

## VARIMETER Voltage Relay BA 9054, MK 9054N



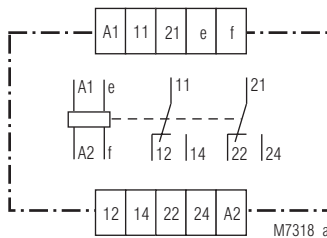
### Your Advantages

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

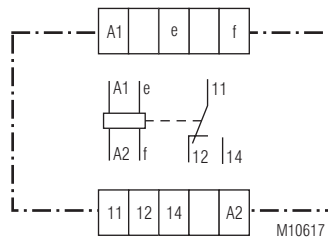
### Features

- According to IEC/EN 60 255, DIN VDE 0435-303, IEC/EN 60 947-1
- to: monitor DC and AC
- BA 9054 with measuring ranges from 15 mV to 1000 V
- MK 9054N with measuring ranges from 15 mV to 500 V
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between Auxiliary Circuit – measuring circuit
- Auxiliary supply AC/DC; BA 9054 with AC
- BA 9054 optionally with start-up delay (MK = standard)
- with time delay, up to max. 100 sec
- BA 9054 optionally with safe separation to IEC/EN 61 140
- MK 9054N optionally with remote potentiometer
- As option with manual reset
- LED indicators for operation and contact position
- MK 9054N as option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width BA 9054: 45 mm
- Width MK 9054N: 22.5 mm

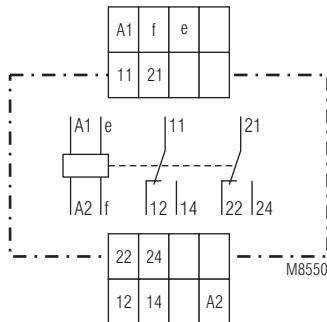
### Circuit Diagrams



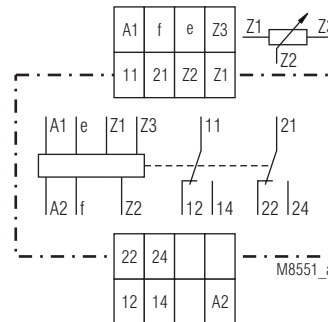
BA 9054



BA 9054/\_ 2 \_



MK 9054N



MK 9054N/1 \_ \_

### Approvals and Markings



\* see variants

### Applications

Monitoring voltage in AC or DC systems

### 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 overcurrent relays the delay is active when the current goes over the tripping value, on undercurrent relays when the current drops below the hysteresis value.

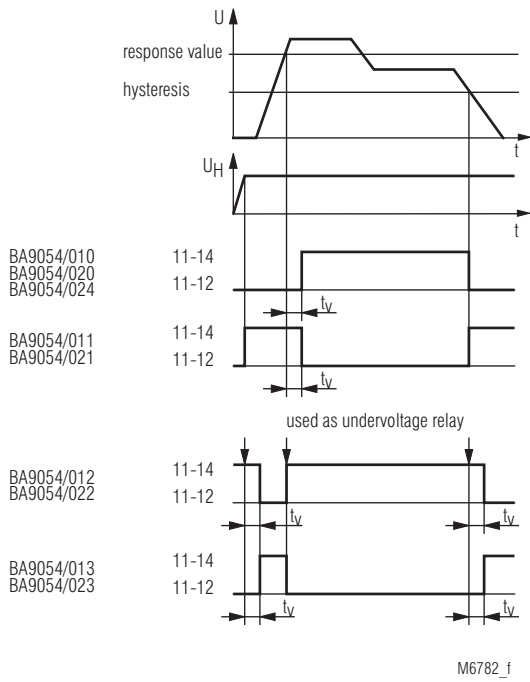
### Indicators

green upper LED: on, when auxiliary supply connected  
yellow lower LED: on, when output relay activated

