ASEA BROWN BOVERI

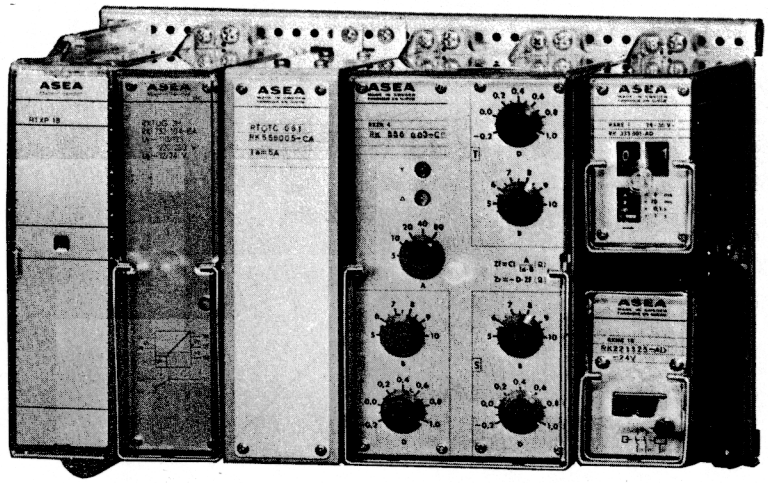
ABB Relays

Type RAKZB

Three-phase impedance relay

B03-3213[E]

Page 1
January 1989
Changed since January 1987
Data subject to change without noti



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Abstract

- **One and two zone versions**
- **Offset circular MHO or modified lens characteristic, 60° or 75°**
- **Forward and reverse reach adjustable**
- **Phase and ground fault detection**
- **Instantaneous or delayed versions**
- **Built-in tripping relay**
- **DC/DC converter supplied**
- **Test switch included**

Application

The RAKZB relay is a compact multi-purpose three-phase impedance relay. *RAKZB's forward reach and backward reach can be adjusted independently of each other, making it appropriate for use as line protection, or as a start relay for distance protection.*

The relay is used as back-up to generator, bus, transformer and line protection. It is also used to protect generators from the effects of underexcitation and loss-of-excitation.

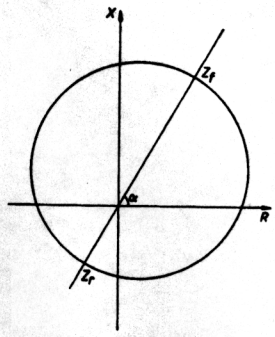
RAKZB is equipped with a switching relay that automatically switches the voltage measuring circuit to measure either the phase to phase voltage or, in the case of a ground fault in a directly grounded system, the phase to ground voltage. A ground current sensing relay activates the switching relay and is included in one RAKZB version. In another version of RAKZB, an external ground current sensing relay may be used for activating the switching relay. An LE labeled "Δ", indicates that the relay is measu ing the phase current and the phase to pha voltage. An LED labeled "Y", indicates that t relay is measuring the phase current and t phase to ground voltage. RAKZB is also avail ble in a version to be used only for short circ protection, eg. for power transformers. The rel is then connected to always measure the pha to phase voltage as well as the current diff ence.

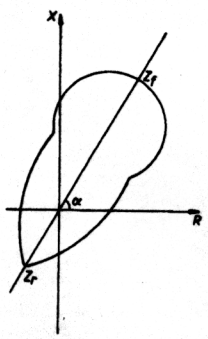
Two characteristics are obtainable, a modifie lens and a circle (see figure). The lens is oft preferred to obtain load and fault discriminatio for long, heavily loaded lines. The circle is a propriate for most usages.

An input for external blocking is provided prevent operation in case of e.g. VT fuse failur and power swings.

Design

RAKZB is available in *six* versions.
The RAKZB has three separate impedance measuring circuits in the RXZK 4 unit, each with a diode and an auxiliary relay contact- output. Individual settings are provided for the forward and reverse reach. The voltage and current inputs are received from a transformer unit. The time-delayed versions use an RXKE 1 digital timer with a setting range of 20 ms to 99 seconds. A dc/dc converter powers the measuring and timing circuits of RAKZB. An RTXP 18 test switch provides accessibility to all current and voltage inputs and trip outputs to enable safe secondary injection testing.





