Phase and neutral overcurrent protection

RACID

1MRK 507 002-BEN
Page 1
Issued June 1999
Changed since July 1998
Data subject to change without notice

(SE970165)

Features

- Two-phase or three-phase time-overcurrent and earth fault relay with starting, delayed and instantaneous functions
- Two measuring ranges, 0,1-0,5 or 0,5-2,5 times rated current, for both overcurrent and earth fault relay
- Adjustable time characteristic:
  - Inverse time; normal inverse, very inverse, extremely inverse, RI-curve
  - Definite time; 0,1-1,2 s or 1-12 s
- Phase indication
- The instantaneous function can be definite time delayed 0,1-1,2 s
- Display showing set values, service currents and fault currents at tripping
- Continuous supervision of internal circuits
- Indication of faulty handling
- Auxiliary voltage 48-220 V ±20%, dc or ac
- COMBIFLEX plug-in or screw connection

Application

RACID is normally used as main or back-up protection in distribution or industrial networks for transformers, capacitor banks, electric boilers and small size generators and motors, as well as for feeders. The relay is also used as a back-up protection for transmission networks, large size generators and transformers.

RACID's built-in flexibility, large setting ranges for currents and delay, makes it possible to order the relay early in the planning of the plant or to store it as a universal time-overcurrent relay. Accurate measurement, low transient overreach, high reset ratio and short reset time contribute to the use of short time steps and smaller margins for current settings in the selective plan.

Overcurrent relay

The start function is used to block other relays in the network or as an alarm. The delayed function for selectivity against other overcurrent relays in the network can be selected with definite or inverse time delay. The instantaneous function is normally set for close-up faults. In cases where selectivity against fuses is required, the definite time delay is used. The low transient overreach also allows for extended reach with smaller setting margins.

Earth fault relay

The earth fault relay is mainly used in direct grounded and low impedance grounded networks. In high impedance grounded networks, the network's size and national standards are the factors determining whether the relay can be used. The instantaneous function is used in the same way as the one in the overcurrent relay, but only in direct grounded and low impedance grounded networks.

Design

RACID consists mainly of three PC boards, a power supply unit, input circuits, processor board and 3 or 4 input transformers all contained in an aluminum casing. A grounded internal shield system provides effective protection against external interference. The circuits are fed with auxiliary voltage from the power supply unit which galvanically separates internal and external voltage. The unit can be fed with either ac or dc voltage independent of polarity.

The relay has one tripping relay and three programmable alarm relays included.

RACID is available in several versions which differ in the following respects:

- the way they are connected and installed
- two-phase and three-phase with or without earth fault relay
- - with or without test switch

The relay has three alarm relays in addition to the tripping relay.

The operation for the following is described:

- Setting
- Normal service
- Tripping

Setting

Setting is done by means of switches and potentiometers. Set values are shown on the display by pushing repeatedly on the “Mode” button. At the same time, the light emitting diodes (LED) to the left of the potentiometers, for each protective function, will light up with a steady glow.

Normal service

The green LED marked “In Service” is on. If the internal supervision discovers an internal fault or if the supply voltage is interrupted, the LED will go out and an alarm relay will pick up.

If the “Reset” button (Service value) is pushed repeatedly, the display will show the actual current in phases L1, L2, L3 and N, while the corresponding L1, L2, L3 or N LED will light up. The current is presented as factor m of the relay’s rated current I_r or IN_r. If the push sequence is not completed, the display and the LED will go out after about 8 minutes.

Start and tripping

The start indications L1, L2, L3 and N show a steady yellow light when any of the set operate levels are exceeded. Resetting of the start indication is done by pushing the “Reset” button.

Tripping is indicated by a flashing red LED beside the function which caused the trip. If more than one function is tripped at the same time, the indication priority is as follows:

1. instantaneous tripping overcurrent I >>
2. instantaneous tripping earth current $I_{\perp}$ >>
3. delayed tripping overcurrent I>
4. delayed tripping earth fault $I_{\perp}$ >

Upon resetting the flashing red LED will change to a steady red light. At the same time, in phase L1, for example, a yellow light will come on and the tripping current will be shown as a factor on the display. By pushing “Reset” several times, the current for phases L2, L3 and N will be obtained in the same way. After the last push, the LED and the display will go out. If a new fault occurs before the protection has been reset, the latest fault indications and currents will be shown.

Incorrect setting

If a function is set outside its setting range, a flashing value will be shown on the display. If no time characteristic has been chosen the display will show flashing zeros. If two time characteristics have been chosen at the same time, the display will also show flashing zeros, but the protection will work according to the topmost of the two time characteristics chosen.Blocking

The instantaneous functions are blocked by setting the potentiometers t» at maximum.

The display will then show 999 while the LED’s for I >> and t >> will light up.

