Zelio® Control
Measurement Relays
RM4 and RM84

File 8430

Catalog
June
05

CONTENTS

a brand of Schneider Electric

Telemecanique

Application Data

Conforming to Standards		IEC 60255-6, EN 60255-6
Product Approvals		File E164353 CNN NKCR; File LR 89150 Guide 3211 07 GL
CE Marking	CE	Zelio-Control measurement relays conform to European regulations relating to CE Marking.
Ambient Air Temperature Around the Device	Storage	-40 to 185 °F (-40 to +85 °C)
	Operation	-4 to 149 °F (-20 to +65 °C)
Permissible Relative Humidity Range	Conforming to IEC 60721-3-3	15 to 85% Environmental class 3K3
Vibration Resistance	Conforming to IEC 60068-2-6, 10 to 55 Hz	a = 0.35 ms
Shock Resistance	Conforming to IEC 60068-2-27	15 gn, 11 ms
Degree of Protection	Housing	IP 50
	Terminals	IP 20
Degree of Pollution	Conforming to IEC 60664-1	3
Overvoltage Category	Conforming to IEC 60664-1	III
Rated Insulation Voltage Between contact circuit and power supply, or between contact circuit and control inputs	Conforming to IEC	500 V
	Conforming to CSA, UL	500 V
Test Voltage for Insulation Tests	Dielectric test	UL Hipot at 2,200 V (IEC 2,500 V)
	Shock wave	4.8 kV
Voltage Limits	Power supply circuit	0.85–1.1 Uc ▲
Disconnection Value	Power supply circuit	> 0.1 Uc
Mounting Position without Derating	In relation to the normal vertical mounting position	Any position
Connection Maximum Cross-Section	Stranded wire without cable end	Two #14 AWG (2.5 mm^2)
	Stranded wire with cable end	Two #16 AWG (1.5 mm^2)
Tightening Torque		4.5–9.9 lb-in (0.5–1.1 N•m)
Mounting		Can be mounted directly to a panel or on a 1.38 in. (35 mm) wide by 0.29 in. (7.5 mm) or 0.59 in. (15 mm) depth mounting track.

Immunity from Electromagnetic Interference (EMC)

(Application Class 2 Conforming to EN 61812-1)

Electrostatic Discharge	Conforming to IEC 61000-4-2	Level 3 (6 kV contact, 8 kV air)
Electromagnetic Fields	Conforming to IEC 61000-4-3	Level 3 (10 V/m)
Rapid Transients	Conforming to IEC 61000-4-4	Level 3 (2 kV output power, 1 kV control)
Shock Waves	Conforming to IEC 61000-4-5	Level 3 (2 kV common mode, 1 kV differential mode)
Radiated and Conducted Emissions	CISPR11	Group 1 Class A
	CISPR22	Class A

▲ Except RM4T, see page 31.

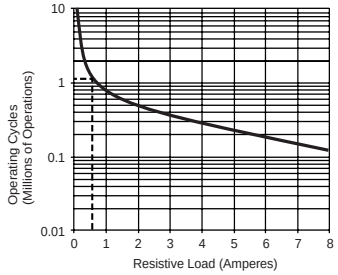
gn = gravitational unit = 9.8 m/s^2

Output Relay Specifications

Mechanical Durability ■	In millions of operating cycles	30 ■		
Current Limit Ith		8 A		
Rated Operational Limits at 158 °F (70 °C)		24 V	115 V	250 V
Conforming to IEC 60947-5-1/1991 and VDE 0660	AC-15	3 A	3 A	3 A
	DC-13	2 A	0.3 A	0.1 A
UL and CSA Current Ratings	Resistive Rating	5 A		
(NEMA/UL B300)	Inductive Rating	3600 VA Make Rating 360 VA Break Rating 5 A Carry		
Minimum Switching Capacity		12 V/10 mA		
Switching Voltage	Rated	250 Vac		
	Max.	440 Vac		
Contact Material		Silver Nickel 90/10		

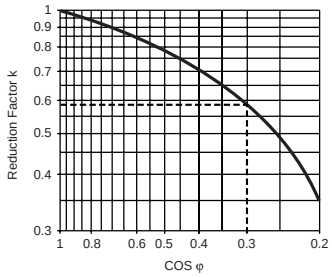
Curve 1
AC Load

Electrical durability of contacts on resistive load in millions of operating cycles ■

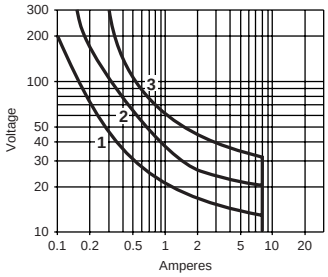


Curve 2
▲

Reduction factor k for inductive loads (applies to values taken from the durability curve opposite) ■



DC Load
Load Limit Curve ■



Example:

An LC1F185 contactor supplied with 115 V/50 Hz for a consumption of 55 VA or a current consumption equal to 0.1 A and cos φ = 0.3.

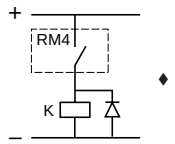
For 0.1 A, Curve 1 indicates a durability of approximately 1.5 million operating cycles.

As the load is inductive, it is necessary to apply a reduction coefficient k to this number of cycles, as indicated by curve 2.

For cos φ = 0.3: k = 0.6

The electrical durability therefore becomes:
1.5×10^6 operating cycles $\times$ 0.6 = 900,000 operating cycles.

1 L/R = 20 ms
2 L/R with load protection diode
3 Resistive load



♦

■ The product life expressed above is based on average usage and and normal operating conditions. Actual operating life will vary with conditions. The above statements are not intended to nor shall they create any expressed or implied warranties as to product operation or life. For information on the listed warranty offered on this product, refer to the Square D terms and conditions of sale found in the *Digest.*

◆ When used with a DC contactor, it is recommended that a free-wheel diode be connected in parallel on the coil.

▲ Curve 2 based on 35% power factor.

RM4JA01

RM4JA32

FUNCTIONS

These devices detect when the current level on an AC or DC supply exceeds a pre-set threshold. They have a transparent, hinged cover on the front face to prevent accidental alteration of the settings. This cover can be sealed.

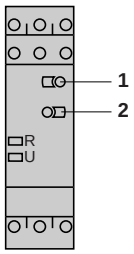
Catalog Number	Overcurrent Control	Overcurrent or Undercurrent Control ■	Measuring Range
RM4JA01	Yes	No	3 mA to 1 A
RM4JA31	Yes	Yes	3 mA to 1 A
RM4JA32	Yes	Yes	0.3 A to 15 A

Applications

- Excitation control of DC machines
- Controlling the load state of motors and generators
- Controlling current drawn by a three-phase motor
- Monitoring heating or lighting circuits
- Controlling pump draining (undercurrent)
- Controlling overtorque (crushers)
- Monitoring electromagnetic brakes or clutches

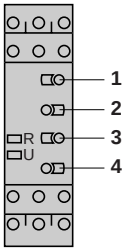
RM4JA01

Width 0.89 in (22.5mm)



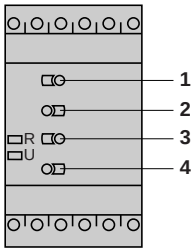
RM4JA31

Width 0.89 in (22.5mm)



RM4JA32

Width 1.77 in (45mm)



1 Adjustment of current threshold as a percentage of the setting range maximum value.

2 Hysteresis adjustment from 5 to 30% ▲.

3 Fine adjustment of time delay as a percentage of the setting range maximum value.

4 10-position switch combining

— selection of the timing range: 1 s, 3 s, 10 s, 30 s, no time delay.
— selection of overcurrent (>) or undercurrent (<) detection. See table below.

R Yellow LED: indicates relay state (Off for de-energized relay, On for energized).

U Green LED: indicates that supply to the RM4 is present.

Detailed Positions for Switch 4

Switch Position	Function	Time Delay (t)
< 0	Undercurrent detection	No time delay
< 1	Undercurrent detection	0.05 to 1 s
< 3	Undercurrent detection	0.15 to 3 s
< 10	Undercurrent detection	0.5 to 10 s
< 30	Undercurrent detection	1.5 to 30 s
> 0	Overcurrent detection	No time delay
> 1	Overcurrent detection	0.05 to 1 s
> 3	Overcurrent detection	0.15 to 3 s
> 10	Overcurrent detection	0.5 to 10 s
> 30	Overcurrent detection	1.5 to 30 s

■ Selection by switch on front face.

▲ Value of current difference between energization and de-energization of the output relay (% of the current threshold to be measured).

OPERATING PRINCIPLE

The supply voltage is connected to terminals A1–A2. The current to be monitored is connected to terminals B1, B2, or B3 (depending on the current range) and C. See the diagram below.

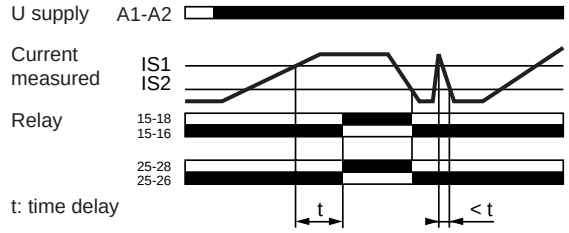
Hysteresis (h) is adjustable between 5 and 30%. For overcurrent, *h = (IS1 – IS2)/IS1;* for undercurrent, *h = (IS2 – IS1)/IS2.* A measuring cycle lasts only 80 ms, allowing rapid detection of changes in current.

Overcurrent detection (RM4JA01 or selector on ">" for model RM4JA3•).
When the current level exceeds the threshold setting (IS1), the output relay is energized (with or without a time delay, depending on the model). When the current returns to a value (IS2) below the threshold, the relay is instantaneously de-energized. The value of IS2 depends on the hysteresis setting.

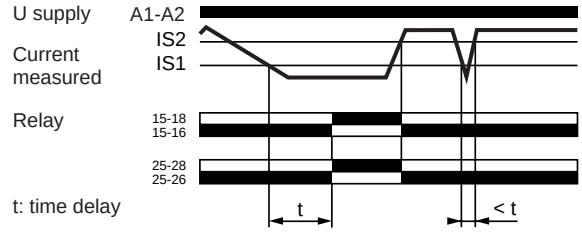
Undercurrent detection (selector on "<" for model RM4JA3• only).
When the current falls below the threshold setting (IS1), the output relay is energized (with or without a time delay, depending on the model). When the current returns to a value (IS2) above the threshold, the relay is instantaneously de-energized. The value of IS2 depends on the hysteresis setting.

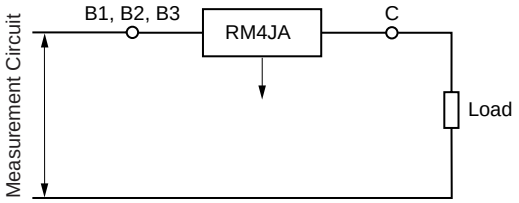
Function Diagrams:

Overcurrent Detection



Undercurrent Detection





NOTE: The measurement ranges can be extended using a current transformer whose secondary is connected to the terminals of the corresponding RM4 relay, or using a resistor connected in parallel with the measuring input (see the example on page 8).

SPECIFICATIONS

Power Supply Circuit Specifications

Type of Relay		RM4JA01			RM4JA31 and RM4JA32			
Rated Supply Voltage (Un)	Vac 50/60 Hz	24	110–130	220–240	24–240	110–130	220–240	380–415
	Vdc	–	–	–	24–240	–	–	–
Average Consumption at Un	VA (Vac)	2	1.9–3.3	2.7–3.5	1.5–3.3	1.9–3.3	2.7–3.4	2.7–3
	W (Vdc)	–	–	–	1.2	–	–	–

Output Relay and Operating Specifications

Type of Relay		RM4JA01	RM4JA31 and RM4JA32
Number of C/O Contacts	SPDT 	1	2
Output Relay State		Energized when: current measured > threshold setting	Energized when: current measured > threshold setting (">" function) current measured < threshold setting ("<" function)
Switching Threshold Setting Accuracy		As a percentage of the full scale value: ±5%	
Switching Threshold Drift		≤ 0.06% per °C, depending on the permissible ambient temperature	
		≤ 0.5%, within the supply voltage range (0.85–1.1 Un)	
Hysteresis (adjustable)		5–30% of the current threshold setting	
Time Delay Setting Accuracy		As a percentage of the full scale value: ±10%	
Time Delay Drift		–	≤ 0.07% per °C, depending on temperature
			≤ 0.5%, within the supply voltage range (0.85–1.1 Un)
Measuring Cycle		≤ 80 ms	

RM4JA01

Measuring Input Specifications

Internal Input Resistance and Permissible Overload Depending on the Current Measurement Ranges						
Type of Relay	RM4JA01 and RM4JA31			RM4JA32		
Measurement Range 50–60 Hz Vac/Vdc	3–30 mA	10–100 mA	0.1–1 A	0.3–1.5	1–5 A	3–15 A
Internal Input Resistance Ri	33 Ω	10 Ω	1 Ω	0.06 Ω	0.02 Ω	0.006 Ω
Permissible Continuous Overload	0.05 A	0.15 A	1.5 A	2 A	7 A	20 A
Permissible Non-Repetitive Overload for t ≤ 3 s	0.2 A	0.5 A	5 A	10 A	15 A	100 A

SELECTION

Current Measurement Relays: Overcurrent Detection

Time Delay	Current to be Measured Depending on Connection Vac or Vdc	Width in. (mm)	Output Relay	Supply Voltage 50/60 Hz	Catalog Number	Weight lb (kg)
None	3–30 mA 10–100 mA 0.1–1 A	0.87 in. (22.5 mm)	1 C/O–SPDT 	24 Vac	RM4JA01B	0.38 (0.172)
				110–130 Vac	RM4JA01F	0.38 (0.172)
				220–240 Vac	RM4JA01M	0.38 (0.172)

Current Measurement Relays: Overcurrent or Undercurrent Detection

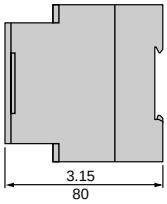
Adjustable Time Delay	Current to be Measured Depending on Connection Vac or Vdc	Width in (mm)	Output Relay	Supply Voltage 50/60 Hz	Catalog Number	Weight lb (kg)
0.05–30 s	3–30 mA 10–100 mA 0.1–1 A	0.87 in. (22.5 mm)	2 C/O–DPDT 	24–240 Vac/Vdc	RM4JA31MW	0.38 (0.172)
				110–130 Vac	RM4JA31F	0.38 (0.172)
				220–240 Vac	RM4JA31M	0.38 (0.172)
				380–415 Vac	RM4JA31Q	0.38 (0.172)
	0.3–1.5 A 1–5 A 3–15 A	1.77 in. (45 mm)	2 C/O–DPDT 	24–240 Vac/Vdc	RM4JA32MW	0.45 (0.204)
				110–130 Vac	RM4JA32F	0.45 (0.204)
				220–240 Vac	RM4JA32M	0.45 (0.204)
				380–415 Vac	RM4JA32Q	0.45 (0.204)

RM4JA32

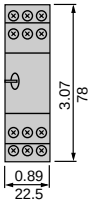
For additional application data, refer to page 2.

DIMENSIONS (approximate)

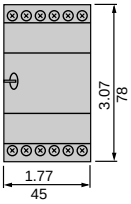
RM4JA (common side view)



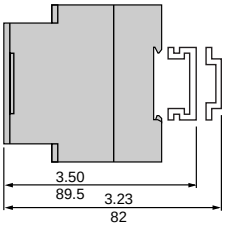
RM4JA●1



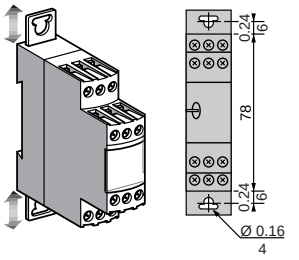
RM4JA32



Rail Mounting



Direct Mounting

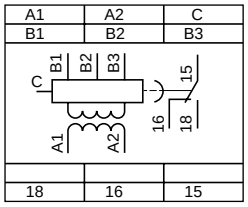


Dual Dimensions = $\frac{\text{in}}{\text{mm}}$

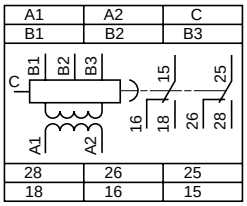
WIRING

Terminal Blocks

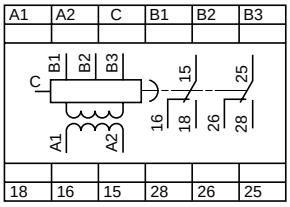
RM4JA01



RM4JA31



RM4JA32

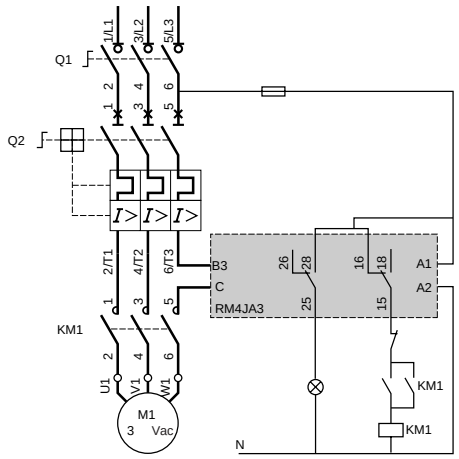


Connection and current values to be measured, depending on type of **RM4JA**					
RM4JA01 and RM4JA31	B1–C	3–30 mA	**RM4JA32**	B1–C	0.3–1.5 A
A1–A2 Supply voltage B1, B2, B3, C Currents to be measured (see table to right)	B2–C	10–100 mA		B2–C	1–5 A
	B3–C	0.1–1 A		B3–C	3–15 A

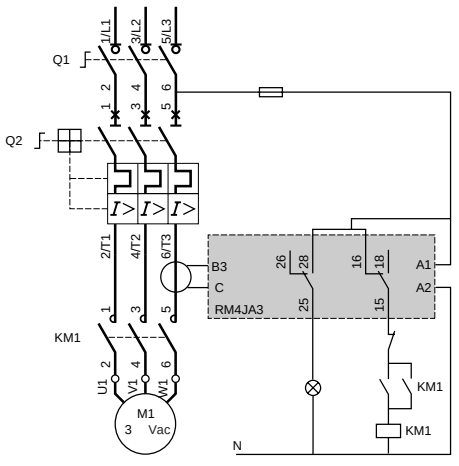
Application Diagrams

Example: Detection of a blockage on a crusher (overcurrent function)

Current measured ≤ 15 A



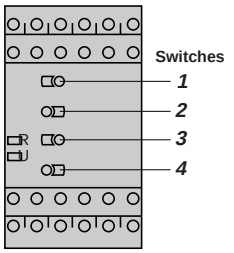
Current measured > 15 A



Example: Measuring Overcurrent

Overcurrent threshold at: 13 A
Output relay time delay (t): 5 s
Reset current threshold: 11 A
Supply voltage: 120 Vac

- Product selected **RM4JA32MW**
  Connection of current being measured: B3–C (3 to 15 A)



Adjustments

- Function and timing range, Switch 4 (see page 4 for a detailed list of switch positions)
  - — Determine whether overcurrent or undercurrent detection is required (in this example, overcurrent).
  - — Determine the timing range, and select a time exceeding the time required from page 4 (in this example, 10 s).
  - — Set Switch 4 according to the criteria above (in this example, set Switch 4 to **> 10**).
- Time delay, Switch 3
  Depending on the maximum range setting displayed on Switch 4 (in this example, 10 s), use the potentiometer, Switch 3, to set the required time delay as a percentage of the value on Switch 4.
  In this example, the required time (t) = 5 s, therefore:

$$\frac{t \times 100}{\text{Time range of Switch 4}} = \frac{5 \times 100}{10} = 50\%$$

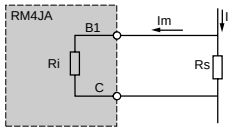
  Set time delay potentiometer, Switch 3, to **50**
- Current-threshold setting potentiometer, Switch 1, set as a percentage of the maximum value of the measuring range selected when wiring
  In this example: Wiring B3–C, the maximum value of the measurement range = 15 A, therefore:

$$\text{Switch 1} = \frac{13 \times 100}{15} = 87\%$$

  Set the current threshold setting potentiometer, Switch 1, to **87**.
- Hysteresis, Switch 2, set as a percentage of the threshold value
  In this example:

$$\text{Switch 2} = \frac{13 - 11}{13} = 15.4\%$$

  Set the hysteresis, Switch 2, to **15**



Extension of the Measurement Range

AC or DC Supply

Connect a resistor, Rs, to terminals B1–C (or B2–C or B3–C) on the measuring input.

The relay energization threshold will be in the center of the setting potentiometer range if the value of Rs is equal to:

$$Rs = \frac{Ri}{(2I/Im) - 1}$$

where:
Ri Internal resistance of input B1–C.
Im Maximum value of the threshold setting range.
I Current threshold to be measured.

Power dissipated by Rs: $P = Rs(I - Im/2)^2$

Application

- Using relay **RM4JA31••** (10–100 mA)
- Connecting B2–C to measure a threshold of 1 A, given that Ri = 10 Ω for this rating and Im = 100 mA

$$Rs = \frac{10}{(2 \times 1 / 0.1) - 1} = 0.526\ \Omega$$

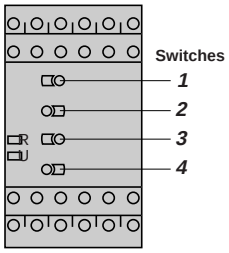
therefore: $P = \left(1 - \frac{0.1}{2}\right)^2 \times 0.526 = 0.47\ W$

Select a resistor, Rs, capable of dissipating at least twice the calculated value (1 W for this example) to limit temperature rise.

On an AC supply, a current transformer could be used.

Example: Measuring Undercurrent

Undercurrent threshold at: 8 A
Output relay time delay (t): 5 s
Reset current threshold: 9 A
Supply voltage: 120 Vac



- Product selected **RM4JA32MW**
  Connection of current being measured: B3–C (3 to 15 A)

Adjustments

- Function and timing range, Switch 4 (see page 4 for a detailed list of switch positions)
  - — Determine whether overcurrent or undercurrent detection is required (in this example, undercurrent).
  - — Determine the timing range, and select a time exceeding the time required from page 4 (in this example, 10 s).
  - — Set Switch 4 according to the criteria above (in this example, set Switch 4 to **< 10**).
- Time delay, Switch 3

  Depending on the maximum range setting displayed on Switch 4 (in this example, 10 s), use the potentiometer, Switch 3, to set the required time delay as a percentage of the value on Switch 4.

  In this example, the required time (t) = 5 s, therefore:

  $$\frac{t \times 100}{\text{Time range of Switch 4}} = \frac{5 \times 100}{10} = 50\%$$ Set time delay potentiometer, Switch 3, to **50**
- Current-threshold setting potentiometer, Switch 1, set as a percentage of the maximum value of the measuring range selected when wiring

  In this example: Wiring B3–C, the maximum value of the measurement range = 15 A, therefore:

  $$\text{Switch 1} = \frac{8 \times 100}{15} = 53\%$$ Set the current threshold setting potentiometer, Switch 1, to **53**.
- Hysteresis, Switch 2, set as a percentage of the threshold value

  In this example:

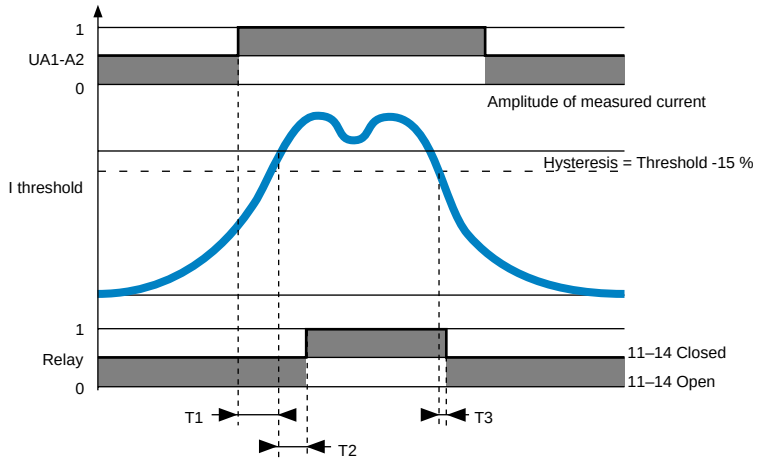
  $$\text{Switch 2} = \frac{9 - 8}{9} = 11.1\%$$ Set the hysteresis, Switch 2, to **11**

- *Current transformer incorporated by passing a cable through the front panel*
- *AC current threshold adjustable from 1–20 A (30 Hz to 400 Hz) via button on front panel*
- *Relay output 5 A–250 Vac–1 N/O contact*
- *Multivoltage supply:*
  - *110–240 Vac, 50/60 Hz,*
  - *24 Vac/Vdc*
- *17.5 mm enclosure, clips onto symmetrical 35 mm DIN rail*

OPERATING PRINCIPLE

The relay contact (11 and 14) closes when the current value exceeds the threshold.

The relay contact (11 and 14) opens when the current value falls below 15% (hysteresis) of the threshold.

