bars. When additional mounting is required specify a 4U equipment frame for 19" rack mounting or a type RHGX 12 or 20 case for panel mounting.

Ordering table

Operate voltage U_s	Output relay	Size	Weight kg	Ordering No.	Circuit diagram	Terminal diagram
19-100 ¹⁾ V	–	4U 18C	2,3	RK 646 007-AA	7417 005-AA	7417 005-AAA
19-100 ¹⁾ V	RXME 18	4U 18C	2,6	RK 646 007-BA	7417 005-BA	7417 005-BAA
19-100 ¹⁾ V	RXSF 1	4U 18C	2,6	RK 646 007-CB	7417 005-CB	7417 005-CBA
10 or 15 V	–	4U 18C	2,6	RK 646 007-DA	7417 005-DA	7417 005-DAA
10 or 15 V	RXME 18	4U 24C	3,0	RK 646 007-EA	7417 005-EA	7417 005-EAA
10 or 15 V	RXSF 1	4U 24C	3,0	RK 646 007-FB	7417 005-FB	7417 005-FBA
100-400 ³⁾ V	–	4U 18C	2,6	RK 646 016-AA ²⁾	7417 032-AA	7417 032-AAA
100-400 ³⁾ V	RXSF 1	4U 18C	2,6	RK 646 016-CA ²⁾	7417 032-CA	7417 032-CAA

¹⁾ See technical data, operate value table; state fixed rating

²⁾ Includes resistor unit with a non-linear resistor and an adjustable resistor mounted on a 19" apparatus plate H x W = 177 x 482 mm = 4U x 19"

³⁾ State factory setting

Accessories:

Non-linear resistors

Operate voltage	Ordering No.	Resistor on 4U 19" apparatus plate 177 x 482 mm
10-400 V	1MRK 002 059-B	RK 795 101-LA

Sample specification

High impedance restricted earth fault relay for transformers, generators or reactors. The relay shall have a high sensitivity and shall give a trip command within one cycle.

CT saturation shall not cause operation at external faults. The relay shall be suitable for 19" rack mounting.

References

RADHD User's Guide

1MDU04008-EN

Power transformer protection Application Guide

AG03-5005

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