

Use of RAHL/RXHL421 as rotor earth-fault protection

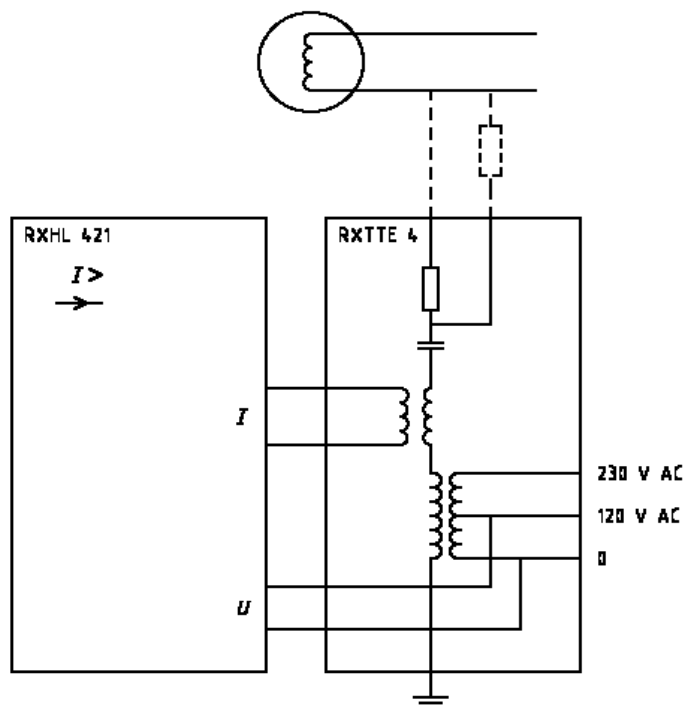
1 General

The rotor circuit of a generator is normally isolated from earth. If the isolation resistance is decreased significantly this can be seen as an earth fault. As the circuit has high impedance to earth one single earth fault will not lead to any direct damages. There is, however, a risk that a second earth fault will occur. In such a case the field circuit will be more or less short-circuited and this can cause severe damages on the generator. Therefore rotor earth faults should be detected and alarmed, so that appropriate actions can be taken to avoid severe generator damages.

2 ABB solution

A voltage injection unit RXTTE 4 is connected to one of the poles of the generator field winding circuit and earth. Either directly to the winding, or via a protective resistor mounted close to the generator, the latter to minimize consequences of a short circuit on the DC-side or an earth-fault on the AC-side of the field exciter. Further the RXHL 421 is connected to RXTTE 4 according to the sketch below.

Generator rotor winding



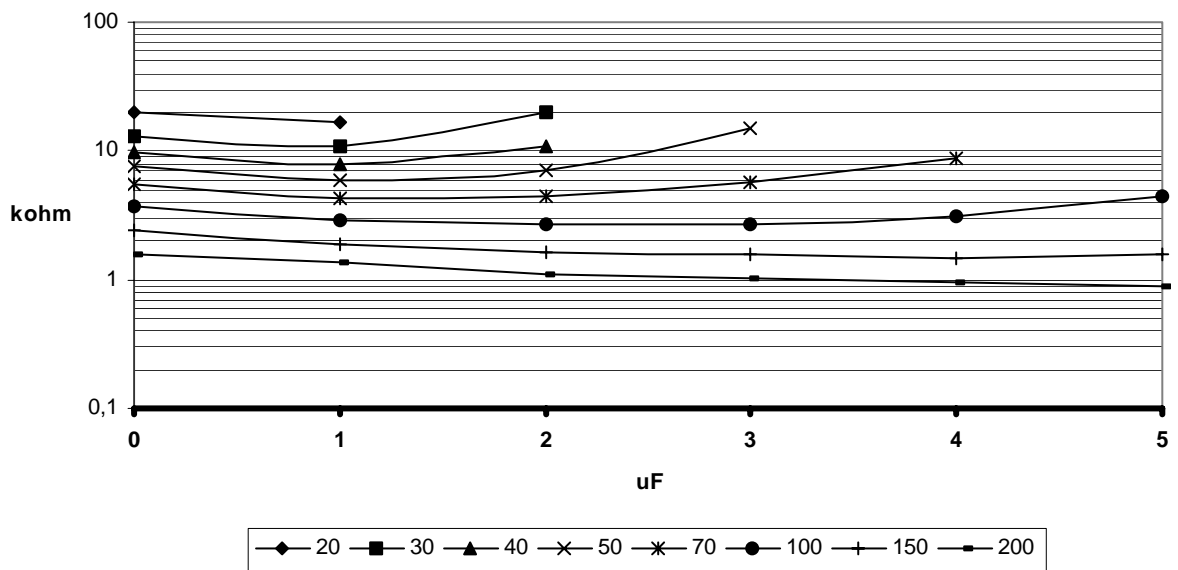
3 Operation

A 50/60 Hz voltage is injected via the injection unit RXTTE 4 to the generator field winding circuit. The injected voltage is 40 V. Series capacitors prevent DC current leakage through the injection unit. The current flow during normal service is dependent on the leakage capacitance between the field circuit and earth. This current is mainly capacitive, i.e. the current is leading the injected voltage by about 90°.

