

(SE970182)

Features

- Overload protection with 2% limiting error in current measurement and with adjustable start and cooling off time
- Short circuit protection
- Earth fault protection
- Long-starting-time protection
- Current-unbalance protection
- Phase failure protection
- Inter-turn short circuit protection
- Stalled rotor protection
- Repeated-starts protection (RAMDE 2)
- Display showing set values, as well as tripping values
- Power consumption in earth current circuit < 1 mVA at 3 mA
- Auxiliary voltage: 48-220 V \pm 20%, ac or dc
- COMBIFLEX plug-in or screw connection

Application

RAMDE can be used for both synchronous and asynchronous motors. There are two versions available; RAMDE 1 and RAMDE 2. RAMDE 1 should be used for synchronous motors where the idle running current is less than 10% of rated current. RAMDE 2 can be used in most other applications.

The current measurements are based on RMS-values, therefore taking into consideration the harmonics common in today's industrial environments. The current-unbalance protection is independent of frequency and phase sequence and therefore also works for motors fed via frequency converters or for reversible motors.

All settings are made on the front of the unit. Set values, service current, thermal content, current unbalance, start time and start current are shown on the display.

Overload protection (I_b)

The protection, which is a thermal overcurrent relay, protects the motor against overheating. The thermal time constant is determined on the basis of the size and construction of the motor. To be able to use the motor's optimal thermal capacity at start-up, the time constant can be increased. At 95% thermal content an alarm is triggered, which is indicated by a light emitting diode (LED), and which can be connected to an output relay. The cooling-down time constant can be prolonged to suit all types of cooling-down methods if the motor stops.

Restarting of the motor is blocked after tripping until the thermal content has decreased below 50%. The relay's thermal content can also be quickly emptied with a switch and the blocking will be released.

Application (cont'd)

The relay can be set with the “Lock-out” switch so that manual resetting must always be done before restarting.

Short circuit protection ($I >$)

For direct-on-line-started motors, the relay’s operate current should be set higher than the start current. For all motors, the relay should be set higher than the maximum fed short circuit current from the motor at external close-up short circuit.

Earth fault protection ($I \neq >$)

If several motors are connected to the same busbar, for selectivity reasons, every motor should have its own earth fault protection. The relay can be delayed to prevent undue tripping when it is being fed from residual connected current transformers.

Long-starting-time protection (t_{start})

This protection mainly protects the rotor against overheating, during start. If the starting time is too long, the protection trips the motor breaker.

At normal start and after set starting time the stalled rotor protection is activated.

Current-unbalance protection ($\Delta I >$)

The relay mainly protects the rotor. Unbalance in the line current, single-phase or two-phase faults and phase failure will cause negative-sequence-current.

Since the unbalance protection measure the difference between the phase currents, this allows for the measure of small negative-

sequence-currents, to detect inter-turn short circuits, two phase short circuits close to the stator’s zero point as well as phase failure.

Stalled rotor protection ($I >_{stall}$)

A stalling or breaking of the rotor during service will be detected when the set starting time has run out. The delay gives selectivity against external faults and heavy varying load. The relay also works as a time delayed back-up short circuit protection when the motor is in service.

Repeated-start protection (t_{sv})

This protection is included only in the RAMDE 2 version.

When a motor is started, there is a considerable rise in temperature in the rotor. To avoid overheating and temperature tensions there is a built-in 2 min block that prevents restarting. If, before a restart, the sum of earlier start times Σt_{start} and previous start time t_{start} is greater than the set start time t_{sv} , then the restart will be blocked. If the thermal content in the motor is greater than what is caused from a 80% relative heat content, then restart will also be blocked. The RAMDE 1 version is not equipped with this protection since it is used to protect motors where the intermittent idle running current is less than 10% of rated current. Each time the load current increases this would correspond to a new start condition and the set start time t_{sv} would soon be exceeded.

Design

RAMDE consists primarily of three PC boards, a power supply unit, input circuits, processor board, and 3 or 4 input transformers all contained in an aluminium casing. An earthed 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.

RAMDE is available in several variants which differ in the following respects:

- the way they are connected and installed
- with or without earth fault protection

- with or without test switch
- version 1 or 2

Mounting kit for flush or semiflush mounting of the relay is available.

The operation for the following is described:

- Setting
- Normal service
- Tripping

Setting

Setting is done by means of switches and potentiometers. Set values are displayed on the digital display by pushing repeatedly on the “Mode” button and at the same time the

LED's 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 following service values will be shown on the display at the same time as the appropriate LED lights up;

- the motor's load current as a factor of the motor's rated current " I_{load} "
- thermal content as percent " $I_{load} \cdot \Theta$ "
- unbalanced current as a factor of the motor's rated current " $\Delta I >$ "
- starting time " t_{start} "
- starting current " I_{start} "
- total starting time " Σt_{start} " (version 2)

If the push sequence is not completed the display and the LED will go out after about 8 minutes.