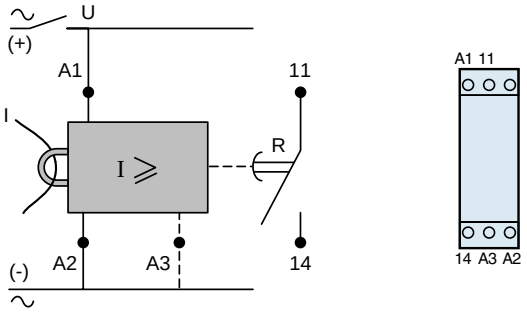


T1: Delay on pick-up 500 ms maximum

T2: Response time to sensing 400 ms ±50%

T3: Response time on de-energization 120 ms ±50%

WIRING



A1–A2 110–240 Vac supply

A1–A3 24 Vac or Vdc supply

RM84871102

SELECTION

AC current control relays

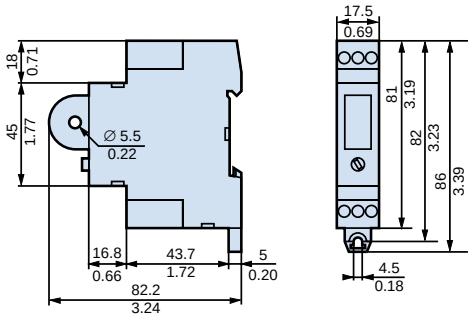
Voltage	Catalog Number	Weight oz (kg)
24 Vac/Vdc; 110–240 Vac	**RM84871102**	2.8 (0.080)

NOTE: The graduated set-point scale on the front panel relates to sinusoidal or delta current measurement. The relay can measure non-sinusoidal currents, for example, currents subject to phase control. In this case, an error coefficient may be assigned to the display; this coefficient is a function of the tripping angle of the phase controller (form factor).

Supply characteristics				
Supply voltage Un			**V**	24Vac/Vdc; 110–240 Vac
Frequency			**Hz**	50/60
Operating range				±15% for 24 Vac/Vdc; -15 to +10% from 110 to 240 Vac
Maximum consumption	24 Vac		**VA**	1
	240 Vac		**VA**	9
	24 Vdc		**W**	0.6
Temperature drift				0.06% per °C
Repeat accuracy				0.45%
Relative humidity				95%
Input characteristics				
Measured current range			**A**	1–20 sinusoidal
Frequency range of measured current			**Hz**	30–400
Setting accuracy			**A**	±10% of the maximum scale value
Switching hysteresis				15% of the set value
Maximum continuous current			**A**	40
Accidental overload current			**A**	100 A for 3 s
Response time to sensing		t2	**ms**	400 ±50%
		t3	**ms**	120 ±50%
Delay on pick-up		t1	**ms**	500 max.
Output circuit characteristics				
Output				1 N/O contact (AgCdO)
Breaking capacity			**VA**	1250
Maximum breaking current			**A**	5 (AC or DC)
Minimum breaking current			**mA**	10 (AC or DC)
Maximum switching voltage			**V**	250 Vac/Vdc
Mechanical life				30×10^6 operating cycles ▲
Electrical life				10^5 operating cycles at 1250 VA resistive ▲
Terminal capacity	With cable end		**AWG (mm²)**	Two #16 (1.5)
	Without cable end		**AWG (mm²)**	Two #14 (2.5)
Other characteristics				
Temperature limits	Operation		**°F (°C)**	-4 to +140 (-20 to +60)
	Storage		**°F (°C)**	-22 to +158 (-30 to +70)
Dielectric strength	Conforming to IEC 255-5		**kV**	2.5/1 min/1 mA/50 Hz
Approvals	c UL us File 173076 CCN NRNT, File 173076 CCN NRNT 7			SA File 217698 Guide 3211 07 CE

▲ The expected life expressed above is based on average usage and normal operating conditions. Actual operating life will vary with conditions. The above statements are not intended to nor shall they create any expressed or implied warranties as to product operation or life. For information on the listed warranty offered on this product, refer to the Square D terms and conditions of sale found in the *Digest.*

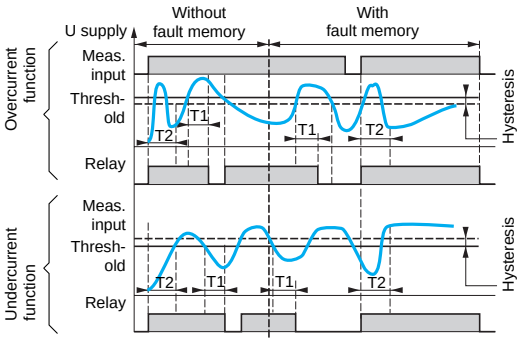
DIMENSIONS (approximate)



Dimensions: mm / in.

Telemecanique

- *Space savings, accurate measurement, and optimized functions improve the safety of your electrical installation.*
- *A DIP switch on the underside of the unit allows you to:*
  - *Select Overcurrent or Undercurrent mode.*
  - *Choose whether to activate the fault memory function, and to set the threshold crossing delay T1 and the inhibit time delay T2.*
    AC/DC mode is detected automatically.
- *Accuracy: three products allow you to choose the best product for greater measuring accuracy, provided by a microprocessor*.



OPERATING PRINCIPLE

Control of AC/DC current without memory

When the value of the controlled current (either AC or DC) reaches the threshold displayed on the front panel, the output relay changes state at the end of time delay T1.

It instantly returns to the initial state when the current drops below the hysteresis threshold, or when the power supply is disconnected.

Control of AC/DC current with memory

The output relay changes state at the end of time delay T1 and remains latched in this position. To reset it, the memory function must be reactivated by disconnecting the auxiliary supply.

Overcurrent function

The time delay on energization, T2, prevents current peaks due to motor starting.

The delay on upward crossing of the threshold, T1, provides immunity to transients and other interference, preventing false triggering of the output relay.

Undercurrent function

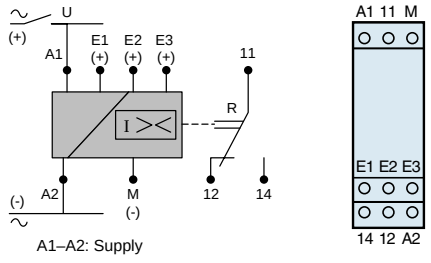
The time delay on energization, T2, prevents the occurrence of current troughs.

The delay on downward crossing of the threshold, T1, provides immunity to random dips, preventing false triggering of the output relay.

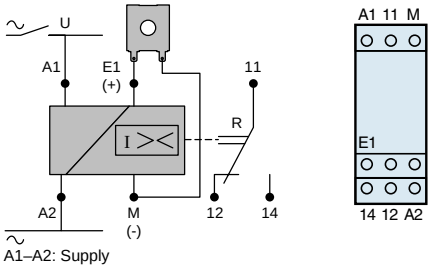
NOTE: In Undercurrent mode, the absolute value of the hysteresis cannot exceed the measurement range maximum.

WIRING

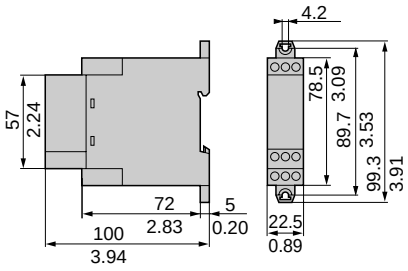
RM8487102p, RM8487103p



RM84871044



DIMENSIONS (approximate)



Dimensions: $\frac{mm}{in.}$

SELECTION

RM848710••

Current control relay

Measurement range	Supply voltage	Catalog Number	Weight, oz (kg)
2–500 mA	24 Vac	**RM84871021**	5.3 (0.150)
	120 Vac	**RM84871023**	5.3 (0.150)
	230 Vac	**RM84871024**	5.3 (0.150)
0.1–10 A	24 Vac	**RM84871031**	5.3 (0.150)
	120 Vac	**RM84871033**	5.3 (0.150)
	230 Vac	**RM84871034**	5.3 (0.150)
10–100 A with current transformer	230 Vac	**RM84871044**	5.3 (0.150)

Accessories

Description	Catalog Number	Weight, oz (kg)
Current transformer	**RM26852304**	2.3 (0.065)

Auxiliary supply characteristics

Relay type		**RM84871021 RM84871023 RM84871024**	**RM84871031 RM84871033 RM84871034**	**RM84871044**
Supply voltage Un	**V**	24, 120, 230 50/60 Hz (galvanic isolation by transformer)		230 50/60 Hz
Operating range		0.8–1.15 Un		
Average consumption	**VA**	3		

Output characteristics

Output relay		1 cadmium-free C/O contact	
Rated current	**A**	8	
Switching voltage	**Vac**	250	
Maximum voltage	**Vac**	440	
Rated breaking capacity	**VA**	2000	
Minimum breaking current	**mA**	100 at 12 Vdc	
Electrical life AC-12		10^5 operating cycles at 8 A at 250 Vac (see ▲ on page 11)	
Mechanical life		2×10^7 operating cycles (see ▲ on page 11)	
Time delay On crossing threshold T1	**s**	0,1–3 ±10%	
Time delay On energization T2	**s**	1–20 ±10%	

Input characteristics

Measurement range		**mA**	2–500		–			–
		A	–		0.1–10			10–100 with current transformer
Frequency of the measured signal		**Hz**	40–500					
Adjustable hysteresis			5–50% of the threshold setting					
Threshold value			10–100% of the range					
Threshold setting accuracy			±10%					
Measurement ranges	Inputs		**E1-M**	**E2-M**	**E3-M**	**E1-M**	**E2-M**	**E3-M**	**E1-M**
	Sensitivity	**mA**	2–20	10–100	50–500	–	–	–	–
		A	–	–	–	0.1–1	0.5–5	1–10	10–100
	Input resistance	**kΩ**	5	1	0.2	0.1	0.2	0.01	4

Other characteristics

Temperature		**°F (°C)**	**Operation:** -4 to +122 (-20 to +50); **Storage:** -40 to +178 (-40 to +70)
Relative humidity	Without condensation		95%
Enclosure material			Self-extinguishing
Degree of protection	Conforming to IEC 60529		Enclosure: IP 40D, terminal block: IP 20
Connection	Stranded wire	**AWG (mm^2)**	**Without cable end:** One #12 (4) or two #14 (2.5); **with cable end:** two #16 (1.5)
Tightening torque		**lb-in (N•m)**	8.8 (1)
Dielectric strength	Conforming to IEC 60255-5	**kV**	2.5 for 1 minute at 1 mA, 50 Hz
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3
Vibration resistance	Conforming to IEC 60068-2-6		a = 0.035 mm (0.0014 in.)

Approvals c UL us File 173076 CCN NRNT, File 173076 CCN NRNT 7 — SA File 217698, Guide 3211 07 — CE

Immunity to electromagnetic interference (EMC) (application class 2 conforming to EN 61812-1)

Electrostatic discharge	Conforming to IEC/EN 61000-4-2	Level 3 (6 kV contact, 8 kV air)
Electromagnetic fields	Conforming to IEC/EN 61000-4-3	Level 3 (10 V/m)
Fast transients	Conforming to IEC/EN 61000-4-4	Level 3 (2 kV)
Shock waves	Conforming to IEC/EN 61000-4-5	Level 3 (2 kV)
Radio frequencies	Conforming to IEC/EN 61000-4-6	Level 3 (10 V rms)
Voltage dips and breaks	Conforming to IEC/EN 61000-4-11	30% for 10 ms, 60% for 100 ms and 1 s, > 95% for 5 s and 10 ms
Damped oscillatory wave at 1 MHz	Conforming to IEC 61255-22-1	Class III
Radiated and conducted emissions		Class B

FUNCTIONS

These devices detect when voltage exceeds a pre-set threshold on an AC or DC supply. They have a transparent, hinged cover on the front face to prevent accidental alteration of the settings. This cover can be sealed.

RM4UA01

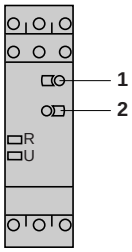
Type of Relay	Overvoltage Control	Overvoltage or Undervoltage Control ■	Measuring Range
RM4UA0•	Yes	No	50 mV to 500 V
RM4UA3•	Yes	Yes	50 mV to 500 V

Applications

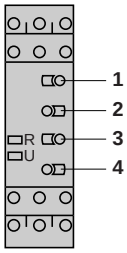
- DC motor overspeed control
- Battery monitoring
- Monitoring of AC or DC supplies
- Speed monitoring (with tacho-generator)

PRESENTATION

RM4UA0●
Width 0.89 in (22.5mm)



RM4UA3●
Width 0.89 in (22.5mm)



1 Adjustment of the voltage threshold as a percentage of the setting range maximum value.

2 Hysteresis adjustment from 5–30%. ▲

3 Adjustment of the time delay as a percentage of the setting range maximum value.

4 Switch combining:

— selection of the timing range: 1s, 3s, 10s, 30s, no time delay
— selection of overvoltage (>) or undervoltage (<) detection. See table below.

R Yellow LED: Indicates relay state (off for de-energized relay, on for energized relay).

U Green LED: Indicates that supply to the RM4 is present.

Details for Switch 4

Switch Position	Function	Time Delay (t)
< 0	Undervoltage detection	No time delay
< 1	Undervoltage detection	0.05 to 1 s
< 3	Undervoltage detection	0.15 to 3 s
< 10	Undervoltage detection	0.5 to 10 s
< 30	Undervoltage detection	1.5 to 30 s
> 0	Overvoltage detection	No time delay
> 1	Overvoltage detection	0.05 to 1 s
> 3	Overvoltage detection	0.15 to 3 s
> 10	Overvoltage detection	0.5 to 10 s
> 30	Overvoltage detection	1.5 to 30 s

■ Selection by the switch on the front face.

▲ Value of the voltage difference between energization and de-energization of the output relay (% of the voltage threshold to be measured).

OPERATING PRINCIPLE

The supply voltage is connected to terminals A1–A2.
The voltage to be monitored is connected to terminal B1, B2, or B3 and terminal C.

Hysteresis (h) is adjustable from 5–30%:
for overvoltage, *h = (US1 – US2) / US1;* for undervoltage, *h = (US2 – US1) / US2.*
A measurement cycle lasts only 80 ms, allowing rapid detection of voltage changes.

Relays set for **overvoltage** detection (RM4UA0• or selector on “>” for model RM4UA3•):

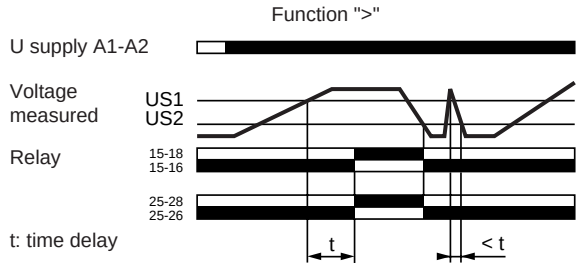
When the voltage exceeds threshold setting US1, the output relay is energized (with or without a time delay). When the voltage returns to value US2 below the threshold, the relay is instantaneously de-energized. The value of US2 depends on the hysteresis setting.

Relays set for **undervoltage** detection (selector on “<”, model RM4UA3• only):

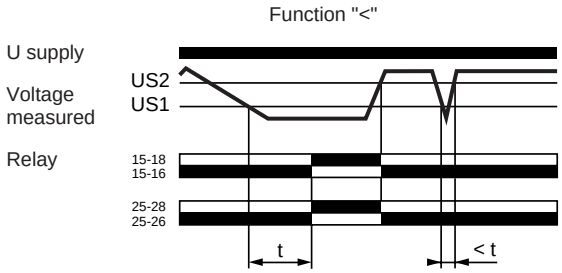
When the voltage falls below threshold setting US1, the output relay is energized (with or without a time delay). When the voltage returns to value US2 above the threshold, the relay is de-energized. The value of US2 depends on the hysteresis setting.

Function Diagrams

Overvoltage Control



Undervoltage Control



NOTE: The measurement ranges can be extended above 500 V by adding a resistor (see page 18). The measurement range on an AC supply can be extended using a voltage transformer whose secondary is connected to the measuring terminals of the corresponding RM4 relay.

SPECIFICATIONS

Power Supply Circuit Specifications

Type of Relay		RM4UA0●			RM4UA3●			
Rated Supply Voltage (Un)	Vac 50/60 Hz	24	110–130	220–240	24–240	110–130	220–240 V	380–415
	Vdc	–	–	–	24–240	–	–	–
Average Consumption at Un	VA (Vac)	2	1.9–3.3	2.7–3.5	1.5–3.3	1.9–3.3	2.7–3.4	2.7–3
	W (Vdc)	–	–	–	1.2	–	–	–

Output Relay and Operating Specifications

Type of Relay	RM4UA0●	RM4UA3●
Number of C/O Contacts, SPDT	1	2
Output Relay State	Energized when: voltage measured > threshold setting	Energized when: voltage measured > threshold setting (">" function) voltage measured < threshold setting ("<" function)
Switching Threshold Setting Accuracy	As a percentage of the full scale value: ±5%	
Switching Threshold Drift	≤ 0.06% per °C, depending on the permissible ambient temperature	
	≤ 0.5%, within the supply voltage range (0.85–1.1 Un)	
Hysteresis (adjustable)	5–30% of the voltage threshold setting	
Time Delay Setting Accuracy	As a percentage of the full scale value: ±10%	
Time Delay Drift	–	≤ 0.5%, within the supply voltage range (0.85–1.1 Un)
Measuring Cycle	≤ 80 ms	≤ 0.07% per °C, depending on the rated operating temperature

Measuring Input Specifications

Internal Input Resistance and Permissible Overload Depending on the Current Measurement Ranges

Type of Relay	RM4UA●1			RM4UA●2			RM4UA●3	
Measurement Range 50–60 Hz Vac and Vdc (V)	0.05–0.5	0.3–3	0.5–5	1–10	5–50	10–100	30–300	50–500
Internal Input Resistance Ri (kΩ)	6.6	43	71	23	112	225	668	1111
Permissible Continuous Overload (V)	20	60	80	90	150	300	400	550
Permissible Non-Repetitive Overload for t ≤ 1 s (V)	25	80	100	100	200	400	500	550

SELECTION

Voltage Measurement Relays: Overvoltage Detection

RM4UA01

Time Delay	Voltage to be Measured Depending on Connection (Vac or Vdc)	Width in. (mm)	Output Relay	Supply Voltage 50/60 Hz	Catalog Number	Weight lb (kg)
None	0.05–0.5 V 0.3–3 V 0.5–5 V	0.87 (22.5)	1 C/O–SPDT	24 Vac	**RM4UA01B**	0.37 (0.168)
				110–130 Vac	**RM4UA01F**	0.37 (0.168)
				220–240 Vac	**RM4UA01M**	0.37 (0.168)
	1–10 V 5–50 V 10–100 V	0.87 (22.5)	1 C/O–SPDT	24 Vac	**RM4UA02B**	0.37 (0.168)
				110–130 Vac	**RM4UA02F**	0.37 (0.168)
				220–240 Vac	**RM4UA02M**	0.37 (0.168)
	30–300 V 50–500 V	0.87 (22.5)	1 C/O–SPDT	24 Vac	**RM4UA03B**	0.37 (0.168)
				110–130 Vac	**RM4UA03F**	0.37 (0.168)
				220–240 Vac	**RM4UA03M**	0.37 (0.168)

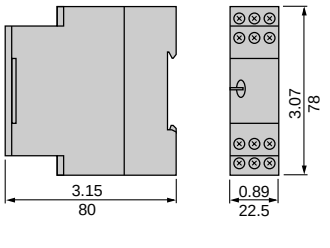
Voltage Measurement Relays: Overvoltage or Undervoltage Detection

Adjustable Time Delay	Voltage to be Measured Depending on Connection (Vac or Vdc)	Width in. (mm)	Output Relay	Supply Voltage 50/60 Hz	Catalog Number	Weight lb (kg)
0.05–30 s	0.05–0.5 V 0.3–3 V 0.5–5 V	0.87 (22.5)	2 C/O–DPDT	24–240 Vac/Vdc	**RM4UA31MW**	0.37 (0.168)
				110–130 Vac	**RM4UA31F**	0.37 (0.168)
				220–240 Vac	**RM4UA31M**	0.37 (0.168)
				380–415 Vac	**RM4UA31Q**	0.37 (0.168)
	1–10 V 5–50 V 10–100 V	1.77 (45)	2 C/O–DPDT	24–240 Vac/Vdc	**RM4UA32MW**	0.37 (0.168)
				110–130 Vac	**RM4UA32F**	0.37 (0.168)
				220–240 Vac	**RM4UA32M**	0.37 (0.168)
				380–415 Vac	**RM4UA32Q**	0.37 (0.168)
	30–300 V 50–500 V	1.77 (45)	2 C/O–DPDT	24–240 Vac/Vdc	**RM4UA33MW**	0.37 (0.168)
				110–130 Vac	**RM4UA33F**	0.37 (0.168)
				220–240 Vac	**RM4UA33M**	0.37 (0.168)
				380–415 Vac	**RM4UA33Q**	0.37 (0.168)

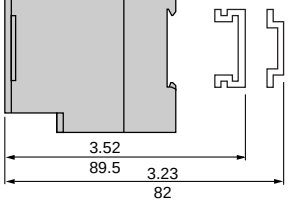
For additional application data, refer to page 2.

DIMENSIONS

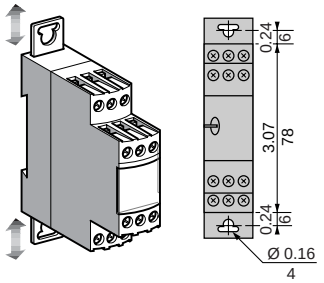
RM4UA
(common side view)



Rail Mounting



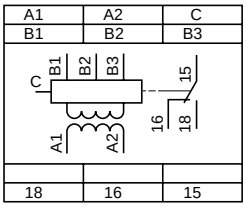
Direct Mounting



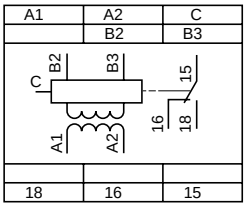
Dual Dimensions = $\frac{\text{in}}{\text{mm}}$

WIRING CONNECTIONS

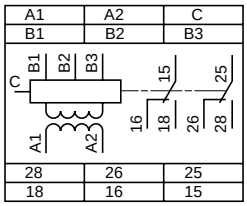
Terminal Blocks
RM4UA01, UA02



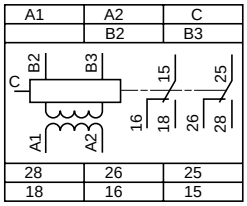
RM4UA03



RM4UA31, UA32



RM4UA33

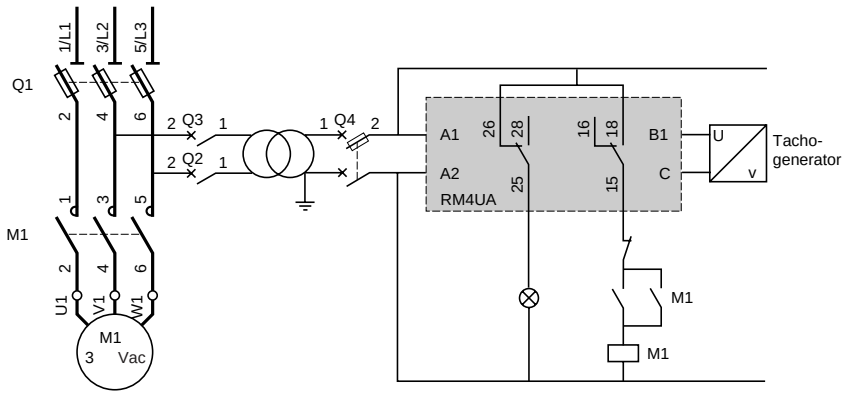


Connection and current values to be measured, depending on type of RM4UA

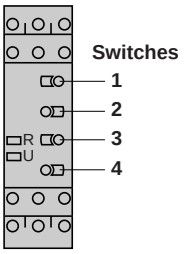
RM4UA•1 A1–A2 supply voltage B1, B2, B3, C Voltages to be measured (see table to right)	B1–C	0.05–0.5 V	**RM4UA•2**	B1–C	1–10 V	**RM4UA•3**	B2–C	30–300 V
	B2–C	0.3–3 V		B2–C	5–50 V		B3–C	50–500 V
	B3–C	0.5–5 V		B3–C	10–100 V			

Application Diagrams

Example: Overspeed Monitoring (Undervoltage Function)



Telemecanique



Example: Measuring Undervoltage

Product selected: **RM4UA32F**
Connection of voltage to be measured: B2–C (5–50 V)

- Undervoltage threshold: 12 Vdc
- Time delay of the output relay (t): 20 s
- Reset voltage threshold: 13.2 V
- Supply voltage: 120 Vac/60 Hz

Adjustments:

- Adjustment of function and timing range, Switch 4 (see page 14 for a detailed list of switch positions):
  - — Determine whether overvoltage or undervoltage detection is required; in this example undervoltage.
  - — Determine the timing range and select a time exceeding the time required; in this example, 30 s.
  - — Position Switch 4 according to the criteria above (in this example, set Switch 4 to **< 30**).
- Fine adjustment of time delay:

  Depending on the maximum range setting displayed on Switch 4 (in this example, 30 s), use the potentiometer, Switch 3, to set the required time delay as a percentage of the value on Switch 4.

  In this example, the required time = 20 s. Therefore:

  $$\frac{t \times 100}{\text{Timing range of Switch 4}} = \frac{20 \times 100}{30} = 66\%$$

  Set the time delay potentiometer, Switch 3, to **66**.

- Set the voltage threshold setting potentiometer, Switch 1, as a percentage of the maximum value of the measuring range selected when wiring.