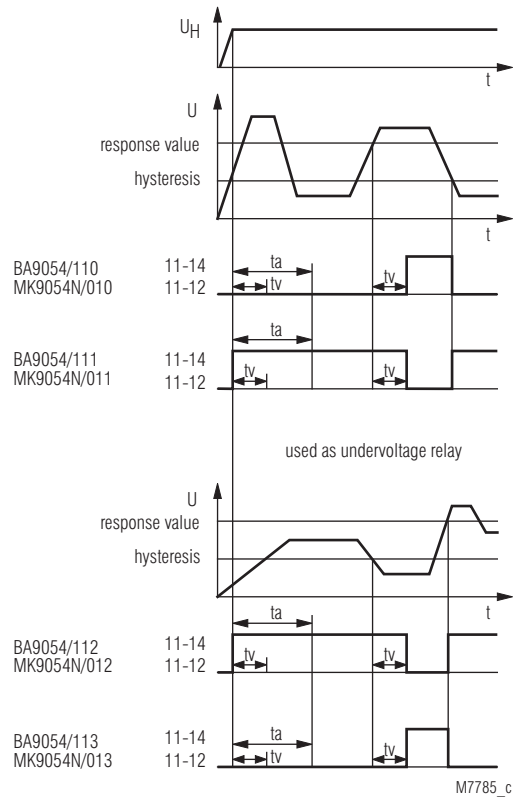
### Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
i, k	Current measuring input
11, 12, 14	1st changeover contact
21, 22, 24	2nd changeover contact

### Function Diagram without Start-up Delay



### Function Diagram with Start-up Delay



Version BA 9054/\_1\_: 2 changeover contacts

Version BA 9054/\_20, /\_21, /\_22, /\_23, /\_24: 1 changeover contact, measuring range  $\geq 70 \dots 700 \text{ V}$

At version BA 9054/6\_\_ with manual reset the contacts remain in the fault state after detecting a fault or after  $t_a$  has elapsed. The contacts are reset by disconnecting the supply voltage.

Input (e, f)

BA 9054 with 1 Measuring range for AC <b>and</b> DC			
Measuring range <sup>1)</sup>		internal resistance	max. permissible contin. voltage
AC	DC		
6 ... 60 mV	5.4 ... 54 mV	20 kΩ	10 V
15 ... 150 mV	13.5 ... 135 mV	40 kΩ	100 V
50 ... 500 mV	45 ... 450 mV	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 <sup>2)</sup>
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V <sup>2)</sup>
50 ... 500 V	45 ... 450 V	2 MΩ	500 V <sup>2)</sup>
70 ... 700 V <sup>3)</sup>	63 ... 630 V	3 MΩ	700 V <sup>4)</sup>
100 ... 1000 V <sup>3)</sup>	90 ... 900 V	3 MΩ	1000 V <sup>4)</sup>

<sup>1)</sup> DC or AC voltage 50 ... 5000 Hz (Other frequency ranges of 10 ... 5000 Hz, e.g. 16 2/3 Hz on request)

<sup>2)</sup> at Overvoltage category II: 600 V

<sup>3)</sup> only with BA 9054/\_20; /\_21; /\_22; /\_23; /\_24 (Version: 1 changeover contact)

<sup>4)</sup> at overvoltage category II: 1000 V

**Please note:**

Measuring ranges 6 ... 60 mV only available at variant BA 9054/080 (Using only for current sensing via shunt!)

MK 9054N with 1 Measuring range for AC <b>and</b> DC			
Measuring range <sup>1)</sup>		internal resistance	max. permissible contin. voltage
AC	DC		
6 ... 60 mV	5.4 ... 54 mV	20 kΩ	10 V
15 ... 150 mV	13.5 ... 135 mV	40 kΩ	100 V
50 ... 500 mV	45 ... 450 mV	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 <sup>2)</sup>
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V <sup>2)</sup>
50 ... 500 V	45 ... 450 V	2 MΩ	500 V <sup>2)</sup>

<sup>1)</sup> DC or AC voltage 50 ... 5000 Hz (Other frequency ranges of 10 ... 5000 Hz, e.g. 16 2/3 Hz on request)

<sup>2)</sup> Not suitable for 400 / 690 V-mains (systems)

**Please note:**

To avoid measuring mistakes, on units with mV input the input must always be terminated. In addition screened wires should be used..