Tripping

Tripping is indicated by a flashing red LED. A tripping indication which has not been reset will automatically go out when another fault occurs. When tripping is caused by the thermal protection, the unbalance protection, or the stalled rotor protection, the load current or unbalanced current will be shown when resetting is done.

Incorrect setting

If a function is set outside its operating range, a flashing value will be shown on the display. If no thermal time constant is selected or if the overload protection is blocked, the display will show flashing zeros at the same time as the LED I_b flashes.

Blocking

The overload relay is blocked either by a switch or by not choosing a thermal time constant. The relays for Long start time or Stalled rotor are blocked by setting t_{start} on maximum, then the display is showing three nines. The unbalance relay is blocked by setting its potentiometer t_1 to maximum, with the display once again showing nines.

Technical data

Table 1: Common data

Rated current I_r	1 or 5 A
Basic current I_b (I_b prop. to the motor's rated current)	0,5-1,2 times I_r
Rated earth current IN_r	3, 10 100 or 500 mA
Rated frequency	50-60 Hz
Auxiliary voltage	48-220 V \pm 20% dc or ac 50-60 Hz
Power consumption per phase: current circuits (at rated current): $I_r = 1$ A $I_r = 5$ A $IN_r = 3$ mA and 10 mA $IN_r = 100$ mA $IN_r = 500$ mA	<50 mVA <250 mVA <1 mVA <1,5 mVA <4 mVA
Auxiliary voltage circuit (dependent on auxiliary voltage): normal service after operation	maximum 9 W maximum 12 W
Overload capacity: Continuous: $I_r = 1$ A and 5 A $IN_r = 3, 10$ and 100 mA $IN_r = 500$ mA For 1 s	3 times I_r 20 times IN_r 10 times IN_r 100 times I_r resp IN_r (max. 350 A for COMBIFLEX)

Technical data (cont'd)

Table 1: Common data

Permitted ambient service temperature	-5°C to +55°C
Temperature and auxiliary voltage dependency	< 1% of set value within temperature and auxiliary voltage range
Storage temperature	-40°C to +70°C
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	5 kV, 1,2/50 μs, 0,5 J
Disturbance tests: Power frequency test Fast transient test 1 MHz burst test	50 Hz, 0,5 kV, 2 min 4-8 kV, 2 min, <i>SS 436 15 03</i> 2,5 kV, 2 s
Weight: without app. bars screw terminals Dimensions: (mm) without test switch with test switch screw terminals	3,76 kg 4,6 kg (4U 24C) H=170, W=168, D=252 (4U 30C) H=170, W=210, D=252 (4U 24C) H=170, W=168, D=252

Table 2: Contact data

Contact data	Signal	Tripping
System voltage	250 V	250 V
Test voltage across 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 3: Overload relay

Current setting I_b	0,5-1,2 times I_r
Limiting error	< 2% of set current
Time constant τ	2-62 min in steps of 2
Current measuring error	< 2% of I_b
Inverse time error Constant time error	< 1% < 0.5 s
Increase of time constant at start τ_{start}	1, 1,125, 1,25 and 1,375 times τ
Cooling down time constant τ_{stop} Reset at	1, 2, 4 and 6 times τ Θ < 50% after trip Θ < 80% after normal stop

Table 4: Short circuit relay

Current setting $I >$ Limiting error Operate time:	2-10 times I_r < 5% of at set current Typical 55 ± 10 ms at 2 times set current
Resetting ratio Resetting time	> 95% < 100 ms
Transient overreach at fully developed dc component and source time constant $L/R < 25$ ms	< 5%

Table 5: Earth fault relay

Current setting $I_{\perp} >$	1-10 times IN_r
Limiting error	< 8% of set current
Operate time	Typical 100 ms at 2 times set current
Set delay	500 ms
Resetting ratio	> 90%
Transient overreach at fully developed dc component and source time constant $L/R < 25$ ms	< 5%

Table 6: Unbalance relay

Current setting $\Delta I >$	0,1-0,5 times I_b
Limiting error	< 2% of I_b
Set delay	1-12 s
Limiting error	< 0,1 s
At phase failure, $\Delta I > 1.0$ times I_b	delay 1 s
Relay does not operate at phase current	< 10% of I_b
Relay blocked at phase current	> 500% of I_b

Table 7: Long-starting-time relay

Set starting	4-120 s. Time measured from start current
Limiting error	> 6% to < 112% of I_b 1 s

Table 8: Stalled rotor relay

Current setting Limiting error Set delay version 1 Set delay version 2	1-4 times I_b < 5% of I_b 1-12 s 0,3 and 3 s
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Table 9: Repeated-starts relay

Set Σ starting time t_{sv} Limiting error	10-120 s 1 s
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Diagrams