Technical Data

Rated voltage	110 V
Current scale factor I_a	0.5, 1, 2.5 or 5 A
Rated frequency	50 or 60 Hz
Overload capacity:	
continuously	$3 \times I_a$
1 second	$70 \times I_a$
Forward reach Z_f:	
50 Hz, 1 A	4.8–178 ohms/loop
60 Hz, 1 A	5.7–213 ohms/loop
Forward reach for difference current measuring RAKZB	*2(4.8–178)* *2(5.7–213)*
Reverse reach Z_r:	(from −0.2 to +1)$\times Z_f$
Minimum operate current	$0.2 \times I_a$
Consistency in operate value	<10 % of Z_f
Ambient temperature range	−10 to 55°C
Operate characteristic	Circle or modified lens, axis ratio 0.41
Characteristic angle	60 or 75°
Reset ratio	103 %

Operate time	5–25 ms excluding output relay
Reset time	40–65 ms
Auxiliary voltage dc:	
electronic circuits EL	24, 48, 55, 110, 125 220 or 250 V
blocking input RL	48–55, 110–125 or 220-250 V
Power consumption:	
current circuit	*0.05* VA/phase at $I=I_a$
voltage circuit	0.24 VA/phase at U_n
auxiliary voltage circuit	12 W
Contact data	See RXME 18 auxiliary relay data table B03-1003E
Insulation Tests:	
Dielectric tests	
Current circuits	50 Hz, 2.5 kV, 1 min
Remaining circuits	50 Hz, 2.0 kV, 1 min
Impulse voltage test	1.2/50 μs, 5.0 kV, 0.5 J
Disturbance Tests:	
Power frequency test	50 Hz, 0.5 kV, 2 min
Fast transient test	4–8 kV, 2 min
1 MHz burst test	2.5 kV, 2 s

To order

Specify:
- Type RAKZB
- Quantity
- Ordering number per table
- Current scale factor I_a
- Rated voltage
- Rated frequency
- Operating characteristic - circular or modified lens
- Current scale RXIG 21 or RXIG 28
- Auxiliary voltage
- Characteristic angle: 60 or 75 degrees

When required:
- Wording on the test switch face plate
  Maximum 10 lines with 10 characters/line

Mounting and connection:
- See under Case dimensions and mounting instructions

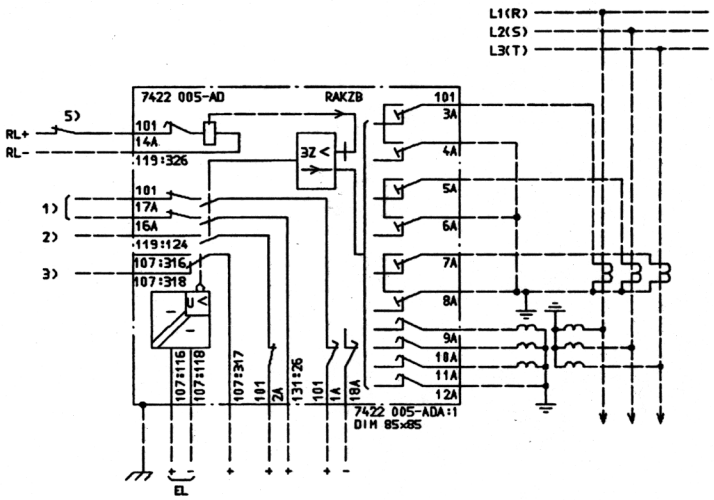
Ordering Table	Size	Mass kg	Ordering No.	Terminal diagram
RAKZB, Version −AC Single-zone, instantaneous relay with tripping relay and target	4S 36C	5.30	RK 654 001-AC	7422 005-ADA
RAKZB, Version −BB Single-zone, delayed relay with trip relay and target	4S 36C	5.55	RK 654 001-BB	-BBA
RAKZB, Version −CB Single-zone, delayed relay with tripping relay and target and built-in ground-current relay	4S 42C	6.50	RK 654 001-CB	-CCA
RAKZB, Version −DB Two-zone, delayed relay with two tripping relays and targets	4S 60C	9.00	RK 654 002-DB	7422 006-DBA
RAKZB, Version −EA Two-zone, delayed relay with two tripping relays and targets, difference current measuring	4S 60C	9.00	RK 654 002-EA	7422 006-EAA
RAKZB, Version −SA Single-zone, delayed relay with tripping relay and target and built-in ground-current relay, difference current measuring	4S 60C	8.00	RK 654 001-SA	7422 005-FBA

