

## Main catalogue part 3

Electronic measuring and monitoring relays for

- Voltage
- Current
- Asymmetry
- Phase sequence
- Frequency
- Special applications



# Main catalogue part 3 Electronic measuring and monitoring relays

Edition 07.2011

3.0

## Further information on other product ranges:



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Dipl.-Ing. W. Bender GmbH & Co. KG  
Londorfer Str. 65

D - 35305 Grünberg  
Postfach 1161

D - 35301 Grünberg  
Telefon +49 6401 807-0  
Fax +49 6401 807-259

E-Mail: [info@bender-de.com](mailto:info@bender-de.com)  
Internet: [www.bender-de.com](http://www.bender-de.com)

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# Power in

## **Bender – Power in electrical safety**

Electrical safety is indispensable. Safe and reliable use of electricity in various sectors calls for a high degree of electrical safety. Bender, a pioneer in this field, has made a major contribution to achieve this.

## **International presence**

With more than 500 employees, Bender has been manufacturing and supplying electrical safety products since 1946. Ten technical offices in Germany and 50 agencies and distributors on all continents make us flexible to provide close and direct dialogue with our customers.

## **Innovative right from the start**

With the first patent in the year 1939, Dipl.-Ing. Walther Bender, the founder of the company, not only had achieved that his idea had become reality, but also the philosophy to protect people and machines against the hazards of electrical current by innovative solutions and to make the use of electric energy even safer and more economical, had been realised. Still today, the name Bender is synonymous with this philosophy.



# electrical safety



3.0

## **Quality in all areas**

Our products are subject to stringent quality guidelines during development, manufacturing and testing. Bender's quality philosophy which have consistently been pursued is reflected in internationally accepted approvals, such as RoHS, ISO9001.

## **Fit for practical application**

Benefit from our knowledge. Training is decisive for your success.

Bender offers a wide range of seminars. From standard courses to expert courses or a training tailored exactly to your personal requirements.

Visit us in the Internet:

[www.bender-de.com](http://www.bender-de.com)

## **Service for you**

You can rely on Bender technology as well as on our service and support. We can advise and assist you in a variety of ways.

From planning and projection through training courses to commissioning and maintenance.

## Device selection

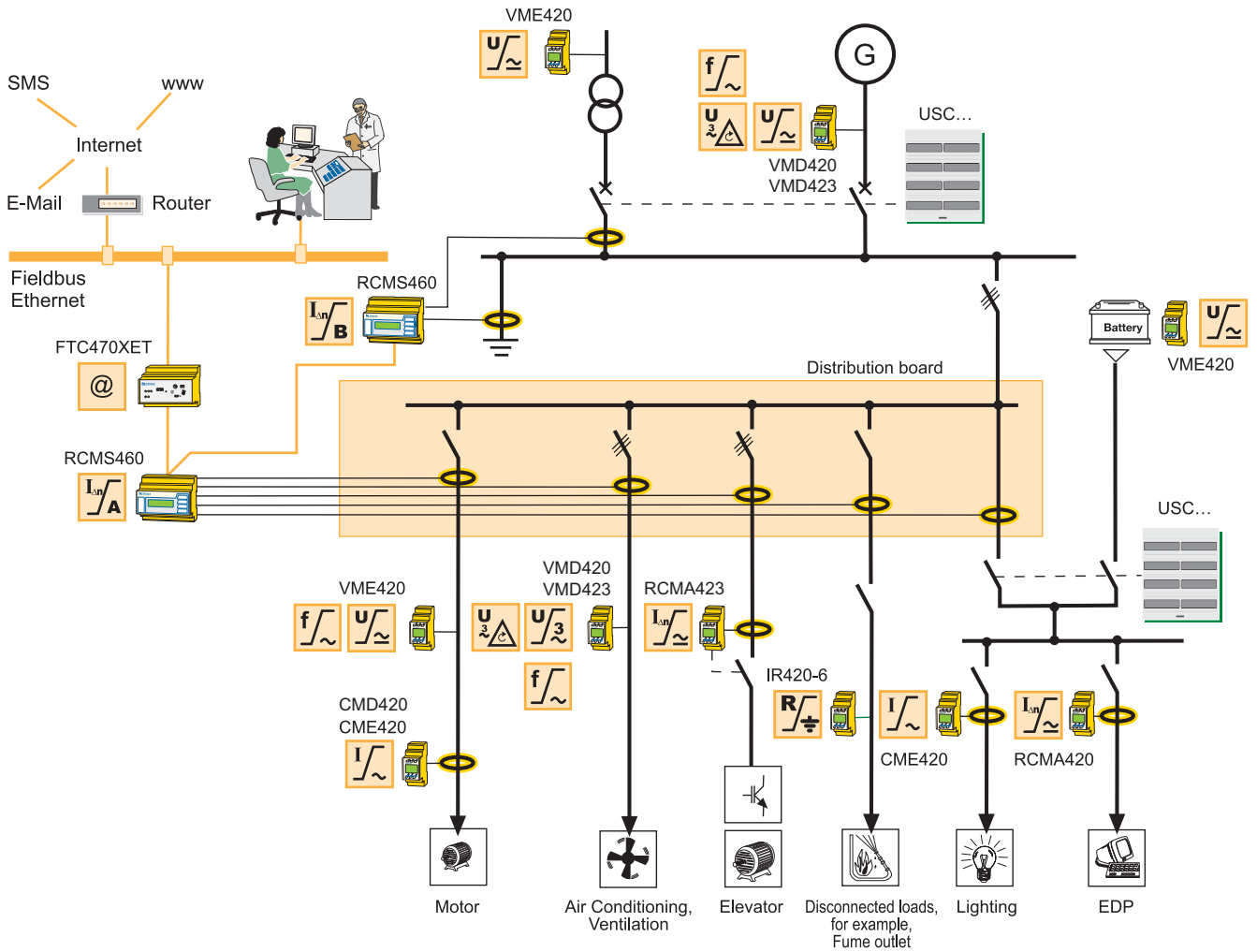
**3.0**

Voltage monitoring												
	VME420 Page 14/15	VME421H Page 14/15	VMD420 Page 16/17	VMD421H Page 16/17	VMD422 Page 18/19	VMD422H Page 18/19	VMD423 Page 18/19	VMD423H Page 18/19	SUR353Z Page 20	SUR357Z/358Z Page 20	SUG140 Page 20	SUG141 Page 20
<b>AC</b> with $U_5$	< U / > U											
without $U_5$		< U / > U										
<b>3 AC</b> with $U_5$			< U / > U		< U / > U		< U / > U					
without $U_5$				< U / > U		< U / > U		< U / > U	< U	< U / > U		
<b>3/NAC</b> with $U_5$			< U / > U		< U / > U		< U / > U					
without $U_5$				< U / > U		< U / > U		< U / > U	< U	< U / > U		
<b>DC</b> with $U_5$	< U / > U										< U	> U
without $U_5$		< U / > U										
<b>Asymmetry</b>			x	x	x	x	x	x				x
<b>Phase sequence</b>			x	x	x	x	x	x				
<b>Phase failure</b>			x	x	x	x	x	x				x
<b>Frequency</b>	< f / > f	< f / > f	< f / > f	< f / > f	< f / > f	< f / > f	< f / > f	< f / > f				

Current monitoring				
	CME420 Page 22	CMD Page 22	CSG140 Page 23	CSG141 Page 23
<b>1 AC</b> with $U_5$	< I / > I			
<b>3 AC</b> with $U_5$		< I / > I		
<b>DC</b> with $U_5$			< I	> I

Available by 08.2011

Special applications						
	ZUE150 Page 24	GM420 Page 24	RM475LY Page 24	SB146/471/473/476 Page 25	SP100 Page 25	AUR381Z Page 21
<b>Automatic restart relay</b>	x					
<b>Loop monitoring</b>		x	x			
<b>Earth fault relay</b>						
<b>Fault voltage relay</b>				x		
<b>Energy backup</b>					x	
<b>Asymmetry relay</b>						x



Examples of application

## The new measuring and monitoring relays feature user-friendly operating elements NEW: with push-wire terminal

3.0

### Avoid critical operating states – reduce the risk

- Modular system for multi-functional monitoring tasks
- Fast r.m.s. value measurement (true r.m.s.\*) for a wide frequency range
- Two different alarm stages prewarning/ alarm provide up-to-date information

### Comprehensive information – measuring instrument not required

- Measured value memory to store and display the first operating value
- Measured value indication and parameter setting via a large LC display
- Optional analogue interfaces (0...10 V, 0(4)...20 mA, 0...400  $\mu$ A).

### Immediate commissioning – reduces initial costs

- VME420 and VMD420 feature a preset function for automatic parameter setting
- One-finger operation for settings -no screw driver required
- Clearly marked connecting terminals and the wiring diagram printed on the relay allows easy installation
- Simply plug in using pushwire terminals instead of screw fastening



**True r.m.s.\***

#### **Device safety – down to the last detail**

- Continuous self monitoring, automatic alarm
- No unauthorised access to the device – due to password protection and sealable transparent cover
- Protective separation in accordance with DIN EN 61140 / VDE 0140 (measuring circuit / alarm circuit)

#### **Flexible indication – ideal for all requirements**

- Two separately adjustable alarm relays with one changeover contact each
- Gold-plated relay contacts allow reliable switching of small currents (> 1 mA)
- Fault memory can be deactivated, N/O operation or N/C operation selectable
- A choice of measuring functions, different settings possible, can be deactivated

#### **Optimum adaptation – suited to every application**

- Wide setting ranges and universal measuring inputs (AC/DC)
- Variable start-up time, response time and delay on release

\* True r.m.s.: True root mean square value

## Push-wire terminal: The benefits to you at a glance

### Safety is top priority

The clamping connection is strong so the contact is even more secure than with conventional screw technology. High shock and vibration loads will not do any damage to the push-wire terminals. Furthermore, by using the push-wire technique it is no longer necessary to check screw terminals after transport or at regular intervals. The push-wire terminal provides high contact stability and is maintenance-free.

The push-wire terminal, which was specially developed for Bender, holds the wire tight. The clamping force of the springs is always kept constant and provides high vibration and contact stability.

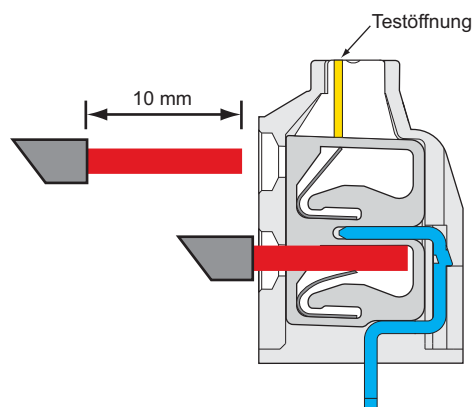
Do you want to check voltages or relay contacts?

No problem – the test opening (ø 2.1 mm) makes it possible to make contact with measurement and test probes safely.

### Your advantages

- Considerable saving in time
- Reliable clamping
- Improved level of safety
- Long-term contacting
- Two terminals are available for each connection

### Quick, safe, stable



When a flexible conductor with ferrule, or a rigid conductor with a cross section of  $0.75\text{mm}^2$ , is inserted, the spring opens automatically. For cross sections of  $\leq 0.75\text{mm}^2$ , it is necessary to open the terminal by pressing the button with a screw driver.

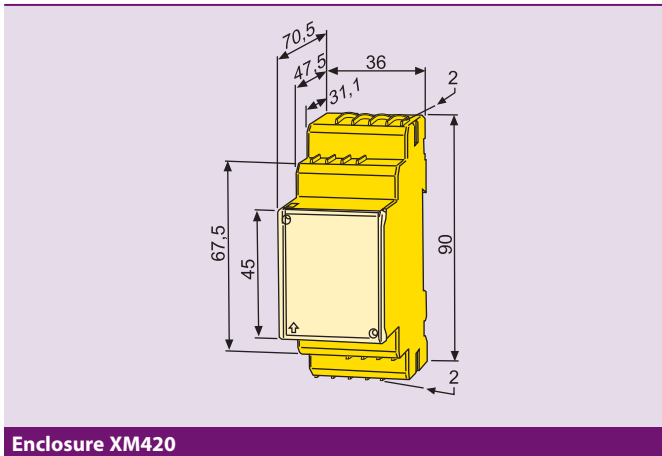
Two wires can be connected at each terminal. Thus, each wire is held by a separate spring. And potentials with current loads of up to 12 A max. can be looped through without any problem.

### Connection and release

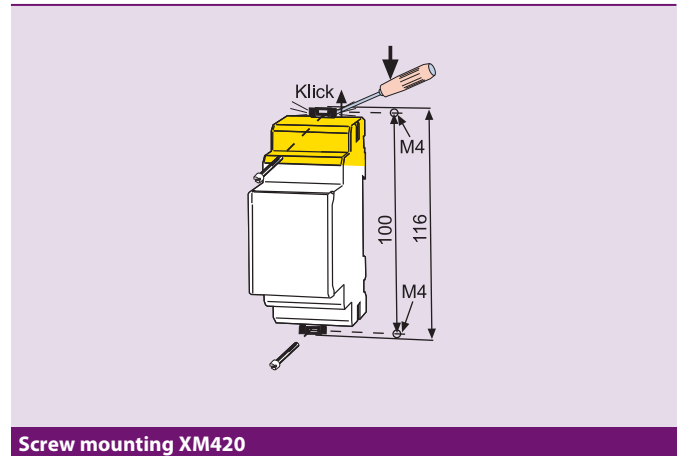
Wire	Connection		Release
Rigid	$0.2 \dots 0.75\text{mm}^2$	$0.2 \dots 0.75\text{mm}^2$	
$0.2 \dots 2.5\text{mm}^2$ AWG 24-14			
Flexible without ferrules			
$0.2 \dots 2.5\text{mm}^2$ AWG 24-14			
Flexible with ferrules	$0.2 \dots 0.75\text{mm}^2$	$0.2 \dots 0.75\text{mm}^2$	
$0.2 \dots 1.5\text{mm}^2$ AWG 24-16			

## Enclosure dimensions

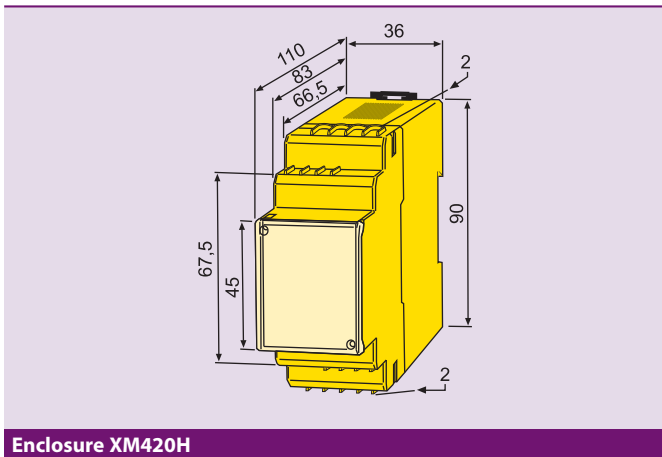
(dimensions in mm)



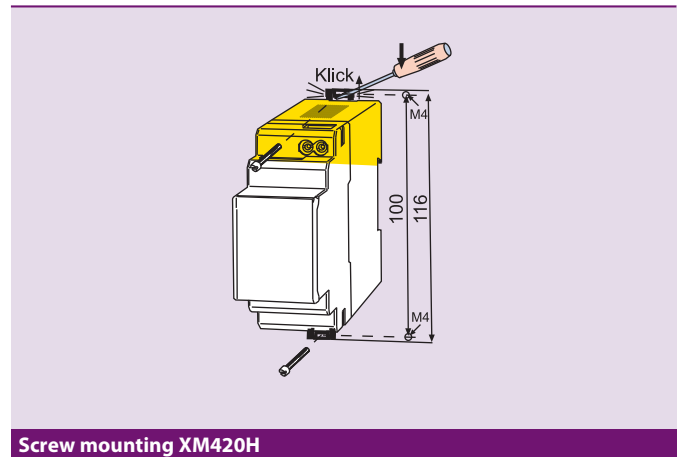
Enclosure XM420



Screw mounting XM420



Enclosure XM420H



Screw mounting XM420H

# Interface options measuring and monitoring relays

## XM420 series

3.0



XM420 series

### Device features

- Flexible interface options for devices of the XM420 series
- Easy forwarding and transfer of measured values to systems for measurement and control
- Galvanical isolation prevents inaccurate measurement results

### Description

For XM420 series measuring and monitoring relays two alarm relays with one changeover contact each is standard. In addition, the following options are available:

#### • Option M

Analogue output with galvanical isolation, output signal selectable via menu:

- DC 0...400  $\mu$ A Current output, e.g. for Bender measuring instruments of the 96... series
- DC 0...10 V Standardised voltage signal
- DC 0/4...20 mA Standardised current output

#### • Option M1C

Analogue output 0/4...20 mA (not galvanically isolated), one changeover contact to be used as a freely configurable alarm message.

#### • Option M2C

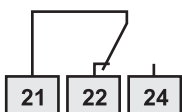
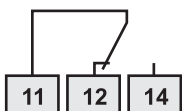
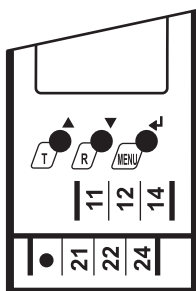
Analogue output 0...400  $\mu$ A (not galvanically isolated), one changeover contact to be used as a freely configurable alarm message.

#### • Option M3C

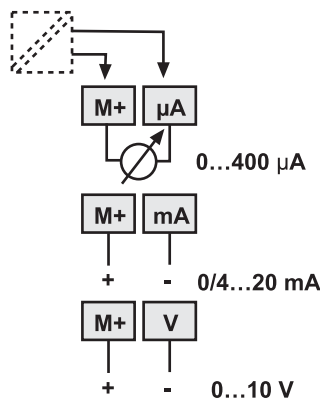
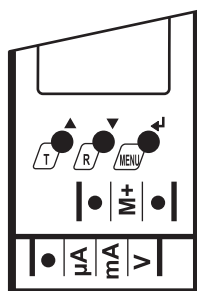
Analogue output 0...10 V (not galvanically isolated), one changeover contact to be used as a freely configurable alarm message.

### Interface options

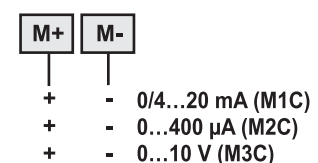
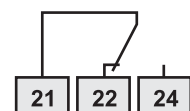
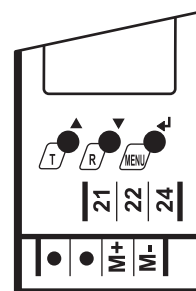
#### Standard



#### Option M



#### Option M1C / M2C / M3C



Interface options				
Series	Option M	Option M1C	Option M2C	Option M3C
VME42...	×	--	--	--
VMD42...	×	--	--	--
CME42...	×	--	--	--

Ordering information			
Type	Designation	Standard	Art. No.
CME420-D-1	Current relay	X	B 7306 0001
CME420-D-2	Current relay	X	B 7306 0002
VMD420-D-1	Current relay 3ph 3NAC	X	B 7301 0005
VMD420-D-2	Current relay 3ph 3NAC	X	B 7301 0006
VMD421H-D-3	Current relay 3ph 3NAC	X	B 7301 0007
VME420-D-1	Current relay 1ph AC/DC	X	B 7301 0001
VME420-D-2	Current relay 1ph AC/DC	X	B 7301 0002
VME421H-D-1	Current relay 1ph AC/DC	X	B 7301 0003
VME421H-D-2	Current relay 1ph AC/DC	X	B 7301 0004

Options M, M1C, M2C and M3C on request.  
 Device version with screw terminals on request.

**Technical data**

**Switching elements**

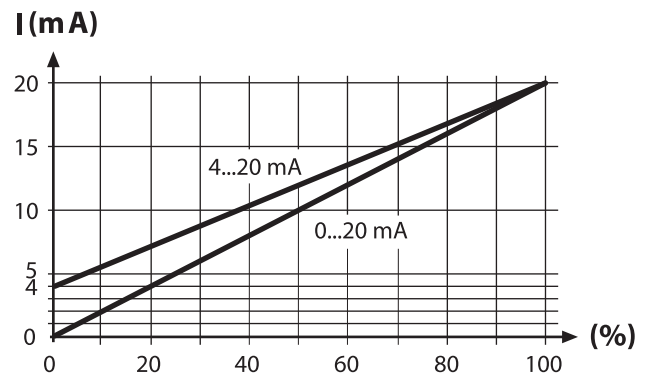
Number of changeover contacts, standard	2 x 1				
Electrical endurance, number of cycles	10.000				
Contact data acc. to IEC 60947-5-1					
Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

**General data**

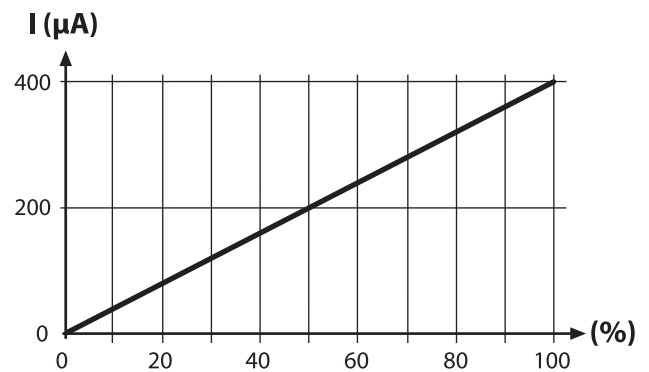
Max. open-circuit voltage (terminals open)	DC 20 V
Max. short-circuit current	30 mA short-circuit proof
Voltage output	DC 0...10 V
Min. load	1 kΩ
Current output	DC 0/4...20 mA
Max. load.	500 Ω
Current output	DC 0...400 μA
Max. load	12.5 kΩ

( ) \* factory setting

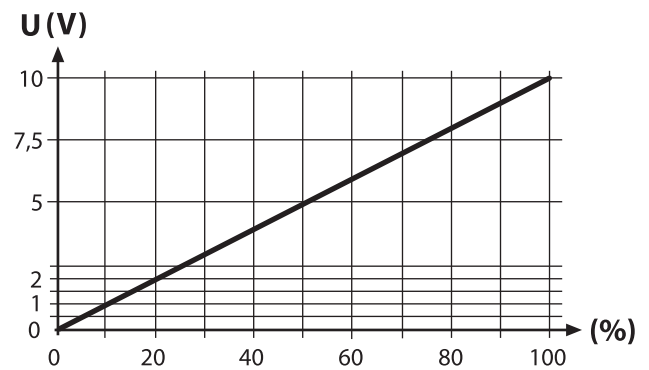
**Current output 0/4...20 mA**



**Current output 0...400 μA**



**Voltage output 0...10 V**



**Note:**

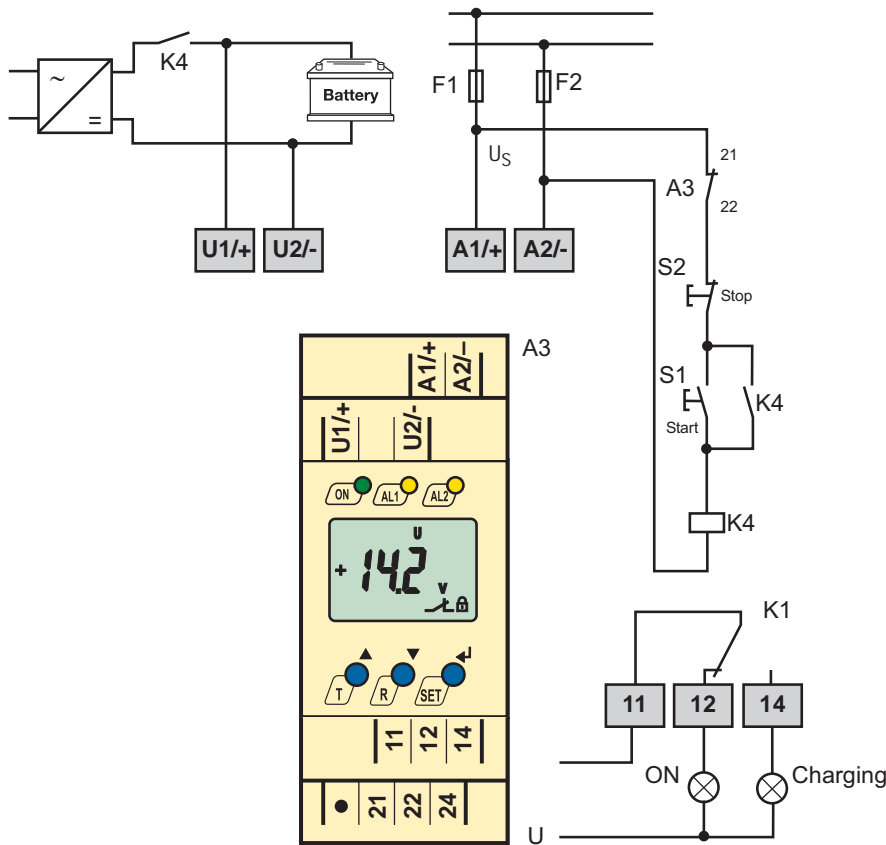
A free configurable value (*I*, *U*, *I<sub>Δn</sub>*, *Asy*) or the response value of the respective device can be set as 100 % value via the menu.

## Device selection –

# Voltage and frequency monitoring relays for AC and DC systems

The voltage and frequency monitoring relays are designed to monitor the upper and lower limits of one or several defined response values. The devices are suitable for AC and DC systems.