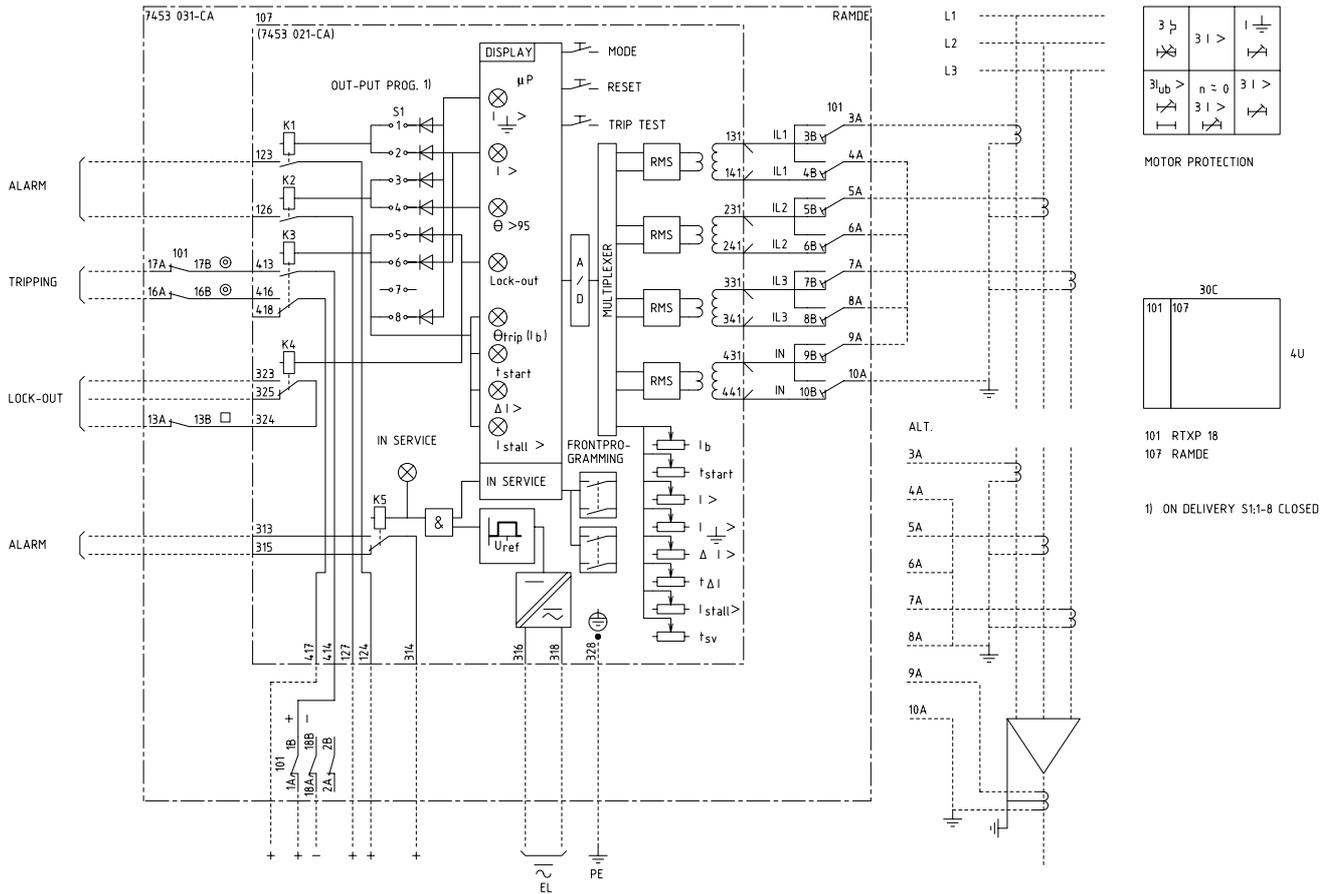


Fig. 1 Circuit diagram No. 7453 031-CA

Ordering

- Specify:
- Quantity
- Ordering No.
- Rated current I_r = 1 or 5 A
- Rated current I_{Nr} = 3, 10, 100 or 500 mA
- Desired wording on the lower half of the test switch face plate max. 13 lines with 14 characters per line.

Mounting and connection:

- COMBIFLEX variant of RAMDE can be mounted in an equipment frame, RHGX casing, flushmounted in a panel or on a panel frame with front connections. Screw terminal variant with rear connections, can be flush or semi-flush mounted. For mounting and connection parts, refer to Case dimensions and mounting instructions, 1MDU03007-EN.

Version	Without earth fault relay	With earth fault relay	
	RAMDE 2	RAMDE 1	RAMDE 2
without app.bars	RK 681 002-AB	RK 681 001-AA	RK 681 003-AB
on 24C app.bars	RK 681 102-AB	RK 681 101-AA	RK 681 103-AA
with test switch on 30C app.bars	RK 681 202-AA	RK 681 201-AA	RK 681 203-AA
with screw terminals	RK 681 302-AA	RK 681 301-AA	RK 681 303-AA
Mounting kit for flush or semiflush mounting of relay, without apparatus bars.			
Relay with:	flush mounting	semi flush mounting	
COMBIFLEX connectio	RK 933 001-AB	not applicable	
Screw connection	RK 933 001-AA	RK 933 001-AB	

References

Manual	1MDU03007-EN
COMBITEST Test system	1MRK 512 001-BEN
Dimensions	1MRK 514 004-BEN

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