The relay RAHL/RXHL 421 measures, via a current transformer in the injection unit, the component of the current, which is in phase with the injected voltage. This component increases when the isolation resistance of the field winding circuit decreases. The relay has the setting range 20-200 mA, which is equal to the active component of the earth-fault current when the resistance to earth is about 20 -1 kohm. The values are somewhat dependent of the value of the leakage capacitance. Typical operate resistance values as a function of the leakage capacitance at different current settings are shown below. The output relays can be programmed to e.g. give a start signal instantaneously and an alarm or trip signal delayed up to 20 s.

In addition the 2-phase current inputs of RAHL 421 can be used as short-circuit and overload protection for the stator winding or the converter.

**RXHL421, IN=200mA : RXTTE4, 1MRK 002108-BA
50 Hz : R=0**



4 Technical data

Permitted field voltage	Maximum 1200 V DC
Supply voltage	120 or 230 V, 50/60 Hz
Operate earth-fault resistance value	Approx. 1-20 kohm see diagram above.
Influence of harmonics in the DC field voltage	Negligible influence of 50 V, 150 Hz or 50V, 300 Hz

Permitted leakage capacitance	1-5 uF, see diagram above
Permitted shaft earthing resistance	Maximum 200 ohm
Protective resistor	220 Ohm, 100 W, plate 135x160 mm
Other data for RAHL/RXHL 421	See catalogue 1MRK 509 053-BEN

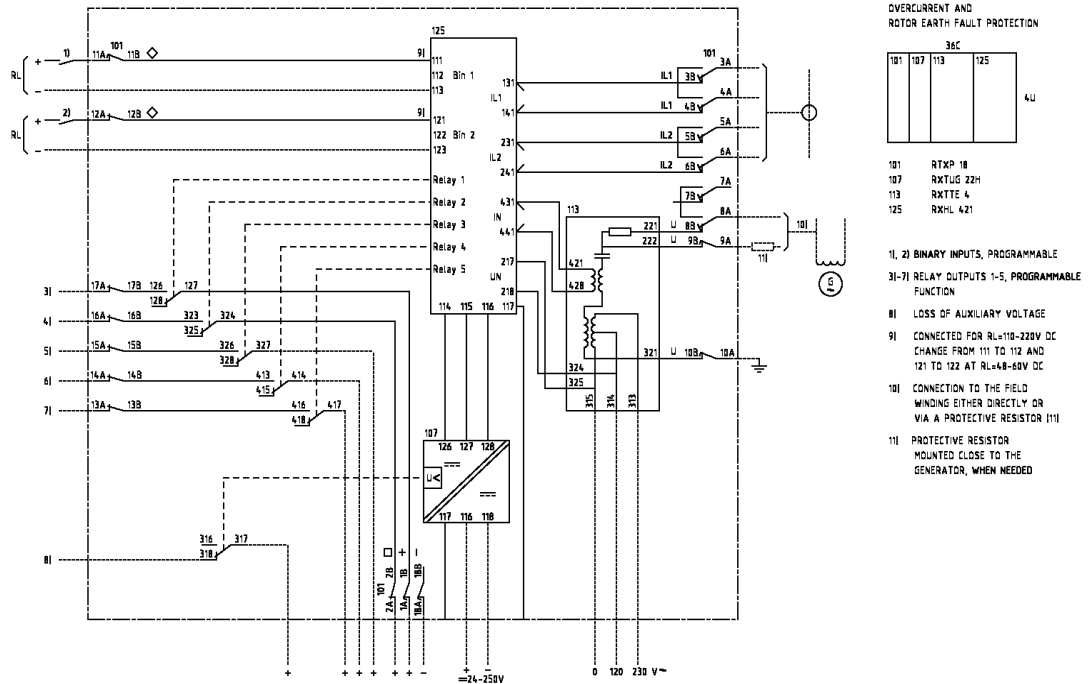


Diagram 1MRK 002 398-AA for rotor earth-fault protection 1MRK 002 397-AA

5 Ordering

RXTTE 4 loose delivery (excl. terminal base) 1MRK 002 108-BA
 RAHL 421 standard protection See catalogue 1MRK 509 053-BEN

Specify:

- 1MRK 000 322-FG for 0,2 A earth, 1 A phase measurement
- 1MRK 000 322-FM for 0,2 A earth, 5 A phase measurement

Alternative

RAHL 421 with RTXP 18, RXTUG 22H, RXHL421 and the injection unit RXTTE 4 assembled as one unit 4U 36C, diagram 1MRK 002 398-AA (above)

Specify :

- 1MRK 002 397-AA
- 1 A or 5 A phase measurement

Protective resistor mounted on a plate RK 795 102-AD

For more information please contact: