Monitoring Technique

VARIMETER
Voltage Relay
MK 9054N

Translation of the original instructions

DOLD

0280377

Product Description

The voltage relay MK 9054N of the VARIMETER series monitors single phase DC or AC voltage systems. The adjustment is made via potentiometers on the front of the device. Early recognition and preventive maintenance avoid interruptions of electrical plants and provides a higher operational and plant safety.

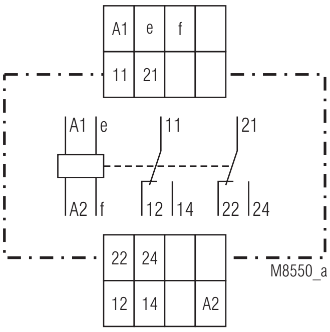
Your Advantages

- Protection against defect by overvoltage
- Preventive maintenance
- For better productivity
- Quicker fault locating
- Precise and reliable

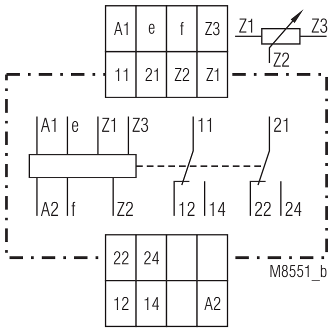
Features

- According to IEC/EN 60255-1, IEC/EN 60947-1
- To: Monitor DC and AC
- With measuring ranges from 15 mV to 500 V
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between auxiliary circuit – measuring ciruit
- Optionally with start-up delay
- With time delay, up to max. 100 sec
- Optionally with remote potentiometer
- As option with manual reset
- Option with fixed settings possible
- LED indicators for operation and contact position
- As option with pluggable terminal blocks for easy exchange of devices
  - With screw terminals
  - Or with cage clamp terminals
- Width 22.5 mm

Circuit Diagrams



MK 9054N



MK 9054N/1_ _

Approvals and Markings

CE CCC [1)]

1) Approval not for all variants

Applications

- Monitoring voltage in AC or DC systems
- For industrial applications

Connection Terminals

Terminal designation	Signal description
A1, A2	Auxiliary voltage
e, f	Voltage measuring input
11, 12, 14	1st changeover contact
21, 22, 24	2nd changeover contact
Z1, Z2, Z3	Remote potentiometer for response value

Function

The relays measure the arithmetic mean value of the rectified measuring voltage. The AC units are adjusted to the r.m.s value. They have settings for response value and hysteresis. The units work as overvoltage relays but can also be used for undervoltage detection. The hysteresis is dependent on the response value.

2 time delays are possible in different variants:
The start up delay t_a operates only when connecting the auxiliary supply. The response delay t_v is active after exceeding a response value. On overvoltage relays the delay is active when the voltage goes over the tripping value, on undervoltage relays when the voltage drops below the hysteresis value.

Safety Notes

Please observe when connecting a remote potentiometer to MK 9054N/1_ _:

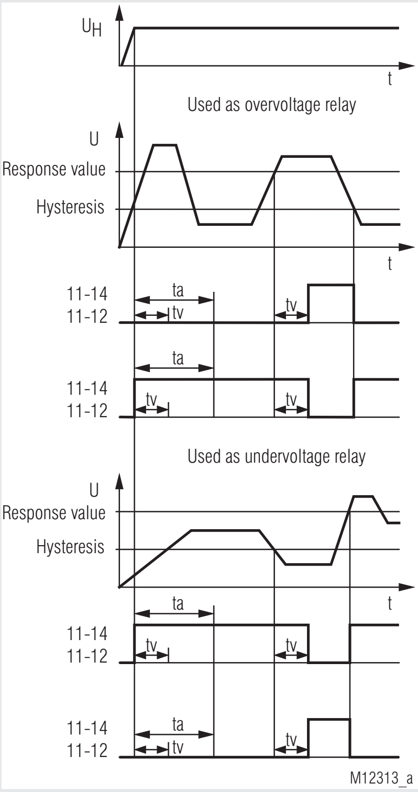
WARNING

Measuring circuit and remote potentiometer not galvanically separated. The remote potentiometer on terminals Z1, Z2, Z3 is related to terminal "e". Therefore "e" should be connected to "N", "-" or GND, so that the remote potentiometer is not connected to the Phase voltage. The remote potentiometer has to be connected volt- and ground-free.

Indicators

Green upper LED:	On, when auxiliary supply connected
Yellow lower LED:	On, when output relay acitvated

Function Diagram



At version MK 9054N/6__ with manual reset the contacts remain in the fault state after detecting a fault or after to has elapsed. The contacts are reset by disconnecting the supply voltage.