  In this example: wiring is B2–C; the maximum value of the measuring range = 50 V; and the undervoltage threshold = 12 Vdc. Therefore:

  $$\text{Setting of Switch 1} = \frac{12 \times 100}{50} = 24\%$$

  Set the voltage threshold setting potentiometer, Switch 1, to **24**.

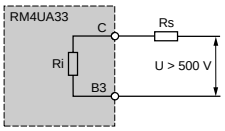
  Set the hysteresis, Switch 2, as a percentage of the threshold value; in this example:

  $$\text{Setting of Switch 2} = \frac{13.2 - 12}{13.2} = 9\%$$

  Set the hysteresis, Switch 2, to **9.**

Extension of the Measuring Range

AC or DC Supply



Simply connect a resistor, Rs, in series with the measuring input, B3 or C.

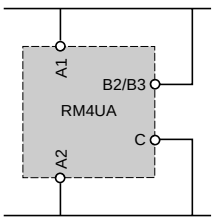
If the value of Rs is equal to:

$$Rs = Ri\left(\frac{U}{Um} - 1\right)$$

where: **Ri** Internal resistance of input B3–C.
Um Maximum value of threshold setting range.
U Voltage threshold to be measured.

The tripping threshold of the relay will be toward the maximum graduation on the threshold setting potentiometer. In general, the power consumed by the resistor does not exceed 0.5 W.

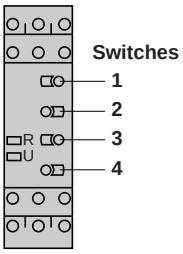
For AC voltages, it is also possible to use a voltage transformer.



Supply by the Measured Voltage

For monitoring mains and power supplies, the RM4UA can be supplied by the voltage to be controlled, if:

- The measurement threshold is within the operating range of the product's power supply (0.85–1.1 Uc)
- Variations of the voltage to be measured are compatible with the supply and measurement voltage ranges



Example: Measuring Overvoltage

Product selected **RM4UA32F**
Connection of voltage to be measured B2–C (5–50 V)

- Overvoltage threshold: 12 Vdc
- Time delay of the output relay (t): 20 s
- Reset voltage threshold: 11 Vdc
- Supply voltage: 120 Vac/60 Hz

Adjustments:

- Adjustment of function and timing range, Switch 4 (See page 14 for a detailed list of switch positions):
  - — Determine whether overvoltage or undervoltage detection is required; in this example overvoltage.
  - — Determine the timing range and select a time exceeding the time required; in this example, 30 s.
  - — Position Switch 4 according to the criteria above; in this example, Switch 4 on **> 30**.
- Fine adjustment of time delay:

  Depending on the maximum range setting displayed on Switch 4 (in this example, 30 s), use the potentiometer, Switch 3, to set the required time delay as a percentage of the value on Switch 4.

  In this example, the required time = 20 s. Therefore:

  $$\frac{t \times 100}{\text{Timing range of Switch 4}} = \frac{20 \times 100}{30} = 66\%$$

  Set the time delay potentiometer, Switch 3, to **66**.

- Set the voltage threshold setting potentiometer, Switch 1, as a percentage of the maximum value of the measuring range selected when wiring.

  In this example: wiring is B2–C; the maximum value of the measuring range = 50 V; and the overvoltage threshold = 12 Vdc. Therefore:

  $$\text{Setting of Switch 1} = \frac{12 \times 100}{50} = 24\%$$

  Set the voltage threshold setting potentiometer, Switch 1, to **24**.

  Set the hysteresis, Switch 2, as a percentage of the threshold value; in this example:

  $$\text{Setting of Switch 2} = \frac{12 - 11}{12} = 8.3\%$$

  Set the hysteresis, Switch 2, to **8.**

- *Space savings, accurate measurement, and optimized functions improve the safety of your electrical installation.*
- *Assurance that equipment is working under the correct conditions by checking the supply voltage.*
- *Using a DIP switch:*
  - *Select Overvoltage or Undervoltage mode.*
  - *Choose whether to activate the fault memory function and the delay on threshold crossing.*
- *Accuracy: two products for greater measuring accuracy, provided by a microprocessor.*

OPERATING PRINCIPLE

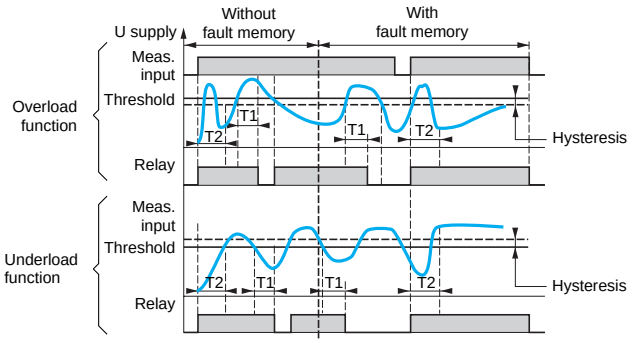
Control of AC/DC voltage without memory

When the value of the controlled voltage (AC or DC) reaches threshold Ue displayed on the front panel, the output relay changes state at the end of time delay T1, which can be set on the front panel to between 0.1 and 3 s.

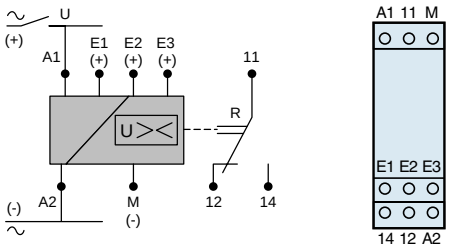
As soon as the voltage drops below 5–50% of the threshold (hysteresis), the output relay instantly changes state again. Changing the hysteresis on the front panel does not modify the value of the pre-set threshold.

Control of AC/DC voltage with memory

When the value of the controlled voltage (AC or DC) reaches threshold Ue displayed on the front panel, the output relay changes state at the end of time delay T1 (which can be set between 0.1 and 3 s on the front panel) and remains latched in this position.

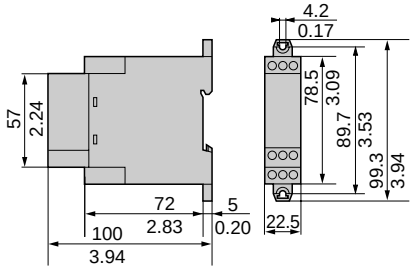


WIRING

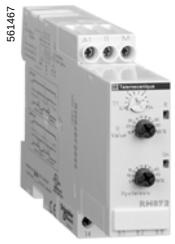


A1–A2: Supply

DIMENSIONS (approximate)



Dimensions: mm / in.



RM8487203•

SELECTION

Measurement range	Supply voltage	Catalog Number	Weight, oz (kg)
0.2–60 V	24 Vac	**RM84872021**	4.2 (0.120)
	120 Vac	**RM84872023**	4.2 (0.120)
	230 Vac	**RM84872024**	4.2 (0.120)
15–600 V	24 Vac	**RM84872031**	4.2 (0.120)
	120 Vac	**RM84872033**	4.2 (0.120)
	230 Vac	**RM84872034**	4.2 (0.120)

Auxiliary supply characteristics

Relay type			**RM8487202p**	**RM8487203p**
Supply voltage, Un		**V**	24, 120, 230 50/60 Hz (galvanic isolation by transformer)	
Operating range			0.8–1.15 Un	
Average consumption		**VA**	3	

Output characteristics

Output relay			1 cadmium-free C/O contact
Rated current		**A**	8
Switching voltage		**Vac**	250
Maximum voltage		**Vac**	440
Rated breaking capacity		**VA**	2000
Minimum breaking current		**mA**	100 at 12 Vdc
Electrical life	AC-12		10^5 operating cycles at 8 A at 250 Vac (see ▲ on page 11)
Mechanical life			2×10^7 operating cycles (see ▲ on page 11)
Time delay	On crossing threshold T1	**s**	0.1–3 ±10%
	On crossing threshold T2	**s**	1–20 ±10%
Delay on pick-up		**ms**	500

Input characteristics

Measurement range		**V**	0.2–60			15–600		
Frequency of the measured signal		**Hz**	40–500					
Adjustable hysteresis			5–50% of the threshold setting					
Threshold value			10–100% of the range					
Threshold setting accuracy			±10%					
Measurement ranges	Inputs		**E1-M**	**E2-M**	**E3-M**	**E1-M**	**E2-M**	**E3-M**
	Sensitivity	**V**	0.2–2	1–10	6–60	15–150	30–300	60–600
	Input resistance	**kΩ**	2	10	60	100	300	600

Other characteristics

Temperature		**°F (°C)**	**Operation:** -4 to +122 (-20 to +50); **Storage:** -40 to +158 (-40 to +70)
Relative humidity	Without condensation		95%
Enclosure material			Self-extinguishing
Degree of protection	Conforming to IEC 60529		Enclosure: IP 40D, terminal block: IP 20
Connection	Without cable end	**AWG (mm^2)**	One #12 (4) or two #14 (2.5)
Flexible cable	With cable end	**AWG (mm^2)**	Two #16 (1.5)
Tightening torque		**lb-in (N•m)**	8.8 (1)
Dielectric strength	Conforming to IEC 60255-5	**kV**	2.5 kV for 1 min at 1 mA 50 Hz
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4 kV/3
Vibration resistance	Conforming to IEC 60068-2-6		a = 0.035 mm (0.0014 in.)
Approvals	c UL us		File 173076 CCN NRNT File 173076 CCN NRNT 7
	CSA		File 217698 Guide 3211 07
	CE		

Immunity to electromagnetic interference (EMC) (application class 2 conforming to EN 61812-1)

Electrostatic discharge	Conforming to IEC/EN 61000-4-2	Level 3 (6 kV contact, 8 kV air)
Electromagnetic fields	Conforming to IEC/EN 61000-4-3	Level 3 (10 V/m)
Fast transients	Conforming to IEC/EN 61000-4-4	Level 3 (2 kV)
Shock waves	Conforming to IEC/EN 61000-4-5	Level 3 (2 kV)
Radio frequencies	Conforming to IEC/EN 61000-4-6	Level 3 (10 V rms)
Voltage dips and breaks	Conforming to IEC/EN 61000-4-11	30% for 10 ms, 60% for 100 ms and 1 s, > 95% for 5 s and 10 ms
Damped oscillatory wave at 1 MHz	Conforming to IEC 61255-22-1	Class III
Radiated and conducted emissions		Class B

- *Simple to install, these threshold relays check their own supply voltage level.*
- *RM48487204•: Select Overvoltage or Undervoltage mode and the memory function via the DIP switches, then set the delay on crossing threshold T1.*
- *RM48487205•: set the required high and low voltage thresholds and the delay on crossing threshold T1.*

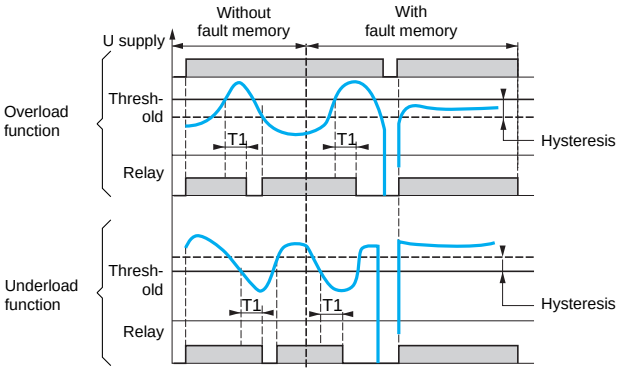
OPERATING PRINCIPLE

Overvoltage–undervoltage control with memory

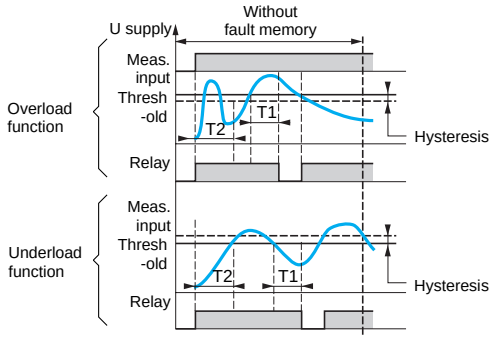
Two operating modes are available:

- AC/DC voltage control without memory
- AC/DC voltage control with memory

Overvoltage–undervoltage control



Threshold without memory



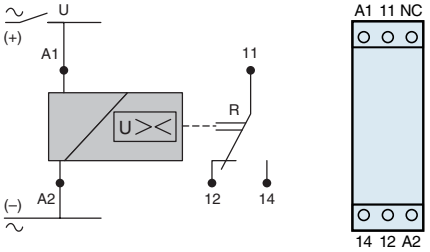
Threshold without memory

The window threshold relay controls an electrical voltage, which also acts as its power supply (for simplified wiring). When the value of the controlled voltage (AC or DC) fluctuates outside the window, the output relay de-energizes at the end of time delay T1, which can be set between 0.1 and 3 s on the front panel.

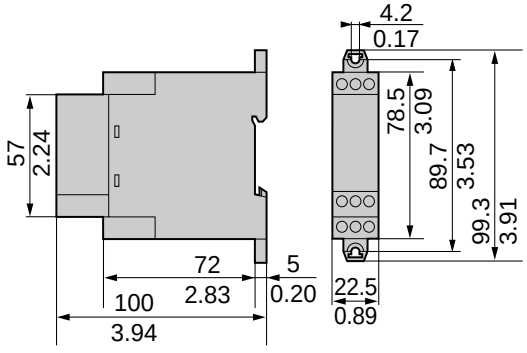
It re-energizes when the voltage returns within the window and stays between the upper and lower thresholds, displayed by two potentiometers on the front panel. A fixed hysteresis ensures bounce-free relay switching around the thresholds.

NOTE: When crossing the upper and lower thresholds, time delay T1 provides immunity to transients to prevent false triggering of the output relay.

WIRING



DIMENSIONS (approximate)



Dimensions: $\frac{mm}{in.}$

RM848720pp

SELECTION

Type	Voltage to be measured	Catalog Number	Weight, oz (kg)
With memory	20–80 Vac/Vdc	**RM84872046**	3.5 (0.100)
	65–260 Vac/Vdc	**RM84872047**	3.5 (0.100)
Without memory	20–80 Vac/Vdc	**RM84872056**	3.5 (0.100)
	65–260 Vac/Vdc	**RM84872057**	3.5 (0.100)

Supply characteristics				
Relay type			**RM8487204•**	**RM8487205•**
Supply voltage Un		**Vac/Vdc**	20–80, 65–260	
Operating range		**V**	15–150, 50–275	
Maximum consumption	260 Vac	**VA**	6.7	6
	80 Vac	**VA**	2	2
	260 Vdc	**W**	2	2
	80 Vdc	**W**	0.8	0.8
Output characteristics				
Output relay			1 cadmium-free C/O contact	
Rated current		**A**	8	
Switching current		**Vac**	250	
Maximum voltage		**Vac**	440	
Rated breaking capacity		**VA**	2000	
Minimum breaking current		**mA**	100 at 12 Vdc	
Electrical life	AC-12		10^5 operating cycles at 8 A at 250 Vac (see ▲ on page 11)	
Mechanical life			2×10^7 operating cycles (see ▲ on page 11)	
Time delay	On crossing threshold T1	**s**	0.1–3 ±10%	
Delay on pick-up		**ms**	500	
Input characteristics				
Relay type			Measures its own supply voltage	
Measurement range		**V**	20–80 or 65–260 depending on model	
Frequency of the signal measured		**Hz**	50–60 ±1	
Hysteresis			Adjustable 5–20%	Fixed 5%
Threshold setting accuracy			±10%	
Repeat accuracy	With constant parameters		±0.3%	
Temperature drift			±0.5% per °C	
Other characteristics				
Temperature		**°F (°C)**	**Operation:** -4 to +122 (-20 to +50); **Storage:** -40 to +158 (-40 to +70)	
Relative humidity	Without condensation		95%	
Enclosure material			Self-extinguishing	
Degree of protection	Conforming to IEC 60529		Enclosure: IP 40D, terminal block: IP 20	
Connection	Without cable end	**AWG (mm²)**	One #12 (4) or two #14 (2.5)	
Flexible cable	With cable end	**AWG (mm²)**	Two #16 (1.5)	
Tightening torque		**lb-in (N•m)**	8.8 (1)	
Dielectric strength	Conforming to IEC 60255-5	**kV**	2.5 kV for 1 min at 1 mA 50 Hz	
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4 kV/3	
Vibration resistance	Conforming to IEC 60068-2-6		a = 0.35 mm (0.014 in.)	

Approvals c UL us File E173076 CCN NRNT, File E173076 CCN NRNT 7 — CSA File 217698, Guide 3211 07 — CE

Immunity to electromagnetic interference (EMC) (application class 2 conforming to EN 61812-1)		
Electrostatic discharge	Conforming to IEC/EN 61000-4-2	Level 3 (6 kV contact, 8 kV air)
Electromagnetic fields	Conforming to IEC/EN 61000-4-3	Level 3 (10 V/m)
Fast transients	Conforming to IEC/EN 61000-4-4	Level 3 (2 kV)
Shock waves	Conforming to IEC/EN 61000-4-5	Level 3 (2 kV)
Radio frequencies	Conforming to IEC/EN 61000-4-6	Level 3 (10 V rms)
Voltage dips and breaks	Conforming to IEC/EN 61000-4-11	30% for 10 ms, 60% for 100 ms and 1 s, > 95% for 5 s and 10 ms
Damped oscillatory wave at 1 MHz	Conforming to IEC 61255-22-1	Class III
Radiated and conducted emissions		Class B

- *LCD display showing the actual value and the pre-set value*
- *Automatic detection for controlling AC or DC signals*
- *Overload or underload modes selectable*
- *Threshold and hysteresis separately adjustable*
- *Memory function in the event of a fault*
- *Delay on threshold crossing*

OPERATING PRINCIPLE

These devices control an AC or DC electric signal.

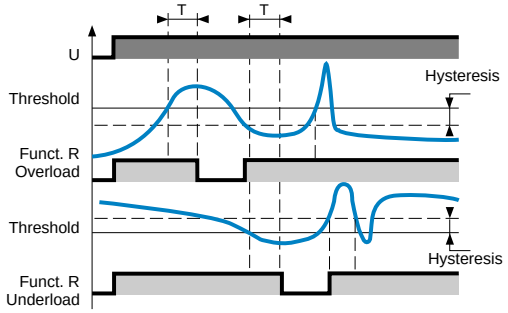
The threshold and hysteresis can be adjusted separately via two potentiometers on the front panel of the device. Before powering up the device, the operating mode must be selected using two DIP switches on the underside of the device (with/without memory, over/under value).

The mode is validated when power is applied to terminals A1–A2.

The signal to be monitored is connected between terminal E1, E2, or E3 (depending on the range) and terminal M.

Voltage or current control, without memory

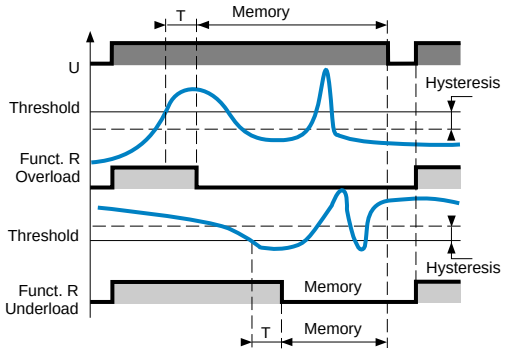
When the value of the controlled signal (AC or DC) reaches the threshold set on the front panel, the output relay opens (fail-safe) at the end of time delay T. It closes immediately when the signal falls below (or rises above, in under-value mode) the threshold minus hysteresis (plus hysteresis, in under-value mode).



Voltage or current control, with memory

When the threshold is reached, the output relay opens at the end of time delay T and remains in that position. The relay is reset by switching off the power supply.

This operating mode enables the detection of over or under values of short duration.



NOTE: The threshold-crossing time delay T, which can be adjusted on the front panel from 0.1 to 3 s, ensures immunity to transients and other interference, to prevent false triggering of the output relay.

In Under Value mode, the absolute value of the hysteresis cannot exceed the maximum of the measurement range.

Programming: display

Normal mode

In this mode, the device displays the value of the measured signal, its form (Vac or Vdc), the mode selected (OVER or UNDER), the memory function (ON or OFF), and the state of the output relay.

The display indicates a measurement overflow with three dashes on the screen and the flashing symbol OVER.

Parameter entry mode

To modify one of the three parameters (Threshold, Hysteresis or Threshold Delay), set the corresponding potentiometer. The value of the modified parameter automatically appears.

After 2 s, the current value of the measured signal reappears in the display (return to Normal mode).

Parameter display mode

To review the parameters, press the push button (VISU) several times in succession to cycle through the settings. Keep the push button depressed to scroll through the values.

Exception

In Under mode (underload), since the hysteresis always exceeds the threshold, it may exceed the maximum measurement range according to the settings *(Threshold + Hysteresis > Max. Threshold).* To remedy this problem, when the hysteresis or threshold setting proportions exceed the management capacity, the value of the hysteresis is automatically corrected so that it does not exceed the range maximum. In addition, the UNDER symbol flashes.

RM84872305

SELECTION

Control relay with LCD display: Voltage-Current

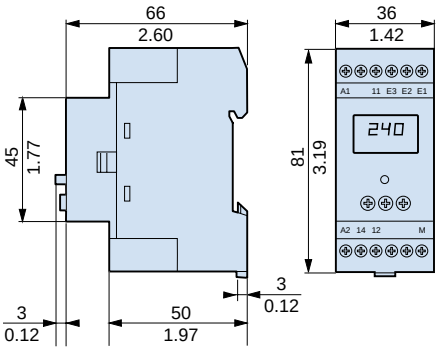
Measurement	Supply voltage	Catalog Number	Weight, oz (kg)
0.2 –60 V	230 Vac	**RM84872305**	5.6 (0.160)
15 –600 V	230 Vac	**RM84872310**	5.6 (0.160)
2–500 mA	230 Vac	**RM84871305**	5.6 (0.160)
0.1–10 A	230 Vac	**RM84871310**	5.6 (0.160)

Supply characteristics			
Supply voltage		**Vac**	230 (50/60 Hz)
Operating range			0.85–1.10 × Un
Maximum power consumption		**VA**	3
Immunity to microbreaks		**ms**	10
Delay on pick-up		**ms**	500
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4 kV/3
Output characteristics			
Relay type			1 C/O contact, AgCdO, 5 A, 250 V
Minimum current		**mA**	100
Mechanical life			5 to 10^6 operating cycles (see ▲ on page 11)
Electrical life	AC-12	**VA**	1250, 10^5 operating cycles (see ▲ on page 11)
	AC-15		Cos φ = 0.3, 6000 operating cycles (see ▲ on page 11)
	DC-13		L/R = 300 ms, 6000 operating cycles (see ▲ on page 11)
Delay on crossing the threshold			0.1–3 s ±10%
LCD display			Relay state. Over or Under mode. Memory function. Type of signal (AC or DC). Measurement overflow.
Other characteristics			
Protection class	Conforming to IEC 529		Terminal block: IP 20, front panel: IP 40, enclosure: IP 50
Enclosure			Self-extinguishing
Terminal capacity	With cable end	**AWG (mm²)**	Two #16 (1.5)
	Without cable end	**AWG (mm²)**	Two #14 (2.5)
Tightening torque		**lb-in (N•m)**	5.3 (0.6) maximum
Temperature limits		**°F (°C)**	**Operation:** -4 to +140 (-20 to +60); **Storage:** -22 to +158 (-30 to +70)
Relative humidity			93% without condensation
Dielectric strength	Conforming to IEC 255-5	**kV**	2.5/1 min/1 mA/50 Hz
Approvals	c UL us	File E173076 CCN NRNT File E173076 CCN NRNT 7	CSA File 217698 Guide 3211 07 CE

Voltage control relay input characteristics								
Relay type			**RM84872305**			**RM84872310**		
Input circuits			E1-M	E2-M	E3-M	E1-M	E2-M	E3-M
Measurement ranges		**V**	0.2–2	1–10	6–60	15–150	30–300	60–600
Input resistance		**kΩ**	2	10	60	100	300	650
Maximum continuous voltage at 68 °F (20 °C)		**V**	4	20	120	200	350	650
Peak overload	< 1 ms at 68 °F (20 °C)	**V**	50	100	300	–	–	–
	< 50 ms at 68 °F (20 °C)	**kV**	–	–	–	2	2	2
Current control relay input characteristics								
Relay type			**RM84871305**			**RM84871310**		
Input circuits			E1-M	E2-M	E3-M	E1-M	E2-M	E3-M
Measurement ranges			2–20 mA	10–100 mA	50–500 mA	0.1–1 A	0.5–5 A	1–10 A
Input resistance		Ω	5	1	0.2	0.1	0.02	0.01
Maximum continuous current at 68 °F (20 °C)			40 mA	200 mA	1 A	2 A	10 A	14 A
Peak overload	< 1 ms at 68 °F (20 °C)	**A**	1	5	8	17	20	50
General input characteristics								
Maximum line voltage			Mains 277 / 480 Vac					
Hysteresis			Adjustable from 5 to 50% of threshold					
Frequency of AC signal measured		**Hz**	40–500					
Threshold setting accuracy			±10%					
Repeat accuracy			±0.1% with constant parameters					
Temperature drift			±0.05% per °C					
Voltage drift			≤ 0.5%					

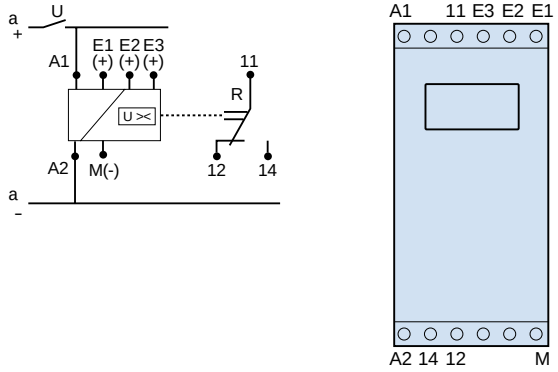
DIMENSIONS (approximate)

RM84871305, RM84871310, RM84872305, RM84872310



Dimensions: $\frac{mm}{in.}$

WIRING



RM84871 Current Measurement Relays

Input current to be measured into proper terminal (E1, E2, or E3)

RM84872 Voltage Measurement Relays

Input voltage to be measured into proper terminal (E1, E2, or E3)

RM4T

FUNCTIONS

These devices monitor three-phase supplies, and protect motors and other loads against the faults listed in the table below. They have a transparent, hinged cover on their front face to prevent accidental alteration of the settings. This cover can be sealed.