Technical data

Table 1: Definitions

I_r	= rated current time-overcurrent relay
IN_r	= rated current neutral current relay
I	= actual current
I_s	= set operate value, overcurrent or earth-fault relay

Table 2: Common data

Rated frequency	50 and 60 Hz			
Operate time in ms (typical) at: I = 1,3 I_s I = 3 I_s I = 10 I_s	Start 40 35 30		Instantaneous 45 40 35	
Resetting time in ms (typical): I instantaneous to 0 from: I = 2 I_s I = 10 I_s I = 20 I_s I instantaneous to 0,9 x I_s from: I = 2 I_s I = 10 I_s I = 20 I_s	Start 40 50 55 65 70 75		Instantaneous 50 55 60 65 70 75	
Resetting ratio	> 95%			
Transient overreach at source time constant L/R < 50 ms	< 5%			
Definite time delay				
Instantaneous function (steps of 0,01 s) limiting error	0,1- 1,2 s < 20 ms at I = 2 I_s			
Delayed function: (steps of 0,01 resp 0,1 s) limiting error at I = 2 I_s	0,1- 1,2 s and 1 - 12 s < 20 ms resp. < 50 ms			
Resetting time in ms (typical) I < 20 I_s	60			
Recovery time in ms (typical) I < 20 I_s	< 45			
Impulse margin time in ms I < 20 I_s	< 65			
Inverse time delay:	**Normal inverse**	**Very inverse**	**Extremely inverse**	**RI curve**
Setting	k-factor 0,05-1,1 in steps of 0,01			
Accuracy class acc. to IEC 255 k-factor = 1,0, I = (2-20) · I_s	5	5	5	none IEC std
Resetting time in ms (typical) I < 20 I_s	60	60	60	60
Recovery time in ms I < 20 I_s	< 45	< 45	< 45	< 45
Impulse margin time in ms I < 20 I_s	< 55	< 45	< 45	< 60
Auxiliary voltage	48-220 V ±20% dc and ac 50-60 Hz			
Power consumption before function at function	< 10 W < 13 W			
Permitted service ambient temperature	-5°C to +55°C			

Technical data (cont'd)

Table 2: Common data

Temperature dependency	< 4% of set function value within the temperature range
Auxiliary voltage dependency	< 1% of set function value within the auxiliary power range 38,4-264 V
Storage temperature	-40°C to +70°C
Tests:	
Humidity test	acc to IEC 68-2-30
Insulation tests: Dielectric test voltage current circuits other circuits	 50 Hz, 2,5 kV, 1 min 50 Hz, 2,0 kV, 1 min
Impulse voltage test	1,2/50 µs, 5 kV, 0,5 J
Disturbance test: Power frequency test Fast transient test 1 MHz test	 50 Hz, 0,5 kV, 2 min 4-8 kV, 2 min 2,5 kV, 2 s
Dimensions:	
without test switch H=170, W=168, D=252 mm	 4U, 24C
with test switch H=170, W=210, D=252 mm	 4U, 30C
with screw terminals H=170, W=168, D=252 mm	 4U, 24C
Weight:	
without apparatus bars	3,76 kg
with screw terminals	4,6 kg

Table 3: Contact data

	Signal	**Tripping**
System voltage	250 V	250 V
Test voltage over open contact	1 kV	1,5 kV
Current-carrying capacity	5 A	15 A
Making and conducting capacity: 1 s 200 ms	 10 A 30 A	 25 A 50 A
Breaking capacity; ac PF > 0,4 250 V dc L/R < 40 ms 48 V dc L/R < 40 ms 110 V dc L/R < 40 ms 220 V	 8 A 1 A 0,4 A 0,2 A	 12 A 0,5 A 0,25 A 0,15 A

Table 4: Time overcurrent relay

Rated current I_r	1 or 5 A
Operate value: start function I > instantaneous function I >>	0,1-0,5 and 0,5-2,5 times I_r 0,5-8 and 2-30 I_r
Limiting error	5% or 1 digit on the LED indicator
Consistency in operate value	1%
Power consumption per phase in current circuit at: $I = I_r =$ 1A 5A	 < 0,03 VA < 0,3 VA
Overload capacity in current circuit: continuous 1 second	 3 I_r 100 I_r (max 350 A for COMBIFLEX)

Table 5: Earth fault relay

Rated current IN_r	0,03; 0,2; 1 or 5 A
Operate value: start function I ⏚ >	 0,1 - 0,5 or 0,5 - 2,5 times IN_r
Instantaneous function I ⏚ >>	0,5 - 8 or 2 - 30 IN_r
Limiting error	5% or 1 digit on the LED indicator
Consistency in operate value	1%
Power consumption per phase in current circuit at: $I = IN_r$ = 0,03 A 0,2 A 1 A 5 A	 < 20 mVA < 25 mVA < 0,03 VA < 0,3 VA
Overload capacity in current circuit: continuous at: $I = IN_r$ = 0,03 A 0,2 A 1 A 5 A For 1 s	 15 IN_r 10 IN_r 3 IN_r 3 IN_r 100 IN_r (max. 350 A for COMBIFLEX)