Sample specification

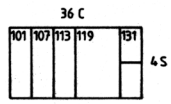
Three-phase, single-zone, impedance relay complete with tripping relay and target. Time delayed tripping output shall have a setting range of 20 ms to 99 s. Auxiliary phase outputs shall be provided to enable faulted phase indication. The relay shall have an adjustable offset circular impedance characteristic. The reverse reach shall be settable between 1 and - 0.2 of the forward reach. The ohmic range shall be 4.8 to 178 ohms at 50 Hz. The relay shall be provided with an input for automatic reconnection of the measuring loop from phase-to-phase to phase-to-ground, depending on the type of fault.

An auxiliary blocking input shall also be provic ed to prevent the impedance relay output fror operating when a dc voltage is applied to thi input. The relay shall also be blocked when th auxiliary dc voltage is too low and when th phase current is below 20 % of rated curren The relay shall be powered from a dc/dc cor verter, which provides galvanic isolation of inte nal circuits from the station battery voltage. Th relay shall be suitable for 19" rack mounting. A test switch shall be included to enable secor dary injection testing.

Terminal diagrams

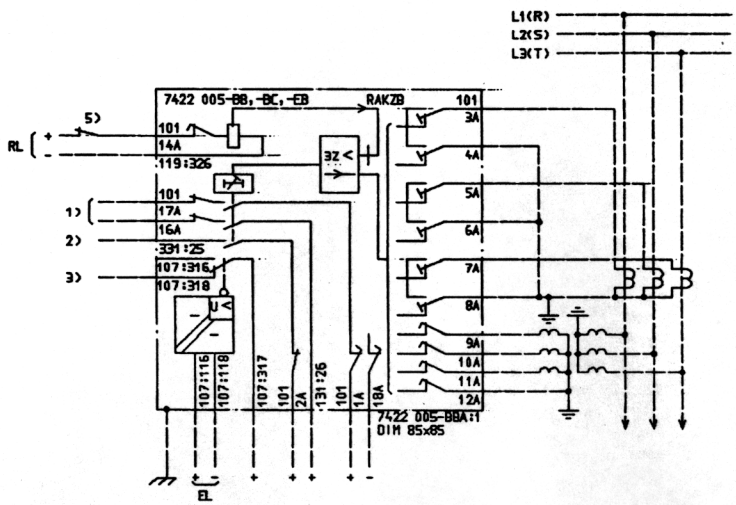


Terminal diagram 7422 005-ADA

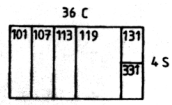


101 RTXP 18 Test switch
107 RXTUG 21H DC/DC converter
113 RTQTC 061 Transformer unit
119 RXZK 4 Three-phase impedance relay
131 RXME 18 Auxiliary relay

1) Tripping of CB etc.
2) Alarm etc.
3) Alarm loss of auxiliary voltage
5) Blocking relay in blocking position



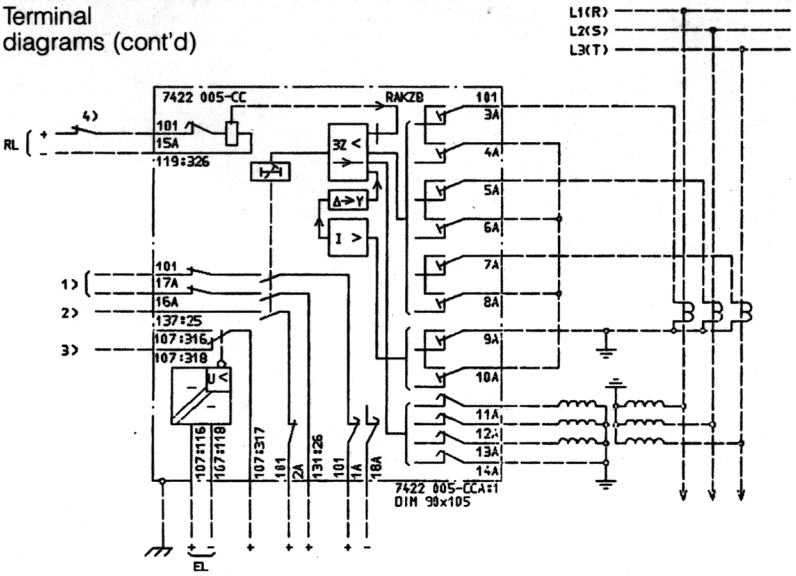
Terminal diagram 7422 005-BBA



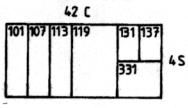
101 RTXP 18 Test switch
107 RXTUG 21H DC/DC converter
113 RTQTC 061 Transformer unit
119 RXZK 4 Three-phase impedance relay
131 RXME 18 Auxiliary relay
331 RXKE 1 Time delay relay