Fault	RM4TG	RM4TU	RM4TR	RM4TA
Phase Reversal	Yes	Yes	Yes	Yes
Phase Loss	Yes	Yes	Yes	Yes
Undervoltage	No	Yes	No	No
Overvoltage and Undervoltage (2 thresholds)	No	No	Yes	No
Phase Imbalance	No	No	No	Yes

Applications

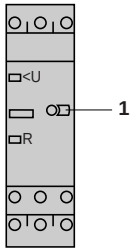
- Control for connection of moving equipment (site equipment, agricultural equipment, refrigerated trucks)
- Control for protection of personnel and equipment against the consequences of reverse running (lifting, handling, elevators, escalators, etc.)
- Control of sensitive three-phase supplies
- Phase loss protection
- Normal/emergency power supply switching

Features

RM4TG

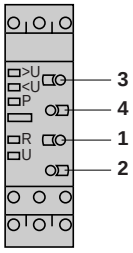
R Yellow LED: Indicates relay output state.

RM4TU

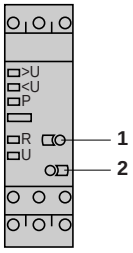


R Yellow LED: Indicates relay output state.
< U Red LED: Undervoltage fault.
1 Undervoltage setting potentiometer.

RM4TR31
RM4TR32

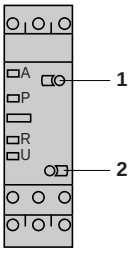


RM4TR33
RM4TR34

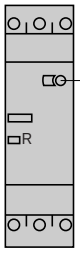


1 Time delay function selector:
⊠ Fault detection delayed (off delay).
▬ Fault detection extended (on delay).
2 Potentiometer for setting time delay in s.
3 Potentiometer for setting overvoltage.
4 Potentiometer for setting undervoltage.
R Yellow LED: Indicates the relay state.
U Green LED: Indicates that the relay power supply is on.
> U Red LED: Overvoltage fault.
< U Red LED: Undervoltage fault.
P Red LED: Phase failure or phase reversal.

RM4TA3



RM4TA0



1 Phase imbalance setting potentiometer, from 5–15%
2 Potentiometer for setting time delay, 0.1 to 10 s.
R Yellow LED: Indicates the relay state.
U Green LED: Indicates that the relay power supply is on.
A Red LED: Phase imbalance.
P Red LED: Phase failure or phase reversal.

OPERATING PRINCIPLE

The supply voltage to be monitored is connected to product terminals L1, L2, and L3.
RM4T relays are self-powered by terminals L1, L2, and L3; they require no separate power supply.

- Monitoring rotation direction of phases and detection of complete loss of one or more phases (**RM4T** all models)

  When terminals L1, L2, and L3 are energized, the relay is energized and the yellow LED comes on only if *(a)* the rotation direction of phases is correct, and *(b)* all three phases are present. If one or more phases have failed, or if the rotation direction is incorrect, the relay is not energized at switch-on. In normal operation (no fault), the relay is energized; it de-energizes instantaneously (or after the time delay) if one or more phases fails. To prevent detection of the absence or failure of a single phase, a voltage exceeding the detection threshold (≈130 V on RM4TG, undervoltage threshold setting on RM4TU and RM4TR) can be generated back through the control circuit. For this purpose, we recommend using RM4TA relays. The illumination of LED **P** signals the absence of a phase on RM4TR and RM4TA.

- Overvoltage and undervoltage detection (**RM4TR**):

  In normal operation, the relay is energized and LEDs **U** and **R** are lit.
  If the average of the three voltages between phases fluctuates outside the range to be monitored, the output relay is de-energized.

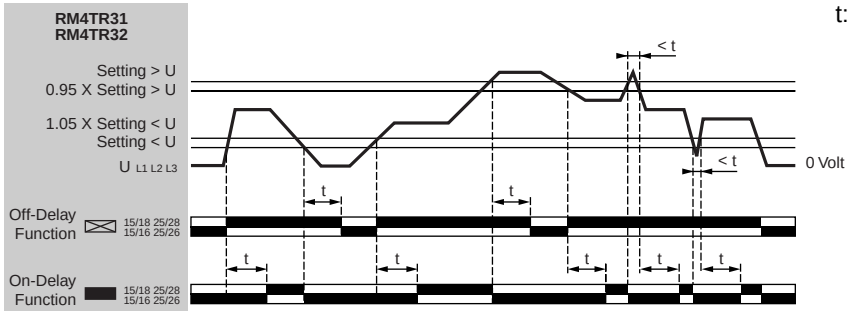
  — Overvoltage: the Red LED "> U" illuminates.

  — Undervoltage: the Red LED "< U" illuminates.

  When the supply returns toward its rated value, the relay is re-energized according to the hysteresis value (5%), and the corresponding red LED goes out. A switch allows selection of a time delay, adjustable from 0.1 s to 10 s. With the off-delay function ⊠, over- or undervoltages have no effect. With the on-delay function ▬, over- or undervoltages delay the re-energization of the relay. Regardless of the switch setting, an over- or undervoltage is detected only if its duration exceeds the measuring cycle time (80 ms).

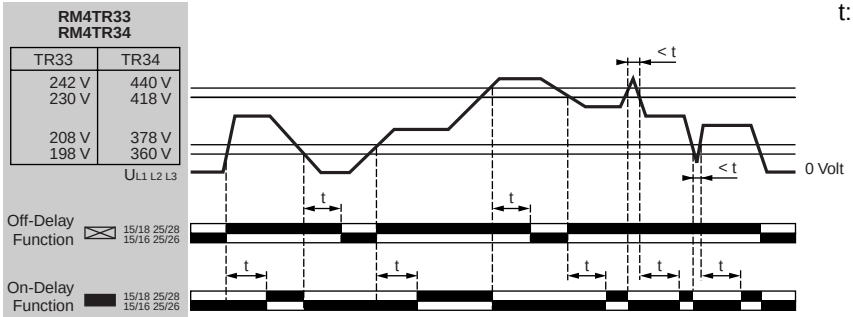
Function Diagram (RM4TR31, RM4TR32)

t: time delay



Function Diagram (RM4TR33, RM4TR34)

t: time delay



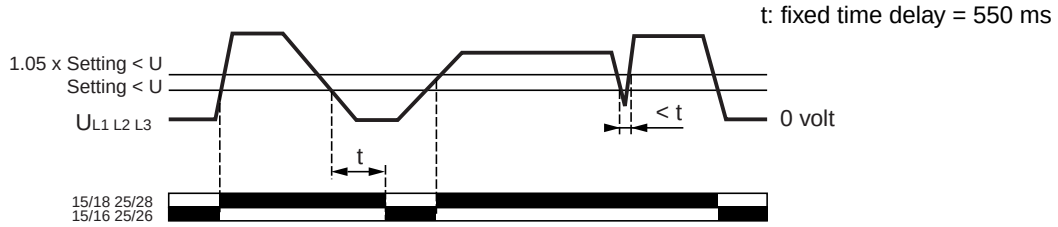
OPERATING PRINCIPLE

- Undervoltage detection only (**RM4TU**)

  In normal operation, the output relay is energized and the yellow LED is lit.

  When the average of the three voltages between phases falls below the undervoltage threshold setting, the relay is de-energized after 550 ms and the red LED "< U" illuminates.

Function Diagram



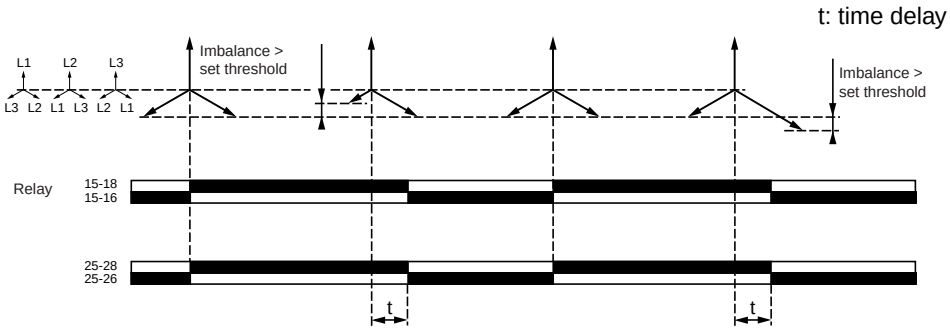
- Detection of phase imbalance (**RM4TA**)

  In normal operation, the output relay is energized and the yellow and green LEDs are lit.

  In the event of an imbalance fault, after a time delay set between 0.1 s and 10 s (on RM4TA3 only), the output relay is de-energized, the yellow LED goes out, and red LED **A** illuminates (RM4TA3• only).

  The relay re-energizes when the measured imbalance value drops below 50% of the imbalance setting (hysteresis).

Function Diagram



Example: Imbalance set at 10%, mains supply voltage 400 V

— Relay de-energization threshold: $400\ V - 10\% = 360\ V$

— Relay re-energization threshold: $400\ V - \frac{10\%}{2} = 380\ V$

NOTE: Distortion in the sine wave of the three-phase supply can cause the RM4T phase supply control relay to malfunction.

Output relay and operating characteristics

Relay type			RM4 TG	RM4 TU	RM4 TR	RM4 TA
Number of C/O contacts			2 C/O–DPDT 	2 C/O–DPDT 	2 C/O–DPDT 	**RM4 TA3•** 2 C/O–DPDT  **RM4 TA0•** 1 C/O–SPDT 
Output relay state			Energized during fault-free operation. De-energized or unable to energize on detection of rotation direction fault or failure of one or more phases.	Energized during fault-free operation. De-energized on detection of undervoltage or rotation direction fault or failure of one or more phases.	Energized during fault-free operation. De-energized on detection of overvoltage, undervoltage or rotation direction fault or phase failure.	Energized during fault-free operation. De-energized on detection of asymmetry fault, phase failure or rotation direction fault.
Switching threshold setting accuracy	As a percentage of the set value		–	±3%	±3%	±3%
Switching threshold drift	Depending on the permissible ambient temperature		–	≤ 0.06% per °C	≤ 0.06% per °C	≤ 0.06% per °C
	Within the measuring range		–	≤ 0.5%	≤ 0.5%	≤ 0.5%
Time delay setting accuracy	As a percentage of the full-scale value		–	±10%	±10%	±10%
Time delay drift	Within the measuring range		–	≤ 0.5%	≤ 0.5%	≤ 0.5%
	Depending on the rated operational temperature		–	≤ 0.07% per °C	≤ 0.07% per °C	≤ 0.07% per °C
Hysteresis	Fixed		–	About 5% of the de-energization threshold	About 5% of the de-energization threshold	About 50% of the asymmetry percentage
Delay on pick-up		**ms**	< 650	< 650	< 650	< 650
Measuring cycle		**ms**	≤ 80	≤ 80	≤ 80	≤ 80

Measuring input characteristics

Relay type		RM4 TG	RM4 T••1 RM4 TR33	RM4 T••2 RM4 TR34
Nominal voltage	**V**	220–440	**RM4 T••1:** 220–240 **RM4 TR33:** 220	**RM4 T••2:** 380–440 **RM4 TR34:** 400
Maximum operating range	**V**	198–484	160–300	290–484

(1) Minimum voltage required for operation of indicators and of the time delay.

SELECTION

RM4TG20

Control Relays: Phase Reversal and Presence of Phases

Time Delay	Rated Mains Supply Voltage ■		Width in (mm)	Output Relay	Catalog Number	Weight lb (kg)
None	220–440 Vac 50/60 Hz		0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TG20**	0.24 (0.110)

Control Relays: Phase Reversal and Presence of Phases + Undervoltage

Time Delay	Rated Mains Supply Voltage ■	Control Threshold	Width in (mm)	Output Relay	Catalog Number	Weight lb (kg)
None	220–240 V 50/60 Hz	Undervoltage 160–220 V	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TU01**	0.24 (0.110)
	380–440 V 50/60 Hz	Undervoltage 300–430 V	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TU02**	0.24 (0.110)

Control Relays: Phase Reversal and Presence of Phases + Overvoltage and Undervoltage

Relays with Fixed Voltage Thresholds

Adjustable Time Delay	Rated Mains Supply Voltage ■	Control Threshold	Width in (mm)	Output Relay	Catalog Number	Weight lb (kg)
0.1–10 s	220 V 50/60 Hz	Undervoltage 198 V Overvoltage 242 V	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TR33**	0.24 (0.110)
	400 V 50/60 Hz	Undervoltage 360 V Overvoltage 440 V	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TR34**	0.24 (0.110)

RM4TR33

Relays with Adjustable Voltage Thresholds

Adjustable Time Delay	Rated Mains Supply Voltage ■	Control Threshold	Width in (mm)	Output Relay	Catalog Number	Weight lb (kg)
0.1–10 s	220–240 V 50/60 Hz	Undervoltage 160–220 V Overvoltage 220–300 V	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TR31**	0.24 (0.110)
	380–440V 50/60 Hz	Undervoltage 300–430 V Overvoltage 420–480 V	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TR32**	0.24 (0.110)

Control Relays: Phase Reversal and Presence of Phases + Imbalance

Time Delay on De-Energization	Rated Mains Supply Voltage ■	Control Threshold	Width in (mm)	Output Relay	Catalog Number	Weight lb (kg)
Fixed 0.5 s	220–240 V 50/60 Hz	Imbalance 5–15%	0.89 in (22.5 mm)	1 C/O–SPDT	**RM4TA01**	0.24 (0.110)
	380–440 V 50/60 Hz	Imbalance 5–15%	0.89 in (22.5 mm)	1 C/O–SPDT	**RM4TA02**	0.24 (0.110)
Adjustable 0.1–10 s	220–240 V 50/60 Hz	Imbalance 5–15%	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TA31**	0.24 (0.110)
	380–440 V 50/60 Hz	Imbalance 5–15%	0.89 in (22.5 mm)	2 C/O–DPDT	**RM4TA32**	0.24 (0.110)

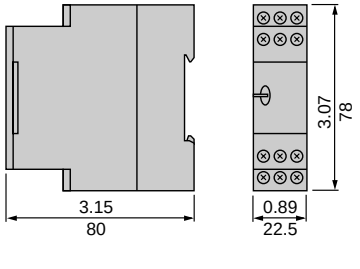
RM4TA01

■ Can be used on other supply voltages if the minimum operational voltages, maximum voltage between phases, and compatibility are within the control threshold ranges shown in the specification table on page 31.

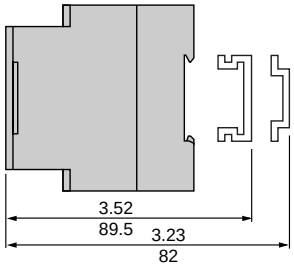
For additional application data, refer to page 2.

DIMENSIONS (approximate)

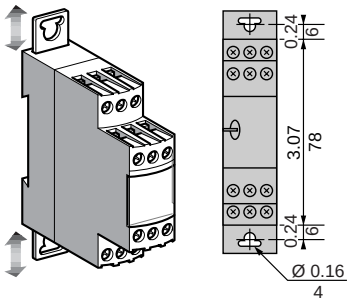
RM4T



Rail Mounting



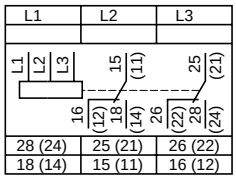
Direct Mounting



Dual Dimensions = $\frac{\text{in}}{\text{mm}}$

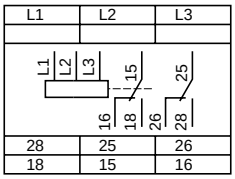
WIRING

Terminal Blocks
RM4TG20, TU0●



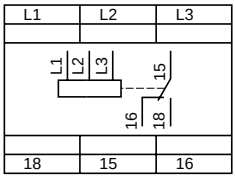
L1, L2, L3	Supply to be monitored
15(11)-18(14)	1st C/O contact
15(11)-16(12)	of the output relay
25(21)-28(24)	2nd C/O contact
25(21)-26(22)	of the output relay

RM4TR3●, TA3●



L1, L2, L3	Supply to be monitored
15–18	1st C/O contact
15–16	of the output relay
25–28	2nd C/O contact
25–26	of the output relay

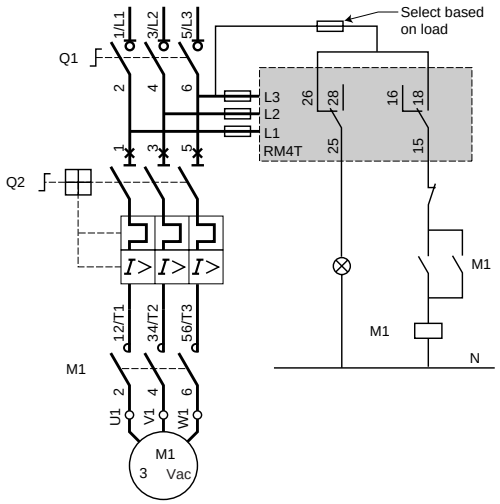
RM4TA0●



L1, L2, L3	Supply to be monitored
15–18	1st C/O contact
15–16	of the output relay

Application Diagram

Example



Suggested Line Fuses for L1, L2, and L3

100 mA, fast blow or standard

- *Optimized installation and space savings (22.5 mm)*
- *No adjustment required to monitor phase failure or phase reversal*
- *Versions with one or two C/O output contacts for selecting the safety level of the installation*
- *Self-powered for ease of installation; uses the controlled supply for its power supply*

OPERATING PRINCIPLE

These relays monitor for:

- correct sequencing of phases L1, L2, and L3
- a total loss of one of these phases

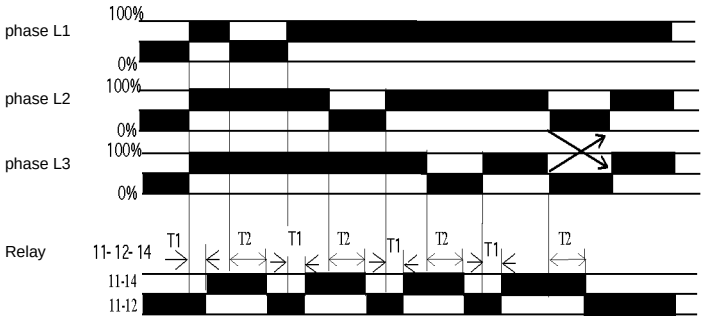
When the phase sequence is correct, the output relay is energized and the yellow LED is lit.

The relay de-energizes and the LED goes out when one of the following faults occurs:

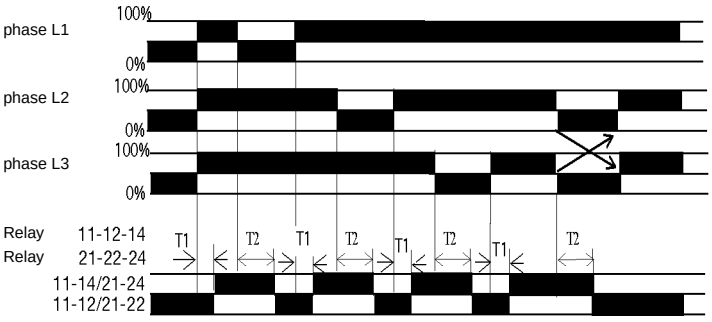
- an incorrect sequence of phases at terminals L1, L2, and L3
- a total loss of one phase or of all three phases (phase failure detection threshold < 50 Vac)

Timing diagrams

RM84873299

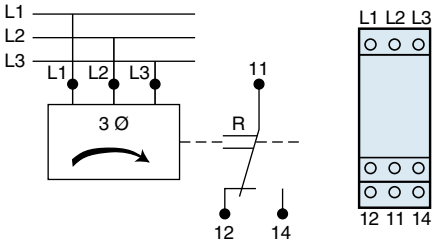


RM84873004

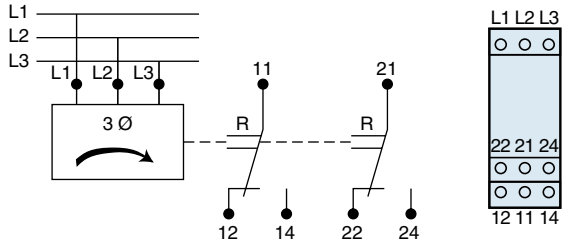


WIRING

RM84873299



RM84873004



RM84873004

SELECTION

Phase control relays

Outputs	Catalog Number	Weight oz (kg)
1 C/O	**RM84873299**	3.5 (0.100)
2 C/O	**RM84873004**	3.5 (0.100)

Input characteristics			
Supply voltage		**Vac**	3 @ 230–400 self-powered
Operating range		**V**	200–500
Frequency			50/60 Hz ±1 Hz
Maximum consumption		**VA**	25
Output characteristics			
Output relay			Cadmium-free
Rated current		**A**	8
Maximum switching voltage		**Vac**	250 / 440
Rated breaking capacity		**VA**	2000
Minimum breaking current		**mA**	10 / 5 V
Electrical life ▲			AC-12: 10^5 operating cycles at 8 A / 250 Vac ▲
Mechanical life ▲			2×10^7 operating cycles ▲
Pick-up delay	t1	**ms**	< 200
Drop-out delay	t2	**ms**	< 300 in the event of loss of one phase
Other characteristics			
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3
Clamping capacity	Without cable end	**AWG (mm^2)**	Two #14 (2.5)
	With cable end	**AWG (mm^2)**	One #12 (4) or two #16 (1.5)
Tightening torque		**lb-in (N•m)**	8.8 (1); M3 screw/IEC 60947-1
Temperature limits	Operation	**°F (°C)**	-4 to +122 (20 to +50)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70)
Enclosure material			Self-extinguishing
Protection class	Terminal block		IP 20
	Enclosure		IP 40
Dielectric strength	Conforming to IEC 60255-5		2.5 kV/1 min/1 mA/50 Hz

Approvals

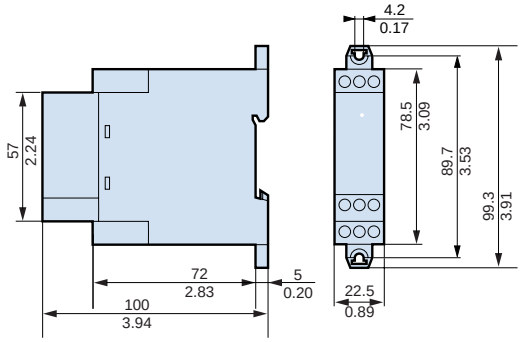
c UL us — File E173076 CCN NRNT
File E173076 CCN NRNT 7

RM84873299 only
File 217698
Guide 3211 07

CE

▲ The expected life expressed above is based on average usage and normal operating conditions. Actual operating life will vary with conditions. The above statements are not intended to nor shall they create any expressed or implied warranties as to product operation or life. For information on the listed warranty offered on this product, refer to the Square D terms and conditions of sale found in the *Digest.*

DIMENSIONS (approximate)



Dimensions: mm / in.

- *Control:*
  - *— phase sequence*
  - *— phase failure*
  - *— voltage drop on one or more phases*
- *Regeneration rate: 90% of Un*
- *Power supply: 3 @ 230 Vac and 3 @ 400 Vac*
- *Dual frequency: 50 and 60 Hz*
- *Yellow LED: phase presence and relay state*
- *Relay output: two C/O contacts, 8 A*

OPERATING PRINCIPLE

These relays monitor for:

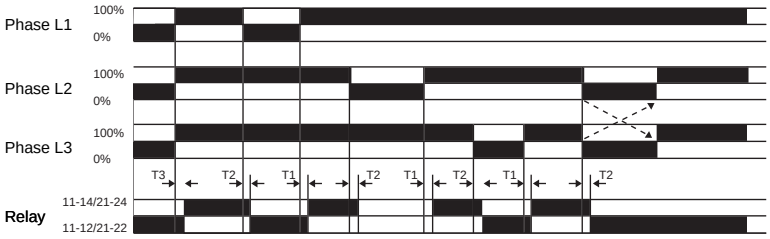
- correct sequencing of phases L1, L2, and L3
- a regeneration rate equal to 90% (-10% of Un)

When the phase sequence is correct, the output relay is energized and the yellow LED is lit.

