

## VARIMETER Voltage Relay BA 9054, MK 9054N



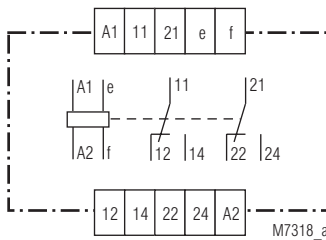
### Your Advantages

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

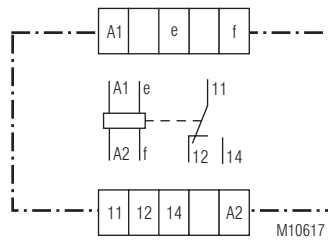
### Features

- 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

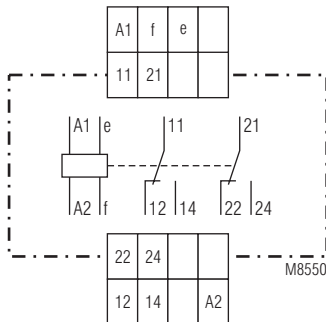
### Circuit Diagrams



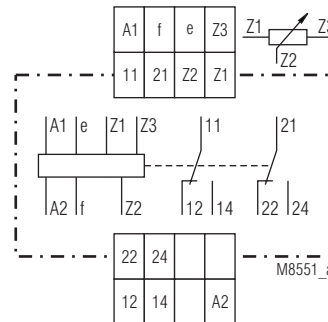
BA 9054



BA 9054/\_ 2 \_



MK 9054N



MK 9054N/1 \_ \_

### Approvals and Markings



\* see variants

### Applications

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

### 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.

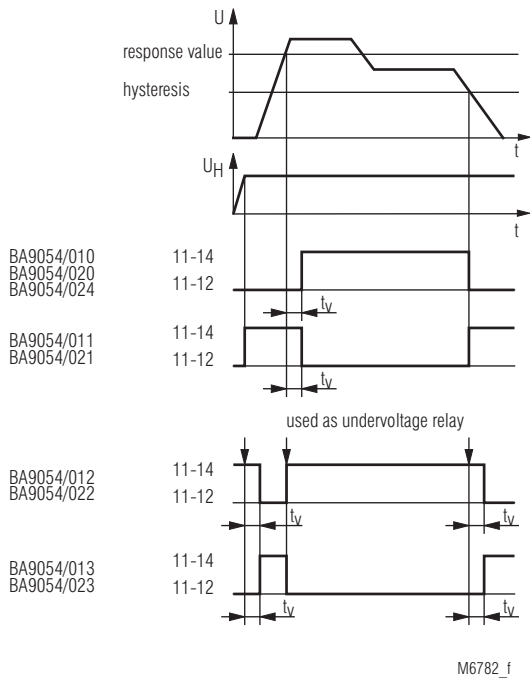
### Indicators

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

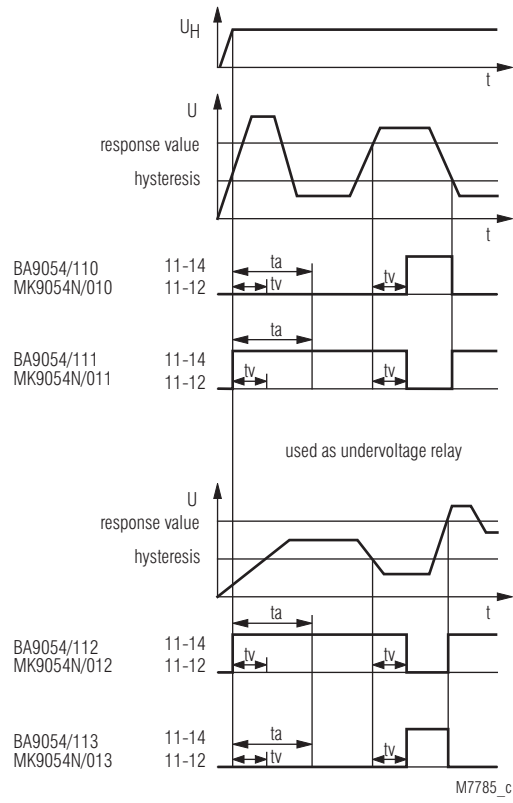
### Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
e, f	Voltage 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  $t$  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 (higher temperature with limitations on request)

### Clearance and creepage distances

rated impulse voltage / pollution degree

BA 9054:	6 kV / 2	IEC 60 664-1
MK 9054N	4 kV / 2	IEC 60 664-1

### EMC

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

### Degree of protection

Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529

**Housing:** 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	IEC/EN 60 068-1
	40 / 060 / 04	EN 50 005

### Climate resistance:

**Terminal designation:** EN 50 005

### Wire connection

BA 9054:	2 x 2.5 mm <sup>2</sup> solid or 2 x 1.5 mm <sup>2</sup> stranded wire with sleeve
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### MK 9054N

#### Screw terminals

<b>(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
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Insulation of wires or sleeve length:

#### Plug in with screw terminals

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)
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Insulation of wires or sleeve length:

#### Plug in with cage clamp terminals

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)
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min. cross section for connection:

Insulation of wires or sleeve length:	12 ±0.5 mm
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### Wire fixing

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	

**Fixing torque:** 0.8 Nm

<b>Mounting:</b>	DIN-rail	IEC/EN 60 715
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### Weight

BA 9054:	AC-device: 280 g AC/DC-fdevice: 200 g
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MK 9054N:	150 g
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## Dimensions

### Width x height x depth

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

## Classification to DIN EN 50155 for BA 9054

### Vibration and

<b>shock resistance:</b>	Category 1, Class B	IEC/EN 61 373
<b>Protective coating of the PCB:</b>	No	

## UL-Data

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

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

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

	Pilot duty B150
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### Ambient temperature:

	- 40 ... + 60°C
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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

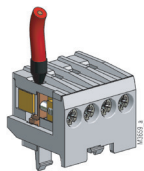
Article number:

- 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

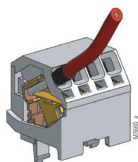
Ordering example for variants

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 $t_v$ Auxiliary voltage Measuring range					Start up delay $t_a$ Time delay $t_v$ Auxiliary voltage Measuring range	
				With UL-approval						
				10	Overvoltage relay energized on trip time delay at setting value				10	Overvoltage relay open circuit operation
				11	Overvoltage relay de-energized on trip time delay at setting value				11	Overvoltage relay closed circuit operation
				12	Undervoltage relay energized on trip time delay at hysteresis value				12	Undervoltage relay open circuit operation
				13	Undervoltage relay de-energized on trip time delay at hysteresis value				13	Undervoltage relay closed circuit operation
				20	Same as BA 9054/024, but with additional moisture protection				0	Standard version without remote potentiometer
				21	Same as BA 9054/011, 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 $470 \text{ k}\Omega$ <b>at this version there is no potentiometer for the response value</b>
				22	Same as BA 9054/012, but with measuring range $\geq 70 \dots 700 \text{ V}$ , 1 C/O contact				6	General definition with manual reset function
				23	Same as BA 9054/013, but with measuring range $\geq 70 \dots 700 \text{ V}$ , 1 C/O contact				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	
				24	Same as BA 9054/010, but with measuring range $\geq 70 \dots 700 \text{ V}$ , 1 C/O contact				Type	
				46	Same as BA 9054/010, reduced reaction-time, measuring range DC $24 \dots 35 \text{ V}$ , it is necessary to connect power supply before measuring voltage					
				47	Same as 46, but with measuring range DC $60 \dots 78 \text{ V}$					
				0	Standard version					
				1	With start up delay $t_a$					
				2	With safe electrical separation of input- and output circuit according to DIN 61140					
				3	With $5 \mu\text{m}$ gold plated contacts					
				5	With forcibly guided contacts					
				6	With manual reset, resetting by disconnecting the power supply					
					Type					

## Options with Pluggable Terminal Blocks



Screw terminal  
(PS/plugin screw)

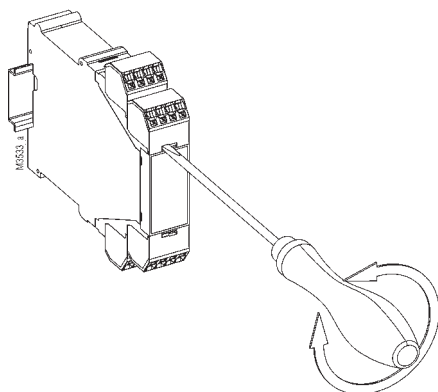


Cage clamp  
(PC/plugin cage clamp)

### 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 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)

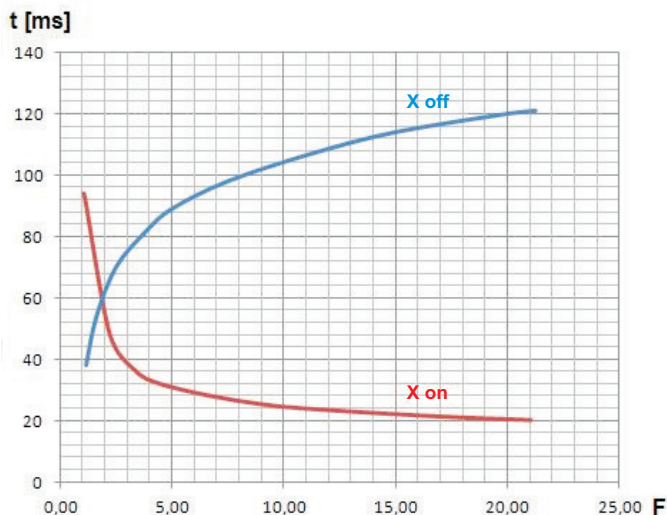
The AC-devices can also monitor DC current. The scale offset in this case is:  $\bar{U} = 0.9 \times U_{\text{eff}}$ .

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



M11504 a

### Time delay of measuring circuit

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

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

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.

### Example for "X on" (overvoltage detection with BA9054/010):

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 BA9054/012):

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  $t_v=0$ .