Measuring ranges 6 ... 60 mV + 15 ... 150 mV (Using only for current sensing via shunt!)

**Measuring principle:** arithmetic mean value  
**Adjustment:** The AC-devices can also monitor DC-voltage. The scale offset in this case is ( $\bar{U} = 0.90 U_{eff}$ )  
**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:** ≤ ± 0.5 %

**Recovery time**

at devices with manual reset (Reset by braking of the auxiliary voltage)  
 BA 9054/6\_ \_; 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  $t_a$ :**

BA 9054/1 \_ \_: 1 ... 20 s; 1 ... 60 s; 1 ... 100 s, adjustable on logarithmic scale.  $t_a$  is started when the supply voltage is connected. During elapse of time the output contact is in good state  
 MK 9054N: 0.1 ... 20 s; 0.1 ... 60 s; 0.1 ... 100 s

**Auxiliary Circuit BA 9054 and MK 9054N**

**Auxiliary voltage  $U_H$  (A1, A2)**

BA 9054, Nominal voltage: AC 24, 42, 110, 127, 230, 400 V

**Voltage range:** 0.8 ... 1.1  $U_H$

**Nominal frequency:** 50 / 60 Hz

**Frequency range:** ± 5 %

**Nominal consumption:** 2.5 VA

BA 9054, MK 9054N:		
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 %

BA 9054		
Nominal voltage	Voltage range	Frequency range
DC 12 V	DC 10 ... 18 V	battery voltage

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

**Output**

**Contacts**

BA 9054: 2 changeover contacts  
 MK 9054N: 2 changeover contacts

**Thermal current  $I_{th}$**

BA 9054: 2 x 5 A  
 MK 9054N: 2 x 4 A

**Switching capacity**

BA 9054 to AC 15:  
 NO contact: 2 A / AC 230 V IEC/EN 60 947-5-1  
 NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1  
 MK 9054N to AC 15: 1.5 A / AC 230 V IEC/EN 60 947-5-1  
 BA 9054, MK 9054N to DC 13: 1 A / DC 24 V IEC/EN 60 947-5-1  
 IEC/EN 60 947-5-1

**Electrical life**

BA 9054 to AC 15 at 3 A, AC 230 V: 5 x 10<sup>5</sup> switching cycles  
 MK 9054N: to AC 15 at 3 A, AC 230 V: 10<sup>5</sup> switching cycles

**Short-circuit strength**

**max. fuse rating:** 6 AgL IEC/EN 60 947-5-1

**Mechanical life**

BA 9054: 50 x 10<sup>6</sup> switching cycles  
 MK 9054N: 30 x 10<sup>6</sup> switching cycles