### Example of application



#### Type

##### System voltage

AC

DC

##### Function

Underfrequency / overfrequency

Undervoltage / overvoltage

Preset function

Password protection

History memory (first alarm value)

##### Supply voltage

Supply voltage range  $U_s$

##### Response values

Undervoltage  $U <$

Overvoltage  $U >$

Underfrequency Hz  $<$

Overfrequency Hz  $>$

Rated frequency

Hysteresis  $U$

Hysteresis  $f$

Response time

Integrated energy backup unit

Response delay  $t_{on}$

Delay on release  $t_{off}$

Start-up delay  $t$

##### Operating elements – alarm LEDs

Power On LED

Alarm LEDs

##### Switching elements

Number of switching elements

Operating principle

##### General features

Enclosure dimensions in mm (H x W x D)

Accessories

Interface option

Approvals and certifications



**VME420**

×
×

×
×
×
×
×

DC 9.6...94 V, AC 16...72 V, AC/DC 70...300 V

AC / DC 6...300 V
AC / DC 6...300 V
10...500 Hz
10...500 Hz
DC, 15...460 Hz
1...40 %
0.1...2 Hz
AC ≤ 70 ms / DC ≤ 130 ms
--
0...300 s
0...300 s
0...300 s

×
×

2 x 1 changeover contacts, programmable  
N/O operation / N/C operation\*

90 x 36 x 70.5
Mounting clip
M
UL, GOST, Lloyd's Register

**Chapter 3.1 - Page 28 – 31**



**VME421H**

×
×

×
×
×
×
×

$U_N$

AC / DC 70...300 V
AC / DC 70...300 V
70...500 Hz
70...500 Hz
DC, 15...460 Hz
1...40 %
0.1...2 Hz
AC ≤ 70ms / DC ≤ 130 ms
×
0...300 s
0...300 s
0...300 s

×
×

2 x 1 changeover contacts, programmable  
N/O operation / N/C operation\*

90 x 36 x 105.5
Mounting clip
M
UL, GOST, Lloyd's Register

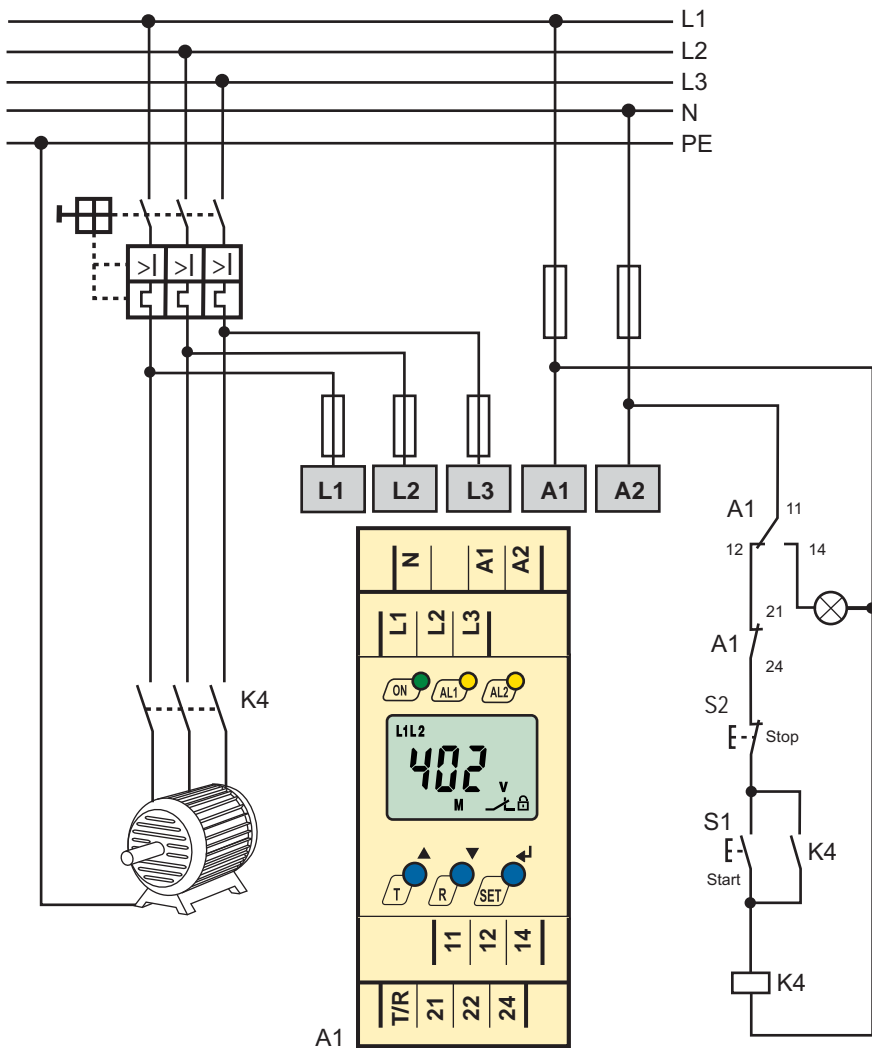
**Chapter 3.1 - Page 32 – 35**

\*programmable

## Device selection – Voltage and frequency monitoring relays for 3(N)AC systems

The voltage and frequency monitoring relays of the VMD420/421H series are designed to monitor the upper and lower limits of one or several defined response values. The devices can be used for three-phase systems with or without an N conductor. Furthermore, the devices feature additional monitoring functions such as phase sequence, phase failure, frequency, and asymmetry monitoring.

### Example of application



#### Type

##### System voltage

3AC

3NAC

##### Function

Undervoltage / overvoltage

Asymmetry / phase failure

Phase sequence / frequency

Preset function

Password protection

History memory (first alarm value)

##### Supply voltage

Supply voltage range  $U_s$

##### Response values

Undervoltage  $U <$

Overvoltage  $U >$

Underfrequency Hz  $<$

Overfrequency Hz  $>$

Rated frequency

Asymmetry

Hysteresis  $U$

Hysteresis  $f$

Operating time voltage / frequency

Integrated energy backup unit

Response delay  $t_{on}$

Delay on release  $t_{off}$

Start-up delay  $t$

##### Operating elements – alarm LEDs

Power On LED

Alarm LEDs

##### Operating elements – switches/buttons

Undervoltage / overvoltage

AC/DC switches

Buttons

##### Switching elements

Number of switching elements

Operating principle

##### General features

Enclosure dimensions in mm (H x W x D)

Accessories

Interface option

Approvals and certifications



**VMD420**



**VMD421H**

×
×

×
×

×
×
×
×
×
×

×
×
×
×
×
×

DC 9.6...94 V, AC 16...72 V, AC/DC 70...300 V

$U_N$

AC 6...500 V / 6...288 V
AC 6...500 V / 6...288 V
10...500 Hz
10...500 Hz
15...460 Hz
5...30 %
1...40 %
0.1...2 Hz
≤ 140 ms / 335 ms
--
0...300 s
0...300 s
0...300 s

AC 70...500 V / 70...288 V
AC 70...500 V / 70...288 V
10...500 Hz
10...500 Hz
15...460 Hz
5...30 %
1...40 %
0.1...2 Hz
≤ 140 ms / 335 ms
min. 2.5 s
0...300 s
0...300 s
0...300 s

×
×

×
×

--  
--  
TEST / RESET / MENU

--  
--  
TEST / RESET / MENU

2 x 1 changeover contacts, programmable  
N/O operation / N/C operation\*

2 x 1 changeover contacts, programmable  
N/O / N/C operation\*

90 x 36 x 70.5  
Mounting clip  
M  
UL, GOST, Lloyd's Register

90 x 36 x 105.5  
Mounting clip  
M  
UL, GOST, Lloyd's Register

\*programmable

## Device selection – Voltage and frequency monitoring relays for mains decoupling of private electricity generation systems

3.0

Continuous voltage and frequency monitoring for private generation systems > 30 kW is required according to DIN VDE0126-1-1.

The voltage and frequency monitoring relays of the VMD422/423 series are designed to monitor the upper and lower limits of one or several defined response values.

The devices can be used for three-phase systems with or without N conductor.

In order to fulfil the requirements of the electricity supply companies, the VMD422(H) can be adapted to all requirements and can also be used in problematical grid ranges.

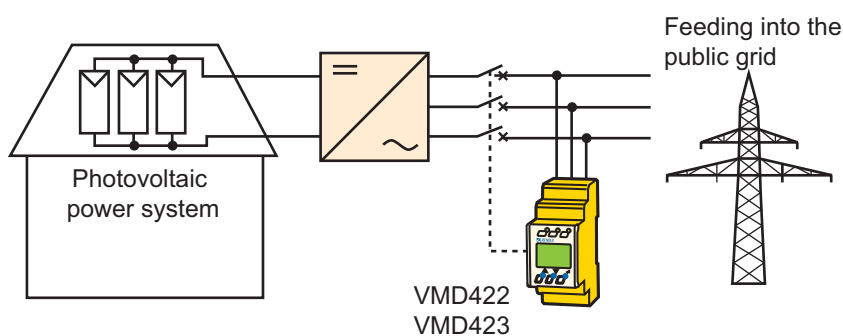
The VMD423(H) can be used on the secondary side of the voltage transformer used in medium-voltage systems, ensuring safe and reliable grid disconnection within 80 ms in the event of non-compliance with voltage and frequency limit values.

The limit values of the VMD422/423 are preset in compliance with the limit values for frequency and voltage defined in DIN VDE 0126-1-1. In this way, fast commissioning is guaranteed.

In addition, the phase sequence and asymmetry is continuously monitored.

The moving average value required since 1.1.2010, measured over a period of 10 minutes as an overvoltage, is also available.

### Example of application



Example of a connection for VMD422, VMD423

#### Type

##### System voltage

3AC

3NAC

##### Function

Overvoltage (10 minute measuring interval)

Underfrequency / overfrequency

Undervoltage / overvoltage

Asymmetry / phase failure

Phase sequence / frequency

Password protection

History memory (first alarm value)

##### Supply voltage

Supply voltage range  $U_s$

##### Response values

System configuration

Undervoltage <  $U$

Overvoltage >  $U1$

Undervoltage measured as an average value over a period of 10 minutes >  $U2$

Underfrequency Hz <

Overfrequency Hz >

Rated frequency

Asymmetry

Hysteresis  $U$

Hysteresis  $f$

Response time

Integrated energy backup unit

Response delay  $t_{on}$

Delay on release  $t_{off}$

Start-up delay  $t$

##### Operating elements – alarm LEDs

Power On LED

Alarm LED undervoltage

Alarm LED overvoltage

##### Switching elements

Number of switching elements

Mode of operation

##### General features

Enclosure dimensions in mm (H x W x D)

Accessories

Approvals and certifications



×	×	×	×
×	×	×	×

×	×	×	×
×	×	×	×
×	×	×	×
×	×	×	×
×	×	×	×
×	×	×	×

DC 9.6...94 V / AC 16...72 V, AC/DC 70...300 V	$U_N$	DC 9.6...94 V / AC 16...72 V, AC/DC 70...300 V	$U_N$
---	-------	---	-------

3(N)AC / 3AC AC 320...380 V / 184...218 V AC 423...460 V / 244...264 V AC 440...460 V / 253...264 V	3(N)AC / 3AC AC 320...380 V / 184...218 V AC 423...460 V / 244...264 V AC 440...460 V / 253...264 V	3(N)AC / 3AC AC 10...500 V / 10...288 V AC 10...500 V / 10...288 V AC 10...500 V / 10...288 V	3(N)AC / 3AC AC 70...500 V / 70...288 V AC 70...500 V / 70...288 V AC 10...500 V / 10...288 V
--	--	--	--

47.5...49.5 Hz	47.5...49.5 Hz	45.0...65.0 Hz	45.0...65.0 Hz
50.2...52.0 Hz	50.2...52.0 Hz	45.0...65.0 Hz	45.0...65.0 Hz
40...65 Hz	40...65 Hz	40...65 Hz	40...65 Hz
5...30 %	5...30 %	5...30 %	5...30 %
1...40 %	1...40 %	1...40 %	1...40 %
0.1...2 Hz	0.1...2 Hz	0.1...2 Hz	0.1...2 Hz
≤ 180 ms	≤ 180 ms	≤ 80 ms	≤ 80 ms
--	min. 2.5 s	--	min. 2.5 s
0...300 s	0...300 s	0...300 s	0...300 s
0...300 s	0...300 s	0...300 s	0...300 s
0...300 s	0...300 s	0...300 s	0...300 s

×	×	×	×
×	×	×	×
×	×	×	×

2 x 1 changeover contacts, programmable N/C operation	2 x 1 changeover contacts, programmable N/C operation	2 x 1 changeover contacts, programmable N/O operation / N/C operation*	2 x 1 changeover contacts, programmable N/O operation / N/C operation*
--	--	---	---

90 x 36 x 70.5 Mounting clip GOST	90 x 36 x 105.5 Mounting clip GOST	90 x 36 x 70.5 Mounting rail GOST	90 x 36 x 105.5 Mounting rail GOST
---	--	---	--

<b>Chapter 3.1 - Page 44 – 49</b>	<b>Chapter 3.1 - Page 44 – 49</b>	<b>Chapter 3.1 - Page 50 – 55</b>	<b>Chapter 3.1 - Page 50 – 55</b>
-----------------------------------	-----------------------------------	-----------------------------------	-----------------------------------

\*programmable

## Device selection – Voltage relays for 3(N)AC systems or DC systems



3.0

Voltage relays monitor the upper and lower limits of one or several defined response values in 3(N)AC systems up to 690 V or DC systems up to 30 V.



Type	SUR353Z	SUR357Z	SUR358Z	SUG140	SUG141
<b>System voltage</b>					
3NAC	×	×	×	--	--
3AC	×	×	×	--	--
DC	--	--	--	×	×
<b>Function</b>					
Undervoltage	×	--	--	×	--
Overvoltage	--	--	--	--	×
Undervoltage / overvoltage	--	×	×	--	--
<b>Supply voltage</b>					
Supply voltage range $U_S$	without	without	without	AC 85...275 V, DC 9.6...84 V	AC 85...275 V, DC 9.6...84 V
<b>Measuring circuit</b>					
Measuring range / nominal system voltage $U_n$	3AC 100, 230, 400, 415, 500, 690 V	3AC 100, 110, 230, 400, 500, 690 V	3AC 100, 110, 230, 400, 500, 690 V	DC 0.4...4 V, 3...30 V	DC 0.4...4 V, 3...30 V
Response values	$0.7...0.95 \times U_n$	$0.7...0.95 \times U_n$ $1.05...1.3 \times U_n$	$0.7...0.95 \times U_n$ $1.05...1.3 \times U_n$	Scale range 1...10	Scale range 1...10
Rated frequency	50...60 Hz	50...60 Hz	50...60 Hz	DC	DC
Hysteresis approx.	2 %	2 %	2 %	2...10 %	2...10 %
Response time	500 ms	500 ms	500 ms	100 ms	100 ms
Integrated energy backup unit	--	--	--	--	--
Response delay	0.5...5 s	0.5...5 s	0.5...5 s	0.1...10 s	0.1...10 s
<b>Operating elements – alarm LEDs</b>					
Power On LED	--	×	×	×	×
Alarm LED	×	--	--	--	--
Alarm LED undervoltage	--	×	×	×	--
Alarm LED overvoltage	--	×	×	--	×
<b>Operating elements – potentiometer</b>					
Undervoltage	×	×	×	×	--
Overvoltage	--	×	×	--	×
Response delay	×	×	×	×	×
Hysteresis	--	--	--	×	×
<b>Switching elements</b>					
Number of switching elements	1 x 2 changeover contacts	1 x 2 changeover contacts 2 x 2 changeover contact	1 x 2 changeover contacts 2 x 2 changeover contact	1 x 2 changeover contacts	1 x 2 changeover contacts
Operating principle	N/C operation	N/C operation N/O or N/C operation	N/C operation N/O or N/C operation	N/O or N/C operation	N/O or N/C operation
<b>General features</b>					
Enclosure dimensions in mm (HxWxD)	71 x 111 x 109	71 x 111 x 109	71 x 111 x 109	70 x 45 x 110	70 x 45 x 110
Accessories	SP100	SP100	SP100	Mounting rail	Mounting rail
Approvals and certifications	GOST	GOST	GOST	GOST	GOST
	<b>Chapter 3.1 - Page 56 – 57</b>	<b>Chapter 3.1 - Page 58 – 61</b>	<b>Chapter 3.1 - Page 58 – 61</b>	<b>Chapter 3.1 - Page 62 – 63</b>	<b>Chapter 3.1 - Page 64 – 65</b>

## Device selection – Asymmetry relay for 3(N)AC systems



3.0

Asymmetry relays indicate voltage asymmetries in three-phase systems resulting from uneven distribution of the load or phase failure caused by a blown fuse or wire failure.



**Type** ▶

**AUR381Z**

**System voltage**

3AC	▶
3NAC	▶

	×
	×

**Function**

Asymmetry / phase failure	▶
Undervoltage	▶

	×
	×

**Supply voltage**

Supply voltage range $U_S$	▶
----------------------------	---

	without
--	---------

**Measuring circuit**

Setting range asymmetry	▶
Nominal system voltage $U_n$	▶
Response value undervoltage	▶
Rated frequency	▶
Hysteresis approx.	▶
Response time	▶
Response delay	▶

	5...15 % (L-L)
	3 AC 100, 110, 400, 440, 500, 690 V
	0.7...0.95 x $U_n$
	50...60 Hz
	2 %
	500 ms
	0.5...5 s

**Operating elements – alarm LEDs**

Operation	▶
Alarm	▶

	--
	×

**Operating elements – potentiometer**

Asymmetry	▶
Undervoltage	▶
Response delay	▶

	×
	×
	×

**Switching elements**

Number of switching elements	▶
Mode of operation	▶

	1 x 2 changeover contacts
	N/C operation

**General features**

Enclosure dimensions in mm (H x W x D)	▶
Accessories	▶

	71 x 111 x 109
	SP100

## Device selection – Current relay for AC currents



## Device selection – Current relay for 3 AC currents



AC current relays are designed to monitor the upper and lower limits of a preset response value.



**CME420**

AC current relays are designed to monitor the upper and lower limits of a preset response value.

available for delivery  
as from 08.2011



**CMD420**

<b>Type</b>	
<b>System voltage</b>	
AC	×
<b>Function</b>	
Undercurrent / overcurrent	×
Window discriminator function	×
Password protection	×
History memory (first alarm value)	×
<b>Supply voltage</b>	
Supply voltage range $U_S$	DC 9.6...94 V / AC 16...72 V, AC/DC 70...300 V
<b>Response values</b>	
Current	AC 0.05...16 A true r.m.s.
Setting range	0.1...16 A x transformation ratio $n$
Rated frequency	42...2000 Hz
Transformation ratio factor $n$	1...2000
Hysteresis approx.	10...40 %
Response time approx.	≤ 70 ms
Response delay	0...99 s
Delay on release	0...99 s
<b>Operating elements – alarm LEDs</b>	
Operation	×
Alarm undercurrent	×
Alarm overcurrent	×
Alarm window discriminator function	×
<b>Switching elements</b>	
Number of switching elements	2 x 1 changeover contacts, programmable
Mode of operation	N/O operation / N/C operation*
<b>General features</b>	
Enclosure dimensions in mm (H x W x D)	90 x 36 x 70.5
Accessories	Mounting clip
Interface option	M
Approvals and certifications	UL, GOST, Lloyd's Register

**Chapter 3.3 - Page 72 – 75**

\*programmable

<b>Type</b>	
<b>System voltage</b>	
3AC	×
<b>Function</b>	
Undercurrent / overcurrent	×
Window discriminator function	×
Password protection	×
<b>Supply voltage</b>	
Supply voltage range $U_S$	DC 9.6...94 V, AC 16...72 V, AC/DC 70...300 V
<b>Response values</b>	
Current	AC 0.05...16 A true r.m.s.
Setting range	0.1...16 A x transformation ratio $n$
Rated frequency	42...2000 Hz
Hysteresis approx.	1...40 %
Response time approx.	100 ms
Response delay	0...99 s
Delay on release	0...99 s
<b>Operating elements – alarm LEDs</b>	
Operation	×
Alarm undercurrent	×
Alarm overcurrent	×
Alarm, window discriminator function	×
<b>Switching elements</b>	
Number of switching elements	2 x 1 changeover contacts, programmable
Mode of operation	N/O or N/C operation
<b>General features</b>	
Enclosure dimensions in mm (H x W x D)	90 x 36 x 70.5
Interface option	M
	--

## Device selection – Current relay for DC currents



DC current relays are designed to monitor the upper and lower limits of a preset response value.

<b>Type</b>	▶
<b>System voltage</b>	
DC	▶
<b>Function</b>	
Undercurrent	▶
Overcurrent	▶
<b>Supply voltage</b>	
Supply voltage range $U_s$	▶
<b>Response values</b>	
Current	▶
Setting range	▶
Hysteresis approx.	▶
Response time approx.	▶
Response delay	▶
<b>Operating elements – alarm LEDs</b>	
Operation	▶
Alarm undercurrent	▶
Alarm overcurrent	▶
<b>Operating elements – potentiometer</b>	
Current	▶
Response delay	▶
Hysteresis	▶
<b>Switching elements</b>	
Number of switching elements	▶
Operating principle	▶
<b>General features</b>	
Enclosure dimensions in mm (H x W x D)	▶
Accessories	▶
Approvals and certifications	▶



<b>CSG140</b>
×
×
--
AC 50...60 Hz 85...275 V, DC 9,6...84 V, DC 77...286 V
DC 0.5...5 A, 0.5...5 mA / 2...20 mA DC 1...10 A, 6...60 mA / 50...500 mA
Scale range 1...10
2...10 %
100 ms
0.1...10 s
×
×
--
×
×
×
1 x 2 changeover contacts
N/O or N/C operation
70 x 45 x 110
Mounting rail
GOST

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<b>CSG141</b>
×
--
×
AC 50...60 Hz 85...275 V, DC 9,6...84 V, DC 77...286 V
DC 0.5...5 A, 0.5...5 mA / 2...20 mA DC 1...10 A, 6...60 mA / 50...500 mA
Scale range 1...10
2...10 %
100 ms
0.1...10 s
×
--
×
×
×
1 x 2 changeover contacts
N/O operation / N/C operation
70 x 45 x 110
Mounting rail
GOST

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## Device selection – Monitoring relay for specific applications

Bender offers different versions for special monitoring functions such as loop monitoring, fault voltage monitoring or restart function. Please contact our Sales Department for further details.

### Type ▶

#### System voltage

Automatic restart relay ▶	
Loop monitoring ▶	

#### Supply voltage

Supply voltage range $U_S$ ▶	
------------------------------	--

#### Measuring circuit

Loop resistance $> R$ ▶	
Series resistance ▶	
Cross resistance ▶	
Max. system leakage capacitance ▶	
Rated frequency ▶	
Hysteresis approx. ▶	
Response time ▶	
Start-up delay $t$ ▶	
Response delay $t_{on}$ ▶	
Delay on release $t_{off}$ ▶	
Response value $U_A$ ▶	
Reset value $U_B$ ▶	

#### Operating elements – alarm LEDs

Operation ▶	
Alarm ▶	
Loop resistance $> R$ ▶	
Extraneous voltage $> U_f$ ▶	

#### Operating elements – switches/buttons

Buttons ▶	
-----------	--

#### Operating elements – potentiometer

Series resistance ▶	
Response delay ▶	

#### Switching elements

Number of switching elements ▶	
Operating principle ▶	

#### Enclosure

Enclosure dimensions in mm (H x W x D) ▶	
Accessories ▶	
Approvals and certifications ▶	



ZUE150



GM420



RM475LY

Automatic restart relay	×
Loop monitoring	--

Supply voltage range $U_S$	AC 110, 230, 240 V
----------------------------	--------------------

Loop resistance $> R$	--
Series resistance	--
Cross resistance	--
Max. system leakage capacitance	--
Rated frequency	50...60 Hz
Hysteresis approx.	--
Response time	--
Start-up delay $t$	--
Response delay $t_{on}$	0.1...100 s
Delay on release $t_{off}$	--
Response value $U_A$	0.65 x $U_S$
Reset value $U_B$	0.8 x $U_S$

Operation	--
Alarm	--
Loop resistance $> R$	--
Extraneous voltage $> U_f$	--

Buttons	--
---------	----

Series resistance	--
Response delay	×

Number of switching elements	1 N/O contact
Operating principle	N/O operation

Enclosure dimensions in mm (H x W x D)	71 x 62 x 109
Accessories	Mounting rail
Approvals and certifications	--

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Automatic restart relay	--
Loop monitoring	×

Supply voltage range $U_S$	DC 9.6...94 V / AC 16...72 V, AC/DC 70...300 V
----------------------------	---

Loop resistance $> R$	×
Series resistance	--
Cross resistance	--
Max. system leakage capacitance	--
Rated frequency	42...460 Hz
Hysteresis approx.	1...40 %
Response time	in case of open loop connection ( $R > 50$ ) $\leq 40$ ms in case of closed loop connection ( $R >$ ) $\leq 500$ ms in case of extraneous voltage ( $> U$ ) $\leq 100$ ms
Start-up delay $t$	0...99 s
Response delay $t_{on}$	0...99 s
Delay on release $t_{off}$	0...99 s
Response value $U_A$	--
Reset value $U_B$	--

Operation	×
Alarm	×
Loop resistance $> R$	×
Extraneous voltage $> U_f$	×

Buttons	TEST / RESET operation
---------	------------------------

Series resistance	--
Response delay	0...99 s

Number of switching elements	2 x 1 changeover contact
Operating principle	N/O or N/C operation

Enclosure dimensions in mm (H x W x D)	90 x 36 x 70.5
Accessories	Mounting clip
Approvals and certifications	Lloyd's Register

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Automatic restart relay	--
Loop monitoring	×

Supply voltage range $U_S$	AC 230, 400, 500 V, AC 90...132 V, DC 9.8...84 V, DC 77...286 V
----------------------------	--

Loop resistance $> R$	--
Series resistance	50...500 $\Omega$
Cross resistance	1000 $\Omega$
Max. system leakage capacitance	50 $\mu$ F
Rated frequency	50...60 Hz
Hysteresis approx.	--
Response time	< 1 s
Start-up delay $t$	--
Response delay $t_{on}$	1...10 s
Delay on release $t_{off}$	--
Response value $U_A$	--
Reset value $U_B$	--

Operation	×
Alarm	Cross / series resistance
Loop resistance $> R$	--
Extraneous voltage $> U_f$	--

Buttons	TEST / RESET
---------	--------------

Series resistance	×
Response delay	×

Number of switching elements	1 x 2 changeover contacts
Operating principle	N/O or N/C operation

Enclosure dimensions in mm (H x W x D)	73 x 99 x 75
Accessories	EV22S
Approvals and certifications	--

Chapter 3.4 - Page 88 – 91



Type	SB146	SB471/473/476	SP100*
<b>System voltage</b>			
Fault voltage	×	×	--
Energy backup for the SUR... and AUR... series	--	--	×
<b>Supply voltage</b>			
Supply voltage range <i>U</i>	AC 10...65 V, DC 10...90 V AC 65...276 V, DC 90...308 V	AC 10...65 V, DC 10...90 V AC 65...276 V, DC 90...308 V	DC 27 V
<b>Measuring circuit</b>			
Measuring channels	6	(SB471) 1, (SB473) 3, (SB476) 6	--
Rated frequency	50...1000 Hz	50...1000 Hz	--
Hysteresis approx.	--	--	--
Response time	≤ 100 ms	≤ 100 ms	--
Fault voltage <i>U<sub>f</sub></i>	AC 21.6...24 V, DC 19...24 V	AC 21.6...24 V, DC 19...24 V	--
<b>Operating elements – alarm LEDs</b>			
Operation	×	×	--
Alarm	× (connection) and per channel	× (connection) and per channel	--
<b>Operating elements – switches/buttons</b>			
Buttons	TEST / RESET	TEST / RESET	--
<b>Switching elements</b>			
Number of switching elements	1 x 1 changeover contact	1 x 2 changeover contacts (1 changeover contact SB476)	--
Operating principle	N/C operation	N/C operation	--
<b>General features</b>			
Enclosure dimensions in mm (H x W x D)	99 x 45 x 114.5	73 x 99 x 75	70 x 45 x 110
Accessories	--	--	Mounting rail
Approvals and certifications	--	GOST	--
	<b>Chapter 3.4 - Page 92 – 93</b>	<b>Chapter 3.4 - Page 94 – 97</b>	<b>Chapter 3.4 - Page 98 – 99</b>

\* guarantees voltage supply for the preset time delay period





The voltage relays are designed to monitor voltages in single-phase or three-phase DC or AC systems.

