VARIMETER
Voltage Relay
BA 9054

Translation
of the original instructions

DOLD

0221541

Your Advantages

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

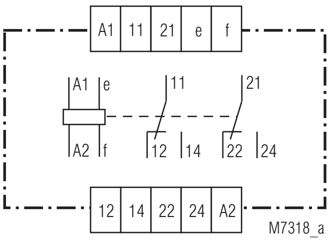
Features

- According to IEC/EN 60255-1, IEC/EN 60947-1
- To: Monitor DC and AC
- With measuring ranges from 15 mV to 1000 V
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between Auxiliary Circuit – measuring ciruit
- Auxiliary supply AC and AC/DC
- Optionally with start-up delay
- With time delay, up to max. 100 sec
- Optionally with safe separation to IEC/EN 61140 (on request)
- As option with manual reset
- LED indicators for operation and contact position
- Width: 45 mm

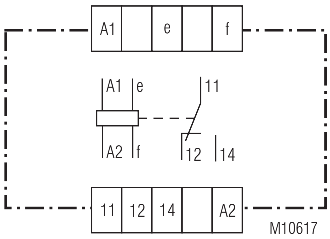
Product Description

The voltage relay BA 9054 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.

Circuit Diagrams



BA 9054



BA 9054/_ 2 _

Approvals and Markings

[1)] Approval not for all variants

Applications

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

Function

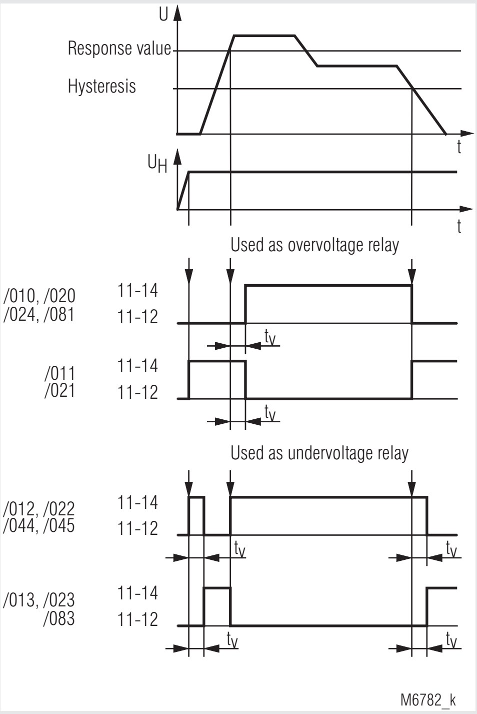
The relays measure the arithmetic mean value of the rectified measuring voltage. The AC units are adjusted to the r.m.s value. They have settings for response value and hysteresis. The units work as overvoltage relays but can also be used for undervoltage detection. The hysteresis is dependent on the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

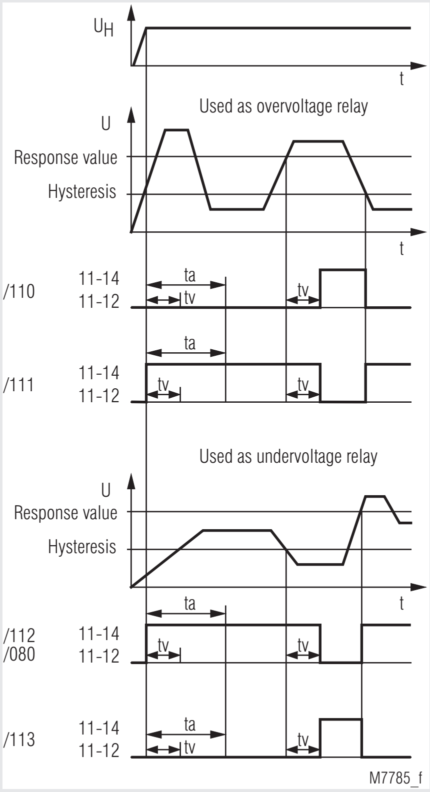
Indicators

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)

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)]	5.4 ... 54 mV [3) 4) 5)]	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
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V
50 ... 500 V	45 ... 450 V	2 MΩ	500 V
70 ... 700 V [2)]	63 ... 630 V [2)]	3 MΩ	1000 V
100 ... 1000 V [2)]	90 ... 900 V [2)]	3 MΩ	1000 V

[1)] DC or AC voltage 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)
[2)] Only with BA 9054/_20; /_21; /_22; /_23; /_24
(Version: 1 changeover contact)
[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)] Using only for current sensing via shunt!
[5)] Measuring ranges 6 ... 60 mV (only available at variant BA 9054/08_).

Please note:
- ≤ 600 V: Overvoltage category III
- > 600 V: Overvoltage category II

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)	
BA 9054/6_ _:	≤ 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 , 0 ... 300 s setting 0 s = without time delay
Start-up delay t_a:	
BA 9054/1 _ _:	1 ... 20 s, 1 ... 30 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

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 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

Technical Data

Auxiliary voltage U_H (A1, A2) for mono voltages

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

Output

Contacts:	2 changeover contacts	
Thermal current I_{th}:	2 x 5 A	
Switching capacity		
to AC 15:		
NO contact:	2 A / AC 230 V	IEC/EN 60947-5-1
Variants /_20 to /_24 (Version: 1 changeover contact)		
To AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60947-5-1
NC contact:	1 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 3 A, AC 230 V cos φ = 1:	2 x 10^5 switching cycles	
Short-circuit strength		
max. fuse rating:	6 A gG / gL	IEC/EN 60947-5-1
Mechanical life:	30 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		
Overvoltage category		
Measuring voltage		
≤ 600 V:	III	
> 600V:	II	
Rated impulse voltage / pollution degree		
Aux. voltage / measuring input:	6 kV / 2	IEC 60664-1
Auxiliary voltage / contacts:	6 kV / 2	IEC 60664-1
Measuring input / contacts:	6 kV / 2	IEC 60664-1
Contacts 11,12,14 / 21, 22, 24:	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:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve	
Wire fixing:	Plus-minus terminal screws M3.5 with self-lifting clamping piece	IEC/EN 60999-1
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Mounting:	DIN-rail	IEC/EN 60715
Weight		
AC-device:	280 g	
AC/DC-device:	200 g	

Dimensions

Width x height x depth: 45 x 75 x 120 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61373
Service temperature classes:	OT1, OT2 compliant OT3 and OT4 with operational limitations	
Protective coating of the PCB:	No	

CCC-Data

Thermal current I_{th}: 5 A

Switching capacity

to AC 15:	2 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

BA 9054/010 AC 25 ... 250 V AC/DC 80 ... 230 V
Article number: 0053642

- 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
- Width: 45 mm

BA 9054/012 AC 25 ... 250 V AC/DC 80 ... 230 V
Article number: 0053714

- For Undervoltage monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U_H: AC/DC 80 ... 230 V
- Time delay t_v by U_{ab}: 0 ... 20 s
- Width: 45 mm

Varianten

BA 9054/820: AC 70 ... 700 V AC/DC 80 ... 230 V
article number: 0069637
like BA 9054/020,
Temperature range
Operation: - 40 ... + 60 °C
Operation: - 40 ... + 70*) °C
(OT4 according to DIN EN 50155 with the following restrictions)

*) - Device mounted
Measuring voltage at e/f max. AC/DC 300 V
Auxiliary voltage at A1(+)/A2 max. DC 110 V
Overvoltages only temporary
Contact current max. AC 5 A

- Device mounted
Measuring voltage at e/f max. AC/DC 700 V;
Auxiliary voltage at A1(+)/A2 max. AC 110 V / DC 130 V
Overvoltages only temporary
Contact current max. AC 1 A

- Device mounted with 1 cm distance
Measuring voltage at e/f max. AC/DC 300 V;
Auxiliary voltage at A1(+)/A2 max. DC 110 V
Overvoltages only temporary
Contact current max. AC 2 A

Ordering Example for Variants

BA 9054 /_ _ _ AC 25 ... 250 V AC/DC 80 ... 230 V 0 ... 20 s 1 ... 20 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range

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 energized on trip time delay at hysteresis value
13	Undervoltage relay de-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, overloadable up to AC/DC 1000 V, 1 C/O contact
22	Same as BA 9054/012, overloadable up to AC/DC 1000 V, 1 C/O contact
23	Same as BA 9054/013, overloadable up to AC/DC 1000 V, 1 C/O contact
24	Same as BA 9054/010, overloadable up to AC/DC 1000 V, 1 C/O contact
32	Same as BA 9054/022, with 4 x AC/DC 500 V input resistances in series
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 (on req.)
6	With manual reset, resetting by disconnecting the power supply

Type

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: $\overline{U} = 0.9 \times U_{eff.}$

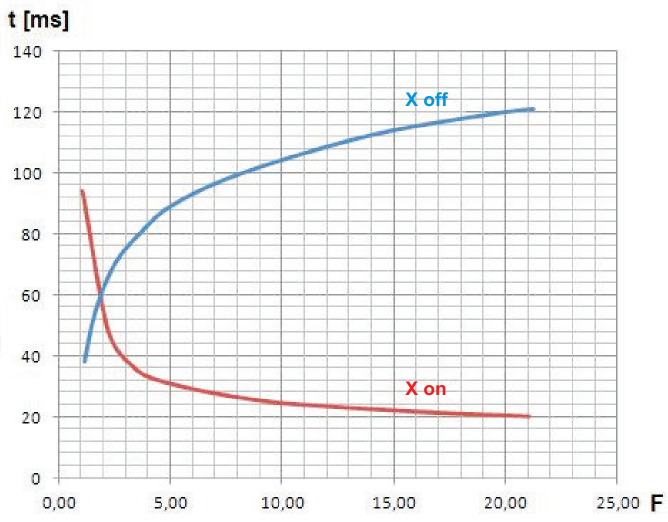
AC 25 ... 250 V is equivalent to DC 22.5 ... 225 V

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



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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 BA 9054/010):
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 BA 9054/012):
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 $t_v = 0$.