## Technical Data

### General Data

<b>Operating mode:</b>	Continuous operation	
<b>Temperature range:</b>	- 40 ... + 60°C	
<b>Clearance and creepage distances</b>	rated impulse voltage / pollution degree	
BA 9054:	6 kV / 2	IEC 60 664-1
MK 9054N:	4 kV / 2	IEC 60 664-1
<b>EMC tested according to railway standard EN 50155</b>		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
<b>Degree of protection</b>		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
<b>Housing:</b>	Thermoplastic with V0 behaviour according to UL subject 94	
<b>Vibration resistance:</b>	Amplitude 0.35 mm IEC/EN 60 068-2-6 frequency 10 ... 55 Hz	
<b>Climate resistance:</b>	40 / 060 / 04	IEC/EN 60 068-1
<b>Terminal designation:</b>	EN 50 005	
<b>Wire connection</b>		
BA 9054:	2 x 2.5 mm <sup>2</sup> solid or 2 x 1.5 mm <sup>2</sup> stranded wire with sleeve	
MK 9054N:		
<b>Screw terminals (integrated):</b>	1 x 4 mm <sup>2</sup> solid or 1 x 2.5 mm <sup>2</sup> stranded ferruled (isolated) or 2 x 1.5 mm <sup>2</sup> stranded ferruled (isolated) or 2 x 2.5 mm <sup>2</sup> solid	
Insulation of wires or sleeve length:	8 mm	
<b>Plug in with screw terminals</b>		
max. cross section for connection:	1 x 2.5 mm <sup>2</sup> solid or 1 x 2.5 mm <sup>2</sup> stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
<b>Plug in with cage clamp terminals</b>		
max. cross section for connection:	1 x 4 mm <sup>2</sup> solid or 1 x 2.5 mm <sup>2</sup> stranded ferruled (isolated)	
min. cross section for connection:	0.5 mm <sup>2</sup>	
Insulation of wires or sleeve length:	12 ±0.5 mm	
<b>Wire fixing</b>		
BA 9054:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1	
MK 9054N:	Plus-minus terminal screws M3.5 box terminals with wire protection or cage clamp terminals	
<b>Mounting:</b>	DIN-rail IEC/EN 60 715	
<b>Weight</b>		
BA 9054:	AC-device:	280 g
	AC/DC-fdevice:	200 g
MK 9054N:		150 g

### Dimensions

#### Width x height x depth

BA 9054:	45 x 75 x 120 mm
MK 9054N:	22.5 x 90 x 97 mm

## UL-Data

### Auxiliary voltage U<sub>H</sub> (A1, A2)

BA 9054: AC 24, 42, 48, 110, 115, 120 V

### Thermal current I<sub>th</sub>:

BA 9054: 2 x 5 A

MK 9054N: 2 x 4 A

### Clearance and creepage distances

BA 9054, MK 9054N: 4 kV / 2 IEC 60 664-1

### HF irradiation

BA 9054 (80 MHz ... 2.7 GHz) 10 V/m IEC/EN 61 000-4-3

**Switching capacity:** Pilot duty B150

**Ambient temperature:** - 40 ... + 60°C



Technical data that is not stated in the UL-Data, can be found in the technical data section.

## CCC-Data

### Switching capacity

to AC 15: 1.5 A / AC 230 V IEC/EN 60 947-5-1

to DC 13: 1 A / DC 24 V IEC/EN 60 947-5-1



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

## Standard Types

BA 9054/010 AC 25 ... 250 V AC 230 V

Article number: 0053639

- for Overcurrent monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U<sub>H</sub>: AC 230 V
- Time delay t<sub>v</sub> by U<sub>an</sub>: 0 ... 20 s
- Width: 45 mm

BA 9054/012 AC 25 ... 250 V AC 230 V

Article number: 0053711

- for Undercurrent monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U<sub>H</sub>: AC 230 V
- Time delay t<sub>v</sub> by U<sub>ab</sub>: 0 ... 20 s
- Width: 45 mm

MK 9054N.12/010 AC 25 ... 250 V AC/DC 80 ... 230 V t<sub>v</sub> 0 ... 20 s t<sub>a</sub> 0.1 ... 20 s

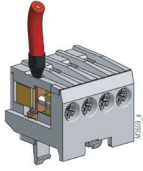
Article number:

- for Overcurrent monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U<sub>H</sub>: AC/DC 80 ... 230 V
- Time delay t<sub>v</sub> by U<sub>an</sub>: 0 ... 20 s
- Start up delay t<sub>a</sub>: 0.1 ... 20 s
- Width: 22.5 mm