## VME420

Multi-functional relay for overvoltage, undervoltage and frequency monitoring  
in AC/DC systems with external supply voltage

VME420

### Device features

- Monitoring AC/DC systems for undervoltage, overvoltage and frequency in the voltage range of 0...300 V
- Various monitoring functions selectable  $< U, > U, < f, > f$
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

### Approvals and certifications



### Product description

The VME420 series voltage relays are designed to monitor the frequency, undervoltage, overvoltage and the voltage between two threshold values in AC and DC systems. The voltages are measured as r.m.s. values. The currently measured value is continuously shown on the LC display. The measured value required to trigger the alarm relay is stored. Due to adjustable response times, installation-specific characteristics, such as device-specific start-up procedures, short-time voltage fluctuations, etc. can be considered. The relays require an external supply voltage.

### Typical applications

- Voltage and frequency monitoring of single-phase machines and electrical installations
- Earth fault monitoring in medium-voltage systems via voltage transformers
- Monitoring of battery systems
- Switching machinery and equipment on and off at a certain voltage level

### Function

Once the supply voltage is applied, the start-up delay "t" begins. Measured voltage and frequency values changing during this time do not influence the switching state of the alarm relays.

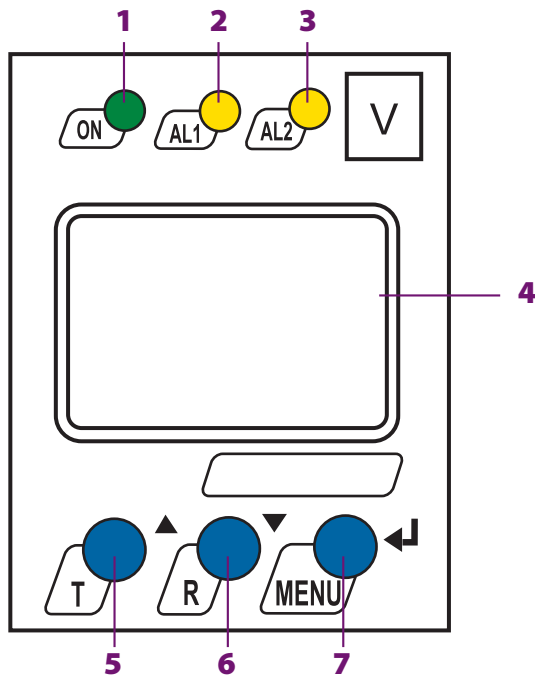
The devices feature two separately adjustable measuring channels (overvoltage/undervoltage). When the measuring quantity exceeds the response value ("Alarm 1") or falls below the response value ("Alarm 2"), the time of the response delays " $t_{on1/2}$ " begins. Once the response delay has elapsed, the alarm relays switch and the alarm LEDs light up. When the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release time " $t_{off}$ " begins. When " $t_{off}$ " has elapsed, the alarm relays switch back to their initial position. When the fault memory is activated, the alarm relays remain in alarm position until the reset button *R* is pressed. When the fault memory is set to continuous mode, the alarm parameters remain stored, even on failure of the supply voltage.

### Preset function

After connecting the device for the first time, the nominal system voltage will be determined (PrE run), and the response values for overvoltage and undervoltage as well as for under-frequency and overfrequency will automatically be set. When no voltage is determined within a nominal system voltage range (PrE run), the response values will be set to the minimum or maximum voltage. In this case, the message "AL not SET" appears on the display. As long as no button is pressed, a nominal system voltage is being searched cyclically (PrE run). If a button is pressed, the search will be interrupted and the message "AL not SET" disappears. In this case, the appropriate response values have to be set in the menu. When activating the frequency monitoring function, the preset frequency will automatically be stored.



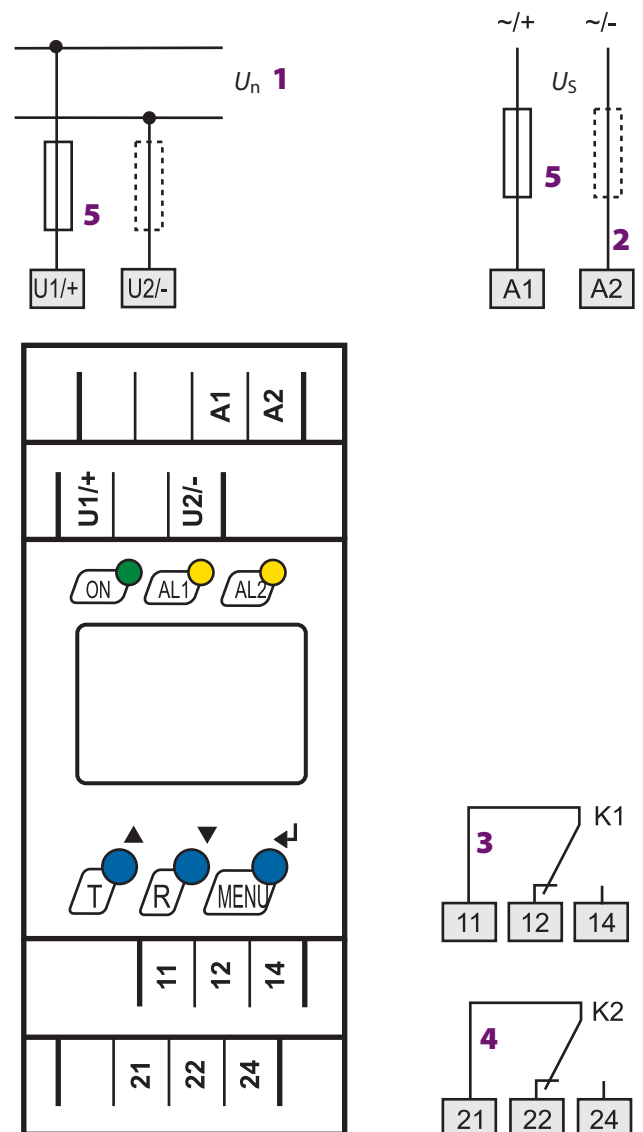
Operating elements



- 1 - LED Power on "ON" (green); lights when supply voltage is applied and flashes in the event of system fault alarm
- 2 - Alarm LED "AL1" (yellow), lights when the set response value is exceeded  $> U / < f / > f$  and flashes in the event of system fault alarm
- 3 - Alarm LED "AL2" (yellow), lights when the value falls below the set response value  $< U / < f / > f$  and flashes in the event of system fault alarm
- 4 - Multi functional LC display
- 5 - Test button "T": UP button: To change the measured value display, move upwards in the menu or to change parameters.  
To call up the self test, press the button  $> 1.5$  s.
- 6 - Reset button "R": Down button: To change the measured value display, move downwards in the menu or to change parameters.  
To delete stored alarms, press the button  $> 1.5$  s.
- 7 - "MENU" button: Enter button: To confirm the measured value display or parameter change.  
To call up the menu system:  
Press the button  $> 1.5$  s.  
Press the ESC button  $> 1.5$  s to abort an action or to return to the previous menu level.

When the menu item "LEd" is activated, the alarm LED "AL1" indicates that K1 is in the alarm state. When "AL2" lights up, K2 is in the alarm state.

Wiring diagram



- 1 - Connection to the system/load being monitored
- 2 - Supply voltage  $U_S$  (see ordering information)
- 3 - Alarm relay K1: Configurable for  $< U / > U / < f / > f / \text{ERROR}$
- 4 - Alarm relay K2: Configurable for  $< U / > U / < f / > f / \text{ERROR}$
- 5 - Line protection according to IEC 60364-4-43: 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

### Ordering information

Type	Supply voltage $U_S^*$	Nominal system voltage $U_n^*$	Display range	Response value	Art. No.
VME420-D-1	DC 9.6 V...94 V / AC 15...460 Hz, 16...72 V	AC / DC 0...300 V / 15...460 Hz	AC/DC 0...300 V	AC / DC 6...300 V	B 7301 0001
VME420-D-2	DC 70...300 V / AC 15...460 Hz, 70...300 V	AC / DC 0...300 V / 15...460 Hz	AC/DC 0...300 V	AC / DC 6...300 V	B 7301 0002

Device version with screw terminals on request

\* Absolute values

### Accessories

Type	Art No.
Mounting clip for screw fixing (1 piece per device)	B 9806 0008

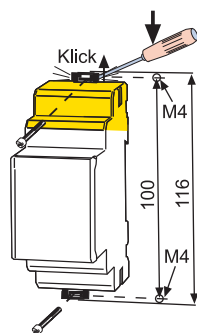
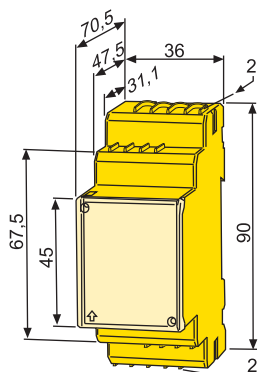
### Dimension diagram XM420

Dimensions in mm

Open the front plate cover in direction of arrow!

### Screw mounting

Note: The upper mounting clip must be ordered separately (see ordering information).



**Technical data**
**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	2.5 kV / III
Protective separation (reinforced insulation) between:	(A1, A2) - (U1/+, U2/-) - (11-12-14) - (21-22-24)
Voltage test acc. to IEC 61010-1	2.21 kV

**Supply voltage**
**VME420-D-1:**

Supply voltage $U_s$	AC 16...72 V / DC 9.6...94 V
Frequency range $U_s$	15...460 Hz

**VME420-D-2:**

Supply voltage $U_s$	AC/DC 70...300 V
Frequency range $U_s$	15...460 Hz
Power consumption	≤ 3.5 VA

**Measuring circuit**

Measuring range (r.m.s. value)	AC / DC 0...300 V
Rated frequency $f_n$	DC, 15...460 Hz
Frequency display range	10...500 Hz

**Response values**

Undervoltage < $U$ (Alarm 2)	AC / DC 6...300 V
Overvoltage > $U$ (Alarm 1)	AC / DC 6...300 V
Resolution of setting $U$ 6.0...49.9 V	0.1 V
Resolution of setting $U$ 50...300 V	1 V

**Preset function:**

Undervoltage < $U = (0.85 U_n)^*$ for $U_n = 230 V / 120 V / 60 V / 24 V$	196 V / 102 V / 51 V / 20.4 V
Overvoltage > $U = (1.1 U_n)^*$ for $U_n = 230 V / 120 V / 60 V / 24 V$	253 V / 132 V / 66 V / 26.4 V
Relative uncertainty, voltage at 50/60 Hz	±1.5 %, ±2 digits
Relative uncertainty in the voltage range 15...460 Hz	±3 %, ±2 digits
Hysteresis $U$	1...40 % (5 %)*
Underfrequency < Hz	10...500 Hz**
Overfrequency > Hz	10...500 Hz**
Resolution of setting $f$ 10.0...99.9 Hz	0.1 Hz
Resolution of setting $f$ 100...500 Hz	1 Hz

**Preset function:**

Underfrequency for $f_n = 16.7 Hz / 50 Hz / 60 Hz / 400 Hz$	15.7 Hz / 49 Hz / 59 Hz / 399 Hz
Overfrequency for $f_n = 16.7 Hz / 50 Hz / 60 Hz / 400 Hz$	17.7 Hz / 51 Hz / 61 Hz / 401 Hz
Hysteresis frequency Hys Hz	0.1...2 Hz (0.2 Hz)*
Relative uncertainty in the frequency range 15...460 Hz	±0.2 %, ±1 digit

**Specified time**

Start-up delay $t$	0...300 s (0 s)*
Response delay $t_{on1/2}$	0...300 s (0 s)*
Delay on release $t_{off}$	0...300 s (0.5 s)*
Resolution of setting $t, t_{on1/2}, t_{off}$ (0...10 s)	0.1 s
Resolution of setting $t, t_{on1/2}, t_{off}$ (10...99 s)	1 s
Resolution of setting $t, t_{on1/2}, t_{off}$ (100...300 s)	10 s
Operating time voltage $t_{ae}$	DC/AC 16.7 Hz: ≤ 130 ms, AC 42...460 Hz: ≤ 70 ms
Operating time frequency $t_{ae}$	AC 15...460 Hz: ≤ 310 ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time $t_b$	≤ 300 ms

**Displays, memory**

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0...300 V
Operating uncertainty, voltage at 50/60 Hz	±1.5 %, ±2 digit
Operating uncertainty, voltage in the range 15...460 Hz	±3 %, ±2 digits
Operating uncertainty, frequency in the range of 15...460 Hz	±0.2 %, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	off / 0...999 (off)*
Fault memory (M) alarm relay	on / off / con (on)*

**Switching elements**

Number	2 x 1 changeover contacts (K1, K2)				
Operating principle	N/C or N/O operation				
	K2: Err, < $U$ , > $U$ , < Hz, > Hz, S.AL (undervoltage < $U$ : N/C operation n.c.)*				
	K1: Err, < $U$ , > $U$ , < Hz, > Hz, S.AL (overvoltage > $U$ : N/O operation n.o.)*				
Electrical endurance, number of cycles	10000				
Contact data acc. to IEC 60947-5-1:					
Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

**Environment/EMC**

EMC	IEC 61326
Operating temperature	-25 °C...+55 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

**Connection**

Connection	push-wire terminals
Connection properties:	
rigid	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule	0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

**Other**

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Software version	D235 V2.2x
Weight	≤ 150 g

( )\* = factory setting

\*\* = The technical data applies to the operating range of the rated frequency 15...460 Hz only

## VME421H

Multi-functional relay for undervoltage, overvoltage and frequency monitoring in AC/DC systems without external supply voltage

3.1



VME421H

### Device features

- Undervoltage, overvoltage and frequency monitoring of AC/DC systems  
9.6...150 V (VME421H-D-1)  
70...300 V (VME421H-D-2)
- Without external supply voltage
- Integrated energy backup
- Various monitoring functions selectable  
<  $U$ , >  $U$ , <  $f$  / >  $f$
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function  
(automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays  
(one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal  
(two terminals per connection)
- RoHS compliant

### Approvals and certifications



### Product description

The VME421H series voltage relays are designed to monitor the frequency, undervoltage, overvoltage and the voltage between two threshold values (window discriminator function) in AC and DC systems. The voltages are measured as r.m.s. values. The currently measured value is continuously shown on the LC display. The measured value required to trigger the alarm relay is stored. Due to adjustable response times, installation-specific characteristics, such as device-specific start-up procedures, short-time voltage fluctuations, etc. can be considered. The device is supplied with power by the system being monitored and utilises an internal energy backup.

### Typical applications

- Voltage and frequency monitoring of single-phase machines and electrical installations
- Earth fault monitoring in medium-voltage systems via voltage transformers
- Monitoring of battery systems
- Switching machinery and equipment on and off at a certain voltage level

### Function

Once the supply voltage is applied, the start-up delay " $t$ " begins. Measured voltage and frequency values changing during this time do not influence the switching state of the alarm relays.

The devices feature two separately adjustable measuring channels (overvoltage/undervoltage). When the measuring quantity exceeds the response value ("Alarm 1") or falls below the response value ("Alarm 2"), the time of the response delays " $t_{on1/2}$ " begins. Once the response delay has elapsed, the alarm relays switch and the alarm LEDs light up. When the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release delay " $t_{off}$ " begins. When " $t_{off}$ " has elapsed, the alarm relays switch back to their initial position. When the fault memory is activated, the alarm relays remain in alarm position until the reset button  $R$  is pressed.

### Energy backup

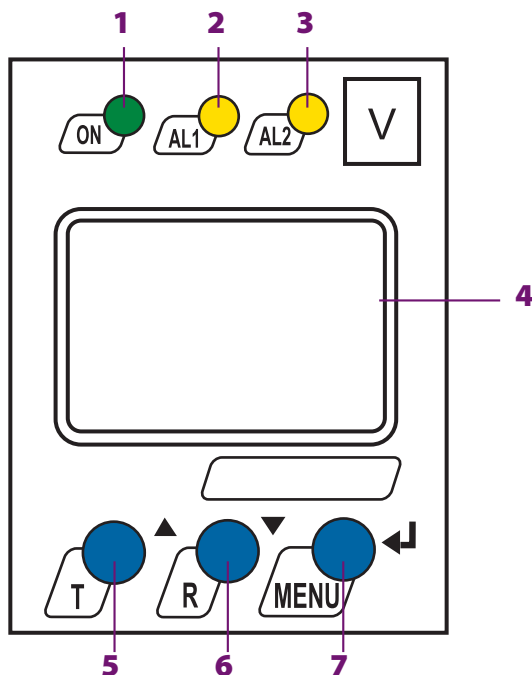
Also in the event of complete power failure of the system being monitored, the delay times are effective during the energy backup time. When the fault memory is set to continuous mode, the alarm parameters remain stored, even on failure of the supply voltage.

### Preset function

After connecting the device for the first time, the nominal system voltage will be determined (PrE run), and the response values for overvoltage and undervoltage as well as for underfrequency and overfrequency will automatically be set. When no voltage is determined within a nominal system voltage range (PrE run), the response values will be set to the minimum or maximum voltage. In this case, the message "AL not SET" appears on the display. As long as no button is pressed, a nominal system voltage is being searched cyclically (PrE run). If a button is pressed, the search will be interrupted and the message "AL not SET" disappears. In this case, the appropriate response values have to be set in the menu. When activating the frequency monitoring function, the preset frequency will automatically be stored.

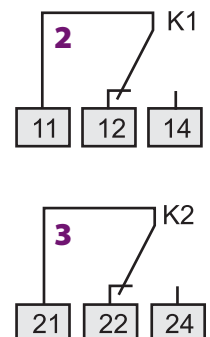
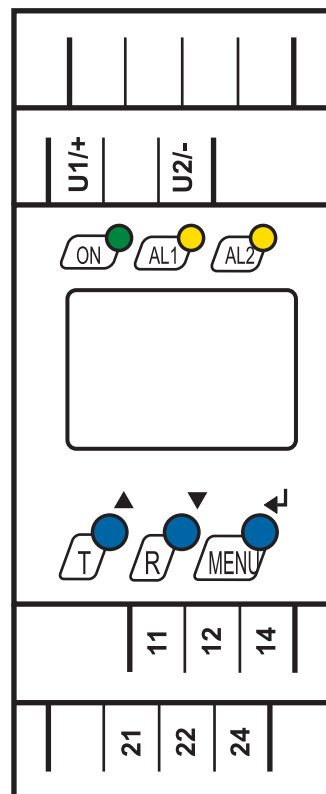
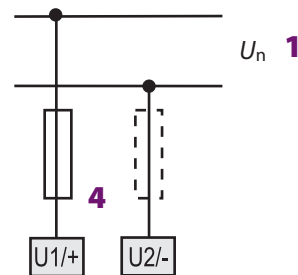


Operating elements



- 1 - LED Power on "ON" (green); lights when supply voltage is applied and flashes in the event of system fault alarm
- 2 - Alarm LED "AL1" (yellow), lights when the set response value is exceeded  $> U / < f / > f$  and flashes in the event of system fault alarm
- 3 - Alarm LED "AL2" (yellow), lights when the value falls below the set response value  $< U / < f / > f$  and flashes in the event of system fault alarm
- 4 - Multi-functional LC display
- 5 - Test button "T": Up button: To change the measured value display, move downwards in the menu or to change parameters.  
To call up the self test, press the button  $> 1.5$  s.
- 6 - Reset button "R": Down button: To change the measured value display, move downwards in the menu or to change parameters.  
To delete stored alarms, press button  $> 1.5$  s
- 7 - "MENU" button: Enter button: To confirm the measured value display or parameter change.  
To call up the menu system, press the button  $> 1.5$  s.  
Press the ESC button  $> 1.5$  s: to abort an action or to return to the previous menu level.

Wiring diagram



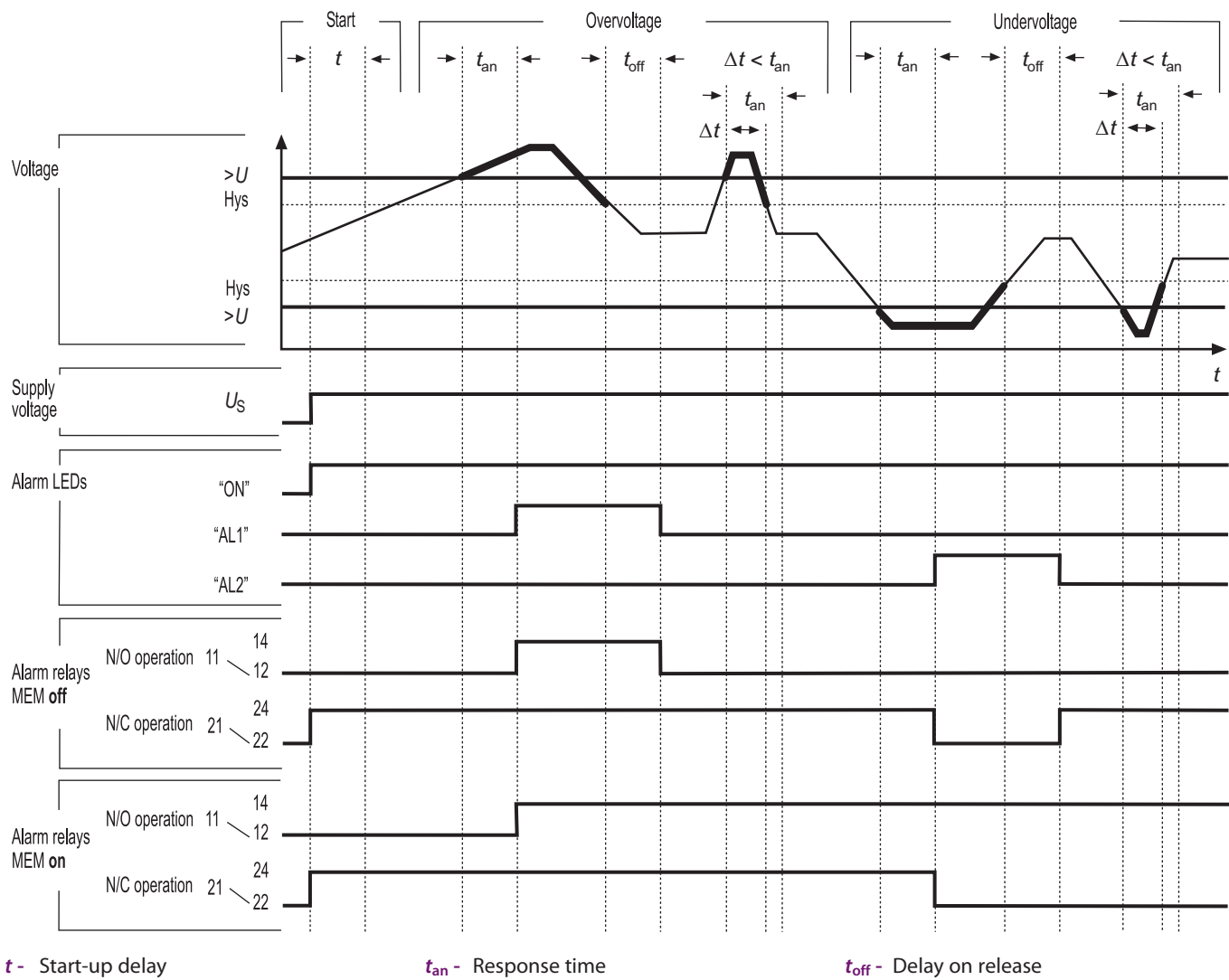
- 1 - Connection to the system/load being monitored
- 2 - Alarm relay K1: Configurable for  $< U / > U / < f / > f / \text{ERROR}$
- 3 - Alarm relay K2: Configurable for  $< U / > U / < f / > f / \text{ERROR}$
- 4 - Line protection according to IEC 60364-4-43: 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

Ordering information					
Type	Supply voltage $U_S$	Nominal system voltage $U_n^*$	Display range	Response value	Art. No.
VME421H-D-1	--	DC 9.6...150 V / AC 15...460 Hz 9.6...150 V	AC / DC 9.6...150 V	AC / DC 9.6...150 V	B 7301 0003
VME421H-D-2	--	DC 70...300 V / AC 15...460 Hz 70...300 V	AC / DC 70...300 V	AC / DC 70...300 V	B 7301 0004

Device version with screw terminals on request.  
\* Absolute values

Accessories	
Type	Art No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

### Timing diagram voltage monitoring



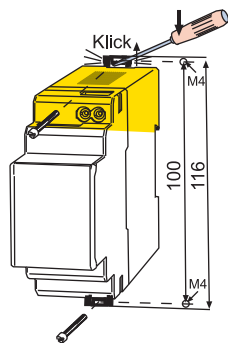
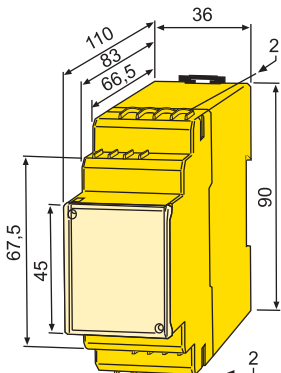
### Dimension diagram XM421

Dimensions in mm

Open the front plate cover in direction of arrow!

#### Screw mounting

Note: The upper mounting clip must be ordered separately (see ordering information).