1) Tripping of CB etc.
2) Alarm etc.
3) Alarm loss of auxiliary voltage
5) Blocking relay in blocking position

Terminal diagrams (cont'd)

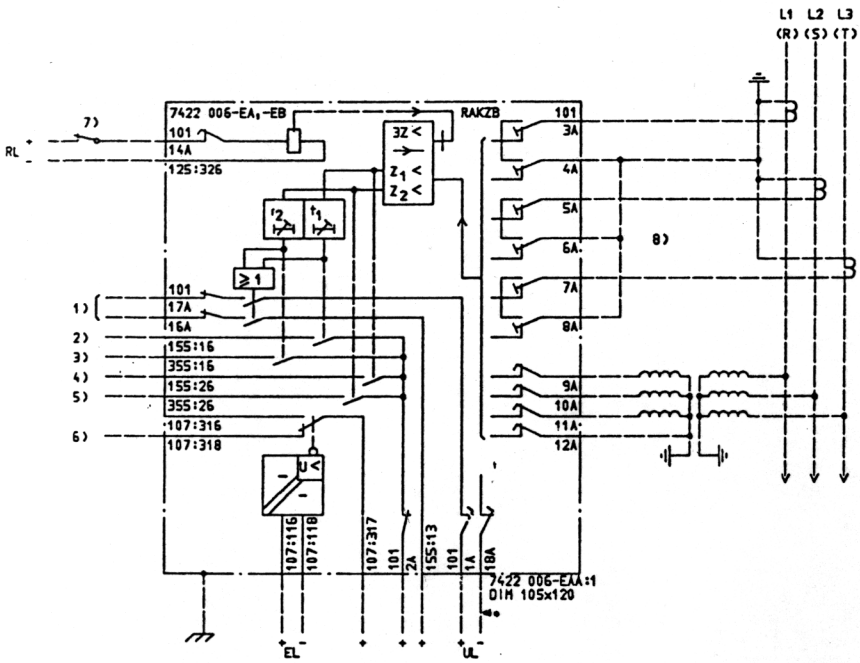


Terminal diagram 7422 005-CCA

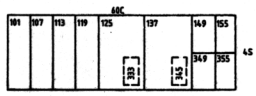


101 RTXP 18 Test switch
107 RXTUG 21H DC/DC converter
113 RTQTC 061 Transformer unit
119 RXZK 4 Three-phase impedance relay
131 RXME 18 Auxiliary relay
137 RXKE 1 Time delay relay
331 RXIG 21 Current relay

1) Tripping of CB etc.
2) Alarm etc.
3) Alarm loss of auxiliary voltage
4) Blocking relay in blocking position



Terminal diagram 7422 006-EAA



101 RTXP 18 Test switch
107 RXTUG 21H DC/DC converter
113 119 RTQTC 062 Transformer unit
125 137 RXZK 4 Three-phase impedance relay
149 349 RXKF 1 Time relay
155 355 RXSF 1 Alarm relay
333 345 RTXE 1 Resistor or varistor blocks

1) Trip etc.
2) Alarm trip step 1
3) Alarm trip step 2
4) Alarm start step 1
5) Alarm start step 2
6) Loss of EL
7) Blocking relay in blocking position
8) Wiring at RL=220–250 V
9) Wiring at RL=110–125 V
10) Wiring at RL=48–55 V

Reference	Buyer's Guide	No.
	Auxiliary relay data table	B03-1003E
	Time-delay relay data table	B03-1603E
	Pickup time-delay relay, RXKE 1	B03-1613E
	Current relay RXIG 2	B03-2032E
	Dc-dc converter RXTUG 21H	B03-9113E
	Test system COMBITEST	B03-9510E
	Dimensions	B03-9382E

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