Technical Data

Input (e, f)

With 1 Measuring range for AC **a n d** DC			
Measuring range [1]		Internal resistance	Max. permissible contin. voltage
AC	DC		
6 ... 60 mV [3) 4)]	5,4 ... 54 mV [3) 4)]	20 kΩ	10 V
15 ... 150 mV [3) 4)]	13.5 ... 135 mV [3) 4)]	40 kΩ	100 V
50 ... 500 mV [3)]	45 ... 450 mV [3)]	270 kΩ	250 V
0.5 ... 5 V	0.45 ... 4.5 V	500 kΩ	300 V
1 ... 10 V	0.9 ... 9.0 V	1 MΩ	300 V
5 ... 50 V	4.5 ... 45 V	2 MΩ	500 V [2)]
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V [2)]
50 ... 500 V	45 ... 450 V	2 MΩ	500 V [2)]

[1)] DC or AC voltage 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)
[2)] Not suitable for 400 / 690 V-mains (systems)
[3)] To avoid measuring mistakes, twisted/shielded wires must always be used at the measuring input for device versions with an mV measuring range.
[4)] Only suitable for current measurment via shunt!

Measuring principle: Arithmetic mean value
Adjustment: The AC-devices can also monitor DC-voltage. The scale offset in this case is ($\overline{U} = 0.90\ U_{eff}$)
Temperature influence: < 0.05 % / K

Setting Ranges

Setting
Response value: Infinite variable 0.1 U_N ... 1 U_N relative scale
Hysteresis
at AC: Infinite variable 0.5 ... 0.98 of setting value
At DC: Infinite variable 0.5 ... 0.96 of setting value
Accuracy:
Response value at
Potentiometer right stop (max): 0 ... + 8 %
Potentiometer left stop (min): - 10 ... + 8 %
Repeat accuracy
(constant parameter): ≤ ± 0.5 %
Recovery time
at devices with manual reset
(Reset by braking
of the auxiliary voltage)
MK 9054N/6_ _: ≤ 1 s
(dependent to function and auxiliary voltage)
Time delay t_v: Infinite variable at logarithmic scale
from 0 ... 20 s, 0 ... 30 s, 0 ... 60 s, 0 ... 100 s
setting 0 s = without time delay
Start-up delay t_a: 0.1 ... 20 s; 0.1 ... 60 s; 0.1 ... 100 s

Auxiliary voltage U_H (A1, A2)

Nominal voltage	Voltage range	Frequency range
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 … 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 40 ... 265 V	45 … 400 Hz; DC 48 % W
	DC 40 ... 300 V	W ≤ 5 %

Nominal consumption: 4 VA; 1.5 W at AC 230 V Rel. energized
1 W at DC 80 V Rel. energized

Technical Data

Output

Contacts:	2 changeover contacts	
Thermal current I_{th}:	2 x 4 A	
Switching capacity		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60947-5-1
To DC 13:	1 A / DC 24 V	IEC/EN 60947-5-1
Electrical life		
at 2 A, AC 230 V cos φ = 1:	10^5 switching cycles	
Short-circuit strength		
max. fuse rating:	6 A gG / gL	IEC/EN 60947-5-1
Mechanical life:	20 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 40 ... + 60 °C (higher temperature with limitations on request)	
Storage:	- 40 ... + 70 °C	
Altitude:	≤ 2000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61000-4-3
1 GHz ... 2.7 GHz:	10 V/m	IEC/EN 61000-4-3
Fast transients:	4 kV	IEC/EN 61000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61000-4-5
Between wire and ground:	4 kV	IEC/EN 61000-4-5
HF wire guided:	10 V	IEC/EN 61000-4-6
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60529
Terminals:	IP 20	IEC/EN 60529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60068-2-6
Climate resistance:	40 / 060 / 04	IEC/EN 60068-1
Terminal designation:		EN 50005
Wire connection		
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Min. cross section for connection:	0.5 mm²	
Insulation of wires or sleeve length:	$12^{\pm 0.5}$ mm	
Wire fixing:	Plus-minus terminal screws M3.5 box terminals with wire protection or cage clamp terminals	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Mounting:	DIN-rail	IEC/EN 60715
Weight:	150 g	

Dimensions

Width x height x depth:	22.5 x 90 x 97 mm

CCC-Data

Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60947-5-1
To DC 13:	1 A / DC 24 V	IEC/EN 60947-5-1

Info: **Technical data that is not stated in the CCC-Data, can be found in the technical data section.**

Standard Types

MK 9054N.12/010 AC 25 ... 250 V AC/DC 80 ... 230 V t_v 0 ... 20 s t_a 0.1 ... 20 s

Article number: 0053714

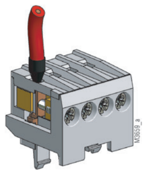
- For Overvoltage monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U_H: AC/DC 80 ... 230 V
- Time delay t_v by U_{an}: 0 ... 20 s
- Start up delay t_a: 0.1 ... 20 s
- Width: 22.5 mm