**Technical data**
**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	2.5 kV / III
Protective separation (reinforced insulation) between:	(U1/+, U2/-) - (11-12-14) - (21-22-24)
Voltage test acc. to IEC 61010-1	2.21 kV

**Supply voltage**

<b>VME421H-D-1:</b>	
Supply voltage $U_s$	none (internally supplied by $U_n$ )

<b>VME421H-D-2:</b>	
Supply voltage $U_s$	none (internally supplied by $U_n$ )
Power consumption	$\leq 4$ VA

**Measuring circuit**

Measuring range (r.m.s. value) (VME421H-D-1)	AC / DC 0...150 V
Measuring range (r.m.s. value) (VME421H-D-2)	AC / DC 0...300 V
Rated frequency $f_n$	DC, 15...460 Hz
Frequency display range	10...500 Hz

**Response values**

<b>VME421H-D-1:</b>	
Undervoltage $< U$ (Alarm 2)	AC / DC 9.6...150 V
Overvoltage $> U$ (Alarm 1)	AC / DC 9.6...150 V

Preset function:	
Undervoltage $< U (0.85 U_n)^*$ for $U_n = 120$ V / 60 V / 24 V	102 V / 51 V / 20.4 V
Overvoltage $> U (1.1 U_n)^*$ for $U_n = 120$ V / 60 V / 24 V	132 V / 66 V / 26.4 V
Resolution of setting $U$ 9.6...49.9 V	0.1 V
Resolution of setting $U$ 50...150 V	1 V

<b>VME421H-D-2:</b>	
Undervoltage $< U$ (ALARM 2)	AC / DC 70...300 V
Overvoltage $> U$ (ALARM 1)	AC / DC 70...300 V
Resolution of setting $U$ 70...300 V	1 V
Preset function:	
Undervoltage $< U (0.85 U_n)^*$ für $U_n = 230$ V / 120 V	196 V / 102 V
Overvoltage $> U (1.1 U_n)^*$ for $U_n = 230$ V / 120 V	253 V / 132 V

<b>VME421H...:</b>	
Relative uncertainty, voltage at 50/60 Hz	$\pm 1.5$ %, $\pm 2$ digits
Relative uncertainty, voltage in the range 15...460 Hz	$\pm 3$ %, $\pm 2$ digits
Hysteresis $U$	1...40 % (5 %)*
Underfrequency $< \text{Hz}$	10...500 Hz**
Overfrequency $> \text{Hz}$	10...500 Hz**
Resolution of setting $f$ 10.0...99.9 Hz	0.1 Hz
Resolution of setting $f$ 100...500 Hz	1 Hz
Preset function:	
Underfrequency for $f_n = 16.7$ Hz / 50 Hz / 60 Hz / 400 Hz	15.7 Hz / 49 Hz / 59 Hz / 399 Hz
Overfrequency for $f_n = 16.7$ Hz / 50 Hz / 60 Hz / 400 Hz	17.7 Hz / 51 Hz / 61 Hz / 401 Hz
Hysteresis frequency Hys Hz	0.1...2 Hz (0.2 Hz)*
Relative uncertainty, frequency in the range 15...460 Hz	$\pm 0.2$ %, $\pm 1$ digit

**Specified time**

Start-up delay $t$	0...300 s (0 s)*
Response delay $t_{on1/2}$	0...300 s (0 s)*
Delay on release $t_{off}$	0...300 s (0.5 s)*
Resolution of setting $t, t_{on1/2}, t_{off}$ (0...10 s)	0.1 s
Resolution of setting $t, t_{on1/2}, t_{off}$ (10...99 s)	1 s
Resolution of setting $t, t_{on1/2}, t_{off}$ (100...300 s)	10 s
Operating time voltage $t_{ae}$	DC/AC 16.7 Hz: $\leq 130$ ms, AC 42...460 Hz: $\leq 70$ ms
Operating time frequency $t_{ae}$	AC 15...460 Hz: $\leq 310$ ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Discharging time energy backup on power failure (VME421H-D-1)	$\geq 3$ s
Discharging time energy backup on power failure (VME421H-D-1)	$\geq 2.5$ s at $f_n < 42$ Hz
Discharging time energy backup on power failure (VME421H-D-2)	$\geq 4$ s at DC 70 $\geq 6$ s at DC 80 V / AC 70 V
Charging time energy backup (VME421H-D-1)	$\leq 60$ s
Charging time energy backup (VME421H-D-2)	$\leq 120$ s
Recovery time $t_b$	$\leq 300$ ms

**Displays, memory**

Display	LC display, multifunctional, not illuminated
Display range measured value (VME421H-D-1)	AC/DC 0...150 V
Display range measured value (VME421H-D-2)	AC/DC 0...300 V
Operating uncertainty, voltage at 50/60 Hz	$\pm 1.5$ %, $\pm 2$ digit
Operating uncertainty, voltage in the range of 15...460 Hz	$\pm 3$ %, $\pm 2$ digits
Operating uncertainty, frequency in the range of 15...460 Hz	$\pm 0.2$ %, $\pm 1$ digit
History memory (HiS) for the first alarm value	data record measured values
Password	off / 0...999 (off)*
Fault memory (M) alarm relay	on / off / con (on)*

**Switching elements**

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C or N/O operation K2: Err, $< U, > U, < \text{Hz}, > \text{Hz}$ , S.AL (undervoltage $< U$ : N/C operation n.c.)* K1: Err, $< U, > U, < \text{Hz}, > \text{Hz}$ , S.AL (overvoltage $> U$ : N/O operation n.o.)*
Electrical endurance, number of cycles	10000
Contact data acc. to IEC 60947-5-1:	
Utilisation category	AC 13 AC 14 DC-12 DC-12 DC-12
Rated operational voltage	230 V 230 V 24 V 110 V 220 V
Rated operational current	5 A 3 A 1 A 0.2 A 0.1 A
Minimum contact rating	1 mA at AC/DC $\geq 10$ V

**Environment/EMC**

EMC	IEC 61326
Operating temperature	-25 °C...+55 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

**Connection**

Connection type	push-wire terminals
Connection properties:	
rigid	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule	0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

**Other**

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP 30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Software version VME421H-D-1	D236 V2.2x
Software version VME421H-D-2	D237 V2.2x
Weight	$\leq 240$ g

( )\* = factory setting

\*\* = The technical data applies to the operating range of the rated frequency 15...460 Hz only.

## VMD420

Multi-functional voltage relay for frequency, overvoltage, undervoltage, phase sequence, phase failure and asymmetry monitoring in 3(N)AC systems



VMD420

### Device features

- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 0...500 V
- Asymmetry, phase failure and phase sequence monitoring
- Various monitoring functions selectable  $< U, > U, < f, > f$
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

### Approvals and certifications



### Product description

The multi-functional VMD420 series voltage relay is designed to monitor the frequency, undervoltage and overvoltage and the voltage between two threshold values in 3(N)AC systems. The voltages are measured as r.m.s. values. The currently measured value is continuously shown on the LC display. The measured value required to trigger the alarm relay is stored. Due to adjustable response times, installation-specific characteristics, such as device-specific start-up procedures, short-time voltage fluctuations, etc. can be considered. The devices require an external supply voltage.

### Typical applications

- Monitoring of voltage-sensitive machines and electrical installations
- Switching machinery and equipment on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads
- Protection of three-phase motors against phase failure and phase open-circuit
- Transformer protection, asymmetrical load can be recognised

### Function

Once the supply voltage is applied, the start-up delay "t" begins. Measured voltage and frequency values changing during this time do not influence the switching state of the alarm relays.

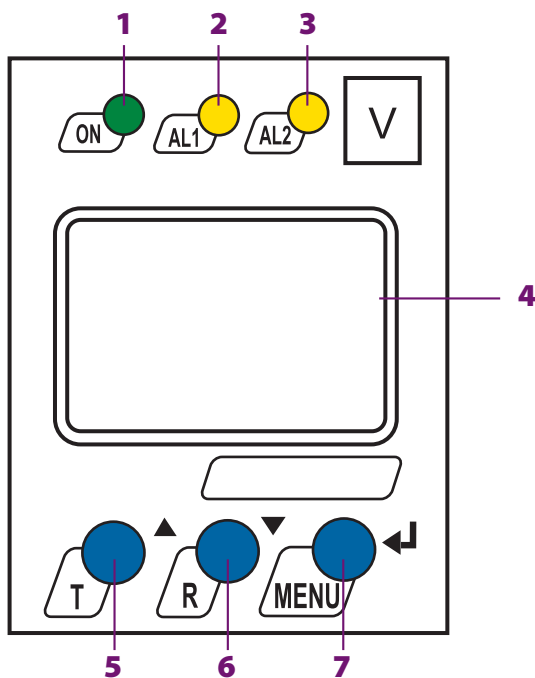
The devices feature two separately adjustable measuring channels (overvoltage/undervoltage). When the measuring quantity exceeds the response value ("Alarm 1") or falls below the response value ("Alarm 2"), the time of the response delays " $t_{on1/2}$ " begins. Once the response delay has elapsed, the alarm relays switch and the alarm LEDs light up. When the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release time " $t_{off}$ " begins. When " $t_{off}$ " has elapsed, the alarm relays switch back to their initial position. When the fault memory is activated, the alarm relays remain in alarm position until the reset button *R* is pressed. When the fault memory is set to continuous mode, the alarm parameters remain stored, even on failure of the supply voltage.

### Preset function

After connecting the device for the first time, the nominal system voltage will be determined (PrE run), and the response values for overvoltage and undervoltage as well as for under-frequency and overfrequency will automatically be set. When no voltage is determined within a nominal system voltage range (PrE run), the response values will be set to the minimum or maximum voltage. In this case, the message "AL not SET" appears on the display. As long as no button is pressed, a nominal system voltage is being searched cyclically (PrE run). If a button is pressed, the search will be interrupted and the message "AL not SET" disappears. In this case, the appropriate response values have to be set in the menu. When activating the frequency monitoring function, the preset frequency will automatically be stored.

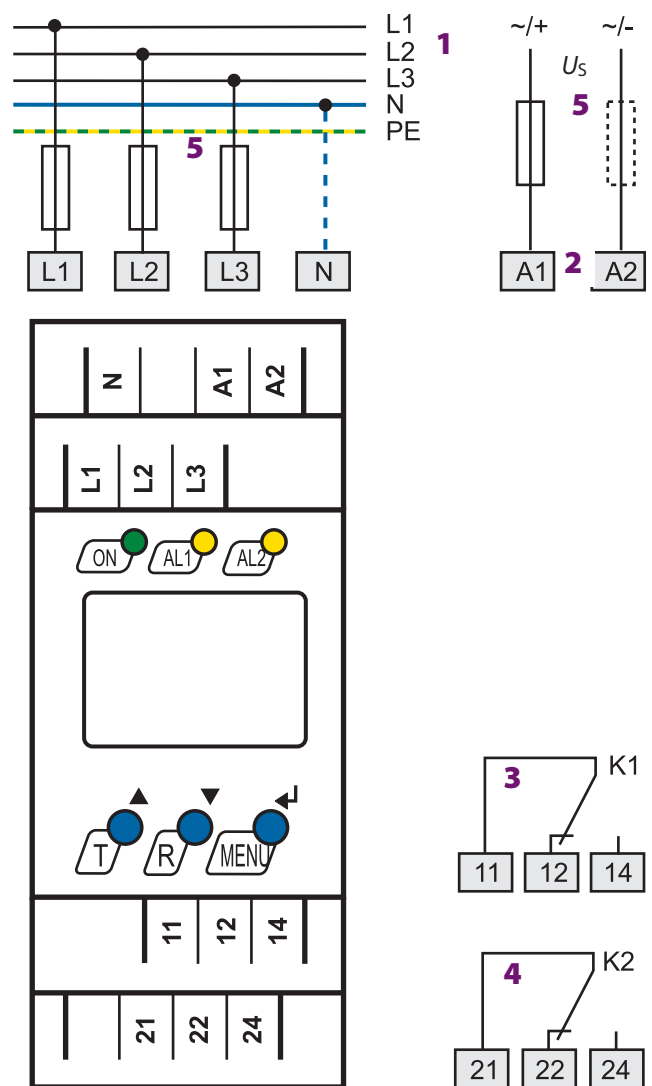


Operating elements



- 1 - LED Power on "ON" (green); lights when supply voltage is applied and flashes in the event of system fault alarm
  - 2 - Alarm LED "AL1" (yellow), lights when the set response value  $> U / < f / > f / > f / \text{Asy} / \text{PHS}$  is exceeded and flashes in the event of system fault alarm
  - 3 - Alarm LED "AL2" (yellow), lights when the value falls below the set response value  $< U / < f / > f / \text{Asy} / \text{PHS}$  or flashes in the event of system fault alarm
  - 4 - Multi functional LC display
  - 5 - Test button "T": Up button: To change the measured value display, move upwards in the menu or change parameters.  
To call up the self test, press the button  $> 1.5$  s.
  - 6 - Reset button "R": Down button: To change the measured value display, move downwards in the menu or change parameters.  
To delete stored alarms, press the button  $> 1.5$  s.
  - 7 - "MENU" button: Enter button: To confirm the measured value display or to confirm changed parameters.  
To call up the menu system, press the button  $> 1.5$  s.  
Press the ESC button  $> 1.5$  s to abort an action or to return to the previous menu level.
- \* - When the menu item "LEd" is activated, the alarm LED "AL1" indicates that K1 is in the alarm state. When "AL2" lights up, K2 is in the alarm state.

Wiring diagram



- 1 - Connection of the AC system/load to be monitored:
- 2 - Supply voltage  $U_S$  (see ordering information)
- 3 - Alarm relay K1: Configurable for  $< U / > U / < f / > f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 4 - Alarm relay K2: Configurable for  $< U / > U / < f / > f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 5 - Fuse as line protection.  
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

### Ordering information

Type	Supply voltage $U_S^*$	Nominal system voltage $U_n^*$	Display range	Response value	Art. No.
VMD420-D-1	AC 16...72 V / DC 9.6...94 V DC, 15...460 Hz	3(N)AC 0 / 500 V 15...460 Hz	AC 0...500 V	AC 6...500 V	B 7301 0005
VMD420-D-2	AC/DC 70...300 V / DC, 15...460 Hz	3(N)AC 0 / 500 V 15...460 Hz	AC 0...500 V	AC 6...500 V	B 7301 0006

Device version with screw terminals on request.

\* Absolute values

### Accessories

Type	Art No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

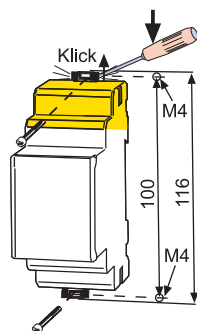
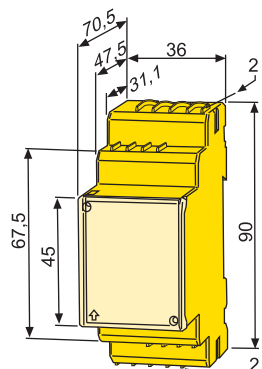
### Dimension diagram XM420

Dimensions in mm

Open the front plate cover in direction of arrow!

### Screw mounting

Note: The upper mounting clip must be ordered separately (see ordering information).



**Technical data**

**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV / III
Protective separation (reinforced insulation) between (A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)	
Voltage test acc. to IEC 61010-1: (N, L1, L2, L3) - (A1, A2), (11, 12, 14)	3.32 kV
(N, L1, L2, L3) - (21, 22, 24)	2.21 kV
(A1, A2) - (11, 12, 14) - (21, 22, 24)	2.21 kV

**Supply voltage**

<b>VMD420-D-1:</b>	
Supply voltage $U_s$	AC 16...72 V/DC 9.6...94 V
Frequency range $U_s$	15...460 Hz
<b>VMD420-D-2:</b>	
Supply voltage $U_s$	AC/DC 70...300 V
Frequency range $U_s$	15...460 Hz
Power consumption	≤ 3.5 VA

**Measuring circuit**

Measuring range (r.m.s. value) (L-N)	AC 0...288 V
Measuring range (r.m.s. value) (L-L)	AC 0...500 V
Rated frequency $f_n$	15...460 Hz
Frequency display range	10...500 Hz

**Response values**

Type of distribution system	3(N) AC / 3 AC (3 AC)*
Undervoltage < U (Alarm 2) (measurement method: 3Ph / 3n)	AC 6...500 V / 6...288 V
Overvoltage > U (Alarm 1) (measurement method: 3Ph / 3n)	AC 6...500 V / 6...288 V
Resolution of setting U	1 V

**Preset function for 3 AC measurement:**

Undervoltage < U (0.85 $U_n$ )* for $U_n = 400$ V/208 V	340 V/177 V
Overvoltage > U (1.1 $U_n$ )* for $U_n = 400$ V/208 V	440 V/229 V

**Preset function for 3(N)AC measurement:**

Undervoltage < U (0.85 $U_n$ )* for $U_n = 230$ V/120 V	196 V/102 V
Overvoltage > U (1.1 $U_n$ )* for $U_n = 230$ V/120 V	253 V/132 V

Asymmetry	5...30 % (30 %)*
Phase failure	by setting the asymmetry
Phase sequence	clockwise/ anticlockwise rotation (off)*
Relative uncertainty, voltage at 50 Hz / 60 Hz	±1.5 %, ±2 digits
Relative uncertainty, voltage in the range of 15...460 Hz	±3 %, ±2 digits
Hysteresis U	1...40 % (5 %)*
Underfrequency < Hz	10...500 Hz**
Overfrequency > Hz	10...500 Hz**
Resolution of setting f (10.0...99.9 Hz)	0.1 Hz
Resolution of setting f (100...500 Hz)	1 Hz

**Preset function:**

Underfrequency for $f_n = 16.7$ Hz/50 Hz/60 Hz/400 Hz	15.7 Hz/49 Hz/59 Hz/399 Hz
Overfrequency for $f_n = 16.7$ Hz/50 Hz/60 Hz/400 Hz	17.7 Hz/51 Hz/61 Hz/401 Hz
Hysteresis frequency Hys Hz	0.1...2 Hz (0.2 Hz)*
Relative uncertainty, frequency in the range of 15...460 Hz	±0.2 %, ±1 digit

**Specified time**

Start-up delay t	0...300 s (0 s)*
Response delay $t_{on1/2}$	0...300 s (0 s)*
Delay on release $t_{off}$	0...300 s (0.5 s)*
Resolution of setting t, $t_{on1/2}$ , $t_{off}$ (0...10 s)	0.1 s
Resolution of setting t, $t_{on1/2}$ , $t_{off}$ (10...99 s)	1 s
Resolution of setting t, $t_{on1/2}$ , $t_{off}$ (100...300 s)	10 s
Operating time voltage $t_{ae}$	≤ 140 ms
Operating time frequency $t_{ae}$	≤ 335 ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time $t_b$	≤ 300 ms

**Displays, memory**

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0...500 V
Operating uncertainty, voltage at 50 Hz/60 Hz	±1.5 %, ±2 digits
Operating uncertainty, voltage in the range of 15...460 Hz	±3 %, ±2 digits
Operating uncertainty, frequency in the range of 15...460 Hz	±0.2 %, ±1 digit
History memory (His) for the first alarm value	data record measured values
Password	off/0...999 (off/0)*
Fault memory (M) alarm relay	on / off / con (on)*

**Switching elements**

Number	2 x 1 changeover contacts (K1, K2)				
Operating principle	N/C operation n.c. or N/O operation n.o.				
	K2: Err, < U, > U, Asy, < Hz, > Hz, PHS, S.AL (undervoltage < U, asymmetry Asy, N/C operation n.c.)*				
	K1: Err, < U, > U, Asy, < Hz, > Hz, PHS, S.AL (overvoltage > U, asymmetry Asy, N/O operation n.o.)*				
Electrical endurance, number of cycles	10000				
Contact data acc. to IEC 60947-5-1:					
Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

**Environment/EMC**

EMC	IEC 61326
Operating temperature	-25 °C...+55 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

**Connection**

Connection	push-wire terminals
Connection properties:	
rigid	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule	0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

**Other**

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Software version	D238 V2.2x
Weight	≤ 150 g

( ) \* = factory setting

\*\* = The technical data applies to the operating range of the rated frequency 15...460 Hz only.

## VMD421H

Multi-functional voltage relay for frequency, overvoltage, undervoltage, phase sequence, phase failure and asymmetry monitoring in 3(N)AC systems



VMD421H

### Device features

- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 70...500/288 V
- Without external supply voltage
- Integrated energy backup
- Asymmetry, phase failure and phase sequence monitoring
- Various monitoring functions selectable  $< U, > U, < f, > f$
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

### Approvals and certifications



### Product description

The multi-functional VMD421 series voltage relay is designed to monitor the frequency, undervoltage and overvoltage and the voltage between two threshold values (window discriminator function) in 3(N)AC systems. The voltages are measured as r.m.s. values. The currently measured value is continuously shown on the LC display. The measured value required to trigger the alarm relay is stored. Due to adjustable response times, installation-specific characteristics, such as device-specific start-up procedures, short-time voltage fluctuations, etc. can be considered. The devices are supplied by the system being monitored and utilise an internal energy backup.

### Typical applications

- Monitoring of voltage-sensitive machines and electrical installations
- Switching machinery and equipment on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads

### Function

Once the supply voltage is applied, the start-up delay "t" begins. Measured voltage and frequency values changing during this time do not influence the switching state of the alarm relays.

The devices feature two separately adjustable measuring channels (overvoltage/undervoltage). When the measuring quantity exceeds the response value ("Alarm 1") or falls below the response value ("Alarm 2"), the time of the response delays " $t_{on1/2}$ " begins. Once the response delay has elapsed, the alarm relays switch and the alarm LEDs light up. When the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release time " $t_{off}$ " begins. When " $t_{off}$ " has elapsed, the alarm relays switch back to their initial position. When the fault memory is activated, the alarm relays remain in alarm position until the reset button R is pressed. When the fault memory is set to continuous mode, the alarm parameters remain stored, even on failure of the supply voltage.

### Energy backup

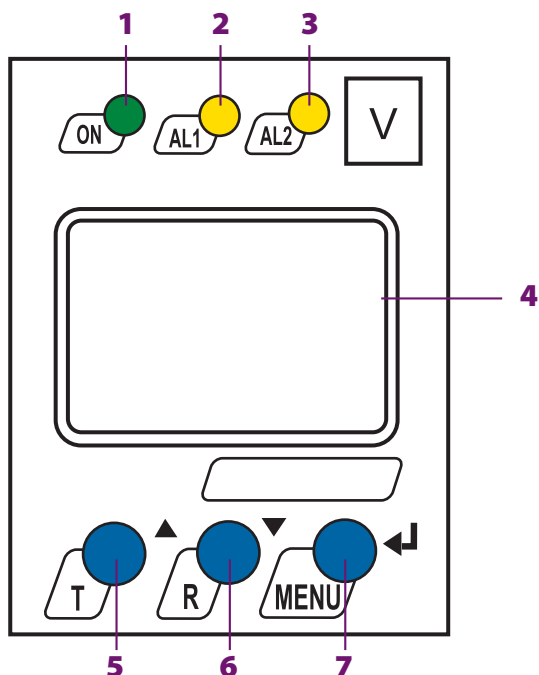
Also in the event of complete power failure of the system being monitored, the delay times are effective during the energy backup time. When the fault memory is set to continuous mode, the alarm parameters remain stored, even on failure of the supply voltage.

### Preset function

After connecting the device for the first time, the nominal system voltage will be determined (PrE run), and the response values for overvoltage and undervoltage as well as for under-frequency and overfrequency will automatically be set. When no voltage is determined within a nominal system voltage range (PrE run), the response values will be set to the minimum or maximum voltage. In this case, the message "AL not SET" appears on the display. As long as no button is pressed, a nominal system voltage is being searched cyclically (PrE run). If a button is pressed, the search will be interrupted and the message "AL not SET" disappears. In this case, the appropriate response values have to be set in the menu. When activating the frequency monitoring function, the preset frequency will automatically be stored.

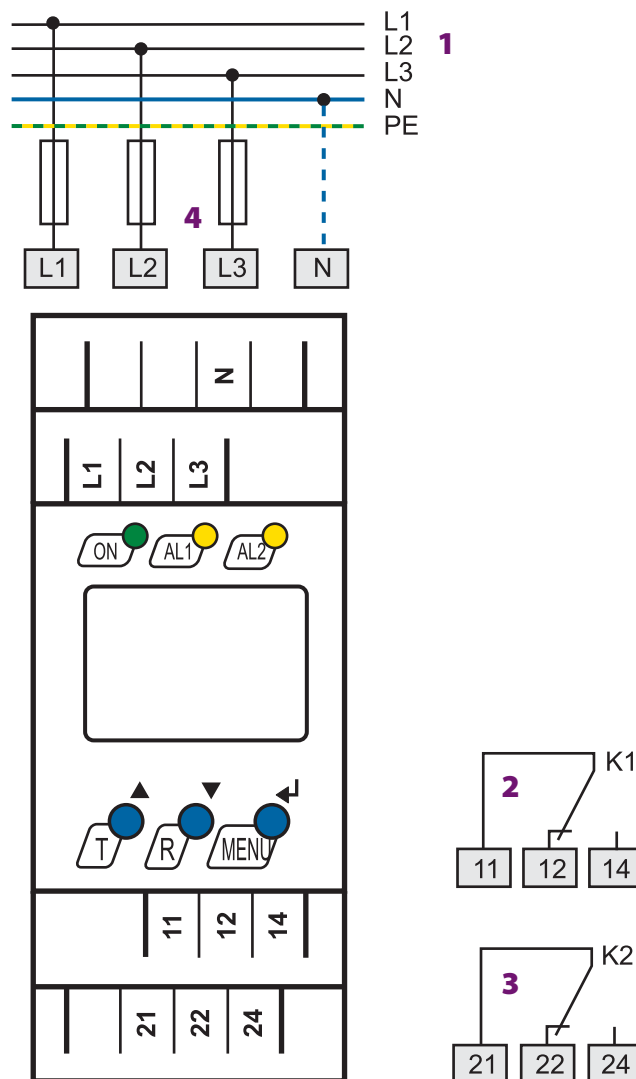


Operating elements



- 1 - LED Power On "ON" (green), lights when the supply voltage is applied or flashes in the event of system fault alarm
- 2 - Alarm LED "AL1" (yellow), lights when the set response value  $> U / < f / > f / > f / \text{Asy} / \text{PHS}$  is exceeded or flashes in the event of system fault alarm
- 3 - Alarm LED "AL2" (yellow), lights when the value falls below the set response value  $< U / < f / > f / \text{Asy} / \text{PHS}$  or flashes in the event of system fault alarm
- 4 - Multi-functional LC display
- 5 - Test button "T": Up button: To change the measured value display, move upwards in the menu or to change parameters.  
To call up the self test, press the button  $> 1.5$  s
- 6 - Reset button "R": Down button: To change the measured value display, move downwards in the menu or to change parameters.  
To delete stored alarms, press the button  $> 1.5$  s.
- 7 - "MENU" button: Enter button: To confirm the measured value display or parameter changes  
To call up the menu system: Press the button  $> 1.5$  s.  
Press the ESC button  $> 1.5$  s: to abort an action or to return to the previous menu level.

Wiring diagram



- 1 - Connection of the AC system/load to be monitored:
- 2 - Alarm relay K1: Configurable for  $< U / > U / < f / > f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 3 - Alarm relay K2: Configurable for  $< U / > U / < f / > f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 4 - Fuse as line protection:  
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

Ordering information

Type	Supply voltage $U_s$	Nominal system voltage $U_n^*$	Display range	Response value	Art. No.
VMD421H-D-3	--	3(N)AC 15...460 Hz/70...500 V	AC 70...500 V	AC 70...500 V	B 7301 0007

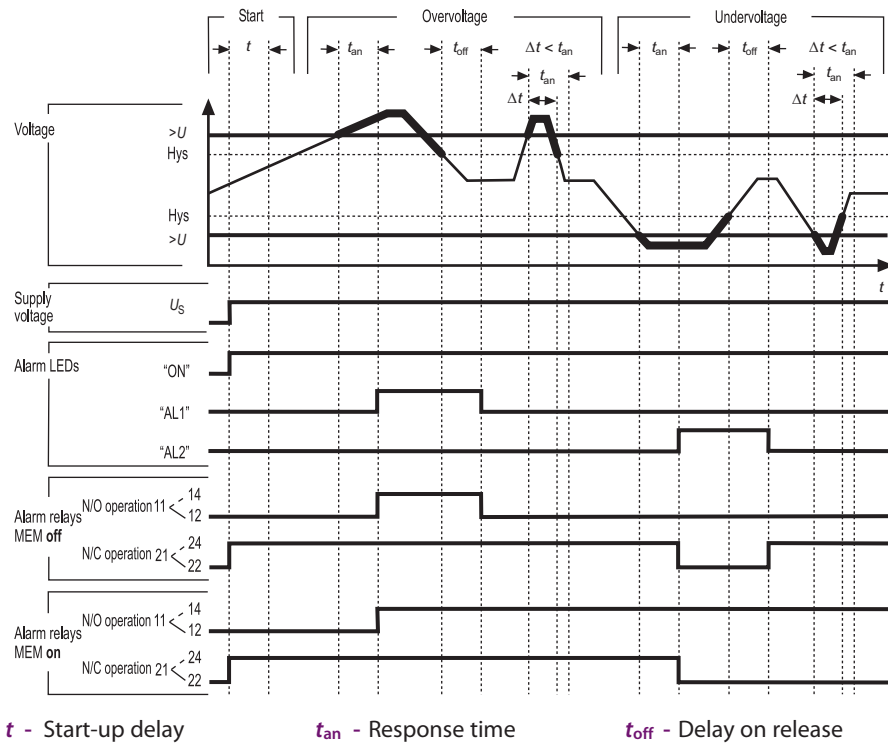
Device version with screw terminals on request

\* Absolute values

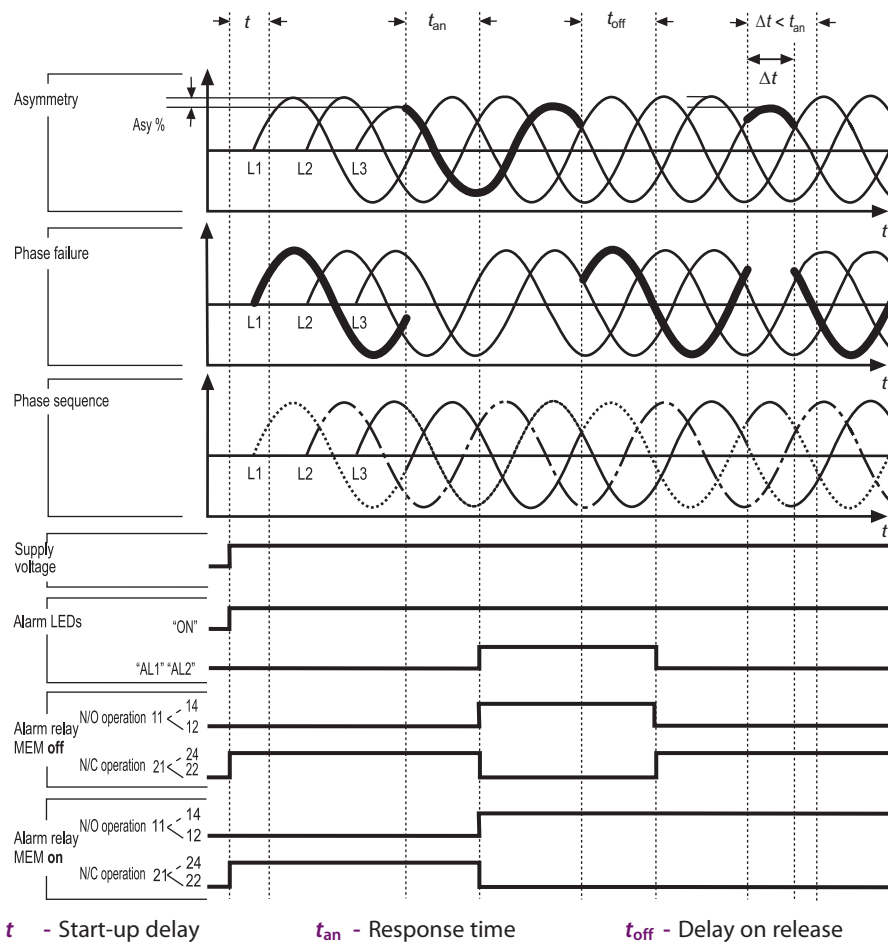
Accessories

Type	Art No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

### Timing diagram voltage monitoring



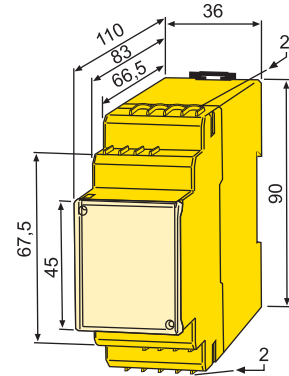
### Timing diagram phase failure, phase sequence, asymmetry



### Dimension diagram XM420

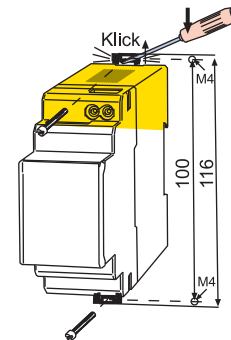
Dimensions in mm

Open the front plate cover in direction of arrow!



### Screw mounting

Note: The upper mounting clip must be ordered separately (see ordering information).



**Technical data**
**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV / III
Protective separation (reinforced insulation) between (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)	
Voltage test acc. to IEC 61010-1:	
(N, L1, L2, L3) - (11, 12, 14)	3.32 kV
(N, L1, L2, L3) - (21, 22, 24)	2.21 kV

**Supply voltage**

Supply voltage $U_s$	none (internally supplied by $U_n$ )
Power consumption	$\leq 5$ VA

**Measuring circuit**

Measuring range (r.m.s. value) (L-N)	AC 0...288 V
Measuring range (r.m.s. value) (L-L)	AC 0...500 V
Rated frequency $f_n$	15...460 Hz
Frequency display range	10...500 Hz

**Response values**

Type of distribution system	3(N) AC / 3 AC (3 AC)*
Undervoltage $< U$ (Alarm 2) (measurement method: 3Ph / 3n)	AC 70...500 V / 70...288 V
Overvoltage $> U$ (Alarm 1) (measurement method: 3Ph / 3n)	AC 70...500 V / 70...288 V
Resolution of setting $U$	1 V
Preset function for 3 AC measurement:	
Undervoltage $< U$ ( $0.85 U_n$ )* for $U_n = 400$ V / 208 V	340 V / 177 V
Overvoltage $> U$ ( $1.1 U_n$ )* for $U_n = 400$ V / 208 V	440 V / 229 V
Preset function for 3(N)AC measurement:	
Undervoltage $< U$ ( $0.85 U_n$ )* for $U_n = 230$ V / 120 V	196 V / 102 V
Overvoltage $> U$ ( $1.1 U_n$ )* for $U_n = 230$ V / 120 V	253 V / 132 V
Asymmetry	5...30 % (30 %)*
Phase failure	by setting of the asymmetry
Phase sequence	clockwise/ anticlockwise rotation (off)*
Relative uncertainty, voltage at 50 Hz / 60 Hz	$\pm 1.5$ %, $\pm 2$ digits
Relative uncertainty, voltage in the range of 15...460 Hz	$\pm 3$ %, $\pm 2$ digits
Hysteresis $U$	1...40 % (5 %)*
Underfrequency $< \text{Hz}$	10...500 Hz
Overfrequency $> \text{Hz}$	10...500 Hz
Resolution of setting $f$ 10.0...99.9 Hz	0.1 Hz
Resolution of setting $f$ 100...500 Hz	1 Hz
Preset function :	
Underfrequency for $f_n = 16.7$ Hz / 50 Hz / 60 Hz / 400 Hz	16.2 Hz / 49.5 Hz / 59.5 Hz / 399 Hz
Overfrequency for $f_n = 16.7$ Hz / 50 Hz / 60 Hz / 400 Hz	17.2 Hz / 50.5 Hz / 60.5 Hz / 401 Hz
Hysteresis frequency $\text{Hys Hz}$	0.2...2 Hz (0.2 Hz)*
Relative uncertainty, frequency in the range of 15...460 Hz	$\pm 0.2$ %, $\pm 1$ digit

**Specified time**

Start-up delay $t$	0...99 s (0 s)*
Response delay $t_{\text{on}1/2}$	0...99 s (0 s)*
Delay on release $t_{\text{off}}$	0...99 s (0.5 s)*
Operating time voltage $t_{\text{ae}}$	$\leq 140$ ms
Operating time frequency $t_{\text{ae}}$	$\leq 335$ ms
Response time $t_{\text{an}}$	$t_{\text{an}} = t_{\text{ae}} + t_{\text{on}1/2}$
Discharging time energy backup on power failure	2.5 s
Charging time energy backup	60 s
Recovery time $t_b$	$\leq 300$ ms

**Displays, memory**

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0...500 V
Operating uncertainty, voltage at 50 Hz / 60 Hz	$\pm 1.5$ %, $\pm 2$ digits
Operating uncertainty, voltage in the range of 15...460 Hz	$\pm 3$ %, $\pm 2$ digits
Operating uncertainty, frequency in the range of 15...460 Hz	$\pm 0.2$ %, $\pm 1$ digits
History memory (HiS) for the first alarm value	data record measured values
Password	off / 0...999 (off)*
Fault memory (M) alarm relay	on / off / con (on)*

**Switching elements**

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation n.c. or N/O operation n.o.
K2: Err, $< U$ , $> U$ , Asy, $< \text{Hz}$ , $> \text{Hz}$ , PHS (undervoltage $< U$ , asymmetry Asy, N/C operation n.c.)*	
K1: Err, $< U$ , $> U$ , Asy, $< \text{Hz}$ , $> \text{Hz}$ , PHS (overvoltage $> U$ , asymmetry Asy, N/O operation n.o.)*	
Electrical endurance, number of cycles	10 000
Fault memory behaviour	ON / OFF (ON)*
Contact data acc. to IEC 60947-5-1:	
Utilisation category	AC 13 AC 14 DC-12 DC-12 DC-12
Rated operational voltage	230 V 230 V 24 V 110 V 220 V
Rated operational current	5 A 3 A 1 A 0.2 A 0.1 A
Minimum contact rating	1 mA at AC/DC $\geq 10$ V

**Environment/EMC**

EMC	IEC 61326-1
Operating temperature	-25 °C...+55 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

**Connection**

Connection	push-wire terminals
Connection properties:	
rigid	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule	0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

**Other**

Operating mode	continuous operation
Mounting position	vertically, see dimension diagram
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Product standards	IEC 61010-1 and IEC 60255-6
Operating manual	TGH1405
Weight	$\leq 240$ g

( )\* = factory setting

## VMD422 / VMD422H

Three-phase voltage and frequency relays  
for CHPs, wind, hydroelectric and photovoltaic power systems  
in accordance with DIN V VDE V 0126-1-1



VMD422 / VMD422H

### Device features

- VMD422 with separate supply voltage  
VMD422H is supplied by the system being monitored
- Undervoltage, overvoltage and underfrequency and overfrequency monitoring in 3(N)AC systems AC 0...400/230 V
- Monitoring of overvoltage by average determination of the latest 10-minute measuring interval
- Asymmetry, phase failure and phase sequence monitoring
- Factory preset according to DIN V VDE V 0126-1-1
- Adjustable start-up delay and delay on release
- Adjustable switching hysteresis for the voltage
- r.m.s. value measurement (AC)
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C operation, fault memory deactivated
- Password protection for device settings
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

### Approvals and certifications



### Product description

When feeding power into the public grid, voltage and frequency monitoring in accordance with DIN V VDE V 0126-1-1 is required to ensure mains decoupling of private electricity generation systems >30 kW (such as CHPs, wind, hydrodynamic and photovoltaic power plants).

The three-phase VMD422 series voltage relays continuously monitor the voltage and frequency at the point of feed-in in 3AC/3NAC systems and activate an alarm relay within 180 ms (response values according to VDEW guideline "Generator at the public low-voltage grid") if voltage and frequency exceed upper and lower limits. An overvoltage ( $> U_2$ ), measured as average value over a 10-minute period, will cause the alarm relay to switch.

The voltages are measured as r.m.s. values. In addition asymmetry, phase failure and phase sequence are monitored.

The response values are preset acc. to DIN V VDE V 0126-1-1 and a password is required to adjust them to the permissible values specified in the standard in order to meet the operator's particular requirements.

The currently measured values are continuously shown on the LC display. The measured value required to trigger the alarm relay is stored. Due to adjustable start-up delay and delay on release, the network operator's specific requirements can be considered such as device-specific start-up procedures, short-time voltage fluctuations etc.

The VMD422 version requires a separate supply voltage, whereas the VMD422H version draws its supplies from the system.

### Typical applications

- Monitoring of automatic switching points between parallel-connected private electricity generation systems and the public low voltage grid
- Applications according to the German standard DIN V VDE V 0126-1-1 (VDE V 0126-1-1): 2006-02
- Universally applicable for photovoltaic systems > 30 kW, CHPs (Combined Heat and Power plants), wind power stations and hydroelectric power plants

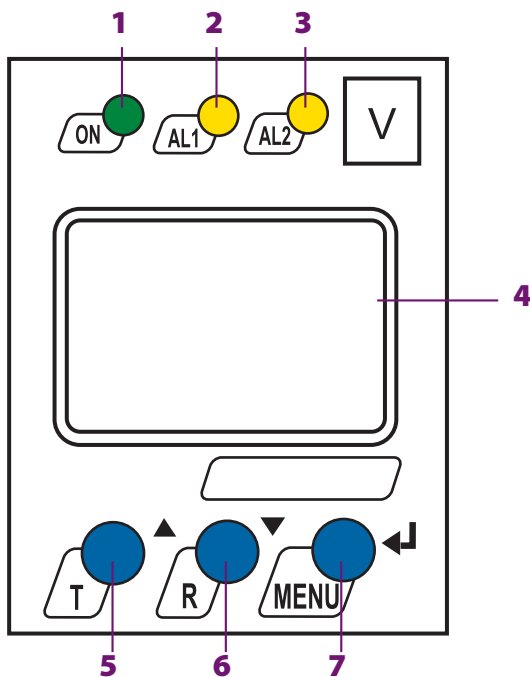
### Function

Once the supply voltage is applied, the start-up delay begins. Measured voltage and frequency values being changed during this start-up period  $t$  do not influence the alarm LEDs and the state of the alarm relays.

The devices utilise several separately adjustable measuring channels (overvoltage/undervoltage, overfrequency/underfrequency). When the measured value exceeds or falls below the response value, the alarm relays switch and the alarm LEDs light up. When the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release time " $t_{\text{off}}$ " begins. When " $t_{\text{off}}$ " has elapsed, the alarm relays switch back to their initial position. When the fault memory is activated, the alarm relays remain in alarm position until the reset button R is pressed. On voltage recovery, the alarm message remains active until the set start-up delay " $t$ " has elapsed.



Operating elements



- 1 - Power On LED "ON" (green): Lights up when voltage is available and when the device is in operation or flashes in case of system fault alarm
- 2 - Alarm LED "AL1" (yellow): Lights up in case of the following fault messages: > U1 / > U2 (10 minute average determination)
- 3 - Alarm LED "AL2" (yellow): Lights up in case of the following fault message: < U  
Both the alarm LEDs "AL1" and "AL2" light up in case of the following fault messages: < f / > f / Asy / PHS, or flash in case of system fault alarm
- 4 - Display: Displays operating information
- 5 - Test-button "T": UP (< 1.5 s) / TEST (> 1.5 s):  
The UP button is used to increase input values or to navigate through the menu.  
The test button is used to start a manual self test.
- 6 - Reset button "R": DOWN (< 1.5 s) / Reset (> 1.5 s):  
The DOWN button is used to decrease input values or to navigate through the menu.  
The reset button is used to activate a manual reset.
- 7 - Enter button (< 1.5 s) / MENU (> 1.5 s):  
The Enter button is used to save input data and changed data.  
Press the "MENU" button to call up the menu system  
Press the ESC button > 1.5 s in the menu mode to abort an action or to return to the previous menu level.

3.1

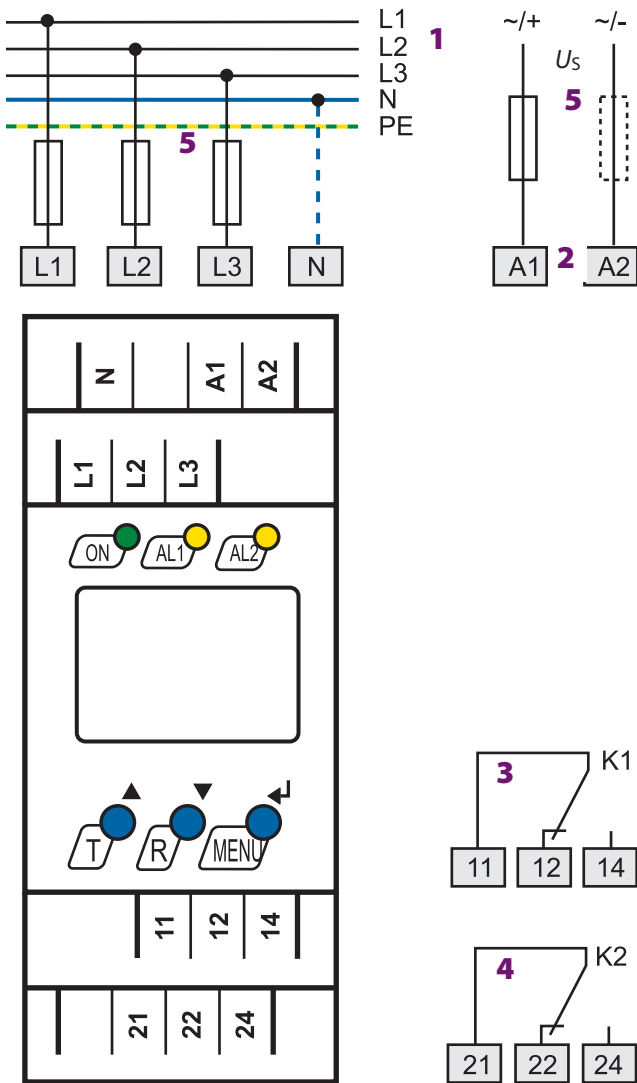
Ordering information					
Type	Supply voltage $U_s^*$	Nominal system voltage $U_n$	Type of connection terminals	Art. No.	
VMD422-D-2	AC 15...460 Hz 70...300 V / DC 70...300 V	3(N)AC 400/230 V 40...65 Hz	Push-wire terminals	B 7301 0011	
VMD422H-D-3	$U_n$	3(N)AC 400/230 V 40...65 Hz	Push-wire terminals	B 7301 0012	

Device version with screw terminals on request.  
\*Absolute values of the voltage range

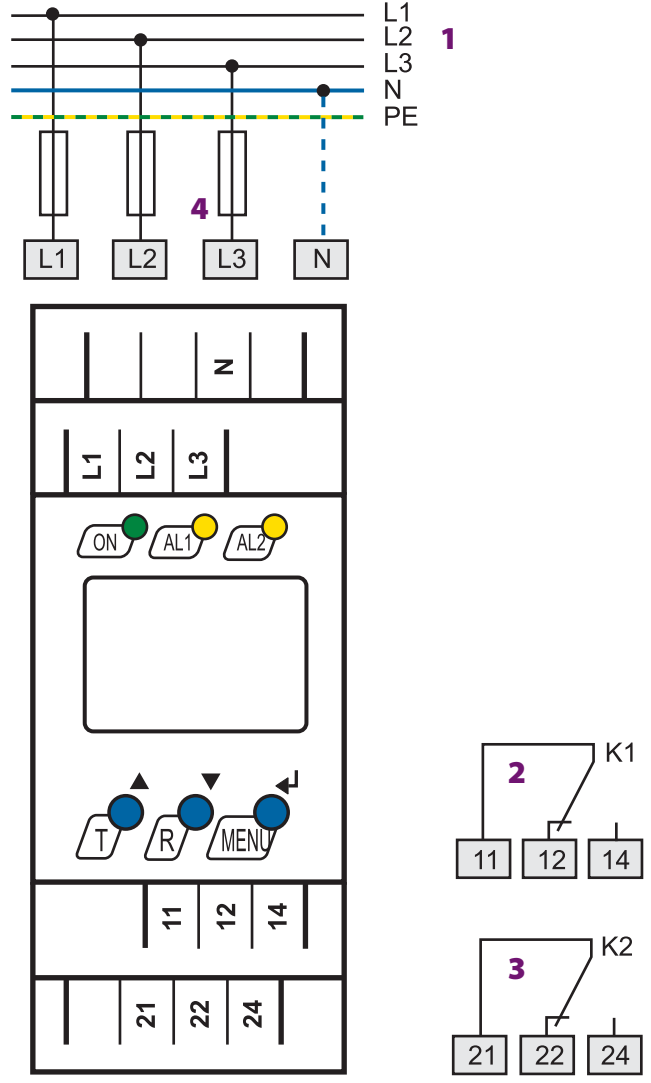
Accessories	
Type	Art. No.
Mounting clip for screw mounting (one clip per device)	B 9806 0008

3.1

Wiring diagram VMD422



Wiring diagram VMD422H



- 1 - Connection to the system being monitored
- 2 - Supply voltage US (see ordering information)
- 3 - Alarm relay K1: For  $\langle U \rangle U1 / \langle f \rangle > f / \text{Asy}$
- 4 - Alarm relay K2: For  $\langle U \rangle > U1 / > U2 / \langle f \rangle > f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 5 - Fuse as line protection.  
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

- 1 - Connection to the system being monitored and to the supply voltage
- 2 - Alarm relay K1: For  $\langle U \rangle U1 / \langle f \rangle > f / \text{Asy}$
- 3 - Alarm relay K2: For  $\langle U \rangle > U1 / > U2 / \langle f \rangle > f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 4 - Fuse as line protection

**Technical data**
**Insulation coordination acc. to IEC 60664-1/IEC 60664-3**

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV / III
Protective separation (reinforced insulation) between (A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)	

**Voltage test according to IEC 61010-1:**

VMD422 and VMD422H: (N, L1, L2, L3) - (A1, A2), (11, 12, 14)	3.32 kV
(N, L1, L2, L3) - (21, 22, 24)	2.21 kV
VMD422: (A1, A2) - (11, 12, 14) - (21, 22, 24)	2.21 kV

**Supply voltage**
**VMD422-D-2:**

Supply voltage $U_S$	AC/DC 70...300 V
Frequency range $U_S$	15...460 Hz
Power consumption	≤ 3.5 VA

**VMD422H-D-3:**

Supply voltage $U_S$	$U_n$
Power consumption	≤ 5 VA

**Measuring circuit**

Measuring range (r.m.s. value) (L-N)	AC 0...288 V
Measuring range (r.m.s. value) (L-L)	AC 0...500 V
Rated frequency $f_n$	40...65 Hz
Frequency display range	10...500 Hz

**Response values**

Type of distribution system	3(N)AC/3 AC (3(N)AC)*
Undervoltage < $U$ (Alarm 2) (measurement method: 3Ph/3n)	AC 320...380 V/184...218 V (3n: AC 184 V)*
Overvoltage > $U_1$ (Alarm 1) (measurement method: 3Ph/3n)	AC 423...460 V/244...264 V (3n: AC 264 V)*
Overvoltage > $U_2$ (Alarm 1) (measurement method: 3Ph/3n)	AC 440...460 V/253...264 V (3n: AC 253 V)*
Overvoltage $U_2$	10-minute average determination
Resolution of setting $U$	1 V
Asymmetry, permanently set	(30%)*
Phase failure	detection of asymmetry
Phase sequence, permanently set	(on, clockwise rotation)*
Relative uncertainty, voltage at 50 Hz	±1.5%, ±1 digit
Hysteresis $U$	1...5% (5%)*
Underfrequency < Hz	47.5...49.8 Hz (47.5 Hz)*
Overfrequency > Hz	50.2...52.0 Hz (50.2 Hz)*
Resolution of setting $f$	0.1 Hz
Hysteresis, frequency Hys Hz, permanently set	(0.1 Hz)*
Relative uncertainty, frequency 40...65 Hz	±0.1%, ±1 digit

**Specified time**

Start-up delay $t$	0...300 s (30 s)*
Delay on release $t_{off}$	0...300 s (30 s)*
Resolution of setting $t, t_{off}$ (0...10 s)	0.1 s
Resolution of setting $t, t_{off}$ (10...99 s)	1 s
Resolution of setting $t, t_{off}$ (10.0...300 s)	10 s
Operating time voltage $t_{ae}$	≤ 180 ms
Operating time frequency $t_{ae}$	≤ 180 ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time $t_b$	≤ 300 ms
Discharging time energy backup on power failure for VMD422H	≥ 2.5 s
Charging time energy backup for VMD422H	≤ 60 s

**Displays, memory**

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0...500 V
Operating uncertainty, voltage at 50 Hz	±1.5%, ±1 digit
Operating uncertainty, frequency 40...65 Hz	±0.1%, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	Off/on/0...999 (on/126)*
Fault memory (M) alarm relay	on/off/con (OFF)*

**Switching elements**

Number	2 x 1 changeover contacts (K1, K2)				
Operating mode K1/K2, permanently set	N/C operation n.c				
	K1: (undervoltage < $U$ , overvoltage > $U_1$ , asymmetry Asy, underfrequency < Hz, overfrequency > Hz, N/C operation n.c.)*				
	K2: (device error Err, undervoltage < $U$ , overvoltage > $U_1$ , asymmetry Asy, underfrequency < Hz, overfrequency > Hz, phase sequence PHS, overvoltage > $U_2$ , N/C operation n.c.)*				
Electrical endurance, number of cycles	10000				
Fault memory	on/off/con (OFF)*				
Contact data acc. to IEC 60947-5-1:					
Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

**Environment/EMC**

EMC	IEC 61326
Operating temperature	-25 °C...+55 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

**Connection**

Connection	push-wire terminals
Connection properties:	
rigid	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule	0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

**Other**

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Software version	D313 V3.0x
Operating manual	TGH1431
Weight VMD422	≤ 150 g
Weight VMD422H	≤ 240 g

( ) \* = factory setting

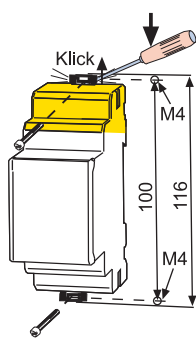
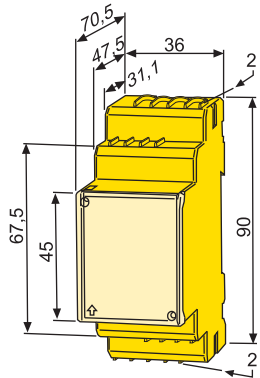
**Dimension diagram XM420 (VMD422)**

Dimensions in mm

Open the front plate cover in direction of arrow!

**Screw mounting**

Note: The upper mounting clip must be ordered separately (see ordering information)



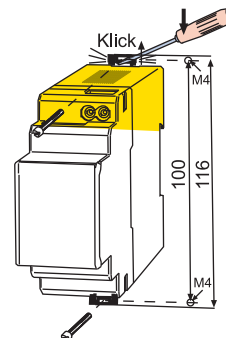
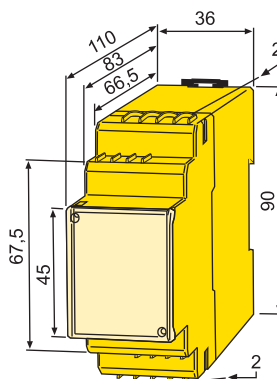
**Dimension diagram XM420 (VMD422H)**

Dimensions in mm

Open the front plate cover in direction of arrow!

**Screw mounting**

Note: The upper mounting clip must be ordered separately (see ordering information)



3.1



## VMD423 / VMD423H

Three-phase voltage and frequency relay  
for CHPs, wind, hydroelectric and photovoltaic systems  
in accordance with DIN V VDE V 0126-1-1



VMD423 / VMD423H

### Device features

- VMD423 with separate supply voltage
- VMD423H is supplied by the system being monitored
- Undervoltage, overvoltage and under-frequency and overfrequency monitoring in 3(N)AC systems AC 0...500 V
- Monitoring of overvoltage by average determination of the latest 10-minute measuring interval
- Asymmetry, phase failure and phase sequence monitoring
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC+DC)
- Digital measured value display via multifunctional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device settings
- Sealable transparent cover
- Push-wire terminal (two terminals per connection)
- Two-module enclosure (36 mm)
- RoHS compliant

### Approvals and certifications



### Product description

When feeding power into the public grid, voltage and frequency monitoring in accordance with DIN V VDE V 0126-1-1 is required to ensure mains decoupling of private electricity generation systems >30 kW (such as CHPs, wind, hydrodynamic and photovoltaic power plants).

The three-phase VMD423 series voltage and frequency relays monitor the voltage and frequency at the point of feed-in. When power is fed into the medium voltage grid, the output voltages and frequencies are measured by means of voltage transformers (100 V). An alarm relay is activated within  $\leq 80$  ms when limit values are reached (response values according to VDEW guideline "Private electricity generation systems at the medium voltage grid"). An overvoltage ( $> U_2$ ), measured as average value over a 10-minute period, will cause the alarm relay to switch.

The voltages are measured as r.m.s. values. In addition asymmetry, phase failure and phase sequence are monitored.

The VMD423 is suitable for multifunctional monitoring tasks and can be adapted to meet all the requirements of electricity supply companies.

The currently measured values are continuously shown on the LC display. The measured value required to trigger the alarm relay is stored. Due to adjustable start-up delay and delay on release, the network operator's specific requirements can be considered such as device-specific start-up procedures, short-time voltage fluctuations etc.

The VMD423 series requires a separate supply voltage, whereas the VMD423H version draws its supplies from the system.

### Typical applications

- Monitoring of automatic switching points between parallel-connected private electricity generation power systems and the public low voltage grid.
- Applications according to DIN V VDE V 0126-1-1 (VDE V 0126-1-1): 2006-02
- Universally applicable for photovoltaic systems > 30 kW, CHPs (Combined Heat and Power plants), wind power stations and hydroelectric power plants

### Function

Once the supply voltage is applied, the start-up delay begins. Measured voltage and frequency values being changed during this start-up period "t" do not influence the alarm LEDs and the state of the alarm relays.

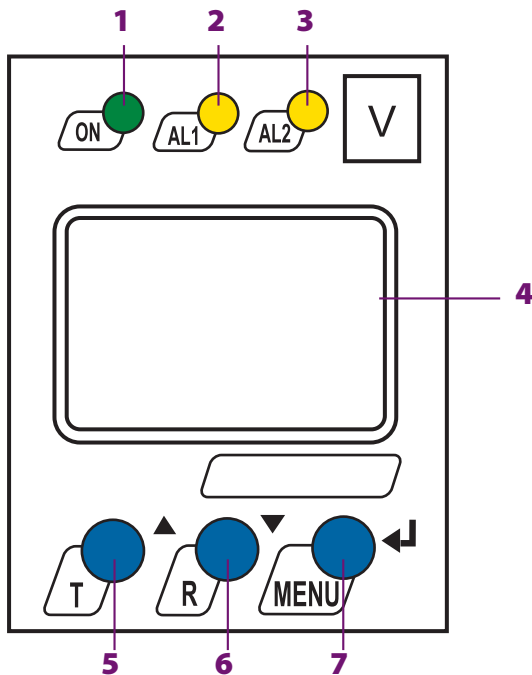
The devices utilise several separately adjustable measuring channels (overvoltage/undervoltage, overfrequency/underfrequency). When the measured value exceeds or falls below the response value, the time of the response delays " $t_{on1/2}$ " begins. Once the response delay has elapsed, the alarm relays switch and the alarm LEDs light up. When the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release time " $t_{off}$ " begins. When " $t_{off}$ " has elapsed, the alarm relays switch back to their initial position. When the fault memory is activated, the alarm relays remain in alarm position until the reset button R is pressed. On voltage recovery, the alarm message remains active until the set start-up delay "t" has elapsed.

### Certificate of non objection in accordance with

- DIN V VDE V 0126-1-1:2006-02 (Germany, France)
- ENEL grid connection guideline 2009 (Italy)
- DIN V VDE V 0126-1-1:2006-02 and EN 50438:2007 (Czech Republic)
- SYNERGRID C10/11:2009-05 (Belgium)



Operating elements



- 1 - Power On LED "ON" (green): Lights up when voltage is available and when the device is in operation or flashes in case of system fault alarm.
  - 2 - Alarm LED "AL1" (yellow): Lights up in case of the following fault messages: > U1 / > U2 (10 minute average determination)
  - 3 - Alarm LED "AL2" (yellow): Lights up in case of the following fault message: < U  
Both the alarm LEDs "AL1" and "AL2" light up in case of the following fault messages: < f / > f / Asy / PHS, the alarm LEDs flash in case of system fault alarm
  - 4 - Display: Displays operating information
  - 5 - Test button "T": Up (< 1.5 s) / Test (> 1.5 s):  
The Up button is used to increase input values or to navigate through the menu.  
The test button "T" is used to start a manual self test.
  - 6 - Reset button "R": Down (< 1.5 s) / Reset (> 1.5 s):  
The Down button is used to decrease input values or to navigate through the menu.  
The reset button "R" is used to activate a manual reset.
  - 7 - Enter button (< 1.5 s) / MENU (> 1.5 s):  
The Enter button is used to save input data and changed data. Press the "MENU" button to call up the menu system.  
Press the ESC button > 1.5 s in the menu mode to abort an action or to return to the previous menu level.
- When the menu item "LEd" is activated, the alarm LED "AL1" indicates that K1 is in the alarm position. When "AL2" lights up, K2 is in the alarm position.

3.1

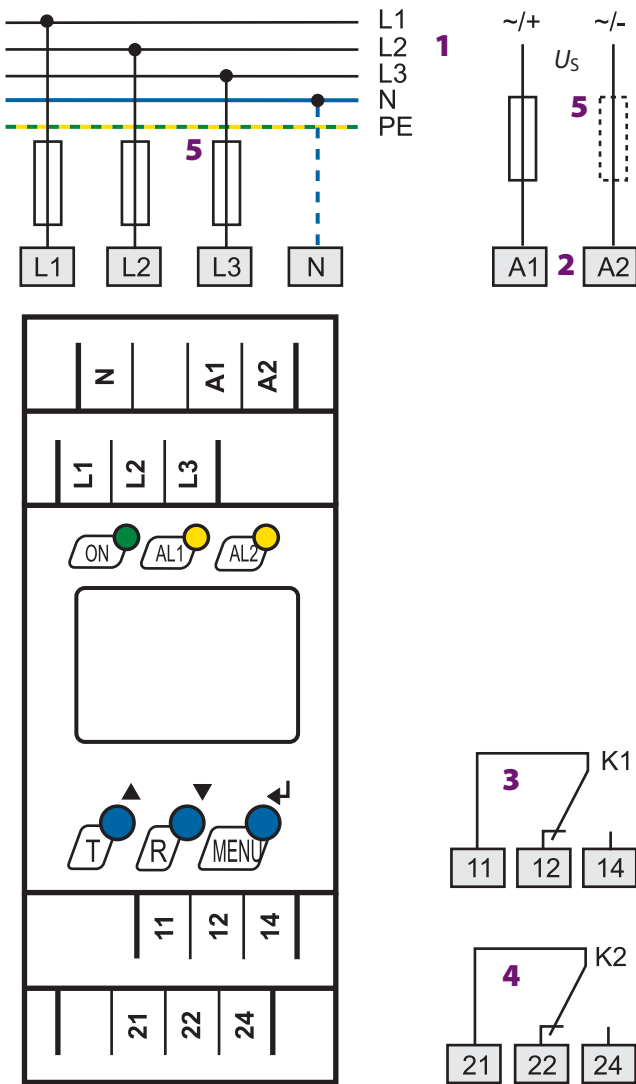
Ordering information						
Type	Supply voltage $U_S^*$	Nominal system voltage $U_n^*$	Display range	Response value	Art. No.	
VMD423-D-1	DC 9.6...94 V / AC 15...460 Hz 16...72 V	3(N)AC 40...65 Hz/0...500 V	AC 0...500 V	AC 10...500 V	B 7301 0020	
VMD423-D-2	DC 70...300 V / AC 15...460 Hz 70...300 V	3(N)AC 40...65 Hz/0...500 V	AC 0...500 V	AC 10...500 V	B 7301 0021	
VMD423H-D-3	$U_n$	3(N)AC 40...65 Hz/0...500 V	AC 0...500 V	AC 70...500 V	B 7301 0022	

Device version with screw terminals on request  
\* Absolute values

Accessories	
Type	Art. No.
Mounting clip for screw mounting (one clip per device)	B 9806 0008

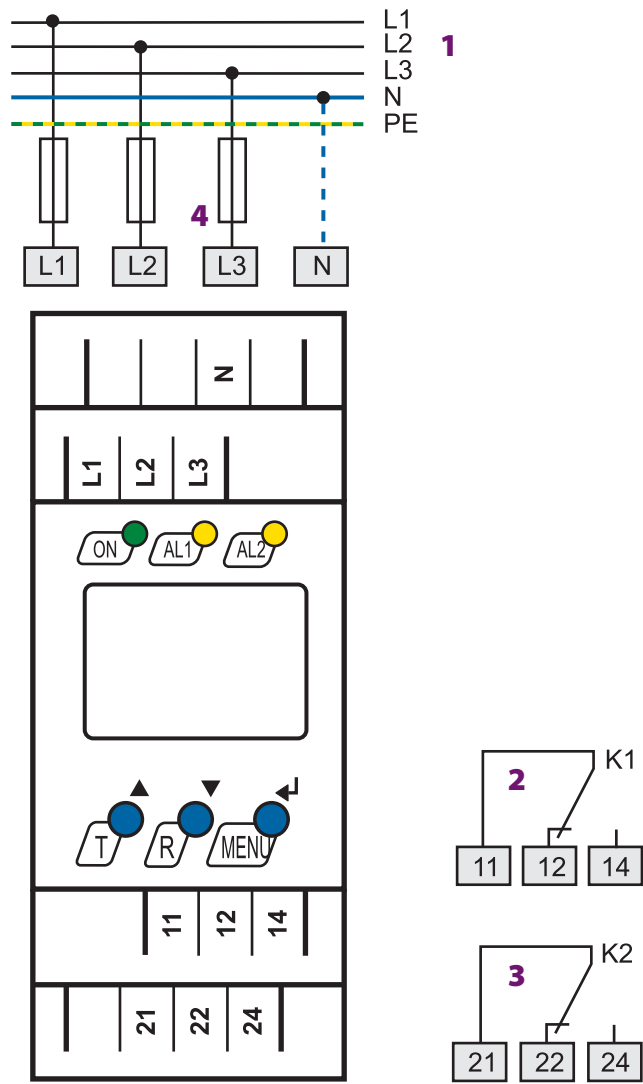
3.1

**Wiring diagram VMD423**



- 1 - Connection to the AC system/load to be monitored:
- 2 - Supply voltage  $U_S$  (see ordering information)
- 3 - Alarm relay K1: Configurable for  
 $\langle U \rangle / \langle U1 \rangle / \langle U2 \rangle / \langle f \rangle / f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 4 - Alarm relay K2: Configurable for  
 $\langle U \rangle / \langle U1 \rangle / \langle U2 \rangle / \langle f \rangle / f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 5 - Fuse as line protection.  
 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

**Wiring diagram VMD423H**



- 1 - Connection to the system to be monitored and to supply voltage
- 2 - Alarm relay K1: Configurable for  
 $\langle U \rangle / \langle U1 \rangle / \langle U2 \rangle / \langle f \rangle / f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 3 - Alarm relay K2: Configurable for  
 $\langle U \rangle / \langle U1 \rangle / \langle U2 \rangle / \langle f \rangle / f / \text{Asy} / \text{PHS} / \text{ERROR}$
- 4 - Fuse as line protection.  
 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

**Technical data**
**Insulation coordination acc. to IEC 60664-1 / IEC 60664-3**

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV / III
Protective separation (reinforced insulation) between (A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)	

**Voltage test according to IEC 61010-1:**

VMD423 and VMD423H: (N, L1, L2, L3) - (A1, A2), (11, 12, 14)	3.32 kV
(N, L1, L2, L3) - (21, 22, 24)	2.21 kV
VMD423: (A1, A2) - (11, 12, 14) - (21, 22, 24)	2.21 kV

**Supply voltage**
**VMD423-D-1:**

Supply voltage $U_s$	AC 16...72 V / DC 9.6...94 V
Frequency range $U_s$	15...460 Hz

**VMD423-D-2:**

Supply voltage $U_s$	AC/DC 70...300 V
Frequency range $U_s$	15...460 Hz
Power consumption	≤ 3.5 VA

**VMD423H-D-3:**

Supply voltage $U_s$	Un
Power consumption	≤ 5 VA

**Measuring circuit**

Measuring range (r.m.s. value) (L-N)	AC 0...288 V
Measuring range (r.m.s. value) (L-L)	AC 0...500 V
Rated frequency $f_n$	40...65 Hz
Frequency display range	25...100 Hz

**Response values**
**VMD423-D-1 / VMD423-D-2**

Type of distribution system	3(N)AC/3 AC (3(N)AC)*
Undervoltage < $U$ (Alarm 2) (measurement method: 3Ph/3n)	AC 10...500 V / 10...288 V (184)*
Overvoltage > $U1$ (Alarm 1) (measurement method: 3Ph/3n)	AC 10...500 V / 10...288 V (264)*
Overvoltage > $U2$ (Alarm 1) (measurement method: 3Ph/3n)	AC 10...288 V (253)*
Overvoltage $U2$	10-minute average determination
Resolution of setting $U$	1 V

**VMD423H-D-3**

Type of distribution system	3(N)AC/3 AC (3(N)AC)*
Undervoltage < $U$ (Alarm 2) (measurement method: 3Ph / 3n)	AC 70...500 V / 70...288 V
Overvoltage > $U$ (Alarm 1) (measurement method: 3Ph / 3n)	AC 70...500 V / 70...288 V
Resolution of setting $U$	1 V
Asymmetry	5...30 % (30 %)*
Phase failure	by setting of the asymmetry
Phase sequence	clockwise R/anticlockwise L (R / on)*
Relative uncertainty, voltage at 50 Hz / 60 Hz	±1.5 %, ±2 digit
Hysteresis $U$	1...40 % (5 %)*
Underfrequency < Hz	45...65 Hz (47.5 Hz)*
Overfrequency > Hz	45...65 Hz (50.2 Hz)*
Resolution of setting $f$	0.1 Hz
Hysteresis frequency Hys Hz	0.1...2 Hz (0.1 Hz)*
Relative uncertainty, frequency in the range of 40...65 Hz	±0.1 %, ±1 digit

**Specified time**

Start-up delay $t$	0...300 s (30 s)*
Response delay $t_{on1/2}$	0...300 s (0.1)
Delay on release $t_{off}$	0...300 s (30 s)*
Resolution of setting $t, t_{off}, t_{on1/2}$ (0...10 s)	0.1 s
Resolution of setting $t, t_{off}, t_{on1/2}$ (10...99 s)	1 s
Resolution of setting $t, t_{off}, t_{on1/2}$ (10.0...300 s)	10 s
Operating time voltage $t_{ae}$	≤ 80 ms
Operating time frequency $t_{ae}$	≤ 80 ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time $t_b$	≤ 300 ms
Discharging time energy backup on power failure for VMD423H	≥ 2.5 s
Charging time energy backup for VMD423H	≤ 60 s

**Displays, memory**

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0...500 V
Operating uncertainty, voltage at 50 Hz / 60 Hz	±1.5 %, ±2 digits
Operating uncertainty, frequency in the range of 40...65 Hz	±0.1 %, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	Off/on/0...999 (on/126)*
Fault memory (M) alarm relay	on/off/con (OFF)*

**Switching elements**

Number	2 x 1 changeover contacts (K1, K2)
Operating principle K1 / K2	N / 0 operation n.o / N / C operation n.c
	K1: (undervoltage < $U$ , overvoltage > $U1$ , asymmetry Asy, underfrequency < Hz, overfrequency > Hz, alarm when starting SAL, N/C operation n.c.)*
	K2: (device error Err, undervoltage < $U$ , overvoltage > $U1$ , asymmetry Asy, underfrequency < Hz, overfrequency > Hz, phase sequence PHS, overvoltage > $U2$ , alarm when starting SAL, N/C operation n.c.)*
Electrical endurance, number of cycles	10000
Fault memory	on/off/con (OFF)*
Contact data acc. to IEC 60947-5-1:	
Utilisation category	AC 13 AC 14 DC-12 DC-12 DC-12
Rated operational voltage	230 V 230 V 24 V 110 V 220 V
Rated operational current	5 A 3 A 1 A 0.2 A 0.1 A
Minimum contact rating	1 mA at AC / DC ≥ 10 V

**Environment/EMC**

EMC	IEC 61326
Operating temperature	-25 °C...+55 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

**Connection**

Connection	push-wire terminal
Connection properties:	
rigid	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule	0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

**Other**

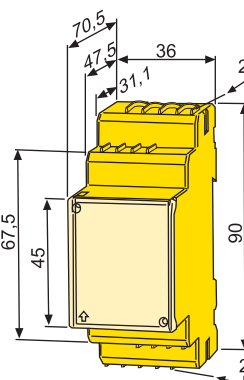
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Software version	D344 V3.1x
Operating manual	TGH1444
Weight VMD423	≤ 150 g
VMD423H	≤ 240 g

( \*) = factory setting

**Dimension diagram XM420 (VMD423)**

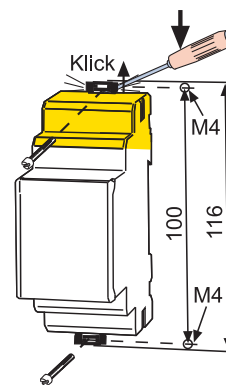
Dimensions in mm

Open the front plate cover in direction of arrow!



**Screw mounting**

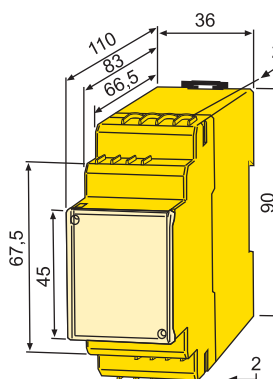
Note: The upper mounting clip must be ordered separately (see ordering information)!



**Dimension diagram XM420 (VMD423H)**

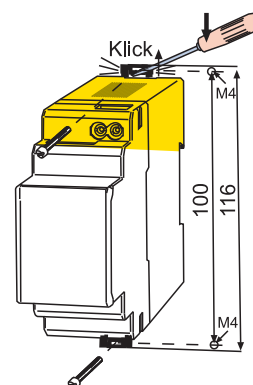
Dimensions in mm

Open the front plate cover in direction of arrow!



**Screw mounting**

Note: The upper mounting clip must be ordered separately (see ordering information)!







**SUR353Z**

### Device features

- Undervoltage monitoring for 3AC / 3NAC systems
- Without external supply voltage
- Adjustable response value:  $0.7 \dots 0.95 \times U_n$
- Nominal system voltages: 3AC 100 V, 230 V, 400 V, 415 V, 500 V, 690 V
- Adjustable response delay:  $0.5 \dots 5$  s
- Alarm LED
- Alarm relay with two potential-free changeover contacts

### Approvals and certifications



### Technical data

#### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 690 V
Rated impulse voltage/pollution degree	6 kV/3

#### Supply voltage

Supply voltage $U_s$	not required
Power consumption	$\leq 5$ VA

#### Measuring circuit

Nominal system voltage $U_n$	see ordering information
Operating range of $U_n$	$0.5 \dots 1.3 \times U_n$
Rated frequency $f_n$	50/60 Hz
Response values	$0.7 \dots 0.95 \times U_n$
Response delay $t$	$0.5 \dots 5$ s
Hysteresis	approx. 2 %
Delay on release	approx. 200 ms

#### Switching elements

Number of changeover contacts	1 x 2
Operating principle	N/C operation
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \phi$ 0.4 0.2 A, DC 220 V, L/R = 0.04 s

### Product description

The SUR353Z series relay is designed to monitor the voltage of three-phase AC systems. Neutral conductor connection is not required, hence the relay is suitable for 3AC and 3NAC systems. External supply voltage is not required.

### Typical applications

- Monitoring of the power supply of motors and electrical installations
- Monitoring of loads
- Switching on and switching off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads

### Function

When supply voltage is applied, the alarm relay works in N/C operation (relay energised). When the phase-to-phase voltage of one, two or all conductors exceeds the set response value "Y", the alarm relay de-energises and the alarm LED "U<sub>n</sub>" goes out after the response delay has elapsed. If the measured quantity drops below the release value, the alarm relay switches back to its original state. Supply voltage and measuring voltage are galvanically separated.

### Note

False alarms resulting from operational measurement errors can be suppressed by setting a time delay. In case of complete system failure, the time delay is not effective, except for the device operating time. If the delay function is to be maintained in case of complete system failure, the energy backup SP100 is recommended to be used.

### Environment/EMC

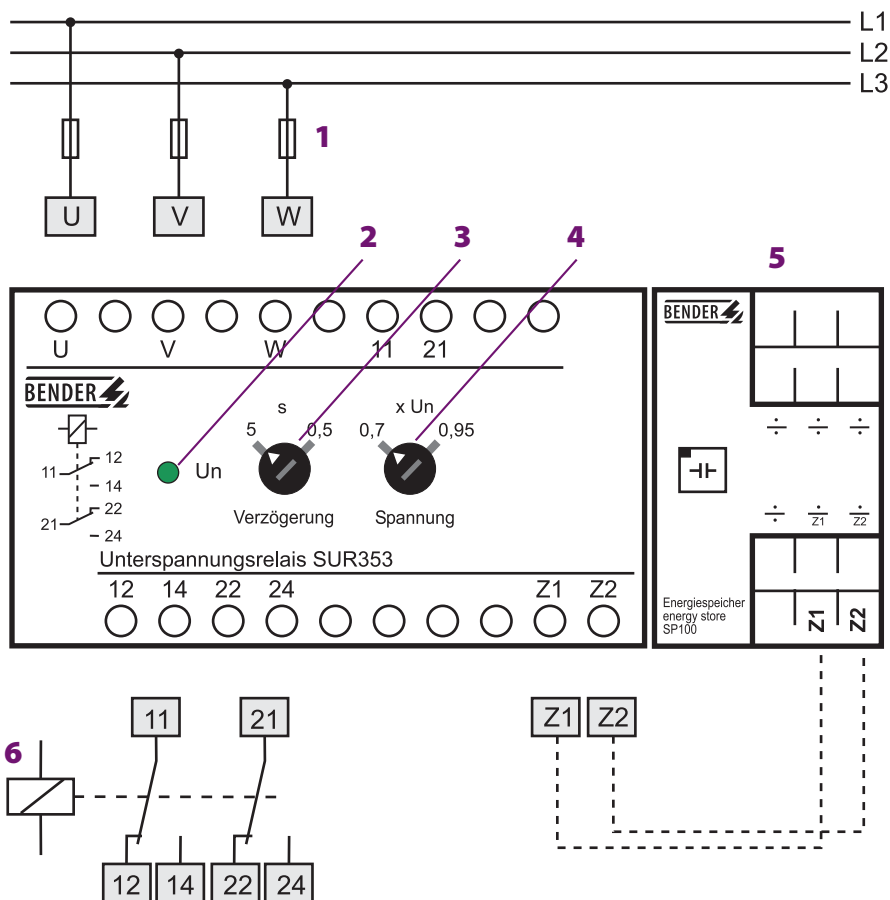
EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-10...+50 °C
Ambient temperature, during storage	-20...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

### Other

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
Screw mounting	refer to dimension diagram
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	IEC 60255-6
Operating manual	BP301006
Weight	$\leq 700$ g



Wiring diagram

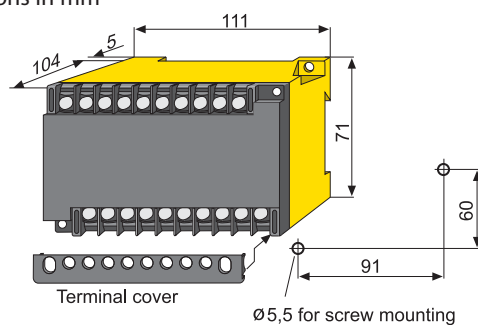


- 1 - 6 A fuse
- 2 - Alarm LED "U<sub>n</sub>", lights under normal conditions and goes out in the event of undervoltage and system failure
- 3 - Adjustable response delay
- 4 - Adjustable response value for undervoltage
- 5 - SP100 energy backup  
An additional means to delay the time for approximately 5 s in the event of complete system failure
- 6 - Alarm relay in N/C operation

Ordering information		
Type	Nominal system voltage $U_n$	Art. No.
SUR353Z	3AC 100 V	B 933 601
SUR353Z	3AC 230 V	B 933 176
SUR353Z	3AC 400 V	B 933 667
SUR353Z	3AC 415 V	B 933 623
SUR353Z	3AC 500 V	B 933 051
SUR353Z	3AC 690 V	B 933 611
Other voltages on request		
SP100	Energy backup	B 935 700

Dimension diagram X200

Dimensions in mm





SUR358Z

### Device features

- Undervoltage and overvoltage monitoring for 3AC / 3NAC systems
- Without external supply voltage
- SUR357Z Common alarm relay for undervoltage and overvoltage
- SUR358Z Separate alarm relays for undervoltage and overvoltage
- Adjustable response value:  
 $0.7 \dots 0.95 \times U_n / 1.05 \dots 1.3 \times U_n$
- Nominal system voltages:  
3AC 100 V, 110 V, 230 V, 400 V, 500 V, 690 V
- Adjustable response delay:  
0.5...5 s
- Power On LED, Alarm LED
- Alarm relay with two potential-free changeover contacts

### Approvals and certifications



### Product description

The SUR357Z/358Z series relays are designed for voltage monitoring in three-phase AC systems. The relays can be used for undervoltage and overvoltage monitoring (window function). Neutral conductor connection is not required, hence the relays are suitable for 3AC and 3NAC systems. Supply voltage and measuring voltage are galvanically separated. Special input transformers attenuate interferences from the system. The devices include an input circuit protection.

### Typical applications

- Monitoring of the power supply of motors and electrical installations
- Monitoring of loads
- Switching on and switching off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads

### Function SUR357Z

When the supply voltage applied is within the set response range, the alarm relay is in N/C operation (relay energised) and the alarm LED lights up. When the value of the nominal system voltage  $U_n$  falls below the set response value  $< U_n$ , the alarm LED goes out. When the voltage exceeds the response value  $> U_n$  the alarm LED goes out. The common alarm relay switches after the response delay has elapsed. If the response values are again within the set response range, the SUR357Z switches back to its original state after approx. 200 ms.

### Funktion SUR358Z

When the voltage applied is within the set response range, the alarm relay K1 for undervoltage works in N/C operation (relay energised) and the alarm relay K2 for overvoltage is in N/O operation (relay de-energised). When the value of the nominal system voltage  $U_n$  falls below the set response value  $< U_n$  the alarm LED " $< U_n$ " lights up and the alarm relay K2 switches after the set response delay has elapsed.

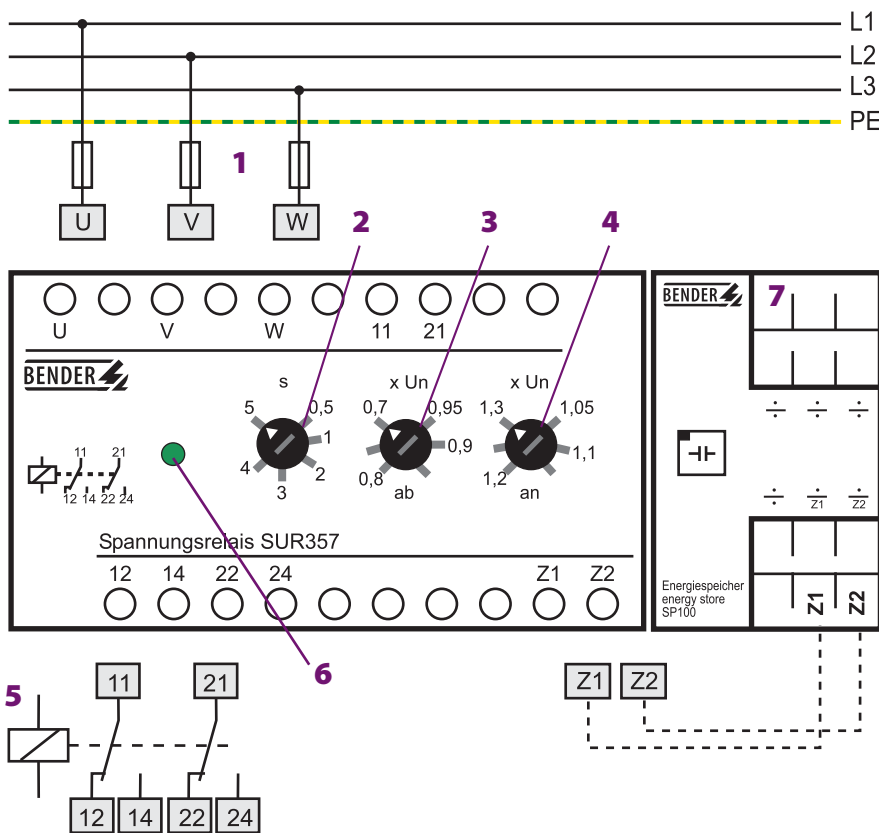
When the nominal system voltage  $U_n$  exceeds the set response value  $> U_n$  the alarm LED " $> U_n$ " lights up and the alarm relay K2 switches after the set response delay has elapsed. When the response values are again within the set response range, the SUR358Z switches back to its original state after approx. 200 ms.

### Note

False alarms resulting from short-time operational measurement errors can be suppressed by setting a time delay. In case of complete system failure, the time delay is not effective, except for the device operating time. If the delay function is to be maintained in case of complete system failure, the energy backup SP100 is recommended to be used.

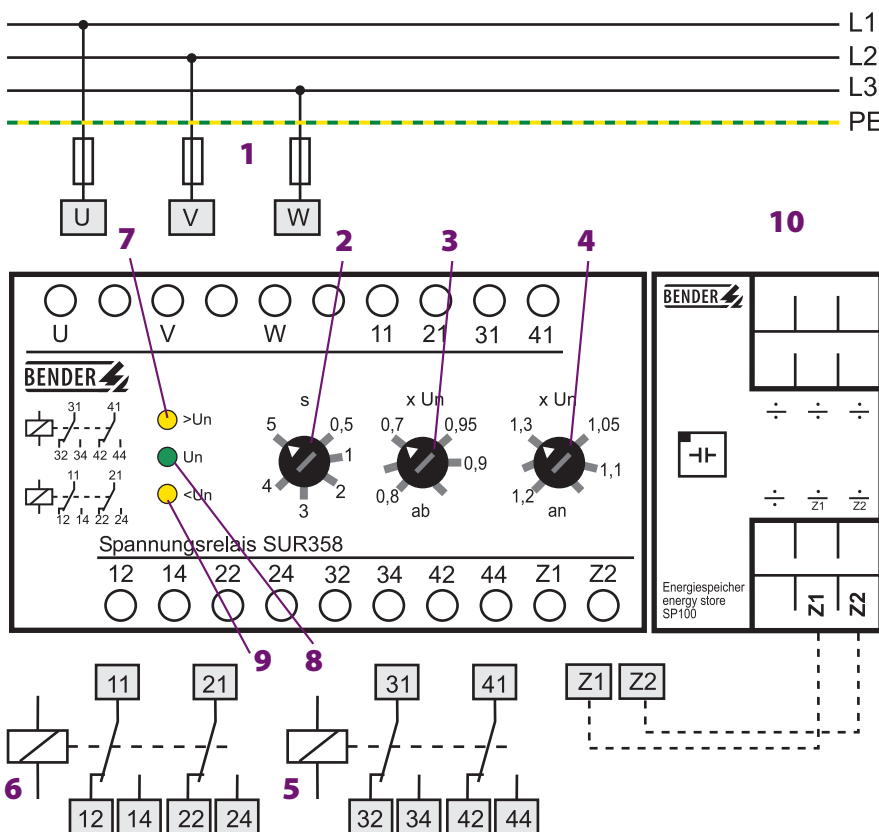


Wiring diagram SUR357Z



- 1 - 6 A fuse
- 2 - Setting potentiometer for response delay "s"
- 3 - Setting potentiometer for undervoltage " $\times U_n$ "
- 4 - Setting potentiometer for overvoltage " $\times U_n$ "
- 5 - Alarm relay with two changeover contacts
- 6 - Alarm LED lights under normal conditions and goes out in the event of overvoltage, undervoltage and system failure.
- 7 - SP100 energy backup  
An additional means to delay the time for approximately 5 s in the event of complete system failure

Wiring diagram SUR358Z



- 1 - 6 A fuse
- 2 - Setting potentiometer for response delay "s"
- 3 - Setting potentiometer for undervoltage " $\times U_n$ "
- 4 - Setting potentiometer for overvoltage " $\times U_n$ "
- 5 - Alarm relay K2 for signalling overvoltage
- 6 - Alarm relay K1 for signalling undervoltage
- 7 - Alarm LED lights in the event of overvoltage " $> U_n$ "
- 8 - Power On LED " $U_n$ "
- 9 - Alarm LED lights in the event of undervoltage " $< U_n$ "
- 10 - SP100 energy backup  
An additional means to delay the time for approximately 5 s in the event of complete system failure.

## Technical data

### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 690 V
Rated impulse voltage/pollution degree	6 kV/3

### Supply voltage

Supply voltage $U_s$	not required
Power consumption	$\leq 6$ VA

### Measuring circuit

Nominal system voltage $U_n$	see ordering information
Operating range of $U_n$	0.5...1.3 x $U_n$
Rated frequency $f_n$	50/60 Hz
Response value undervoltage	0.7...0.95 x $U_n$
Response value overvoltage	1.05...1.3 x $U_n$
Response delay $t$	0.5...5 s
Hysteresis	< 5 %
Delay on release	approx. 200 ms

### Switching elements

Number of changeover contacts	SUR357Z	1 x 2
	SUR358Z	2 x 2
Operating principle	SUR357Z	N/C operation
	SUR358Z undervoltage	N/C operation
	SUR358Z overvoltage	N/O operation
Electrical endurance, number of cycles		12000
Contact class		IIB
Rated contact voltage		AC 250 V/DC 300 V
Making capacity		AC/DC 5 A
Breaking capacity		2 A, AC 230 V, $\cos \phi$ 0.4
		0.2 A, DC 220 V, L/R = 0.04 s

### Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-10...+50 °C
Ambient temperature, during storage	-20...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

### Other

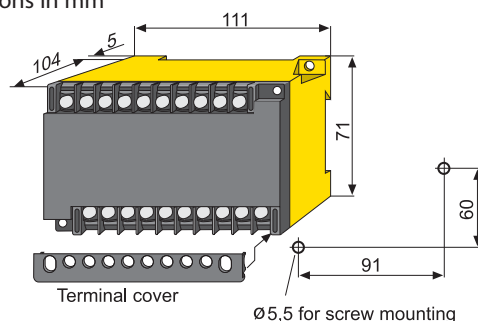
Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
Electrical endurance, number of cycles	12
Screw mounting	refer to dimension diagram
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	IEC 60255-6
Operating manual	TBP301007
Weight	$\leq 700$ g

## Ordering information

Type	Nominal system voltage $U_n$	Art. No.
SUR357Z	3AC 100 V	B 933 603
SUR357Z	3AC 110 V	B 933 200
SUR357Z	3AC 230 V	B 933 153
SUR357Z	3AC 400 V	B 933 697
SUR357Z	3AC 500 V	B 933 053
SUR357Z	3AC 690 V	B 933 014
SUR358Z	3AC 100 V	B 933 605
SUR358Z	3AC 110 V	B 933 217
SUR358Z	3AC 230 V	B 933 155
SUR358Z	3AC 400 V	B 933 701
SUR358Z	3AC 500 V	B 933 055
SUR358Z	3AC 690 V	B 933 709
Other voltages on request		
SP100	Energy backup	B 935 700

## Dimension diagram X200

Dimensions in mm







SUG140

**Device features**

- Undervoltage relay for DC voltages
- External supply voltage
- Adjustable response values: 0.4...4 V / 3...30 V
- Adjustable response delay: 0.1...10 s
- Adjustable hysteresis: 2...10 %
- Power On LED, Alarm LED
- Alarm relay with two potential-free changeover contacts
- 45 mm enclosure

**Note**

In case of new installations refer to VME420.

**Approvals and certifications**



**Product description**

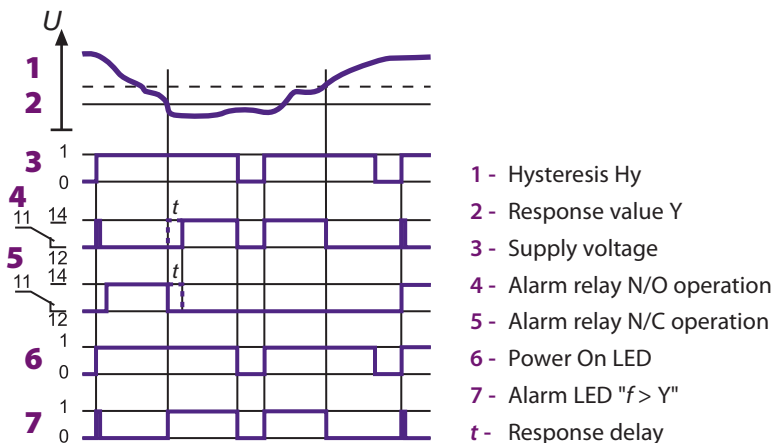
The SUG140 series relay is designed to monitor the undervoltage in a DC system. External supply voltage is required. Response value, response delay and hysteresis are adjustable.

**Typical applications**

- Monitoring of batteries
- Monitoring of voltage levels
- Switch to set the threshold values for analogue signals 0...10 V
- Monitoring of DC supplies

**Function**

The voltage to be monitored has to be connected to the terminals L1+ or L2+ resp. to L-. If the voltage drops below the set response value "Y", the alarm relay switches after the response delay has elapsed and the alarm LED "U<Y" lights up. When the measured quantity exceeds the set response value plus hysteresis "Hy", the relay switches back to its original state after approximately 70 ms. The operating principle of the alarm relay can be set to N/O or N/C operation.



**Note**

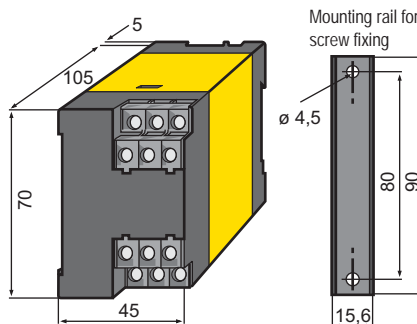
False alarms resulting from short-time operational measurement errors can be suppressed by setting a time delay. The set response delay remains effective even in case of complete supply voltage failure.

Ordering information		
Type	Supply voltage $U_s$	Art. No.
SUG140	AC 85...275 V	B 934 642
SUG140	DC 9.6...84 V	B 934 647

Accessories	
Mounting rail for screw mounting	B 974 728

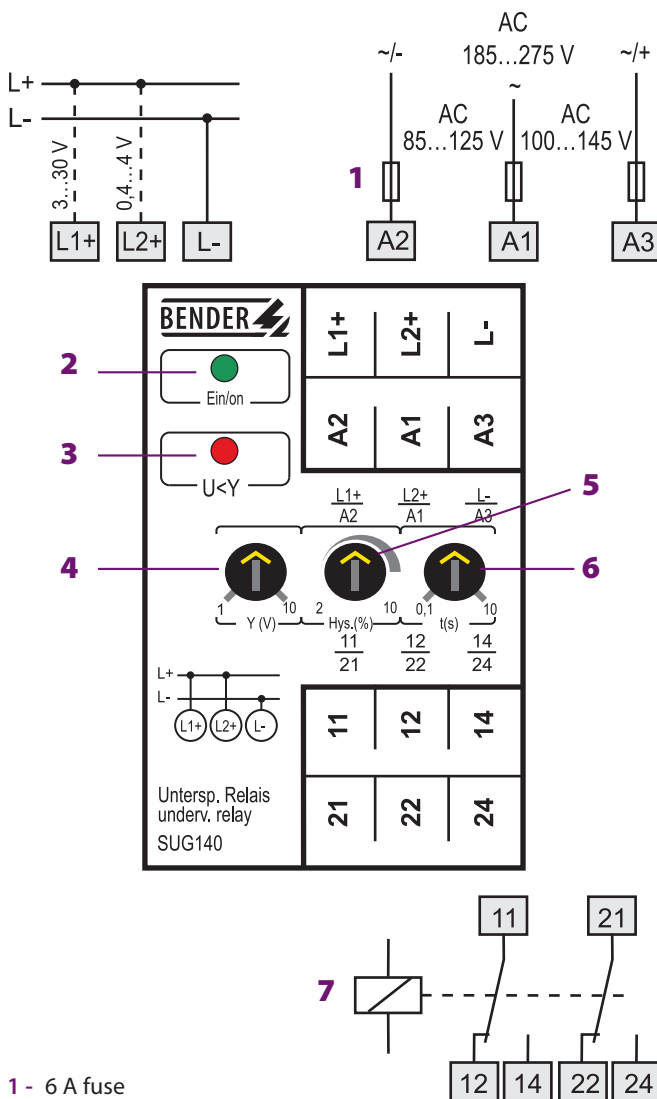
**Dimension diagram X140**

Dimensions in mm



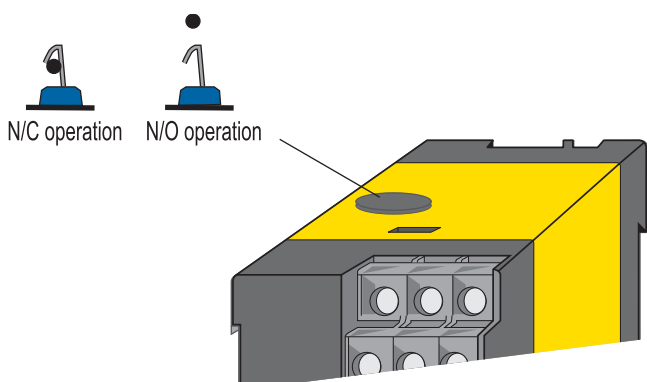


Wiring diagram



- 1 - 6 A fuse
- 2 - Power ON LED
- 3 - Alarm LED
- 4 - Adjustable response value
- 5 - Adjustable hysteresis
- 6 - Adjustable response delay
- 7 - Alarm relay

Setting of the operating principle of the alarm relay



Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse withstand voltage/pollution degree	4 kV/3

Supply voltage

Supply voltage $U_s$	see ordering information
Power consumption	$\leq 2.5$ VA

Measuring circuit

Rated frequency $f_n$	DC
Response values (max. permissible voltage)	0.4...4 V (40 V) 3...30 V (300 V)
Response delay $t$	0.1...10 s
Hysteresis	2...10 %
Recovery time $t_b$	0.2 s
Delay on release	approx. 70 ms
Repetition accuracy	$\pm 1.5$ %
Temperature influence	$< 0.2$ % / °C

Switching elements

Number of changeover contacts	1 x 2
Operating principle	NC / N/O operation (N/O operation)*
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \phi$ 0.4 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-15...+50 °C
Ambient temperature, during storage	-20...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

Other

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
Screw mounting	with mounting rail
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	IEC 60255-6
Operating manual	BP305001
Weight	$\leq 250$ g

( ) \* factory setting

3.1



SUG141

### Device features

- Overvoltage relays for DC voltages
- External supply voltage
- Adjustable response values: 0.4...4 V / 3...30 V
- Adjustable response delay: 0.1...10 s
- Adjustable hysteresis: 2...10 %
- Power On LED, Alarm LED
- Alarm relay with two potential-free changeover contacts
- 45 mm enclosure

### Note

In case of new installations refer to VME420.

### Approvals and certifications



### Product description

The SUG141 series relay is designed to monitor the overvoltage in a DC system. External supply voltage is required. Response value, response delay and hysteresis are adjustable.

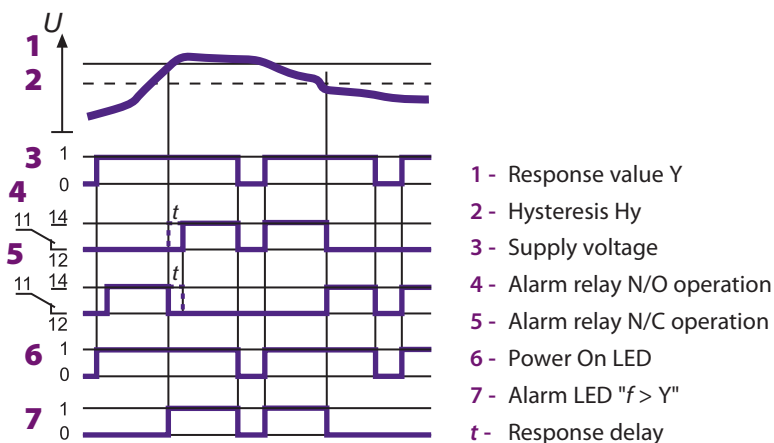
### Typical applications

- Monitoring of batteries
- Monitoring of voltage levels
- Switch to set the threshold values for analogue signals 0...10 V
- Monitoring of DC supplies

### Function

The voltage to be monitored has to be connected to the terminals L1+ or L2+ resp. to L-. When the voltage exceeds the set response value "Y", the alarm relay switches after the response delay has elapsed and the alarm LED "U<Y" lights up. When the measured quantity exceeds the set response value plus hysteresis "Hy", the relay switches back to its original state after approximately 70 ms. The operating principle of the alarm relay can be set to N/O or N/C operation.

### Note



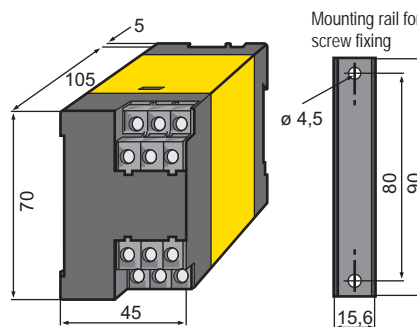
False alarms resulting from short-time operational measurement errors can be suppressed by setting a time delay. The set response delay remains effective even in case of complete supply voltage failure.

Ordering information		
Type	Supply voltage $U_s$	Art. No.
SUG141	AC 85...275 V	B 934 643
SUG141	DC 9.6...84 V	B 934 649

Accessories	
Mounting rail for screw mounting	B 974 728

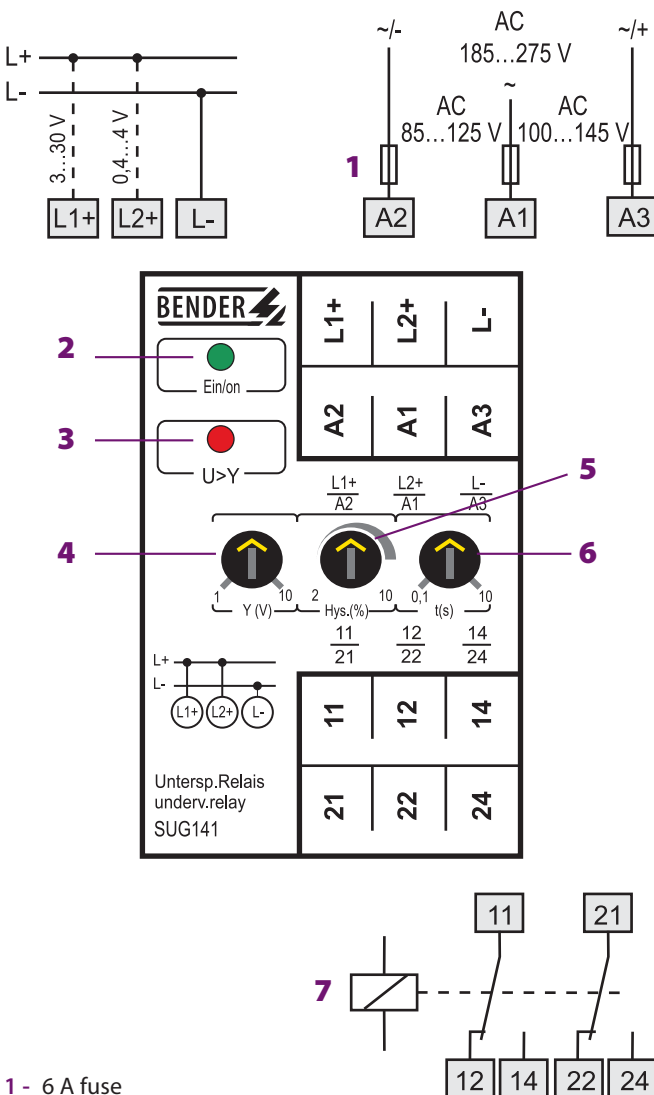
### Dimension diagram X140

Dimensions in mm



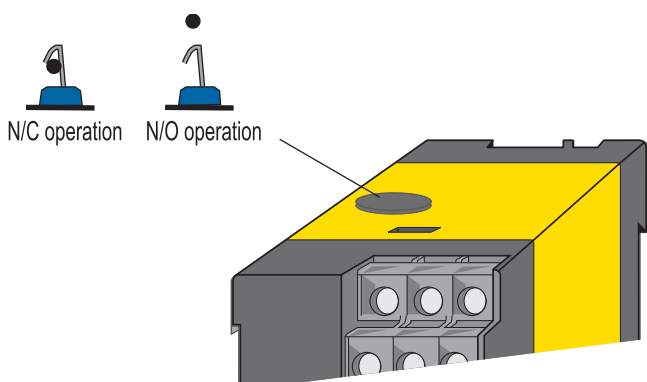


Wiring diagram



- 1 - 6 A fuse
- 2 - Power On LED "ON"
- 3 - Alarm LED "f > Y"
- 4 - Adjustable response value
- 5 - Adjustable hysteresis
- 6 - Adjustable response delay
- 7 - Alarm relay

Setting of the operating principle of the alarm relay



Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse withstand voltage/pollution degree	4 kV/3

Supply voltage

Supply voltage $U_s$	see ordering information
Power consumption	$\leq 2.5$ VA

Measuring circuit

Rated frequency $f_n$	DC
Response values (max. permissible voltage)	0.4...4 V (40 V) 3...30 V (300 V)
Response delay $t$	0.1...10 s
Hysteresis	2...10 %
Recovery time $t_b$	0.2 s
Delay on release	approx. 70 ms
Repetition accuracy	$\pm 1.5$ %
Temperature influence	$< 0.2$ % / $^{\circ}$ C

Switching elements

Number of changeover contacts	1 x 2
Operating principle	NC / N/O operation (N/O operation)*
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \phi$ 0.4 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-15...+50 $^{\circ}$ C
Ambient temperature, during storage	-20...+70 $^{\circ}$ C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

Other

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
Screw mounting	with mounting rail
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	IEC 60255-6
Operating manual	BP305002
Weight	$\leq 250$ g

( \*)\* factory setting



Asymmetry relays are designed to monitor voltage asymmetries in three-phase systems.





AUR381Z

### Device features

- Monitoring of 3(N)AC systems for asymmetry, undervoltage, phase failure
- Without external supply voltage
- Adjustable response value:  
5...15 % / 0.7...0.95 x  $U_n$
- Response delay: 0.5...5 s
- Power On LED, Alarm LED
- Alarm relay with two potential-free changeover contacts

### Product description

The AUR381Z series relays are designed to monitor 3(N)AC systems for asymmetry, undervoltage and phase failure. External supply voltage is not required. The internal supply voltage is electrically isolated from the system. Special input transformers attenuate the interferences from the system. An integrated protective circuit is provided for use in systems with interferences.