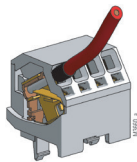
Ordering example for variants

BA 9054 /	/61	AC 25 ... 250V	AC 230 V	0 ... 20 s	1 ... 20 s	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 $t_v$				Start up delay $t_a$	Time delay $t_v$
				Auxiliary voltage	Measuring range				Auxiliary voltage	Measuring range
				With UL-approval						
				10	Overcurrent relay energized on trip time delay at setting value				10	Overvoltage relay open circuit operation
				11	Overcurrent relay de-energized on trip time delay at setting value				11	Overvoltage relay closed circuit operation
				12	Undercurrent relay energized on trip time delay at hysteresis value				12	Undervoltage relay open circuit operation
				13	Undercurrent relay de-energized on trip time delay at hysteresis value				13	Undervoltage relay closed circuit operation
				21	Same as BA 9054/011, but with measuring range $\geq 70 \dots 700 \text{ V}$ , 1 C/O contact				0	Standard version without remote potentiometer
				22	Same as BA 9054/012, but with measuring range $\geq 70 \dots 700 \text{ V}$ , 1 C/O contact				1	Standard version with remote potentiometer (resp. value) Z1, Z2, Z3 for 470 k $\Omega$ <b>at this version there is no potentiometer for the response value</b>
				23	Same as BA 9054/013, but with measuring range $\geq 70 \dots 700 \text{ V}$ , 1 C/O contact				6	General definition with manual reset function
				24	Same as BA 9054/010, but with measuring range $\geq 70 \dots 700 \text{ V}$ , 1 C/O contact					Type of terminals
				0	Standard version					Without indication: terminal blocks fixed, with screw terminals
				1	With start up delay $t_a$					PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
				2	With safe electrical separation of input- and output circuit according to DIN 61140					PS (plug in screw): pluggable terminal blocks with screw terminals
					Meas. range up to $\leq 10 \text{ A}$ : DIN EN 60947-1; 4 kV/2 in relation of overvoltage category III with basic insulation to DIN EN 60664-1 of 4 kV; Meas. range up to $\geq 15 \text{ A}$ : overvoltage category II with basic insulation of 2.5 kV					Type
				3	With 5 $\mu\text{m}$ gold plated contacts					
				5	With forcibly guided contacts					
				6	With manual reset, resetting by disconnecting the power supply					

## Options with Pluggable Terminal Blocks



Screw terminal  
(PS/plugin screw)

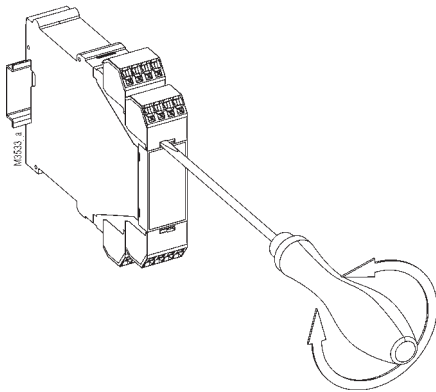


Cage clamp  
(PC/plugin cage clamp)

## 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 BA 9054 / MK 9054N 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)

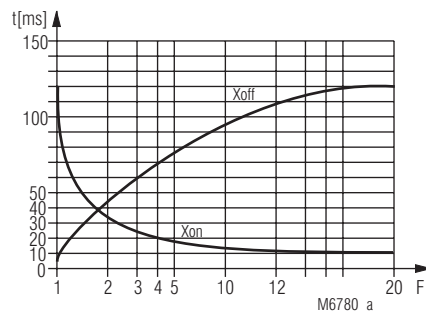
The AC-devices can also monitor DC current. The scale offset in this case is:  $U = 0.9 \times U_{\text{eff}}$ .

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)

## Characteristics



### Switching delay

The characteristic shows the switching delay depending on the values of  $X_{\text{on}}$  -  $X_{\text{off}}$  when switching the current on or off. A slow current change reduces the delay.

$$F = \frac{U_{\text{applied}}}{U_{\text{setting}}}$$