Diagram

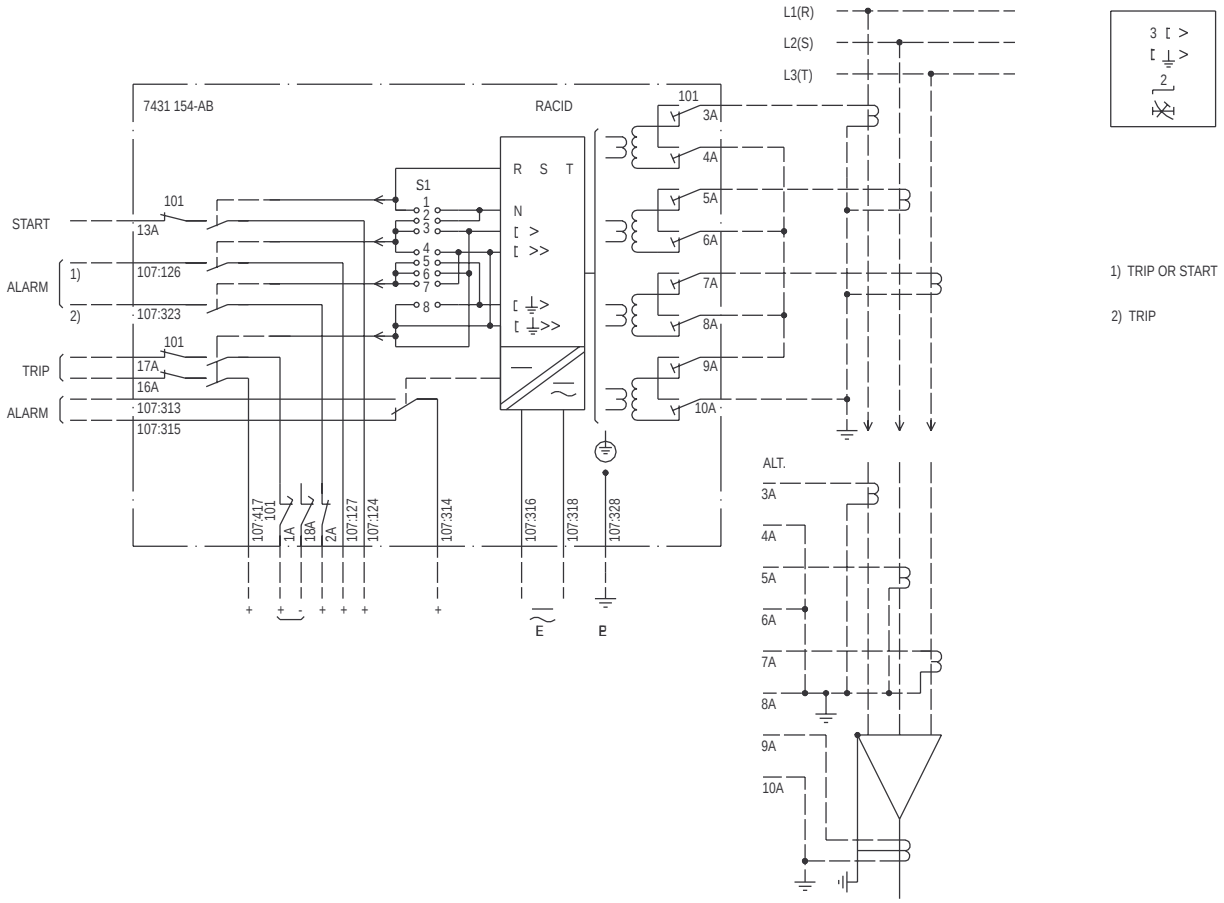

Fig. 1 Three-phase time-overcurrent and earth fault relay with test switch. Terminal diagram 7431 154-ABA

Ordering

Specify:

- Quantity
- Ordering number
- Rated current I_r = 1 or 5 A
- Rated current IN_r = 0,03, 0,2, 1, or 5 A
- Desired wording on the lower half of the test switch face plate max. 13 lines with 14 characters per line.

Mounting and connection:

COMBIFLEX versions of RACID can be mounted in an equipment frame, RHGX casing, flush mounted in a panel or on a panel frame with front connections. Screw terminal versions with rear connection, can be flush or semi-flush mounted. For mounting and connection parts, refer to the manual: Installation and connection.

Ordering table

	Ordering No.		
Design	3Ø + N	3Ø	2Ø + N
without apparatus bars	RK 671 003-AA	RK 671 013-AA	RK 671 023-AA
on 24C apparatus bars	RK 671 103-AA	RK 671 113-AA	RK 671 123-AA
test switch on 30C apparatus bars	RK 671 203-AA	RK 671 213-AA	RK 671 223-AA
screw terminal connection	RK 671 303-AA	RK 671 313-AA	RK 671 323-AA

Mounting kit for flush or semiflush mounting of relay, without apparatus bars		
Relay with:	flush mounting	semi flush mounting
COMBIFLEX connection	RK 933 001-AB	Not applicable
Screw connection	RK 933 001-AA	RK 933 001-AB

Reference

Manual RACID 1MDU07006-EN

Manufacturer

ABB Automation Products AB
Substation Automation Division
SE-721 59 Västerås
Sweden
Tel: +46 (0) 21 34 20 00
Fax: +46 (0) 21 14 69 18