The relay de-energizes and the LED goes out when one of the following faults occurs:

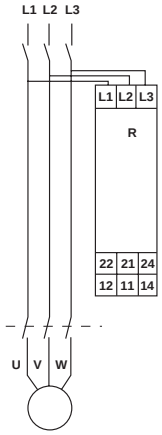
- incorrect sequence of phases at terminals L1, L2, and L3
- voltage drop on one or more phases

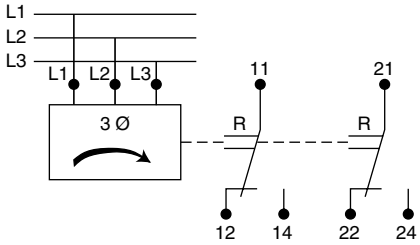
Timing diagrams



T3 < 200 ms

WIRING





RM84873511
RM84873512

RM84873511

SELECTION

Phase control relays

Voltage	Catalog Number	Weight oz (kg)
230 Vac	**RM84873511**	4.2 (0.120)
400 Vac	**RM84873512**	4.2 (0.120)

Input characteristics

Supply voltage		**Vac**	3 @ 230 and 3 @ 400 self-powered
Operating range			-20 to +15% Un
Frequency			50–60 Hz ±1 Hz
Maximum consumption at Un		**VA**	17 at 50 Hz (20 at 60 Hz)
		VA	23 +15% at 50 Hz (27 at 60 Hz)

Output characteristics

Output type			2 cadmium-free C/O contacts
Rated current		**A**	8
Maximum switching voltage		**Vac**	250 / 440
Rated breaking capacity		**VA**	2000
Minimum breaking current		**mA**	100 / 12 V
Electrical life ▲			AC-12: 10^5 operating cycles at 8 A/ 250 Vac ▲
Mechanical life ▲			2×10^7 operating cycles ▲
Time to onset of fault t2 (dropout)		**ms**	< 200
Time to disappearance of fault t1 (pickup)		**ms**	< 200
Clamping capacity	Without cable end	**AWG (mm²)**	One #12 (4) or two #14 (2.5)
	With cable end	**AWG (mm²)**	Two #16 (1.5)

Other characteristics

Tightening torque		**lb-in (N•m)**	8.8 (1); M3 screw/IEC 60947-1
Temperature limits	Operation	**°F (°C)**	-4 to +122 (-20 to +50)
	Storage	**°F (°C)**	-40 to +158 (-40 to +70)
Humidity			95% max. without condensation
Enclosure material			Self-extinguishing
Protection class	Terminal block		IP 20
	Enclosure		IP 40
Dielectric strength	Conforming to IEC 60255-5	**kV**	2.5/1 min/1 mA/50 Hz
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4 kV/3
Insulation coordination	Conforming to IEC 60664-1		Overvoltage category III; degree of pollution 3; 4 kV/3
Vibration	Amplitude	**mm**	0.35 peak
Conforming to IEC 60068-2-6	Frequency	**Hz**	10–55

Approvals c UL us File E173076 CCN NRNT, File E173076 CCN NRNT 7 — SA File 217698, Guide 3211 07 — CE

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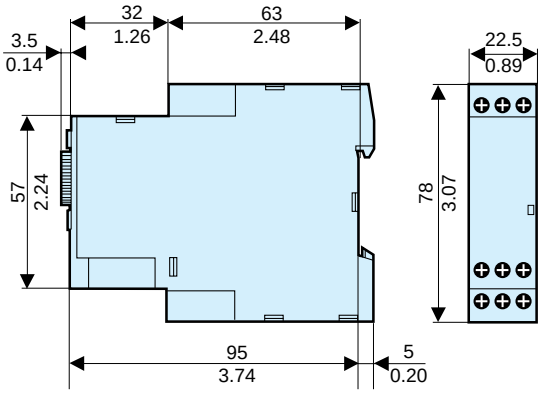
DIMENSIONS (approximate)



Dimensions: mm / in.

- *Control:*
  - *phase imbalance (asymmetry)*
  - *phase sequence*
  - *phase failure*
  - *voltage drop on one or more phases*
- *Asymmetry rate adjustable on the front panel: -5% to -15% of Un*
- *Power supply: 3 @ 230 Vac and 3 @ 400 Vac*
- *Dual frequency: 50 and 60 Hz*
- *Yellow LED: phase presence and relay state*
- *Relay output: two C/O contacts, 8 A*

OPERATING PRINCIPLE

These relays monitor for:

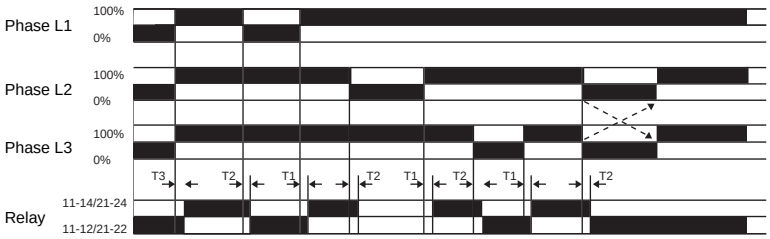
- correct sequencing of phases L1, L2, and L3
- a regeneration rate of -5% to -15% of Un

When the phase sequence is correct, the output relay is energized and the yellow LED is lit.

The relay de-energizes and the LED goes out when one of the following faults occurs:

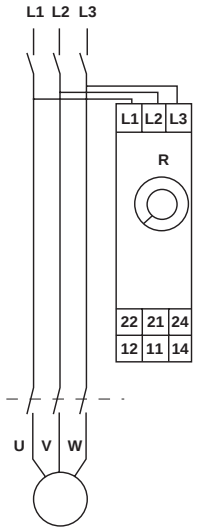
- incorrect sequence of phases at terminals L1, L2, and L3
- voltage drop on one or more phases

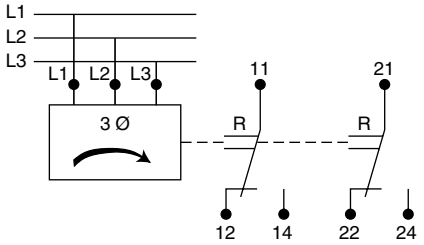
Timing diagrams



T3 < 200 ms

WIRING





RM84873501
RM84873502

RM84873501

SELECTION

Phase asymmetry control relays

Voltage	Catalog Number	Weight, oz (kg)
230 Vac	**RM84873501**	4.2 (0.120)
400 Vac	**RM84873502**	4.2 (0.120)

Input characteristics

Supply voltage		**Vac**	3 @ 230 and 3 @ 400 self-powered
Operating range			-20 to +15% Un
Frequency			50–60 Hz ±1 Hz
Maximum consumption at Un		**VA**	17 at 50 Hz (20 at 60 Hz)
		VA	23 +15% at 50 Hz (27 at 60 Hz)

Output characteristics

Output type			2 cadmium-free C/O contacts
Rated current		**A**	8
Maximum switching voltage		**Vac**	250 / 440
Rated breaking capacity		**VA**	2000
Minimum breaking current		**mA**	100 / 12 V
Electrical life ▲			AC-12: 10^5 operating cycles at 8 A/ 250 Vac ▲
Mechanical life ▲			2×10^7 operating cycles ▲
Time to onset of fault t2 (dropout)		**ms**	< 200
Time to disappearance of fault t1 (pickup)		**ms**	< 200
Clamping capacity	Without cable end	**AWG (mm²)**	One #12 (4) or two #14 (2.5)
	With cable end	**AWG (mm²)**	Two #16 (1.5)

Other characteristics

Tightening torque		**lb-in (N•m)**	8.8 (1); M3 screw/IEC 60947-1
Temperature limits		**°F (°C)**	**Operation:** -4 to +122 (-20 to +50); **Storage:** -40 to +158 (-40 to +70)
Humidity			95% max. without condensation
Enclosure material			Self-extinguishing
Protection class	Terminal block		IP 20
	Enclosure		IP 40
Dielectric strength	Conforming to IEC 60255-5	**kV**	2.5/1 min/1 mA/50 Hz
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3
Vibration	Amplitude	**mm**	0.35 peak
Conforming to IEC 60068-2-6	Frequency	**Hz**	10–55
Approvals	c UL us File E173076 CCN NRNT, File E173076 CCN NRNT 7		SA File 217698, Guide 3211 07 CE

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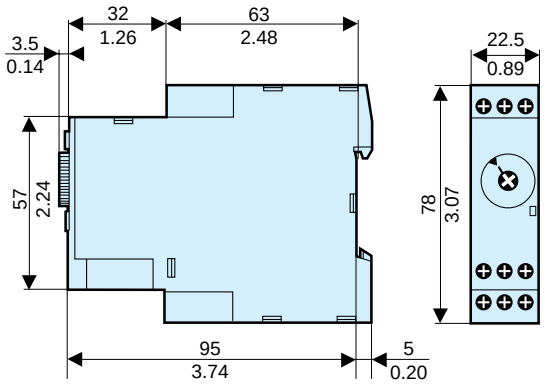
DIMENSIONS (approximate)



Dimensions: mm / in.

- *Control:*
  - *phase sequence*
  - *loss of one or more phases*
  - *undervoltage*
- *Senses its own supply voltage*
- *Potentiometer for adjusting mains power*
- *Adjustable time delay in the event of a fault: 0.2–10 s*
- *Relay output: two C/O contacts, 8 A*
- *Two LEDs: power on and relay state*

NOTE: Time delay T is not operational during loss of L1 and L2. It operates during loss of L3, phase inversion, or voltage drop. Its purpose is to avoid false triggering of the output relays during transient states, notably during motor starting.

OPERATING PRINCIPLE

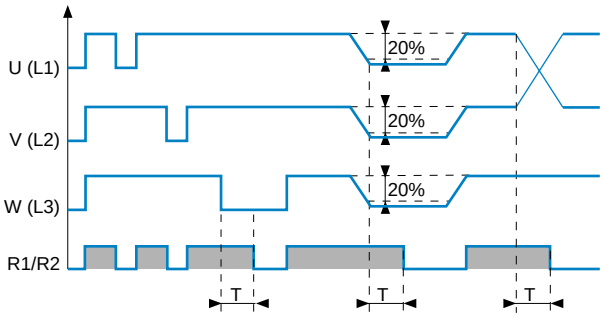
On a three-phase supply, this relay simultaneously monitors:

- phase sequence
- loss of a phase, with a maximum regeneration rate of 70% of the voltage indicated by a potentiometer on the front panel
- symmetrical voltage drop on the three phases of less than 20% of the pre-set value

When the three phases are in sequence, the output relay is energized and the yellow LED is lit.

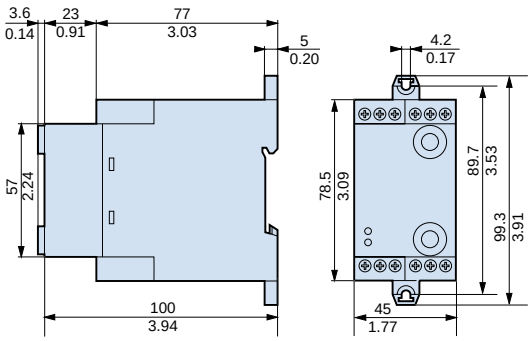
The output relay de-energizes and the LED goes out (after time delay T, adjustable from 0.2–10 s on the front panel) when one of the following faults occurs:

- reversed direction of phase rotation
- absence of one or more phases
- voltage drop



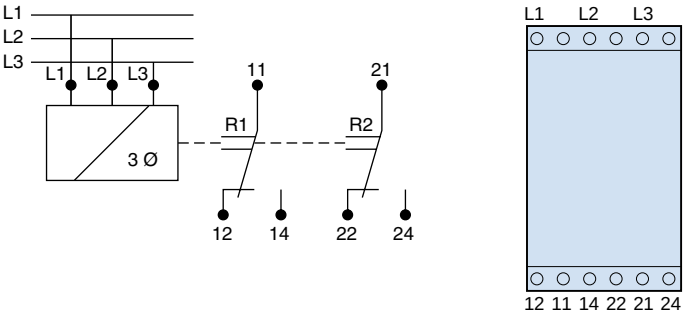
DIMENSIONS (approximate)

RM84873010
RM84873012
RM84873015
RM84873016



Dimensions: mm / in.

WIRING



RM84873010

SELECTION

Phase sequence and loss of phase control relays

Voltage	Setting range Vac	Catalog Number	Weight oz (kg)
3 @ 230 Vac	180–260	**RM84873010**	12.3 (0.350)
3 @ 400 Vac	320–460	**RM84873012**	12.3 (0.350)
3 @ 480 Vac	380–550	**RM84873015**	12.3 (0.350)
3 @ 575 Vac	460–660	**RM84873016**	12.3 (0.350)

Technical characteristics

Supply			Self-powered, terminals L1–L2
Operating range			0.7–1.2 × Un
Frequency		**Hz**	50/60
Maximum consumption		**VA**	6
Immunity to microbreaks		**ms**	10
Delay on pick-up		**ms**	500
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3

Input characteristics

Measurement input resistance		**kΩ**	1 at Un
Regeneration rate			max. 70% of the threshold setting
Undervoltage detection (symmetrical drop)			a 20% of the threshold setting
Threshold setting accuracy			±10%

Output characteristics

Output type			2 C/O contacts, AgCdO
Breaking capacity			2000 VA (AC), 80 W (DC)
Maximum breaking current	AC/DC	**A**	8
Minimum breaking current	AC/DC	**mA**	100
Maximum switching voltage		**Vac/Vdc**	250
Electrical life ▲	AC-12		2000 VA, 10^5 operating cycles ▲
	AC-15		Cos φ = 0.3, 6000 operating cycles ▲
	DC-13		L/R = 300 ms, 6000 operating cycles ▲
Time delay in the event of a fault		**s**	0.2–10 Max.: 10–15

Other characteristics

Indication	Power on		Green LED
	Relay		Yellow LED
Enclosure			Self-extinguishing
Terminals	Without cable end	**AWG (mm²)**	Two #14 (2.5)
	With cable end	**AWG (mm²)**	Two #16 (1.5)
	Tightening torque	**lb-in (N•m)**	5.3 (0.6) max.
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70)
Relative humidity			93% without condensation
Vibration	Amplitude	**mm**	0.35
	Frequency	**Hz**	10–55
Insulation resistance	Conforming to IEC 60664-1	**MΩ**	> 100 at 500 V
Dielectric strength		**kV**	3 at 1 mA for 1 minute/50 Hz
Approvals	c UL us File E173076 CCN NRNT File E173076 CCN NRNT 7		SA File 217698 Guide 3211 07 CE

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- *Control:*
  - *— phase imbalance (asymmetry)*
  - *— phase sequence*
  - *— disconnection of one or more phases with regenerated voltage equivalent to 95% of Un*
- *Asymmetry rate adjustable on the front panel: 5–20%*
- *Three-phase power supply: 3 @ 230 Vac and 3 @ 400 Vac*
- *Dual frequency: 50 and 60 Hz*
- *Two LEDs: indicate phase presence and relay state*
- *Adjustable time delay in the event of a fault: 0.5–10 s*
- *Relay output:*
  - *— one C/O contact, 8 A*
  - *— two C/O contacts, 8 A*

OPERATING PRINCIPLE

The device is self-powered by two phases. A green LED indicates that the power supply is on.

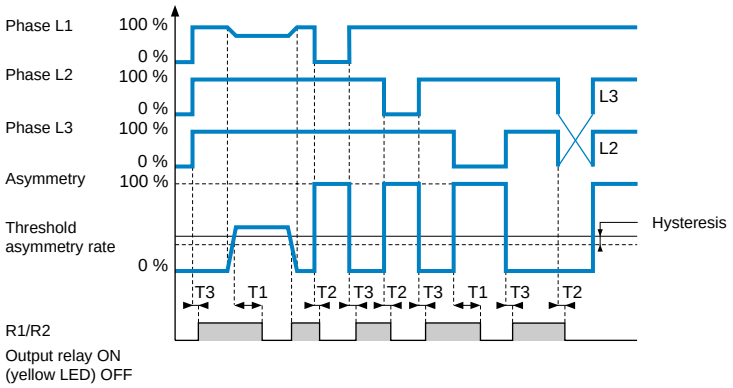
When the phase sequence is correct and the asymmetry rate is lower than the threshold indicated on the front panel, the output relay is energized and the yellow phase presence LED is lit.

The output relay de-energizes after a delay T1 (adjustable on the front panel) when one of the following faults occurs:

- incorrect phase sequence
- absence of L3
- asymmetry rate higher than the threshold setting: an imbalance representing an increase or decrease in the voltage of two phases compared to the voltage of a different phase

The output relay de-energizes instantaneously in the event of a phase loss on L1 or L2. A hysteresis fixed at about 10% ensures bounce-free relay switching around the threshold.

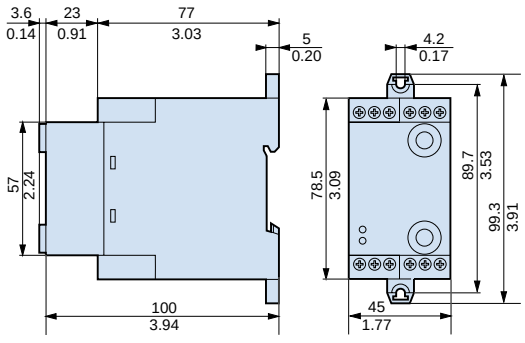
Since differential measurement is used, the relay does not react to symmetrical increases or decreases in the mains supply.



T1: Delay after a fault
T2: Delay on power-down
T3: Delay on power-up.

DIMENSIONS (approximate)

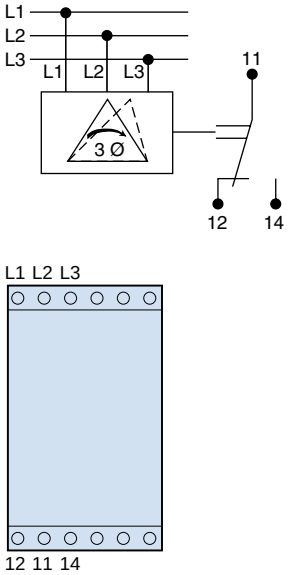
RM84873300, RM84873301, RM84873310, RM84873311



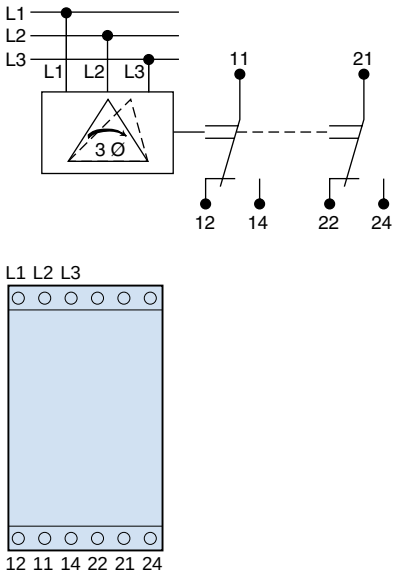
Dimensions: mm / in.

WIRING

RM84873300, RM84873301



RM84873310, RM84873311



RM84873300

SELECTION

Phase asymmetry control relays, self-powered

Number of output contacts	Supply voltages measured	Catalog Number	Weight oz (kg)
1	3 @ 230 Vac	**RM84873300**	12.7 (0.360)
	3 @ 400 Vac	**RM84873301**	12.7 (0.360)
2	3 @ 230 Vac	**RM84873310**	12.7 (0.360)
	3 @ 400 Vac	**RM84873311**	12.7 (0.360)

Auxiliary power supply characteristics			
Auxiliary voltage	self-powered from terminals L1-L2	**Vac**	230, 400
Operating range			0.8–1.2 × Un
Frequency		**Hz**	50–60
Maximum consumption		**VA**	4 at Un, 8 at Un +20%
Immunity to microbreaks		**ms**	10
Delay on power-up	t3	**s**	1 max.
Delay on power-down	t2		300 max.
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3
Input characteristics			
3-phase supply	Rated voltage	**Vac**	3 @ 230, 3 @ 400
	Operating range	**Vac**	185–275, 320–480
Frequency (can be altered via switch beneath the device)		**Hz**	50–60
Regeneration rate			max. 95% of Un
Asymmetry rate adjustment			5–20% of Un
Threshold setting accuracy	Conforming to VDE 0435		±20% at full scale
Temperature drift			0.1% per °C
Repeat accuracy			±1% at full scale
Fixed hysteresis			10% of the threshold setting
Output characteristics			
Output type			1 or 2 C/O contact, AgCdO
Breaking capacity			2000 VA (AC), 80 W (DC)
Maximum breaking current	AC/DC	**A**	8
Minimum breaking current	AC/DC	**mA**	100
Maximum switching voltage		**Vac/Vdc**	250
Electrical life	AC-12		2000 VA, 10^5 operating cycles (see ▲ on page 41)
	AC-15		Cos φ = 0.3, 6000 operating cycles (see ▲ on page 41)
	DC-13		L/R = 300 ms, 6000 operating cycles (see ▲ on page 41)
Mechanical life			5×10^6 operating cycles (see ▲ on page 41)
Other characteristics			
Time delay in the event of fault t1		**s**	0.5–10, Max.: 10–16
Indication	Supply		Green LED
	Relay		Yellow LED
Protection class	Terminal block		IP 20
	Enclosure		IP 30
Enclosure			Self-extinguishing
Terminal block clamping capacity	Without cable end	**AWG (mm^2)**	Two #14 (2.5)
	With cable end	**AWG (mm^2)**	Two #16 (1.5)
	Tightening torque	**lb-in (N•m)**	5.3 (0.6) max. (M3 screw/IEC 60947-1)
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60, conforming to IEC 60068-2-14)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70, conforming to IEC 60068-2-1/2)
Relative humidity	Conforming to IEC 60068-2-30		93% without condensation
Vibrations	Amplitude	**mm**	0.35
(conforming to IEC 68-2-6)	Frequency	**Hz**	10–55
Insulation resistance	Conforming to IEC 60255-5	**mΩ**	> 100 at 500 Vac
Dielectric strength	Conforming to IEC 60255-5	**kV**	2.5 / 1 min / 1 mA / 50 Hz
Impulse voltage	Conforming to IEC 60255-5/664-1	**kV**	5/wave 1.2–50 µs
Approvals	c UL us File E173076 CCN NRNT, File E173076 CCN NRNT 7		SA File 217698, Guide 3211 07 — CE — **GL•: RM8487330• only**

- *Controls overvoltage and undervoltage on its own power supply (window type)*
- *RM84873201: phase to phase*
  RM84873211: between phase and neutral
- *Minimum and maximum thresholds separately adjustable*
- *Absence of neutral detected on relay RM84873211*
- *Delay on crossing the upper or lower threshold, adjustable from 0.1–10 s on the front panel of the device*
- *Two yellow LEDs: overvoltage and undervoltage*
- *One green LED: power on*
- *Two output relays: upper and lower threshold*
- *Two separate time delays*

Tr = about 3 s
T1 = adjustable fault delay: 0.1–10 s
T2 = adjustable fault delay: 0.1–10 s

OPERATING PRINCIPLE

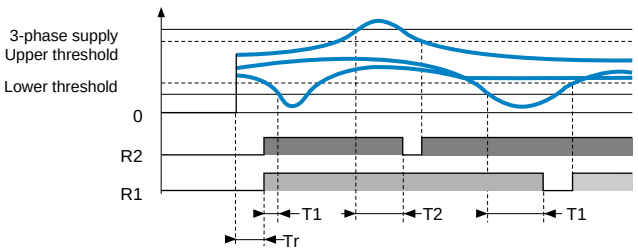
The two output contacts are energized when the measured voltages are between the minimum and maximum thresholds, separately adjustable using two potentiometers on the front panel of the device.

When one or more voltages fluctuates outside the window between the two thresholds, the relay corresponding to the fault de-energizes (following a delay adjustable on the front panel). Each relay can have its own individual time delay (0.1 to 10 s).

A hysteresis fixed at 3% ensures bounce-free relay switching when the voltage levels return to a value between the upper and lower thresholds.

The device is not affected by the phase sequence or harmonic distortion.

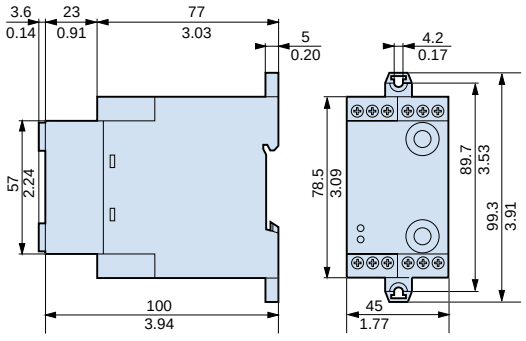
A green LED indicates that the power supply is on. Two yellow LEDs indicate when the upper and lower thresholds are exceeded: they are lit when the voltages are within the set window.



Catalog Number	Lower threshold	Upper threshold
RM84873201	340–392	408–460
RM84873211	195–225	235–264

DIMENSIONS (approximate)

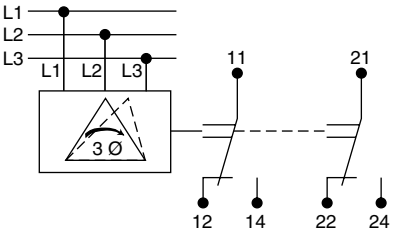
RM84873201, RM84873211

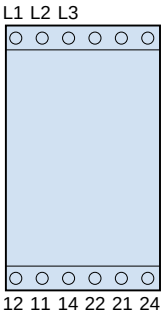


Dimensions: $\frac{mm}{in.}$

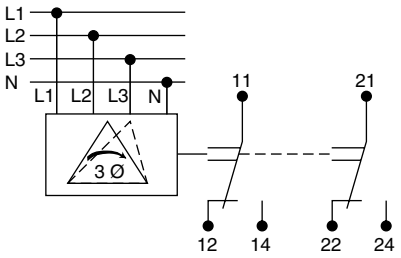
WIRING

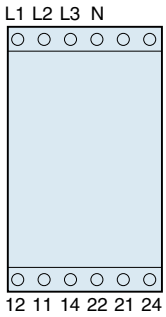
RM84873201





RM84873211





RM84873211

SELECTION

Voltage control relays for 3-phase supply

Power supplies measured	Catalog Number	Weight oz (kg)
3 @ 400 Vac	**RM84873201**	10.9 (0.310)
3 @ 400 Vac + neutral	**RM84873211**	10.9 (0.310)

Supply characteristics

Supply voltage Un on terminals L1-L2		**Vac**	400 ±30% (50/60 Hz)
Maximum power		**VA**	4 at Un 8 at Un +20%
Immunity to microbreaks		**ms**	10
Delay on pick-up		**s**	About 3
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3

Control circuit characteristics

Adjustment of upper threshold			102–115% of Un
Adjustment of lower threshold			85–98% of Un
Fault delay		**s**	0.1–10 (0 to +50%)
Hysteresis			About 3%
Setting accuracy			±10%
Repeat accuracy	Upper threshold		0.06%
	Lower threshold		0.09%
Temperature drift			±0.05% per °C

Output circuit characteristics

Output			2 C/O contacts, AgCdO
Breaking capacity			2000 VA (AC), 80 W (DC)
Maximum breaking current	AC/DC	**A**	8
Minimum breaking current	AC/DC	**mA**	100
Maximum switching voltage		**Vac or Vdc**	250
Mechanical life			30×10^6 operating cycles (see ▲ on page 41)
Electrical life	AC-12		2000 VA, 10^5 operating cycles (see ▲ on page 41)
	AC-15		Cos φ = 0.3, 6000 operating cycles (see ▲ on page 41)
	DC-13		L/R = 300 ms, 6000 operating cycles (see ▲ on page 41)

Other characteristics

Delay on crossing the threshold		**s**	0.1–10 Max.: 10–15)
Indication	Supply		Green LED
	Overvoltage relay		Yellow LED
	Undervoltage relay		Yellow LED
Protection class	Terminal block		IP 20
Conforming to IEC 60529-5	Enclosure		IP 50
Enclosure			Self-extinguishing
Terminal capacity	With cable end	**AWG (mm^2)**	Two #16 (1.5)
	Without cable end	**AWG (mm^2)**	Two #14 (2.5)
Tightening torque	Conforming to IEC 60947-1	**lb-in (N•m)**	5.3 (0.6) max. (M3 screw)
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60, conforming to IEC 60068-1-14)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70, conforming to IEC 60068-1-1/2)
Relative humidity	Conforming to IEC 60068-2-30		93% without condensation
Vibrations	Amplitude	**mm**	0.35
Conforming to IEC 682-6	Frequency	**Hz**	10–55
Insulation resistance	Conforming to IEC 60255-5	**MΩ**	> 10 at 500 Vac
Dielectric strength	Conforming to IEC 60255-5	**kV**	> 2.5/1min/1 mA/50 Hz
Impulse voltage	Conforming to IEC 60255-5/664-1	**kV**	5, wave 1.2-50 µs

Approvals c UL us File E173076 CCN NRNT, File E173076 CCN NRNT 7 — SA File 217698, Guide 3211 07 — CE

FUNCTIONS

These devices are designed for monitoring single phase mains and power supplies. They have a transparent, hinged cover on their front face to prevent accidental alteration of the settings. This cover can be sealed.

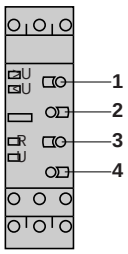
RM4UB

Applications

- Protecting electronic or electromechanical devices against overvoltage and undervoltage
- Normal/emergency power supply switching

Features

RM4UB



1 Overvoltage setting potentiometer
2 Undervoltage setting potentiometer
3 Time delay function selector
Fault detection delayed (off delay)
Fault detection extended (on delay)
4 Potentiometer for setting time delay (s)
R Yellow LED: Indicates relay state
U Green LED: Indicates that supply to the RM4 is present
>U Red LED: Overvoltage fault
<U Red LED: Undervoltage fault

OPERATING PRINCIPLE

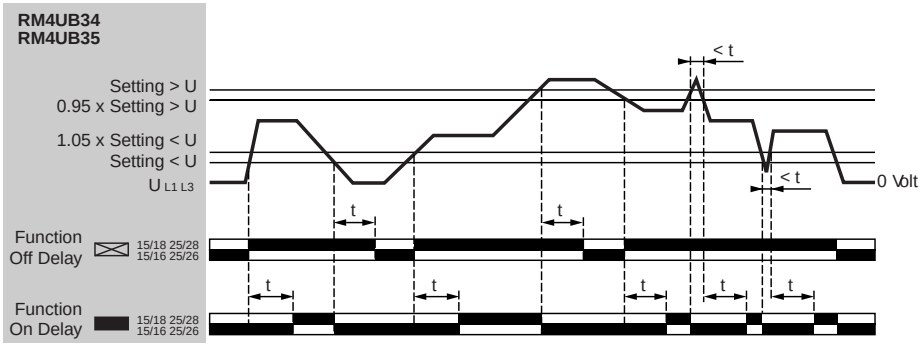
The supply voltage to be monitored is connected to product terminals L1, L3. RM4UB relays are self-powered by terminals L1 and L3; they require no separate power supply.

When the voltage fluctuates outside the range to be monitored, the output relay is de-energized.

- Overvoltage: Red LED “> U” illuminates
- Undervoltage: Red LED “< U” illuminates

When the supply returns toward its rated value, the relay is re-energized according to the hysteresis value (5%), and the corresponding red LED goes out. A switch allows selection of an adjustable time delay from 0.1–10 s. With the off-delay function ⊠, over- and undervoltages have no effect. With the on-delay function ▬, over- and undervoltages delay the re-energization of the relay. Regardless of the switch setting, an over- or undervoltage is detected only if its duration exceeds the measuring cycle time (80 ms).

Function Diagram



SPECIFICATIONS

Output Relay and Operational Specifications

Number of C/O (SPDT) Contacts		2 C/O–DPDT 
Output Relay State		Energized during fault-free operation. De-energized on detection of an overvoltage or undervoltage fault.
Setting Accuracy of Switching Threshold	As a percentage of the setting value	±3%
Switching Threshold Drift	Depending on the permissible ambient temperature	≤ 0.06% per °C
	Within the measuring range	≤ 0.5%
Accuracy of Time Delay Setting	As a percentage of the full scale value	±10%
Time Delay Drift	Within the measuring range	≤ 0.5%
	Depending on the rated operational temperature	≤ 0.07% per °C
Hysteresis	Fixed	About 5% of the de-energization threshold
Measuring Cycle		≤ 80 ms

Measuring input Specifications

Minimum Operational Voltage	**RM4UB34:** 60 V **RM4UB35:** 160 V
Maximum Permissible Voltage Between L1 and L3	**RM4UB34:** 300 V **RM4UB35:** 300 V

SELECTION

Relays with Adjustable Thresholds

RM4UB

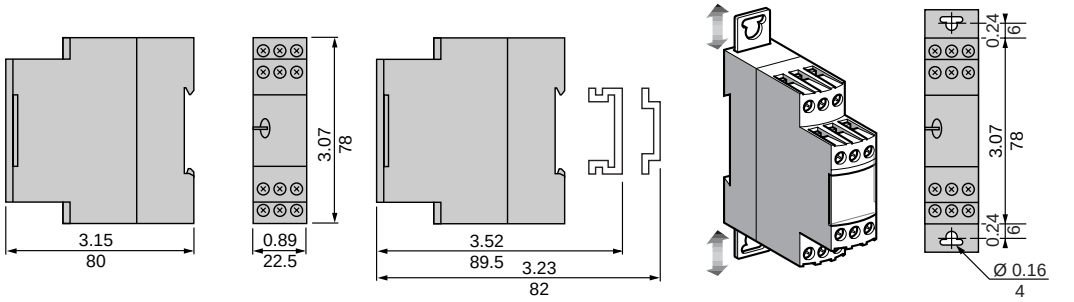
Adjustable Time Delay	Rated Mains Supply Voltage ■	Control Threshold	Width in (mm)	Output Relay	Catalog Number	Weight lb (kg)
0.1–10 s	100–200 V 50/60 Hz	Undervoltage 80–120 V Overvoltage 160–220 V	0.89 in (22.5 mm)	2 C/O  DPDT	**RM4UB34**	0.24 lb (0.110 kg)
	180–270 V 50/60 Hz	Undervoltage 160–220 V Overvoltage 220–300 V	0.89 in (22.5 mm)	2 C/O  DPDT	**RM4UB35**	0.24 lb (0.110 kg)

■ Can be used on other supply voltages if the minimum operational voltages, maximum voltage between phases, and compatibility are within the control threshold ranges shown in the table above.

For additional application data, refer to page 2.

DIMENSIONS (approximate)

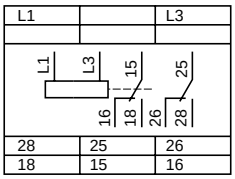
RM4UB **Rail Mounting** **Direct Mounting**



Dual Dimensions = in / mm

WIRING CONNECTIONS

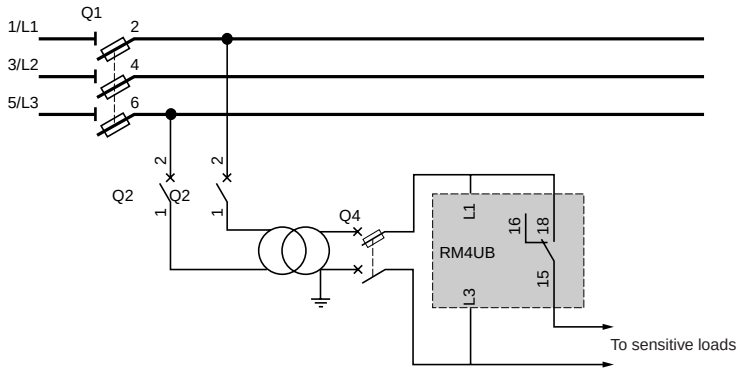
Terminal Blocks
RM4UB



L1, L2, L3	Supply to be monitored
15–18	1st C/O contact
15–16	of the output relay
25–28	2nd C/O contact
25–26	of the output relay

Application Diagram

Example



FUNCTIONS

RM4LG01

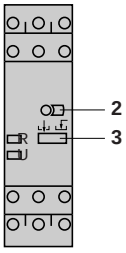
RM4LA32

These devices monitor the levels of conductive liquids. They control the actuation of pumps or valves to regulate levels; they are also suitable for protecting submersible pumps from running empty or tanks from overflowing. They can also control dosing of liquids in mixing processes and protect heating elements in the event of non-immersion. They have a transparent, hinged cover on the front face to prevent accidental alternation of the settings. This cover can be sealed.

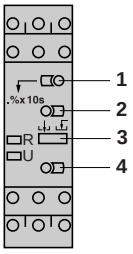
- Compatible liquids include, but are not limited to:
  - — Spring, municipal, industrial, and sea water
  - — Metallic, acidic, and basic salt solutions
  - — Liquid fertilizers
  - — Non-concentrated alcohol (< 40%)
  - — Liquids in the food processing industry, such as milk, beer, and coffee
- Non-compatible liquids include, but are not limited to:
  - — Chemically pure water
  - — Fuels and flammable liquid gases
  - — Oil and concentrated alcohol (> 40%)
  - — Ethylene, glycol, paraffin, varnish, and paint

Features

RM4LG01
Width 0.89 in (22.5 mm)



RM4LA32
Width 0.89 in (22.5 mm)



1 Fine adjustment of the time delay (as a percentage of the maximum value of the setting range)
2 Fine adjustment of the response sensitivity (as a percentage of the maximum value of the setting range)
3 Function selector switch:
empty ⌊⌋ or fill ⌈⌉ .
4 Switch combining:
— selection of the response sensitivity range
— selection of time delay on energization ⊠ or de-energization ■ of the relay
R Yellow LED: indicates the relay state (off when de-energized, on when energized)
U Green LED: indicates the presence of the relay supply

Details for Switch 3

Switch Position	Time Delay	Sensitivity
500 ⊠	On delay	High = 500 kΩ range
500 ■	Off delay	High = 500 kΩ range
50 ⊠	On delay	Medium = 50 kΩ range
50 ■	Off delay	Medium = 50 kΩ range
5 ⊠	On delay	Low = 5 kΩ range
5 ■	Off delay	Low = 5 kΩ range

OPERATING PRINCIPLE

Operation is based on a change in the resistance measured between immersed or non-immersed electrodes. Low resistance between electrodes means liquid is present. High resistance between electrodes means no liquid is present. The electrodes can be replaced by other sensors or probes that transmit values representing variations in resistance. The AC measuring voltage, which is < 30 V and galvanically insulated from the supply and contact circuits, ensures safe use and the absence of any electrolysis phenomena.

Application

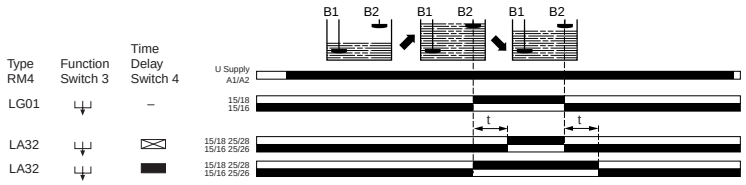
- Detecting a liquid level: operating with 2 electrodes (one reference electrode and one high level electrode) or an LA9RM201 probe (example: preventing tank overflow)
- Regulating a liquid level between a minimum and a maximum level: operating with 3 electrodes or an LA9RM201 probe (example: a water tower)

Configuration

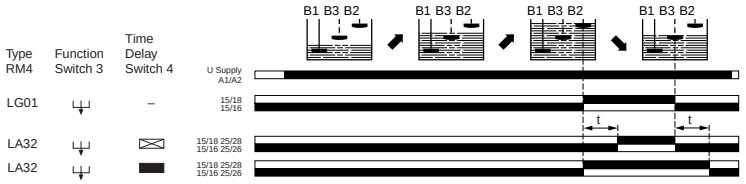
- Empty function : The output relay is energized when high level electrode B2 is immersed, and de-energized when low level electrode B3 is dry. ■
- Fill function : The output relay is energized when the low level electrode is dry, and de-energized when the high level electrode is immersed. ■

On model RM4LA32, a time delay can be set on energization or de-energization of the output relay, to raise the maximum level (function) or to lower the minimum level (function). This function also makes it possible to avoid output relay pulsing (wave effect) when operating with two electrodes.

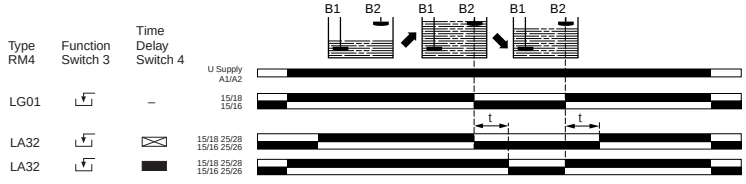
Empty Function, Maximum Level Detection (2 Electrodes or 1 Probe LA9RM201)



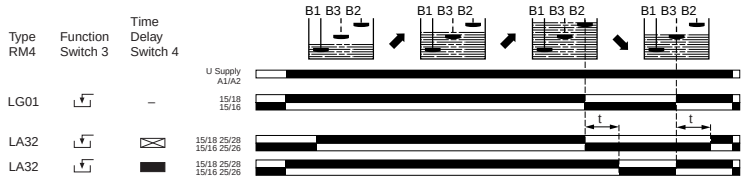
Empty Function, Regulation between a Maximum and a Minimum Level (3 Electrodes or 2 Probes LA9RM201)



Fill Function, Maximum Level Detection (2 Electrodes or 1 Probe LA9RM201)



Empty Function, Regulation between a Maximum and a Minimum Level (3 Electrodes or 2 Probes LA9RM201)



B1: Reference electrode **B2: High level electrode** **B3: Low level electrode**

■ When operating with two electrodes, the high level electrode performs both high and low level functions.

SPECIFICATIONS

Power Supply Circuit Specifications

Type of Relay 50/60 Hz		RM4LG01				RM4LA32				
Rated Supply Voltage (Un)	50/60 Hz Vac	24 Vac	110–130 Vac	220–240 Vac	380–415 Vac	24–240 Vac	24 Vac	110–130 Vac	220–240 Vac	380–415 Vac
	Vdc	–	–	–	–	24–240 Vdc	–	–	–	–
Average Consumption at Un	Vac	1.9 VA	2.6 VA	2.4 VA	2.9 VA	2.7 VA	3.1 VA	2.7 VA	2.6 VA	3.4 VA
	Vdc	–	–	–	–	2.4 W	–	–	–	–

Output Relay and Operating Specifications

Number of SPDT (C/O) Contacts	1 C/O SPDT	2 C/O DPDT
Output Relay State	Switch configurable: empty or fill	

Electrode Circuit Specifications ■

Sensitivity Scale	5–100 (adjustable) kΩ	0.25–5 kΩ	2.5–50 kΩ	25–500 kΩ
Maximum AC Electrode Voltage (peak to peak)	24 V	24 V	24 V	24 V
Maximum Current in the Electrodes	1 mA	1 mA	1 mA	1 mA
Maximum Cable Capacity	10 nF	200 nF	25 nF	4 nF
Maximum Cable Length	330 ft (100 m)	3300 ft (1000 m)	330 ft (100 m)	66 ft (20 m)

RM4LG01

RM4LA32

LA9RM201

SELECTION

Liquid Level Control Relays

Time Delay	Sensitivity Scale	Width in (mm)	Output Relay	Voltage 50/60 Hz	Catalog Number	Weight lb (kg)
None	5–100 kΩ	0.87 in (22.5 mm)	1 C/O–SPDT	24 Vac	**RM4LG01B**	0.36 (0.165)
				110–130 Vac	**RM4LG01F**	0.36 (0.165)
				220–240 Vac	**RM4LG01M**	0.36 (0.165)
				380–415 Vac	**RM4LG01Q**	0.36 (0.165)
Adjustable 0.1–10 s	0.25 -5 kΩ 2.5 -50 kΩ 25 -500 kΩ	0.87 in (22.5 mm)	2 C/O–DPDT	24–240 Vac/ Vdc	**RM4LA32MW**	0.36 (0.165)
				24 Vac	**RM4LA32B**	0.36 (0.165)
				110–130 Vac	**RM4LA32F**	0.36 (0.165)
				220–240 Vac	**RM4LA32M**	0.36 (0.165)
				380–415 Vac	**RM4LA32Q**	0.36 (0.165)

Liquid Level Control Probe

Type of Installation	Maximum Operating Temperature	Catalog Number	Weight lb (kg)
Suspended by cable	212 °F (100 °C)	**LA9RM201**	0.22 (0.100)

■ The electrodes may also be incorporated in the probes. The probes are normally designed for mounting to a tank using a bracket with a seal (closed tanks) or suspended by their own electrical connecting cable (boreholes, etc.). See page 53 “Setting-up” Probe LA9RM201.

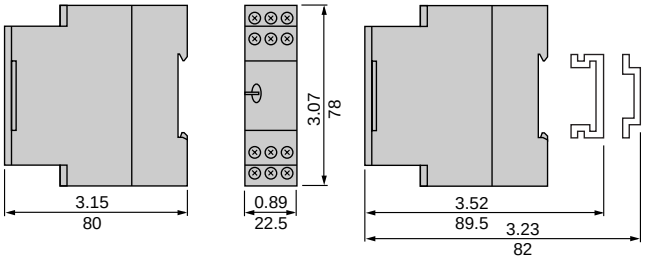
For additional application data, refer to page 2.

For additional probe, refer to page 66.

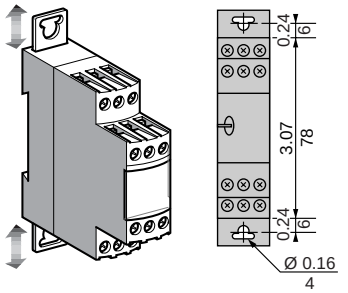
DIMENSIONS

RM4LG01

Rail Mounting

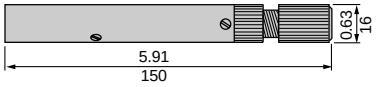


Direct Mounting



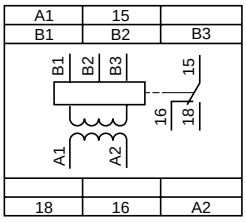
Dual Dimensions = $\frac{\text{in}}{\text{mm}}$

Probe LA9RM201

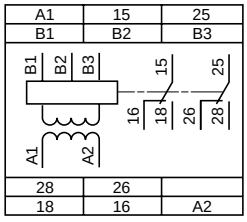


WIRING CONNECTIONS

RM4LG01



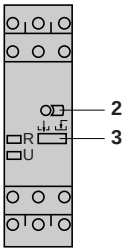
RM4LA32



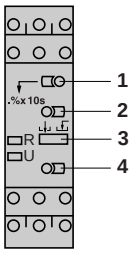
A1–A2	Supply Voltage
B1, B2, B3	Electrodes (see table below)
15–18	1st C/O contact
15–16	of the output relay
25–28	2nd C/O contact
25–26	of the output relay

Electrode and Level Controlled

B1	Reference or tank ground electrode
B2	High Level
B3	Low Level



RM4LG01



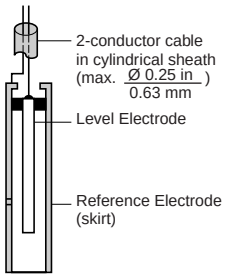
RM4LA32

Setup

1. Select the empty or fill function as appropriate for the application.
2. If necessary, set potentiometer **1** to minimum (time delay).
3. Set potentiometer **2** to minimum. On RM4LA, select the lowest sensitivity range using potentiometer **4** (5 or 5).
4. With all the electrodes immersed, turn the sensitivity potentiometer toward maximum until the relay is energized (function) or de-energized (function), then exceed the threshold by about 10% to compensate for variation in the supply voltage.
5. If the relay does not energize, do one of the following:
   - Use a higher sensitivity scale (selector **4** on RM4LA32)
   - Replace relay RM4LG with relay RM4LA32 and start the adjustment procedure again
6. Check that the relay de-energizes (function) or energizes (function) as soon as electrodes B3 and B2 are out of the liquid. If the relay does not de-energize, select a lower sensitivity scale.
7. Protect the electrode connection point against corrosion. In areas where thunderstorms are likely, also protect the electrode lines.

NOTE: The high level can be raised from 0.1 –10 s using the adjustable time delay with function . The low level can be lowered using this same time delay with function .

Probe LA9RM201



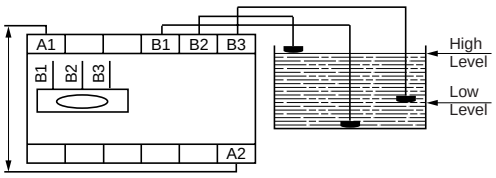
This suspended-type probe is coaxial. In addition to the normal (central) electrode, the stainless steel skirt can also act as the ground (reference) electrode, so no separate reference probe is needed. Controlling one level requires one probe instead of two; controlling two levels requires two probes instead of three. The skirt also acts as a calming chamber to prevent inaccuracy resulting from an agitated surface of the liquid (waves).

Use only a **two-conductor** connecting cable with common cylindrical PVC sheathing and a maximum diameter of 0.25 in. (6.3 mm).

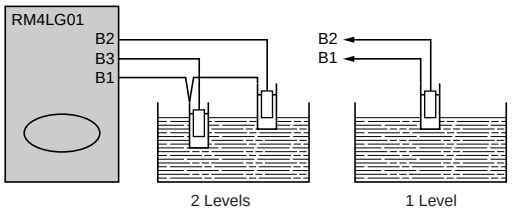
The maximum operating temperature is 212 °F (100 °C).

Probe LA9RM201 can also be mounted to containers such as cisterns or tanks using a bracket or other suitable mounting device.

Connection Examples
Control by Electrodes



Control by Probes



- *Regulation of two levels: minimum and maximum*
- *Function to be monitored (filling/UP or emptying/DOWN) selectable using the switch on the front panel of the device*
- *Probes with AC current flowing through them*
- *Sensitivity adjustment potentiometer on the front panel of the device*
- *Sensitivity adjustable from 5–100 kΩ*

OPERATING PRINCIPLE

These devices control maximum and/or minimum levels of conductive liquids (such as tap water, sea water, waste water, chemical solutions, and coffee).

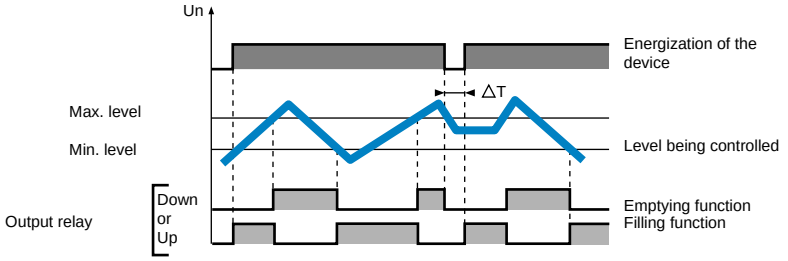
Operation is based on measuring the apparent resistance of the liquid between two submerged probes. When this value falls below the threshold setting on the front panel of the device, the output relay changes state. To avoid electrolytic phenomena, an AC current runs across the probes.

