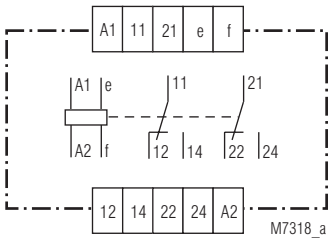
VARIMETER
Voltage Relay
BA 9054, MK 9054N

0221541

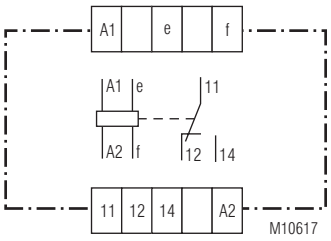
BA 9054

MK 9054N

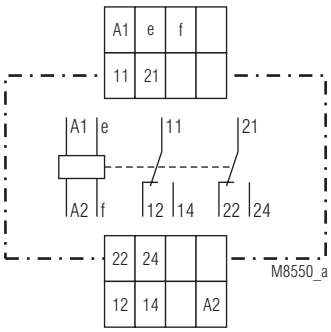
Circuit Diagrams



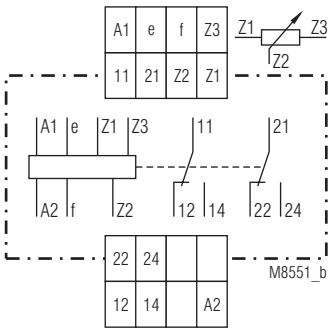
BA 9054



BA 9054/_ 2 _



MK 9054N



MK 9054N/1_ _

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
at MK 9054/1_ _: Z1, Z2, Z3	remote potentiometer for response 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.

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
- 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 ciruit
- 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 61140
- MK 9054N optionally with remote potentiometer
- As option with manual reset
- Option with fixed settings possible
- 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

Approvals and Markings

Canada / USA A025518

* see variants

Applications

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

Function

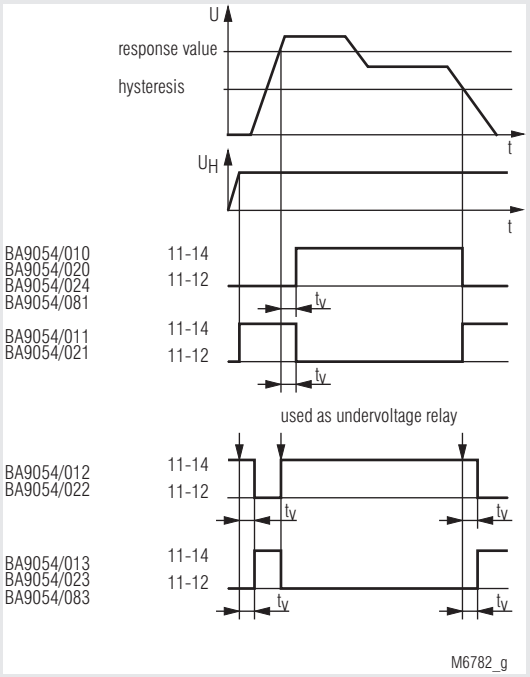
The relays measure the arithmetic mean value of the rectified measuring voltage. The AC units are adjusted to the r.m.s value. They have settings for response value and hysteresis. The units work as overvoltage relays but can also be used for undervoltage detection. The hysteresis is dependent on the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

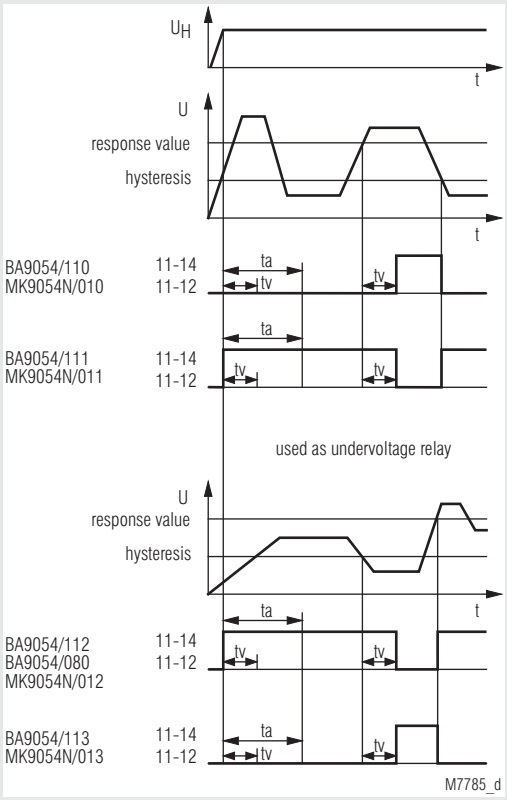
Indicators

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

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 ≥ 70 ... 700 V
At version BA 9054/6__ 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.

Input (e, f)

BA 9054 with 1 Measuring range for AC **a n d** DC			
Measuring range[1]		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[2]
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V[2]
50 ... 500 V	45 ... 450 V	2 MΩ	500 V[2]
70 ... 700 V[3]	63 ... 630 V	3 MΩ	700 V[4]
100 ... 1000 V[3]	90 ... 900 V	3 MΩ	1000 V[4]

[1] DC or AC voltage 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)

[2] at Overvoltage category II: 600 V

[3] only with BA 9054/_20; /_21; /_22; /_23; /_24
(Version: 1 changeover contact)

[4] at overvoltage category II: 1000 V

Please note:
Measuring ranges 6 ... 60 mV only available at variant BA 9054/08_
(Using only for current sensing via shunt!)

MK 9054N with 1 Measuring range for AC **a n d** DC			
Measuring range[1]		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[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)

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 ($\overline{U} = 0.90\ U_{eff}$)
Temperature influence: < 0.05 % / K

Technical Data

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
Electrical life IEC/EN 60 947-5-1
BA 9054
to AC 15 at 3 A, AC 230 V: 5 x 10^5 switching cycles
MK 9054N:
to AC 15 at 3 A, AC 230 V: 10^5 switching cycles
Short-circuit strength
max. fuse rating: 6A gG (gL) IEC/EN 60 947-5-1
Mechanical life
BA 9054: 50 x 10^6 switching cycles
MK 9054N: 30 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 40 ... + 60°C (higher temperature with limitations on request)	
Storage:	- 40 ... + 70°C	
Altitude:	< 2.000 m	
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
HF wire guided:	10 V	IEC/EN 61 000-4-6
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	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	40 / 060 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire connection		
BA 9054:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve	
MK 9054N		
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		
BA 9054:	Plus-minus terminal screws M3.5 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	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Mounting:	DIN-rail	IEC/EN 60 715
Weight		
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

Classification to DIN EN 50155 for BA 9054

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2 compliant T3 and TX with operational limitations	
Protective coating of the PCB:	No	

UL-Data

Auxiliary voltage U_H(A1, A2)		
BA 9054:	AC 24, 42, 48, 110, 115, 120 V	
Thermal current I_{th}:		
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 Overvoltage monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U_H: AC 230 V
- Time delay t_v by $U_{an:}$ 0 ... 20 s
- Width: 45 mm

BA 9054/012 AC 25 ... 250 V AC 230 V
Article number: 0053711
- for Undervoltage monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U_H: AC 230 V
- Time delay t_v by U_{ab}: 0 ... 20 s
- Width: 45 mm

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:
- 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 for Variants

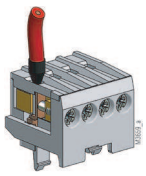
BA 9054 / _ _ _ /61 AC 25 ... 250V AC 230 V 0 ... 20 s 1 ... 20 s

- 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
- 11 Overvoltage relay de-energized on trip time delay at setting value
- 12 Undervoltage relay de-energized on trip time delay at hysteresis value
- 13 Undervoltage relay energized on trip time delay at hysteresis value
- 20 Same as BA 9054/024, but with additional moisture protection
- 21 Same as BA 9054/011, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 22 Same as BA 9054/012, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 23 Same as BA 9054/013, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 24 Same as BA 9054/010, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 46 Same as BA 9054/010, reduced reaction-time, measuring range DC 24 ... 35 V, it is necessary to connect power supply before measuring voltage
- 47 Same as 46, but with measuring range DC 60 ... 78 V
- 0 Standard version
- 1 With start up delay t_a
- 2 With safe electrical separation of input- and output circuit accroding to DIN 61140
- 3 With 5 µm gold plated contacts
- 5 With forcibly guided contacts
- 6 With manual reset, resetting by disconnecting the power supply
- Type

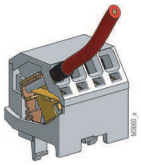
MK 9054N _ _ / _ _ _ AC 25 ... 250 V AC/DC 80 ... 230 V 0 ... 20 s 0,1 ... 20 s

- 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 potentio-meter (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)

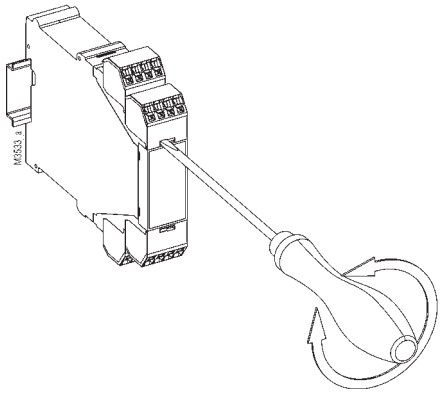


Cage clamp
(PC/plugin cage clamp)

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 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 voltage. The scale offset in this case is: $\overline{U} = 0.9 \times U_{eff.}$

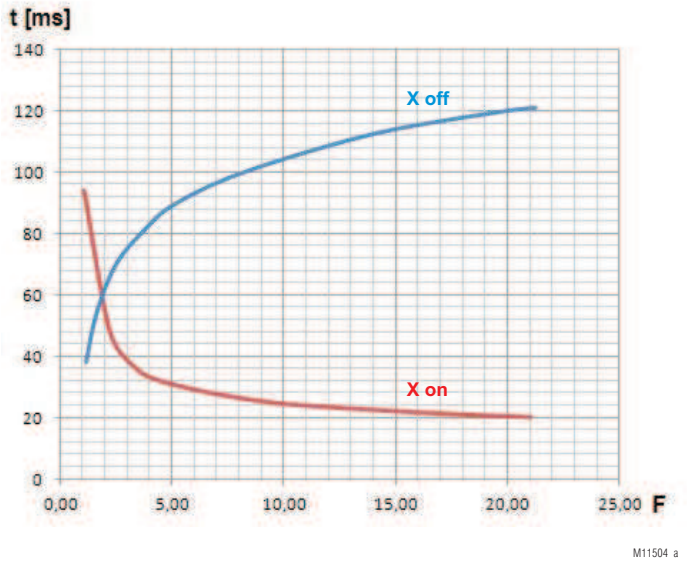
AC 25 ... 250 V is equivalent to DC 22.5 ... 225 V

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 $F = \frac{\text{Meas. value (after rise of meas. value)}}{\text{Setting value}}$

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.

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

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

$$F = \frac{\text{Measured value (after rise of meas. value)}}{\text{Setting value}} = \frac{400\ V}{230\ V} = 1{,}74$$

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.

$$F = \frac{\text{Measured value (befor meas. value drops)}}{\text{Setting value (hysteresis)}} = \frac{230\ V}{100\ V} = 2{,}3$$

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