Ordering Example

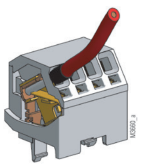
MK 9054N _ _ /_ _ _ AC 25 ... 250 V AC/DC 80 ... 230 V 0 ... 20 s 0,1 ... 20 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range
- 10 Overvoltage relay energized on trip
  11 Overvoltage relay de-energized on trip
  12 Undervoltage relay de-energized on trip
  13 Undervoltage relay energized on trip
- 0 Standard version without remote potentiometer
  1 Standard version with remote potentiometer (resp. value) Z1, Z2, Z3 for 470 kΩ **at this version there is no potentiometer for the response value**
  6 General definition with manual reset function
- Type of terminals
  Without indication: terminal blocks fixed, with screw terminals
  PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  PS (plug in screw): pluggable terminal blocks with screw terminals
- Type

Options with Pluggable Terminal Blocks



Screw terminal
(PS/plugin screw)

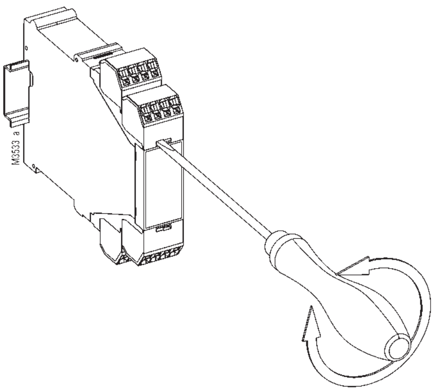


Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Accessories

AD 3:	Remote potentiometer 470 kW Article number: 0050174

Setting

Example:
Voltage relay AC 25 ... 250 V

AC according to type plate:
i.e. the unit is adjusted to AC voltage
25 ... 250 V = measuring range

Response value AC 150 V
Hysteresis AC 75 V

Settings		
upper potentiometer:	0.6	(0.6 x 250 V = 150 V)
Lower potentiometer:	0.5	(0.5 x 150 V = 75 V)

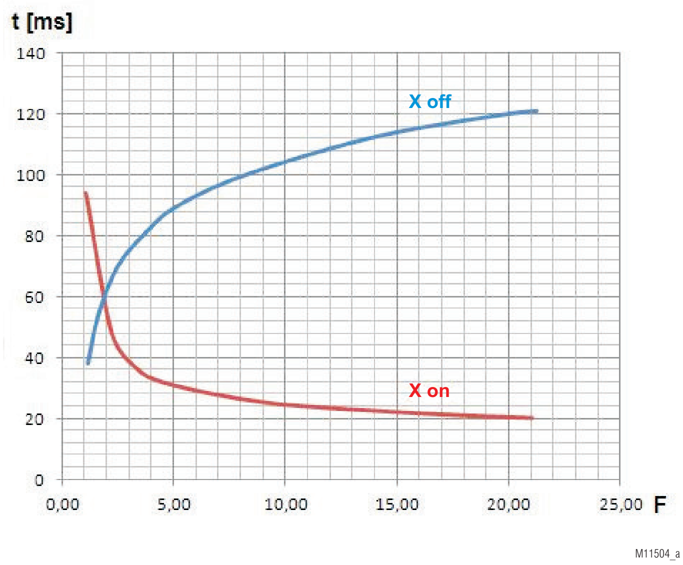
The AC-devices can also monitor DC voltage. The scale offset in this case is: $\overline{U} = 0.9 \times U_{eff.}$

AC 25 ... 250 V is equivalent to DC 22.5 ... 225 V

Response value DC 150 V
Hysteresis DC 75 V

Settings		
upper potentiometer:	0.66	(0.66 x 225 V = 150 V)
Lower potentiometer:	0.5	(0.5 x 150 V = 75 V)

Characteristic



Time delay of measuring circuit

X on: Measured value rises $F = \dfrac{\text{Meas. value (after rise of meas. value)}}{\text{Setting value}}$

X off: Measured value drops $F = \dfrac{\text{Meas. value (befor meas. value drops)}}{\text{Setting value (hysteresis)}}$

The diagram shows the typical delay of a standard devices depending on the measured values "X on and X off" at sudden rise or drop of the signal. At slow change of the measured value the delay is shorter.
The total reaction time of the device results from the adjustable delay t_v and the delay created by the measuring circuit.

The diagram shows an average delay. The delay times could differ on the different variants.

Example for "X on" (overvoltage detection with MK 9054N/010):
Adjusted setting value X on = 230 V.
Caused by a missing neutral the voltage rises suddenly to 400 V

$$F = \frac{\text{Measured value (after rise of meas. value)}}{\text{Setting value}} = \frac{400\ \text{V}}{230\ \text{V}} = 1.74$$

Reading from the diagram:
The output relay switches on after 64 ms at a setting $t_v = 0$.

Example for "X off" (undervoltage detection with MK 9054N/012):
Adjusted hysteresis setting value is 100 V.
Caused by a broken wire the voltage drops suddenly from 230 V to 0 V.

$$F = \frac{\text{Measured value (befor meas. value drops)}}{\text{Setting value (hysteresis)}} = \frac{230\ \text{V}}{100\ \text{V}} = 2.3$$

Reading from the diagram:
The output relay switches off after 70 ms at a setting $t_v = 0$.