Applications include the food-processing and chemical industries.

Regulation of two levels, minimum/maximum

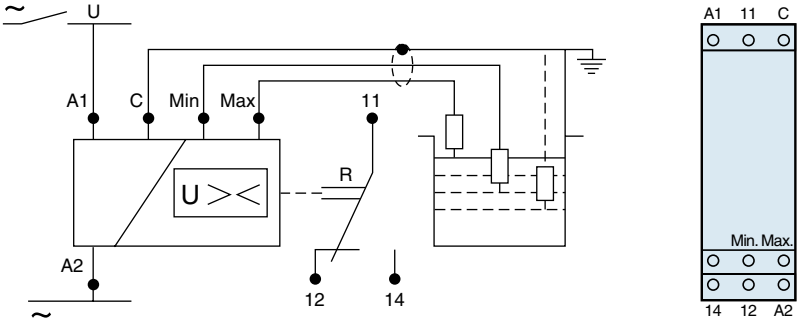
The output relay changes state when the liquid level reaches the maximum level probe, with the minimum level probe submerged. It returns to its initial state when the minimum level probe is no longer in contact with the liquid.

Filling or emptying control



*NOTE: If the voltage break ΔT lasts 1 s or more, then the relay is instantly re-energized if in **Up** mode or de-energized if in **Down** mode.*

WIRING



RM84870001

SELECTION

Filling (Up) and emptying (Down) control relays

Voltage	Catalog Number	Weight oz (kg)
24 Vac	**RM84870001**	4.9 (0.140)
120 Vac	**RM84870003**	4.9 (0.140)
230 Vac	**RM84870004**	4.9 (0.140)

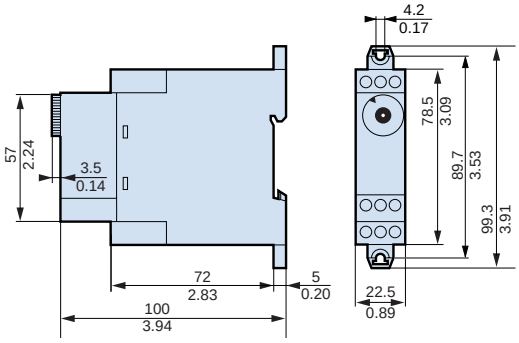
NOTE: The probe cable (maximum length 100 m / 328 ft) need not be shielded, but avoid installing it in parallel with the power supply cables.
When using shielded cable, connect the shielding to the common.

Characteristics

Supply voltage Un		**Vac**	24, 120, 230 (50/60 Hz)
Operating range			0.85–1.15 × Un
Maximum power consumption		**VA**	3
Sensitivity adjustment		**kΩ**	5–100
Measurement accuracy (at maximum sensitivity)			0 to +30%
Electrode voltage (maximum)		**Vac**	24 (50/60 Hz)
Electrode current (maximum)		**mA**	1 (50/60 Hz)
Maximum cable capacity		**nF**	10
Response time	High level	**ms**	300
	Low level	**ms**	500
Output relay (to meet AC-1 requirements, resistive load)			1 C/O contact, AgCdO, 8 A (AC) max.
Galvanic isolation via transformer (4 kV, 8 mm creepage distance)			Class II VDE 0551
Isolation of contacts and electrodes from the supply		**kVac**	2.5
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70)
Approvals	c UL us File E173076 CCN NRNT File E173076 CCN NRNT 7		SA File 217698 Guide 3211 07 CE

For probe, refer to page 66.

DIMENSIONS (approximate)



Dimensions: mm / in.

- *Regulation of two thresholds: minimum or maximum*
- *Emptying control*
- *Probes with AC current flowing through them*
- *Sensitivity adjustment potentiometer on the front panel of the device*
- *Sensitivity adjustable from:*
  - *250 kΩ to 5 kΩ (low sensitivity)*
  - *50 kΩ to 1 MΩ (high sensitivity)*

OPERATING PRINCIPLE

These devices control maximum and/or minimum levels of conductive liquids (such as tap water, sea water, waste water, chemical solutions, and coffee).

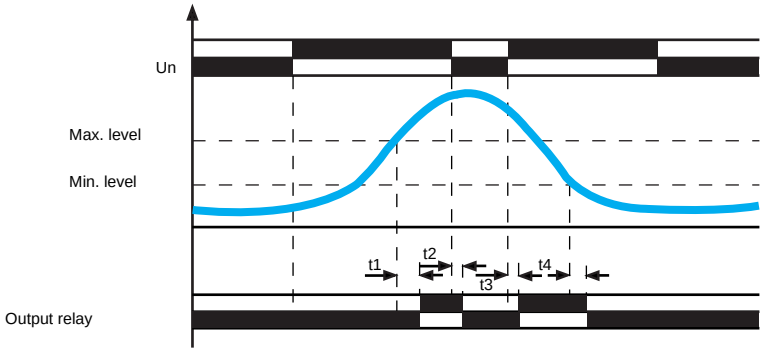
Operation is based on measuring the apparent resistance of the liquid between two submerged probes. When this value falls below the threshold setting on the front panel of the device, the output relay changes state. To avoid electrolytic phenomena, an AC current runs across the probes.

Applications include the food-processing and chemical industries.

Regulation of two levels, minimum/maximum

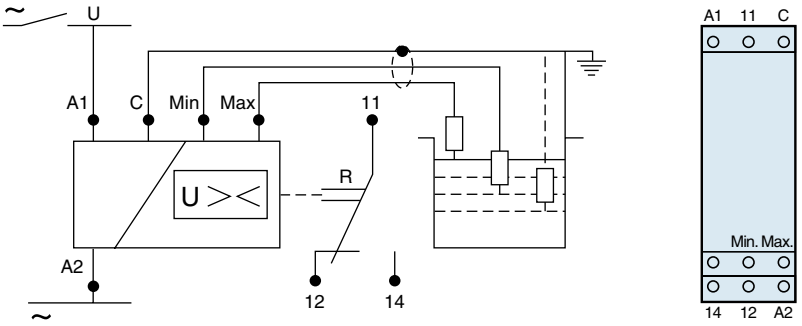
The output relay changes state when the liquid level reaches the maximum level probe, with the minimum level probe submerged. It returns to its initial state when the minimum level probe is no longer in contact with the liquid.

Emptying control



For values of t1, t2, t3, and t4, refer to page 57.

WIRING



RM84870131

SELECTION

Emptying control relays (low and high sensitivity)

Voltage	Sensitivity	Catalog Number	Weight oz (kg)
24 Vac	250 Ω to 5 kΩ	**RM84870121**	5.3 (0.150)
	50 kΩ to 1 MΩ	**RM84870131**	5.3 (0.150)

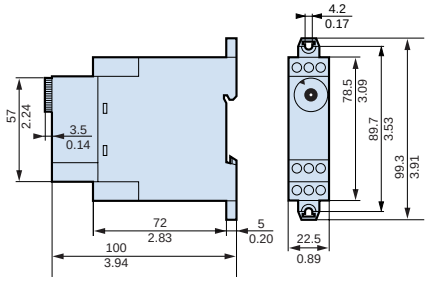
NOTE: The probe cable (maximum length 100 m / 328 ft) need not be shielded, but avoid fitting it in parallel with the power supply cables.
When using shielded cable, do not exceed the capacities indicated.

Characteristics

Relay type			**RE84870121**	**RE84870131**
Supply voltage		**Vac**	24 (50/60 Hz)	
Supply range			±15% of Un -15 to +10% if other products are mounted on the same rail	
Maximum power consumption		**VA**	3	
Sensitivity adjustment			250 kΩ to 5 kΩ	50 kΩ to 1 MΩ
Measurement accuracy (at maximum sensitivity)			±30%	±30%
Maximum electrode voltage		**Vac**	24 (50/60 Hz)	24 (50/60 Hz)
Maximum electrode current			3 mA (50/60 Hz)	50 µA (50/60 Hz)
Maximum cable capacity		**nF**	100	1
Initialization time	t3	**ms**	650	650
De-energization time	t2	**s**	1	1
Response time	t1 (high level)	**ms**	600	600
	t4 (low level)		300 ms	2 s
Output relay (to meet AC-1 requirements, resistive load)			1 C/O contact, cadmium-free, 8 A / 250 Vac	
Galvanic isolation via transformer (4 kV, 8 mm creepage distance)			Class II VDE 0551	
Isolation of contacts and electrodes from the supply 1 min/1 mA/50 Hz (IEC 60 225-5)		**kVac**	2.5	
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/2	
Ambient air temperature	Operation	**°F (°C)**	-4 to +140 (-20 to +60)	
	Storage	**°F (°C)**	-22 to +158 (-30 to +70)	
Degree of protection	Enclosure		IP 50	
	Terminal block		IP 20	
Enclosure material			Self-extinguishing Pc	
Product certifications	c UL us File E173076 CCN NRNT File E173076 CCN NRNT 7		SA File 217698 Guide 3211 07	CE

For probes, refer to page 66.

DIMENSIONS (approximate)



Dimensions: mm / in.

- *Controlling the levels of conductive liquids*
- *Regulation of two thresholds: minimum and maximum*
- *Emptying function*
- *Plug-in, 8- or 11-pin connector*
- *Sensitivity adjustable from 5–100 kΩ*

OPERATING PRINCIPLE

These devices control maximum and/or minimum levels of conductive liquids, such as tap water, sea water, waste water, chemical solutions, and coffee.

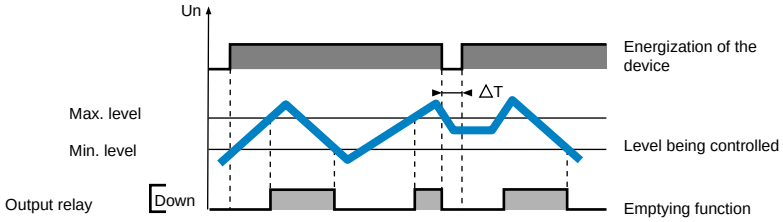
Operation is based on measuring the apparent resistance of the liquid between two submerged probes. When this value falls below the threshold setting on the front panel of the device, the output relay changes state. To avoid electrolytic phenomena, an AC current runs across the probes.

Applications include the food-processing and chemical industries.

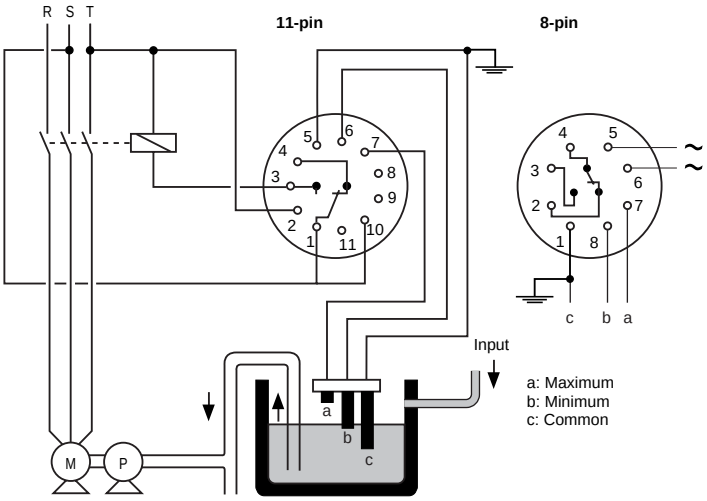
Regulation of two levels, minimum/maximum

The output relay changes state when the liquid level reaches the maximum level probe, with the minimum level probe submerged. It returns to its initial state when the minimum level probe is no longer in contact with the liquid.

Emptying control



WIRING SCHEME



RM84870303

SELECTION

Liquid level control relays

Number of pins	Voltage	Catalog Number	Weight oz (kg)
8-pin	24 Vac	**RM84870301**	4.9 (0.140)
	120 Vac	**RM84870303**	4.9 (0.140)
	230 Vac	**RM84870304**	0.4.9 (0.140)
11-pin	24 Vac	**RM84870306**	4.9 (0.140)
	120 Vac	**RM84870308**	4.9 (0.140)
	230 Vac	**RM84870309**	4.9 (0.140)

NOTE: The probe cable (maximum length 100 m / 328 ft) need not be shielded, but avoid fitting it in parallel with the power supply cables.
When using shielded cable, connect the shielding to the common.

Accessories

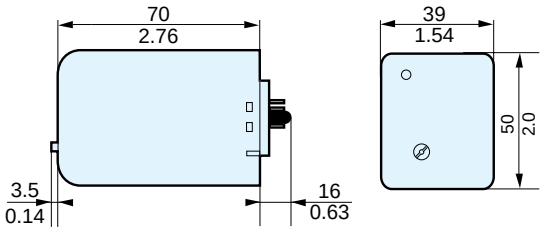
Description		Catalog Number	Weight oz (kg)
8-pin socket	Single tier	**8501NR51**	1.5 (0.043)
	Double tier	**8501NR52**	2.1 (0.060)
11-pin socket	Single tier	**8501NR61**	1.8 (0.050)
	Double tier	**8501NR62**	2.8 (0.078)

Characteristics

Supply voltage Un		**Vac**	24, 120, 230 (50/60 Hz)
Operating range			0.85–1.15 × Un
Maximum power consumption		**VA**	3
Sensitivity adjustment		**kΩ**	5–100
Measurement accuracy (at maximum sensitivity)			0 to +30%
Maximum electrode voltage		**Vac**	24 (50/60 Hz)
Maximum electrode current		**mA**	1 (50/60 Hz)
Maximum cable capacity		**nF**	10
Response time	High level	**ms**	300
	Low level	**ms**	500
Output relay (to meet AC-1 requirements, resistive load)			1 C/O contact, AgCdO a 8 A max.
Galvanic isolation via transformer (4 kV, 8 mm creepage distance)			Class II VDE 0551
Isolation of contacts and electrodes from the supply		**kVac**	2.5
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70)
Approvals	c UL us File E173076 CCN NRNT, File E173076 CCN NRNT 7	CSA File 217698, Guide 3211 07	CE

For probe, refer to page 66.

DIMENSIONS (approximate)



Dimensions: mm / in.

- *Controlling the levels of conductive liquids*
- *Combined fill/empty function*
- *Combined regulation of emptying a well and filling a tank*
- *Plug-in, 11-pin connector*
- *LED indicating the output relay state*
- *Sensitivity adjustable from 5–100 kΩ*

OPERATING PRINCIPLE

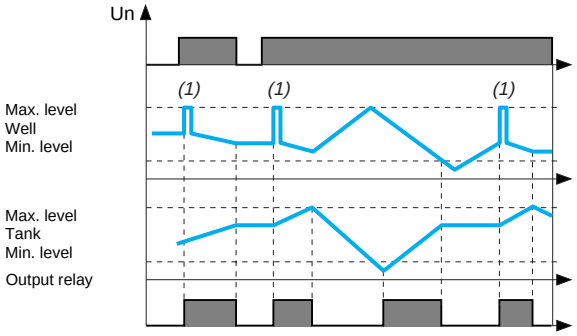
Combined fill/empty function

The output relay changes state when the liquid level in the tank reaches the maximum level probe, with the minimum level probe submerged. It returns to its initial state when the minimum level probe is no longer in contact with the liquid.

When the liquid level in the well reaches the minimum level probe, the pump stops.

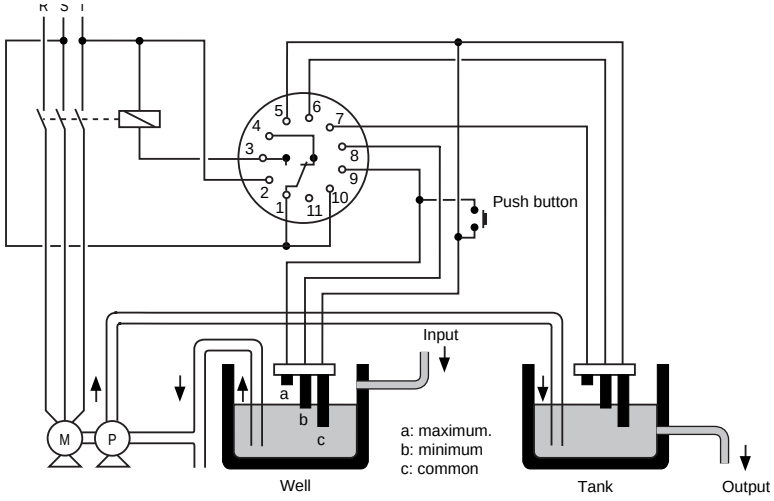
On energization or after a power supply cutoff, if the maximum level probe in the tank is above the liquid level, reset the device by pressing the push button.

Emptying control



(1) Push button

WIRING SCHEME



561009

RM8487040•

SELECTION

Liquid level control relays

Number of pins	Voltage	Catalog Number	Weight oz (kg)
11-pin	24 Vac	**RM84870401**	4.9 (0.140)
	120 Vac	**RM84870403**	4.9 (0.140)
	230 Vac	**RM84870404**	4.9 (0.140)

Accessories

Description		Catalog Number	Weight oz (kg)
11-pin socket	Single tier	**8501NR61**	1.8 (0.050)
	Double tier	**8501NR62**	2.8 (0.078)

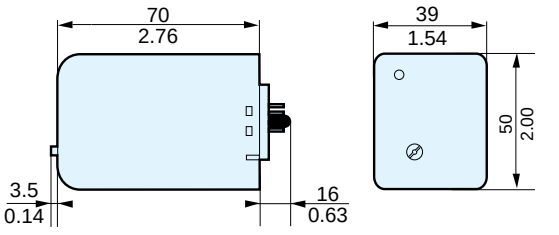
NOTE: The probe cable (maximum length 100 m / 328 ft) need not be shielded, but avoid fitting it in parallel with the power supply cables.
When using shielded cable, connect the shielding to the common.

Characteristics

Supply voltage Un		**Vac**	24, 120, 230 (50/60 Hz)
Operating range			0.85–1.15 × Un
Maximum power consumption		**VA**	3
Sensitivity adjustment		**kΩ**	5–100
Measurement accuracy (at maximum sensitivity)			0 to +30%
Maximum electrode voltage		**Vac**	24 (50/60 Hz)
Maximum electrode current		**mA**	1 (50/60 Hz)
Maximum cable capacity		**nF**	10
Response time	High level	**ms**	300
	Low level	**ms**	500
Output relay (to meet AC-1 requirements, resistive load)			1 C/O contact, AgCdO 8 A max. (AC)
Galvanic isolation via transformer (4 kV, 8 mm creepage distance)			Class II VDE 0551
Isolation of contacts and electrodes from the supply		**kVac**	2.5
Ambient air temperature	Operation	**°F (°C)**	-4 to +140 (-20 to +60)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70)
Product certifications	c UL us File E173076 CCN NRNT2 File E173076 CCN NRNT 8		CSA File 217698 Guide 3211 07 CE

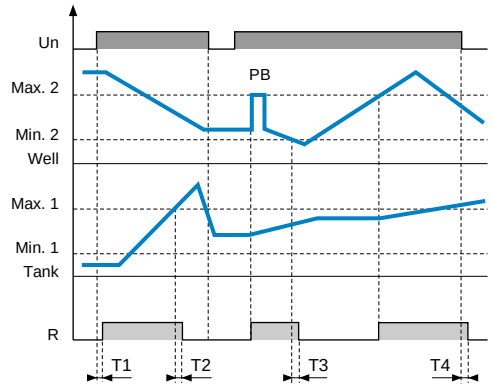
For probe, refer to page 66.

DIMENSIONS (approximate)



Dimensions: mm / in.

- *Control and automatic regulation of liquid levels*
- *Sensitivity adjustable from 5–100 kΩ*
- *Combined regulation of emptying a well and filling a tank*
- *LED indicating power on and output relay state*



T1: Delay on pick-up
T2: Response time on immersion
T3: Response time on emergence
T4: Response time on de-energization

For T values, refer to page 63.

Terminals

A1–A2	Supply voltage
11–12–14	Output relay (R)
C–Min. 1–Max. 1	Tank probe inputs
C–Min. 2–Max. 2	Well or supply tank probe inputs

OPERATING PRINCIPLE

These devices control tank filling at two levels (min. 1, max. 1), with simultaneous control of well or supply tank emptying at two levels (min. 2, max. 2), to protect a pump against running empty.

Operation is based on measuring the apparent resistance of the liquid between two submerged probes. To avoid electrolytic phenomena, an AC current runs across the probes.

NOTE: In certain applications, fine adjustment of sensitivity leads to the detection of undesirable factors, such as the presence of foam or bubbles on the surface of the liquid, or the appearance of leakage impedance between probes (e.g., extended line capacity or humidity).

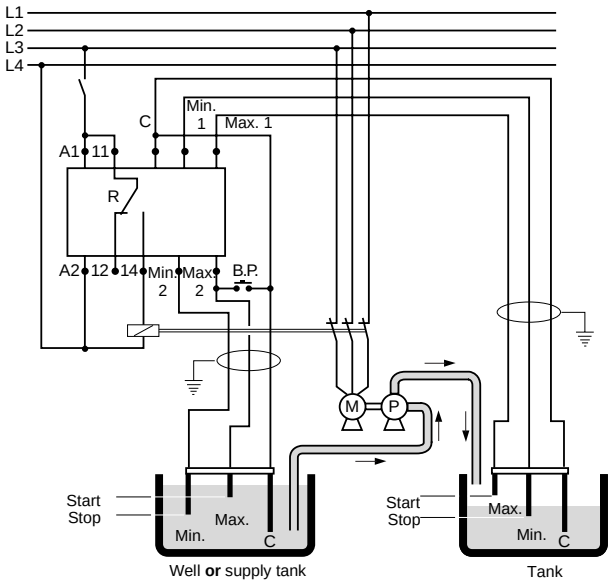
Combined Fill/Empty function

The output relay changes state (de-energizes) when the liquid level in the tank reaches the max. 1 level probe, with the min. 1 level probe submerged. It returns to its initial state (closes) when the min. 1 level probe is no longer in contact with the liquid.

When the liquid level in the well reaches the min. 2 level probe, the pump stops (relay open). This prevents the pump from running empty.

On energization or after a power supply cutoff, if the max. 2 level probe in the tank is above the liquid level, then reset the device by pressing the push button (PB).

WIRING AND APPLICATION SCHEME



RM84870604

SELECTION

Combined fill and empty function

Voltage	Catalog Number	Weight oz (kg)
230 Vac	**RM84870604**	8.8 (0.250)

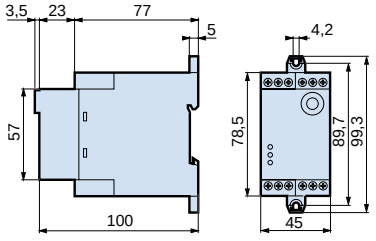
NOTE: The probe cable (maximum length 100 m / 328 ft) need not be shielded, but avoid installing it close to the power supply cables.
To conform to the EMC directive (89/336/EEC), shielded cable must be used, with the shielding connected to the common and to earth.

Supply characteristics				
Supply voltage Un			**Vac**	230 (50/60 Hz) electrical isolation via transformer
Operating range				0.85–1.15 Un
Power			**VA**	**Rated:** 3 max. at Un; **Maximum:** 4 at Un +15%
Immunity to microbreaks			**ms**	10
Delay on pick-up		t1	**ms**	400
Response time on de-energization		t4	**ms**	500
Creepage distance and clearance	Conforming to IEC 60664-1		**kV**	4kV/2
Control characteristics				
Sensitivity range				5–100 kΩ
Setting accuracy				±30% at maximum sensitivity
Electrode voltage			**Vac**	15 (50/60 Hz)
Electrode current			**mA**	1
Accuracy				±30% at maximum sensitivity
Response time	On immersion	t2	**ms**	400
	On emergence	t3	**ms**	700
Output circuit characteristics				
Output type				1 C/O contact, AgCdO
Breaking capacity				2000 VA, 80 W
Maximum breaking current	AC/DC		**A**	8
Minimum breaking current	AC/DC		**mA**	100
Maximum switching voltage			**Vac/Vdc**	250
Mechanical life ▲				5×10^6 operating cycles ▲
Electrical life ▲	AC-12			2000 VA, 10^5 operating cycles ▲
	AC-15			Cos φ = 0.3, 6000 operating cycles ▲
	DC-13			L/R = 300 ms, 6000 operating cycles ▲
Other characteristics				
Enclosure material				Self-extinguishing
Terminal capacity	With cable end		**AWG (mm^2)**	Two #16 (1.5)
	Without cable end		**AWG (mm^2)**	Two #14 (2.5)
Temperature limits	Operation		**°F (°C)**	-4 to +140 (-20 to +60, conforming to IEC 60068-1-14)
	Storage		**°F (°C)**	-22 to +158 (-30 to +70, conforming to IEC 60068-1-1/2)
Relative humidity				93% without condensation
Approvals	c UL us File E173076 CCN NRNT File E173076 CCN NRNT 7			SA File 217698 Guide 3211 07 CE

For probes, refer to page 66.

▲ The expected life expressed above is based on average usage and normal operating conditions. Actual operating life will vary with conditions. The above statements are not intended to nor shall they create any expressed or implied warranties as to product operation or life. For information on the listed warranty offered on this product, refer to the Square D terms and conditions of sale found in the *Digest.*

DIMENSIONS (approximate)



Dimensions: mm / in.

- *Control and automatic regulation of liquid levels*
- *Two sensitivity ranges*
- *Fill or empty function selectable via DIP switch*
- *High or low level alarm selectable via DIP switch*
- *Selectable memory*
- *LEDs indicating power on, output relay state, and alarm relay state*

NOTE: Alarm relay R2 can be programmed to latch in the de-energized state when a fault occurs by setting a switch on the underside of the device (the switch must be operated with the device switched off). To reset alarm relay R2 once the levels have been re-established, the power supply to the device must be switched off.

OPERATING PRINCIPLE

Control of the level of a conductive liquid at specific points (high and low levels) with alarm when the level is abnormally high or abnormally low.

Operation is based on measuring the apparent resistance of the liquid between submerged probes. When this value is below the threshold setting on the front panel of the device, the output relay R1 and/or the alarm relay R2 change state.

To avoid electrolysis phenomena, an AC current runs across the probes.

Sensitivity adjustment

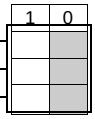
Set the sensitivity so that the relay changes state when the probes are in contact with the liquid, then returns to its initial position as soon as the probes emerge.

NOTE: In certain applications, fine adjustment of sensitivity leads to the detection of undesirable factors, such as the presence of foam or bubbles on the surface of the liquid, or the appearance of leakage impedance between probes (e.g., extended line capacity or humidity).

Programming

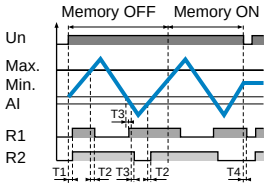
The level controller can be programmed via three switches on the underside of the device:

	1	0
Memory	OFF	ON
Alarm	Low	High
Function	Empty	Fill



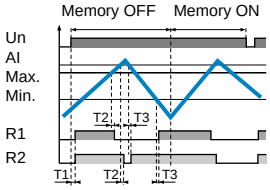
NOTE: The device must be switched off when making Memory, Alarm and Function selections.

Filling control with low level alarm



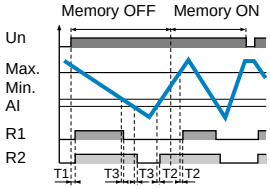
On energization, probe AI is submerged, relays R1 and R2 change to the energized state, and the pump is on. Filling starts, and the LED for relay R1 is lit. When the liquid reaches the max. level probe, relay R1 changes to the de-energized state, and the pump is off. Filling stops, and the LED for relay R1 goes out. Relay R1 re-energizes when the min. level probe emerges. In the event of a fault (continual drop in level), probe AI is emerged, relay R2 changes to the de-energized state, and the alarm is triggered; the LED for relay R2 comes on. This fault can be memorized.

Filling control with high level alarm



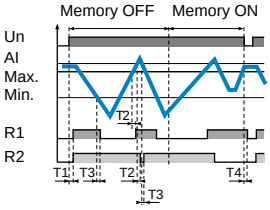
On energization, the level in the tank is low, relays R1 and R2 change to the energized state, and the pump is on. Filling starts, and the LED for relay R1 is lit. When the liquid reaches the max. level probe, relay R1 de-energizes, and the pump is off; filling stops and the relay LED goes out. In the event of a fault, if the level continues to rise and reaches probe AI, relay R2 de-energizes and the alarm is triggered; the LED for relay R2 comes on. This fault can be memorized.

Emptying control with low level alarm



On energization, the min. level, max. level, and AI probes are submerged; relays R1 and R2 change to the energized state; and the pump is on. Emptying starts, and the LED for relay R1 is lit. When the liquid reaches the max. level probe, relay R1 de-energizes and the pump is off; emptying stops, and the LED for relay R1 goes out. In the event of a fault, if the level continues to drop, probe AI emerges, relay R2 de-energizes, and the alarm is triggered; the LED for relay R2 comes on. This fault can be memorized.

Emptying control with high level alarm



On energization, the min. level and max. level probes are submerged and probe AI is above the liquid level; relays R1 and R2 change to the energized state; and the pump is on. Emptying starts, and the LED for relay R1 is lit. When the min. level probe emerges, relay R1 de-energizes, and the pump is off. Emptying stops, and the LED for relay R1 goes out. The relay re-energizes when the max. level probe is submerged. In the event of a fault, if the level continues to rise and reaches probe AI, relay R2 de-energizes and the alarm is triggered; the LED for relay R2 comes on. This fault can be memorized.

T1: Delay on pick-up
T2: Response time on immersion
T3: Response time on emergence
T4: Response time on energization

RM84870504

SELECTION

Liquid level control relays with alarm

Voltage	Catalog Number	Weight oz (kg)
230 Vac	**RM84870504**	9.9 (0,280)

NOTE: The probe cable need not be shielded, but avoid installing it close to the power supply cables.
To conform to the EMC directive (89/336/EEC), shielded cable must be used, with the shielding connected to the common and to earth.

Supply characteristics

Supply voltage Un			**Vac**	230 (50/60 Hz) galvanic isolation by transformer
Operating range				0.85–1.15 Un
Maximum power			**VA**	**Rated:** 3 at Un; **Maximum:** 4 at Un +15%
Immunity to microbreaks			**ms**	10
Delay on pick-up		t1	**s**	About 2
Response time on de-energization		t4t	**ms**	500
Insulation coordination				Category III, degree of pollution 2 conforming to IEC 60664-1/VDE 0110: 4 kV/2

Control characteristics

Sensitivity range				5–100 kΩ
Setting accuracy				±30% at maximum sensitivity
Electrode voltage			**Vac**	15 (50/60 Hz)
Electrode current			**mA**	1
Response time	On immersion	t2	**ms**	400
	On emergence	t3	**ms**	700

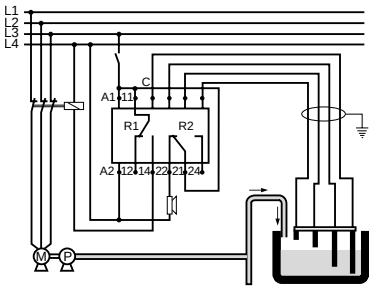
Output circuit characteristics

Output type				2 C/O contacts, AgCdO
Breaking capacity				2000 VA, 80 W
Maximum breaking current	AC/DC		**A**	8
Minimum breaking current	AC/DC		**mA**	100
Maximum switching voltage			**Vac/Vdc**	250
Mechanical life				2×10^6 operating cycles (see ▲ on page 63)
Electrical life	AC-12			2000 VA, 10^5 operating cycles (see ▲ on page 63)
	AC-15			Cos φ = 0.3, 6000 operating cycles (see ▲ on page 63)
	DC-13			L/R = 300 ms, 6000 operating cycles (see ▲ on page 63)

Other characteristics

Enclosure material			Self-extinguishing
Terminal capacity	With cable end	**AWG (mm²)**	Two #16 (1.5)
	Without cable end	**AWG (mm²)**	Two #14 (2.5)
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60, conforming to IEC 60068-1-14)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70, conforming to IEC 60068-1-1/2)
Relative humidity			93% without condensation
Approvals	c UL us		File E173076 CCN NRNT File E173076 CCN NRNT 7
	CSA		File 217698 Guide 3211 07
	CE		

WIRING

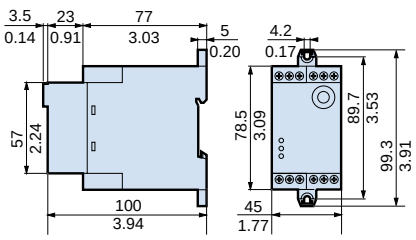


Terminal connections

A1–A2	Supply voltage
11–12–14	Output relay (R1)
21–22–24	Alarm output relay (R2)
C–Min–Max–AI	Probe inputs
Green LED	Power on
Yellow LED	Output relay state
Red LED	Alarm relay state

NOTE: If the reservoir is conductive (metal), it can be used as the reference electrode (C).

DIMENSIONS (approximate)



Dimensions: mm / in.

SELECTION

Electrode holders

Application	No. of probes	Length in. (mm)	Operating temperature °F (°C)	Maximum pressure kg/cm^2	Catalog Number	Weight oz (kg)
Recommended for drink-vending machines and where installation space is limited (Stainless steel)	3	39.4 (1000)	176 (80)	2	**RM79696044**	28.2 (0.800)
Suitable for boilers, pressure vessels and under high temperature conditions (1) (304 stainless steel)	1	39.4 (1000)	392 (200)	25	**RM79696014**	12.7 (0.360)

Electrodes

Description	Material	Catalog Number	Weight oz (kg)
Protected electrode for mounting by suspension	Protective shell: PUC (S7) Electrode: stainless steel	**RM79696043**	5.3 (0.150)
Electrode for use up to 662 °F (350 °C) and 15 kg/cm2 (2)	Stainless steel isolated by ceramic	**RM79696006**	5.3 (0.150)

561034

RM79696043

561036

561035

RM79696006

(1) 3/8" BSP mounting thread with hexagonal head. Use a 24 mm wrench for tightening.

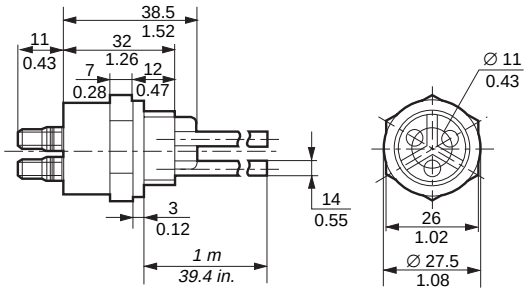
(2) 3/8" BSP mounting thread.

Additional probe shown on page 51.

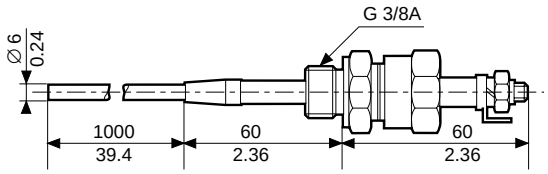
DIMENSIONS (approximate)

Electrode holders

RM79696044

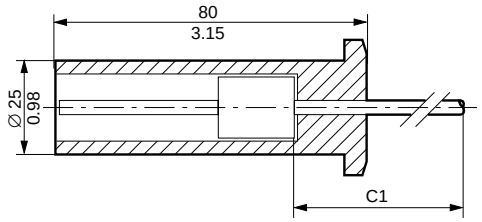


RM79696014

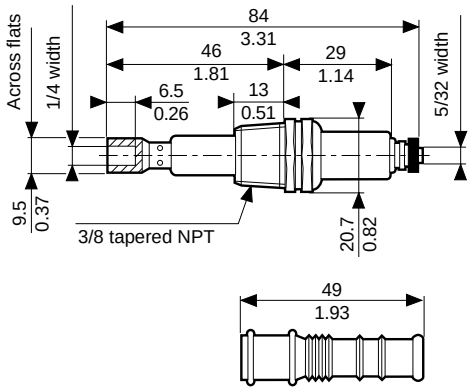


Probes

RM79696043



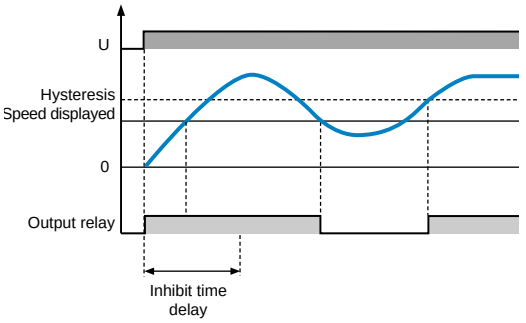
RM79696006



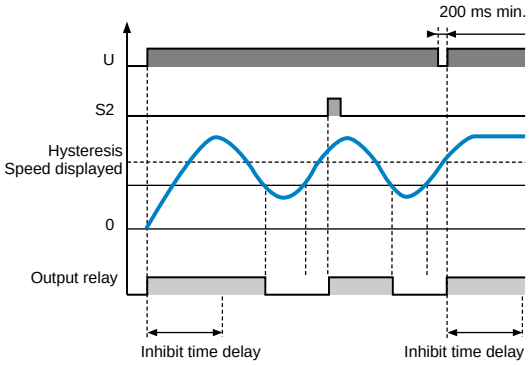
Dimensions: $\frac{mm}{in.}$

- *Detection of motor underspeed, running speed, stopping, or stalling*
- *Information detected by three-wire or NAMUR sensor, or by contact or voltage*
- *Time delay adjustable from 100 ms to 10 min in four sub-ranges*
- *Power-up inhibit time adjustable from 0.3–30 s*
- *Default time delay adjustable from 0.3–3 s*
- *LEDs indicating power on and output relay state*

Without latching



With latching



OPERATING PRINCIPLE

This control relay is used to resolve problems of underspeed on such devices as conveyor belts and conveyors, where crossing a low speed threshold must trigger an alarm.

Speed information is detected via a sensor (such as a three-wire or NAMUR proximity sensor), a volt-free contact, or the voltage.

On power-up, to allow the controlled process to reach its operating speed, control is inhibited for a time between 0.3 and 30 s, adjustable on the front panel of the control relay. When startup requires an inhibition time exceeding 30 s, external contact S2 must be closed during startup (causing the yellow LED to flash), then opened once nominal speed is reached.

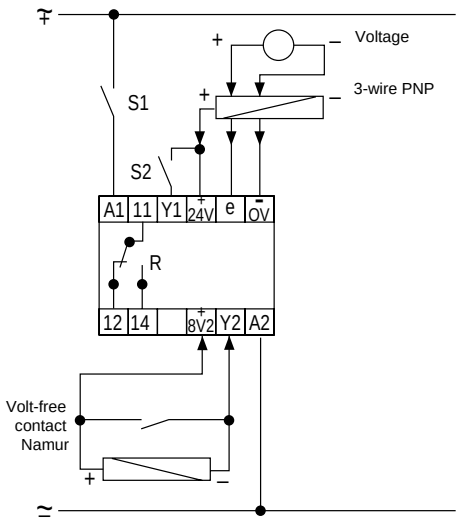
On each cycle of the controlled process, the sensor sends an impulse to the relay. Each of these impulses resets the relay's internal time delay. If the time between two impulses is less than the setting on the relay, then the time delay is reset at each impulse, and the output relay stays closed.

If the speed of the controlled process drops, then the time between two impulses increases. When the time between two impulses exceeds the setting value on the relay, indicating that the controlled process is running at underspeed, the output relay changes state (opens).

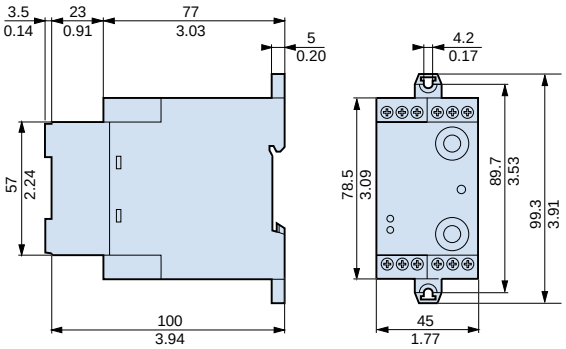
The output relay closes again when the speed of the controlled process exceeds the setting value plus the hysteresis (5% of the setting value).
If Memory mode is selected, then the relay stays open when an underspeed fault is detected. The output relay can only close again after a manual reset is performed by closing external contact S2.

A yellow LED indicates the state of the relay. A green LED indicates that the power supply is on.

WIRING



DIMENSIONS (approximate)



Dimensions: $\frac{mm}{in.}$

Terminals

AI–A2	Supply voltage
11–12–14	Output relay (R)
+24 V–E–0 V	3-wire PNP sensor
E–0 V	Voltage input
+8 V 2–Y2	Contact/NAMUR sensor input

RM84874304

SELECTION

Underspeed control relays

Voltage	Catalog Number	Weight oz (kg)
230 Vac	**RM84874304**	9.0 (0.255)

Supply characteristics

Supply voltage Un		**Vac**	230 (50/60 Hz) galvanic isolation by transformer
Operating range			0.85–1.15 Un
Maximum power consumption		**VA**	3.5 max. at Un and 5 at Un +15%
Immunity to microbreaks		**ms**	10
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3

Input/control circuit characteristics

Input circuit	3-wire sensor		24 V PNP (50 mA max.)
	NAMUR sensor		8.2 V on 1 kΩ
	Contact		Hard contacts
	Voltage input	**V**	30 max.
Input resistance		**kΩ**	16 kΩ except for NAMUR 1
State	High	**V**	Min. 4.5; max. 30
	Low	**V**	Min. 0; max. 1
Cut-off frequency		**Hz**	200
Minimum impulse time		**ms**	5
Minimum time between impulses		**ms**	5
Selection of time delay and memory function	Without memory		0.1–1.0 s, 1–10 s, 0.1–1.0 min, 1–10 min — 8-position switch on front panel
	With memory		0.1–1.0 s, 1–10 s, 0.1–1.0 min, 1–10 min
Hysteresis			5% of the threshold setting
Setting accuracy			10% of the full scale value at 77 °F (25 °C)
Repeat accuracy			±0.5% with constant parameters
Temperature drift			±0.05% per °C
Voltage drift			±1% / V
Reset time		**ms**	200 minimum
Reset time for S2		**ms**	100 minimum
Inhibit time delay		**s**	0.3–30 ±10%

Output circuit characteristics

Output			1 C/O contact, AgCdO
Breaking capacity			2000 VA, 80 W
Maximum breaking current	AC/DC	**A**	8
Minimum breaking current	AC/DC	**mA**	100
Maximum switching voltage		**Vac/Vdc**	100
Mechanical life			5×10^6 operating cycles (see ▲ on page 63)
Electrical life	AC-12		2000 VA, 10^5 operating cycles (see ▲ on page 63)
	AC-15		Cos φ = 0.3, 6000 operating cycles (see ▲ on page 63)
	DC-13		L/R = 300 ms, 6000 operating cycles (see ▲ on page 63)

Other characteristics

Enclosure material			Self-extinguishing
Terminal capacity	With cable end	**AWG (mm^2)**	Two #16 (1.5)
	Without cable end	**AWG (mm^2)**	Two #14 (2.5)
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60, conforming to IEC 60068-1-14)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70, conforming to IEC 60068-1-1/2)
Relative humidity			93% without condensation
Approvals	c UL us	File E173076 CCN NRNT File E173076 CCN NRNT 7	CSA Pending — CE

- *Self-powered*
- *Control of motor overload and underload*
- *Measurement of phase displacement between voltage and current (Cos φ)*
- *Independent adjustment of minimum and maximum thresholds, from 0.1–0.99*
- *Power-up inhibit time adjustable from 0.5–20 s*
- *Default time delay adjustable from 0.3–3 s*
- *Two output relays (one per threshold)*
- *LEDs indicating power on and output relay state*

OPERATING PRINCIPLE

The control relay is used for motor protection. The variation in the power factor (voltage/current phase displacement or Cos φ) is related to the variation in the mechanical load of the motor. The control relay monitors the power factor, and therefore the mechanical load, and checks that it is between two defined and adjustable limits.

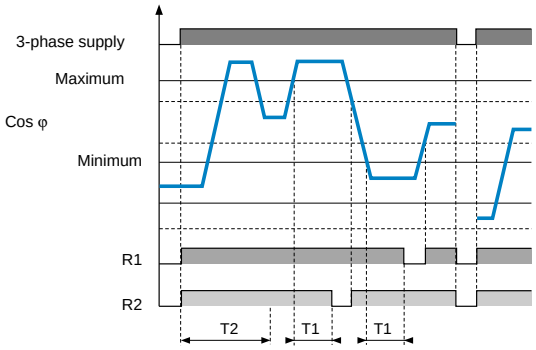
A green LED indicates that the power supply is ON.
Two yellow LEDs indicate the state of the output relays.

On power-up, the two output relays are closed for the duration of the inhibit time (T2 adjustable from 0.5 to 20 s). When the power factor value is between the two threshold settings, both relays are closed.

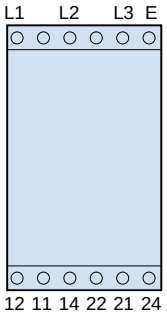
When the power factor exceeds the maximum value set by the user, the high threshold relay is de-energized after a time delay T1 (adjustable from 0.3 to 3 s). During this time delay, the green LED flashes (1 Hz). The relay closes again as soon as the measured value drops below the threshold minus the hysteresis.

When the power factor drops below the minimum value set by the user, the low threshold relay is de-energized after a time delay T1 (adjustable from 0.3 to 3 s). During this time delay, the green LED flashes. The relay closes again as soon as the measured value rises above the threshold plus the hysteresis.

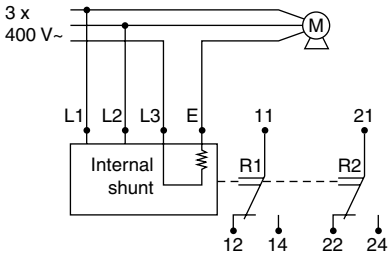
If the high threshold value is set below or equal to the low threshold value, the green LED flashes rapidly (2 Hz).



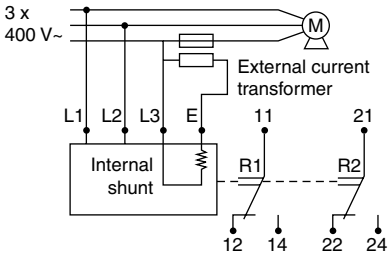
WIRING



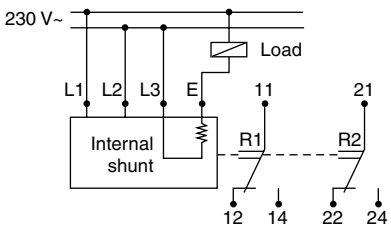
Three-phase network, I < 10 A ~



Three-phase network, I < 10 A ~



Single-phase network, 230 V~



Terminals

L1—L2—L3	Network to be monitored
E	Current read output
11—12—14	Low threshold output relay (R1)
21—22—24	High threshold output relay (R2)

RM84873400

SELECTION

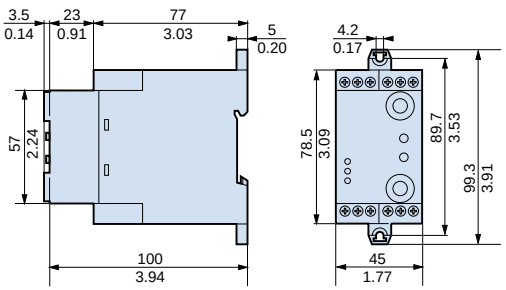
Motor load control relays (Cos φ)

Power supply/control	Catalog Number	Weight oz (kg)
3 @ 230 Vac	**RM84873400**	12.7 (0.360)
3 @ 400 Vac	**RM84873401**	12.7 (0.360)

Supply characteristics			
Supply voltage Un		**Vac**	230, 400, self-powered via L1 and L2
Operating range			0.85–1.15 Un
Power		**VA**	**Rated:** 2 at Un; **Maximum:** 3 at Un +15%
Immunity to microbreaks		**ms**	10
Creepage distance and clearance	Conforming to IEC 60664-1	**kV**	4kV/3
Control input circuit characteristics			
Threshold display			0.1–0.99
Voltage circuit input resistance		**kΩ**	About 2 (Un)
Current measurement			By internal link via 2 terminals
Current range		**A**	0.5–10
Input resistance		**mΩ**	20
Maximum continuous current		**A**	14 at 68 °F (20 °C)
Peak overload		**A**	50 (< 1 s) at 68 °F (20 °C)
Time delays	On energization (t2)	**s**	0.5–20 ±20% of the full scale value
	On crossing the threshold (t1)	**s**	0.3–3 ±20% of the full scale value
Frequency		**Hz**	50–60
Hysteresis	Cos φ ≥ 0.4		10% fixed
	Cos φ < 0.4		10% <Hysteresis < 30%
Setting accuracy			±10% of the full scale value
Repeat accuracy			±0.08% with constant parameters
Temperature drift			±0.05% per °C
Output circuit characteristics			
Output			2 C/O contacts, AgCdO
Breaking capacity			2000 VA, 80 W
Maximum breaking current	AC/DC	**A**	8
Minimum breaking current	AC/DC	**mA**	100
Maximum switching voltage		**Vac/Vdc**	250
Mechanical life ▲			30×10^6 operating cycles ▲
Electrical life ▲	AC-12		2000 VA, 10^5 operating cycles ▲
	AC-15		Cos φ = 0.3, 6000 operating cycles ▲
	DC-13		L/R = 300 ms, 6000 operating cycles ▲
Other characteristics			
Enclosure material			Self-extinguishing
Terminal capacity		**AWG (mm^2)**	With cable end: two #16 (1.5); without cable end: two #14 (2.5)
Temperature limits	Operation	**°F (°C)**	-4 to +140 (-20 to +60, conforming to IEC 60068-1-14)
	Storage	**°F (°C)**	-22 to +158 (-30 to +70, conforming to IEC 60068-1-1/2)
Relative humidity			93% without condensation
Approvals	c UL us	File E173076 CCN NRNT File E173076 CCN NRNT 7	CSA Pending CE

▲ The expected life expressed above is based on average usage and normal operating conditions. Actual operating life will vary with conditions. The above statements are not intended to nor shall they create any expressed or implied warranties as to product operation or life. For information on the listed warranty offered on this product, refer to the Square D terms and conditions of sale found in the *Digest.*

DIMENSIONS



Dimensions: mm / in.

INDEX OF CATALOG NUMBERS

Schneider Electric USA

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