### Typical applications

- Monitoring of the power supply of motors or electrical installations
- Monitoring of asymmetrically loaded systems

### Function overvoltage relay

When supply voltage is applied, the alarm relay is in N/C operation (relay energised). When the difference of the phase-to-phase voltage (asymmetry) exceeds the set response value, the alarm relay deenergises and the alarm LED " $U_n$ " goes out.

When the voltage falls below the response value threshold for undervoltage, the alarm relay behaviour is the same. If the measured quantity falls below or exceeds the release values, the alarm relay returns to its original state.

### Note

False asymmetry alarms resulting from operational measurement errors can be suppressed by setting a time delay. In case of complete system failure, the time delay is not effective, except for the device operating time. If the delay function is to be maintained in case of complete system failure, the energy backup SP100 is recommended to be used.

### Technical data

#### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 630 V
Rated impulse voltage/pollution degree	6 kV/3

#### Supply voltage

Supply voltage $U_s$	not required
Power consumption	≤ 5 VA

#### Measuring circuit

Nominal system voltage $U_n$	see ordering information
Operating range of $U_n$	0.5...1.3 x $U_n$
Frequency $f_n$	50...60 Hz
Response value asymmetry	5...15 % (L-L)
Response value undervoltage	0.7...0.95 x $U_n$
Response delay $t_V$	0.5...5 s
Hysteresis	≤ 5 %

#### Switching elements

Number of changeover contacts	1 x 2
Operating principle	N/C operation
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi 0.4 0.2 A, DC 220 V, L/R = 0.04 s

#### Environment/EMC

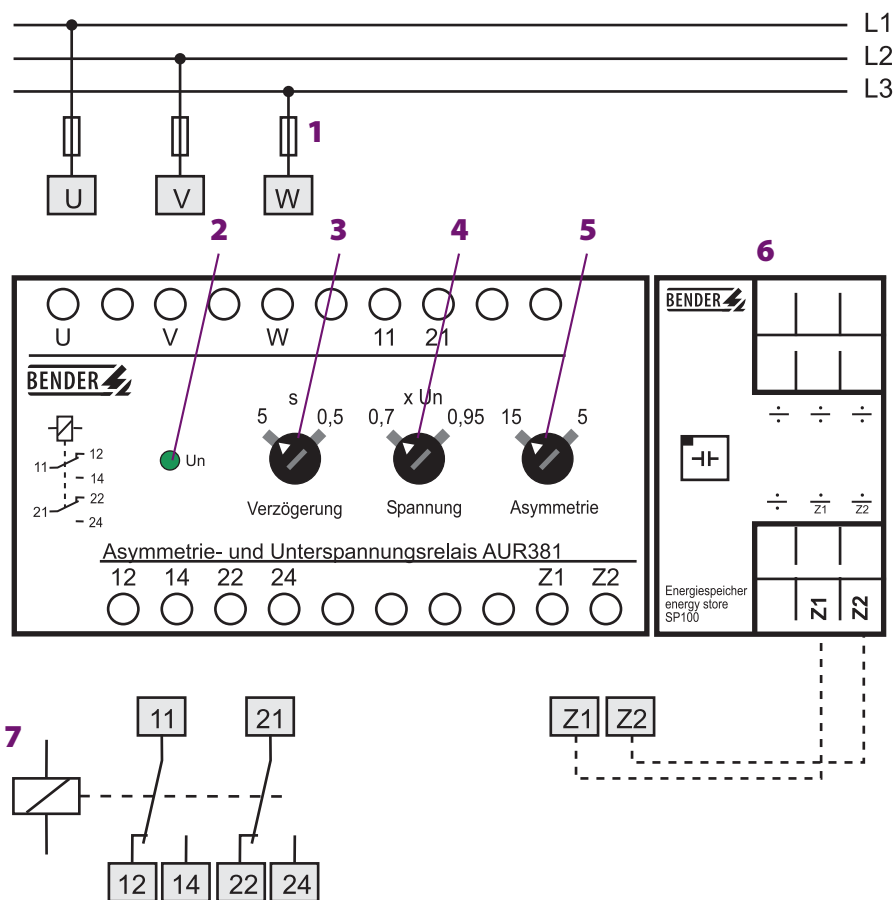
EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-10...+50 °C
Ambient temperature, during storage	-20...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

#### Other

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
Screw mounting	refer to dimension diagram
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	IEC 60266-6
Operating manual	BP302003
Weight	≤ 700 g



Wiring diagram



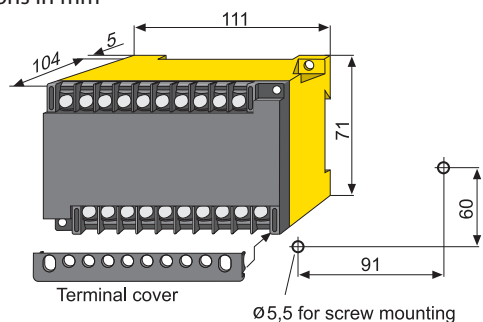
- 1 - 6 A fuse
- 2 - Power On LED "U<sub>n</sub>", goes out in the event of asymmetry, undervoltage and system failure.
- 3 - Adjustable response delay
- 4 - Adjustable response delay for undervoltage
- 5 - Adjustable response value for asymmetry
- 6 - Energy backup SP100, an additional means to delay the time for approximately 5 s in the event of complete system failure
- 7 - Alarm relay in N/C operation

3.2

Ordering information		
Type	Nominal system voltage U <sub>n</sub>	Art. No.
AUR381Z	3(N)AC 100 V	B 935 603
AUR381Z	3(N)AC 110 V	B 935 507
AUR381Z	3(N)AC 400 V	B 935 631
AUR381Z	3(N)AC 440 V	B 935 630
AUR381Z	3(N)AC 500 V	B 935 053
AUR381Z	3(N)AC 690 V	B 935 068
SP100	Energy backup	B 935 700

Dimension diagram X200

Dimensions in mm







Current relays are designed to monitor loads and electrical installations for under-current and overcurrent. Both single-phase and three-phase systems can be monitored.

# CME420

Multifunctional current relay for AC systems,  
overcurrent / undercurrent / window discriminator function



CME420

### Device features

- Undercurrent and overcurrent monitoring in AC systems 0.1...16 A
- Indirect current monitoring with standard current transformers x/5 A up to max. 999 A
- Different monitoring functions selectable <math>I\_{>}</math>, <math>I\_{<}</math> or <math>I\_{>}</math> / <math>I\_{<}</math>
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC)
- Digital measured value display via multifunctional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

### Approvals and certifications



### Product description

The CME420 series current relays monitor undercurrent and overcurrent in AC systems as well as the current between two threshold values (window discriminator function). The currents are measured as r.m.s. values (AC). The currently measured value is continuously shown on the LC display. The measured value required to trigger the alarm relay is stored. Due to adjustable delay times, installation-specific characteristics, such as device-specific making currents, short-time current changes etc. can be considered. Current measurement is possible either directly or indirectly via standard current transformers (x/5 A). External supply voltage is required.

### Typical applications

- Current consumption of motors, such as pumps, elevators, cranes
- Monitoring of lighting circuits, heating circuits, charging stations
- Monitoring of emergency lighting
- Monitoring of screw conveyors, e.g. in sewage plants
- Dust removal in wood working

### Function

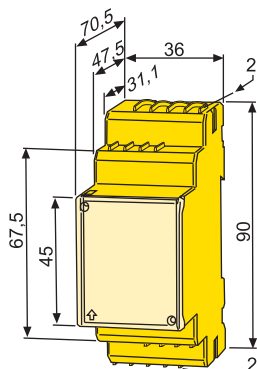
Once the supply voltage is applied, the start-up delay begins. Measured values changing during this time do not influence the switching state of the alarm relays.

The devices provide two separately adjustable measuring channels (overcurrent/undercurrent). When the measuring quantity exceeds the response value ("Alarm 1") or falls below the response value ("Alarm 2"), the time of the response delays " $t_{on1/2}$ " begins. Once the response delay has elapsed, the alarm relays switch and the alarm LEDs light up. When the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release time " $t_{off}$ " begins. When " $t_{off}$ " has elapsed, the alarm relays switch back to their original state (fault memory inactive). When the fault memory is activated, the alarm relays remain in alarm position until the reset button is pressed.

### Dimension diagram XM420

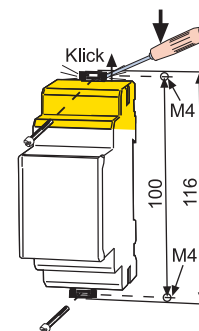
Dimensions in mm

Open the front plate cover in direction of arrow!



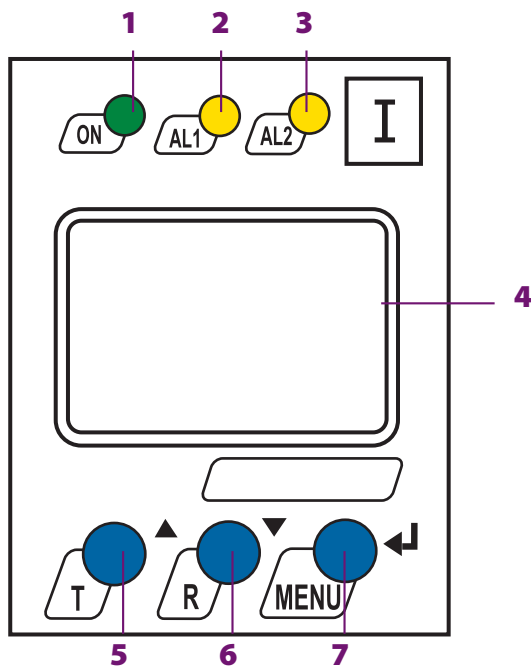
### Screw mounting

Note: The upper mounting clip must be ordered separately (see ordering information).



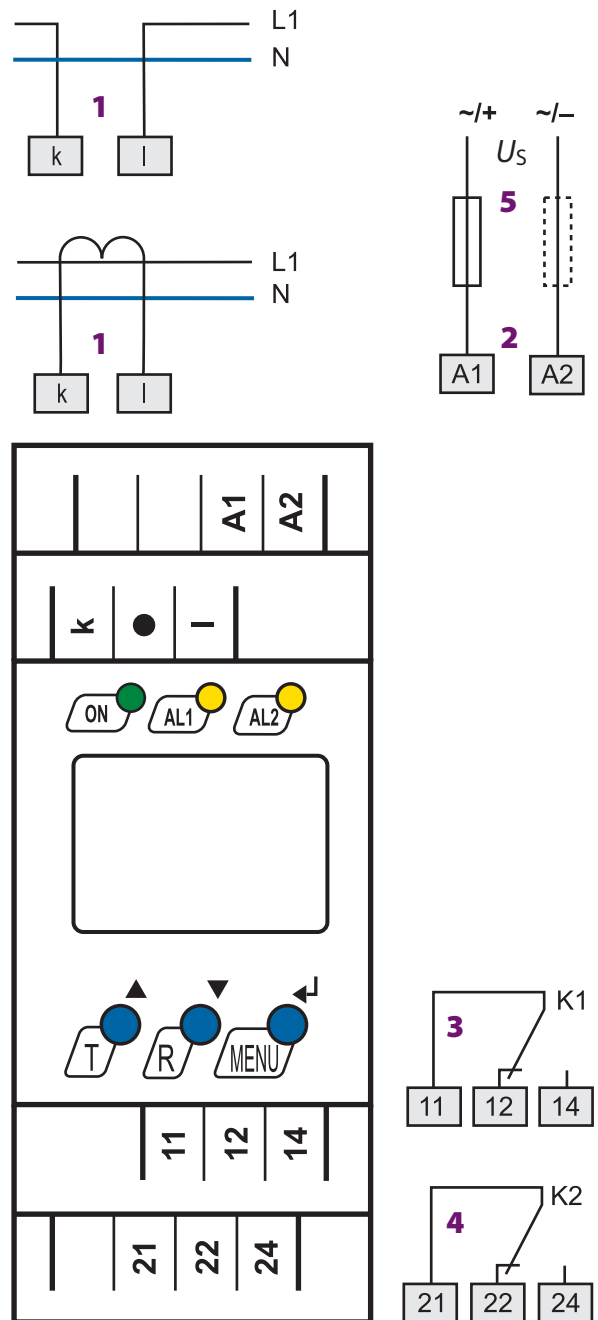


Operating elements



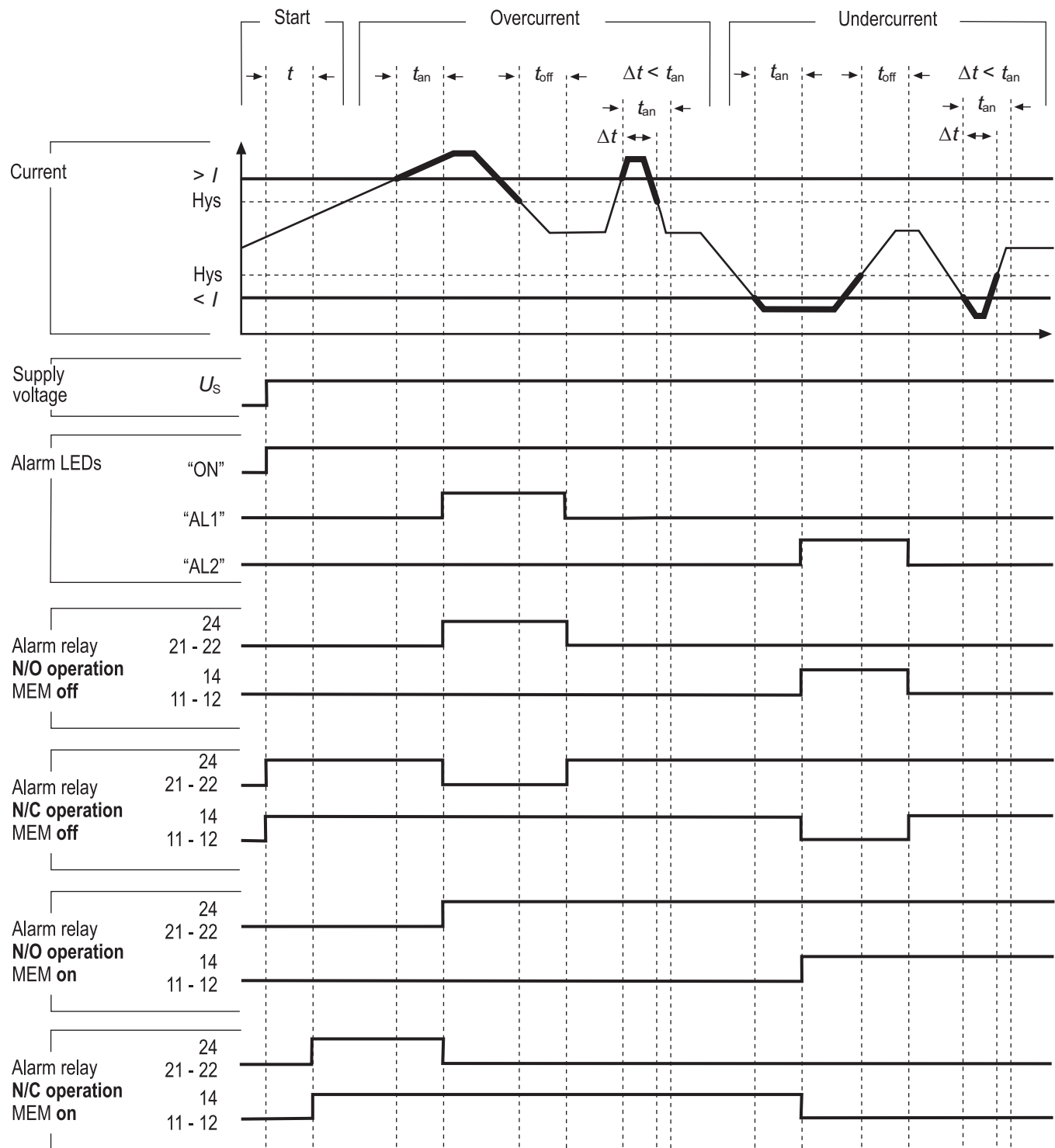
- 1 - Power On LED "ON" (green): lights when supply voltage is applied or flashes in the event of system fault alarm
- 2 - Alarm LED "AL1" (yellow): lights when the set response value is exceeded or flashes in the event of system fault alarm
- 3 - Alarm LED "AL2" (yellow): lights when the value falls below the set response value or flashes in the event of system fault alarm.
- 4 - Multi-functional LC display
- 5 - Test button "T": Up button: To change the measured value display, move upwards in the menu or to change parameters.  
To call up the self test, press the button > 1.5 s
- 6 - Reset button "R": Down button: To change the measured value display, move downwards in the menu or to change parameters.  
To delete stored alarms, press the button > 1.5 s
- 7 - "MENU" button: Enter button: To confirm the measured value display or to confirm changed parameters.  
To call up the menu system, press the button > 1.5 s.  
Press the ESC button > 1.5 s to abort an action or to return to the previous menu level.

Wiring diagram



- 1 - Connection to the system/load being monitored
- 2 - Supply voltage  $U_S$  (see ordering information)
- 3 - Alarm relay K1: Configurable for alarm < / / > / / TEST / ERROR
- 4 - Alarm relay K2: Configurable for alarm < / / > / / TEST / ERROR
- 5 - Line protection according to IEC 60364-4-43: 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

**Timing diagram current monitoring**



- $t$  - Start-up delay
- $t_{an}$  - Response time  
Operating time ( $t_{ae}$ ) + Response delay ( $t_{an 1/2}$ )
- $t_{off}$  - Delay on release

3.3

**Technical data**
**Insulation coordination acc. to IEC 60664-1 / IEC 60664-3**

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	2.5 kV / III
Protective separation (reinforced insulation) between (A1, A2) - (k, l) - (11, 12, 14) - (21, 22, 24)	
Maximum rated voltage of the system being monitored (conductor to be monitored directly connected)	
With protective separation	AC 230 V
Without protective separation	AC 400 V
Voltage test acc. to IEC 61010-1	2.21 kV

**Supply voltage**

Supply voltage $U_s$	see ordering information
Power consumption	≤ 3 VA

**Measuring circuit**

Rated frequency	42...460 Hz
Measuring range	AC 0.05...16 A
Overload capability, continuous	17.6 A
Overload capability < 1 s	40 A
Frequency display range	10...2000 Hz

**Response values**

Undercurrent (alarm 2)	direct connection: AC 0.1...16 A (1 A)*
Overcurrent (alarm 1)	direct connection: AC 0.1...16 A (10 A)* current transformer x/5 A: 0.1 x n...999 A (10 A)*
Transformation ratio n	1...4000 (1)*
Relative uncertainty in the range of 50/60 Hz	±3% ±2 digit
Relative uncertainty in the range 40...460 Hz	±5% ±2 digit
Hysteresis	1...40% (15%)*

**Specified time**

Start-up delay $t$	0...99 s (0.5 s)*
Response delay $t_{on1}$	0...99 s (1 s)*
Response delay $t_{on2}$	0...99 s (0 s)*
Delay on release $t_{off}$	0...99 s (0.1 s)*
Operating time $t_{ae}$	≤ 70 ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time $t_b$	≤ 300 ms

**Displays, memory**

Display range, measured value	AC 0.01...16 A x n
Operating uncertainty in the range of 50/60 Hz	±3% ±2 digit
Operating uncertainty in the range of 40...460 Hz	±5% ±2 digit
Measured-value memory for alarm value	data record measured values
Password	off / 0...999 (off)*
Fault memory alarm relay	on / off (on)*

**Switching elements**

Number	2 relays, each with 1 changeover contact				
Operating principle	NC / N/O operation (N/O operation)*				
Electrical endurance, number of cycles	10.000				
Contact data acc. to IEC 60947-5-1					
Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact load / gold-plated relay contacts	1 mA at AC/DC ≥ 10 V				

**Environment/Environment/EMC**

EMC	IEC 61326-1				
Operating temperature	-25...+55 °C				
Climatic class acc. to IEC 60721					
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)				
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)				
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)				
Classification of mechanical conditions IEC 60721					
Stationary use (IEC 60721-3-3)					3M4
Transport (IEC 60721-3-2)					2M2
Long-time storage (IEC 60721-3-1)					1M3

**Connection**

Connection	push-wire terminals				
Connection properties:					
rigid					0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule					0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule					0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm				
Opening force	50 N				
Test opening, diameter	2.1 mm				

**Other**

Operating mode	continuous operation				
Position of normal use	any				
Degree of protection, internal components (IEC 60529)	IP30				
Degree of protection, terminals (IEC 60529)	IP20				
Enclosure material	polycarbonate				
Flammability class	UL94V-0				
DIN rail mounting acc. to	IEC 60715				
Screw mounting	2 x M4 with mounting clip				
Product standards	IEC 61010-1 and IEC 60255-6				
Operating manual	TGH1400				
Weight	≤ 160 g				

( ) \* factory setting

**Ordering information**

Type	Supply voltage $U_s$ *	Measurement	Display range	Response value	Art. No.
CME420-D-1	DC 9.6...94 V / AC 42...460 Hz	16...72 V directly/via current transformer x/5A	0.1...16 A/5...999 A	0.1...16 A x n	B 7306 0001
CME420-D-2	DC 70...300 V / AC 42...460 Hz	70...300 V directly/via current transformer x/5A	0.1...16 A/5...999 A	0.1...16 A x n	B 7306 0002

Device version with screw terminals on request

\* Absolute values

**Accessories**

Type	Art No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008



CSG140

### Device features

- Undercurrent relay for DC currents
- External supply voltage
- 4 device variants with adjustable response values: 0.5...5/2...20 mA, 0.5...5 A, 1...10 A, 6...60/50...500 mV
- Adjustable response delay: 0.1...10 s
- Adjustable hysteresis: 2...10%
- Power On LED, Alarm LED
- Alarm relay with two potential-free changeover contacts
- 45 mm enclosure

### Note

In case of new installations refer to CME420

### Approvals and certifications



### Product description

The CSG140 series relays are designed to monitor DC currents (DC voltage) for undercurrent. The current is measured directly or by means of a shunt. External supply voltage is required. The response value, response delay and hysteresis are set via potentiometers.

### Typical applications

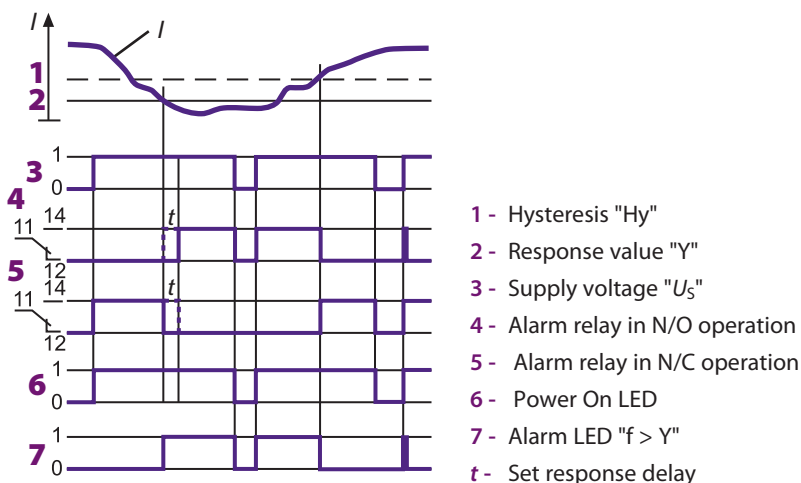
- Monitoring the load and functionality of electric loads
- Power consumption monitoring
- Monitoring of emergency lighting

### Function

The current to be monitored has to be connected to the terminals L1+ or L2+ or L3+. If the current drops below the set response value, the alarm relay switches after the response delay has elapsed and the alarm LED lights up.

When the measured quantity exceeds the set response value plus hysteresis, the relay switches back to its original state after approximately 70 ms.

The operating principle of the alarm relay can be set to N/O or N/C operation.



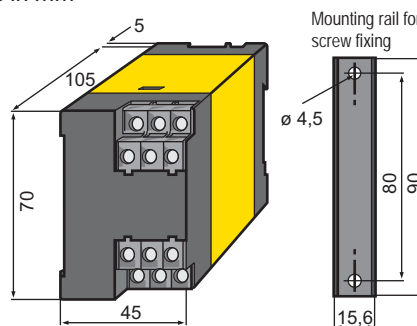
### Note

False alarms resulting from operational measurement errors can be suppressed by setting a time delay. The set response delay remains effective even in case of complete supply voltage failure.

Ordering information			
Type	Supply voltage $U_s$	Response value	Art. No.
CSG140	AC 50...60 Hz / 85...275 V	0.5...5 A	B 943 606
CSG140	AC 50...60 Hz / 85...275 V	0.5...5 mA / 2...20 mA	B 943 601
CSG140	AC 50...60 Hz / 85...275 V	1...10 A	B 943 604
CSG140	AC 50...60 Hz / 85...275 V	6...60 mV / 50...500 mV	B 943 608
CSG140	DC 9.6...84 V	0.5...5 A	B 943 613
CSG140	DC 9.6...84 V	0.5...5 mA / 2...20 mA	B 943 616
CSG140	DC 9.6...84 V	6...60 mV / 50...500 mV	B 943 611
CSG140	DC 77...286 V	0.5...5 A	B 943 626
CSG140	DC 77...286 V	6...60 mV / 50...500 mV	B 943 621
CSG140	DC 77...286 V	0.5...5 mA / 2...20 mA	B 943 625

### Dimension diagram X140

Dimensions in mm

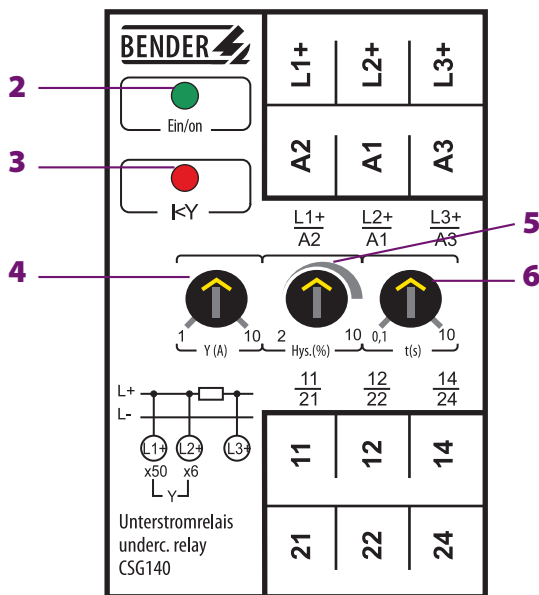
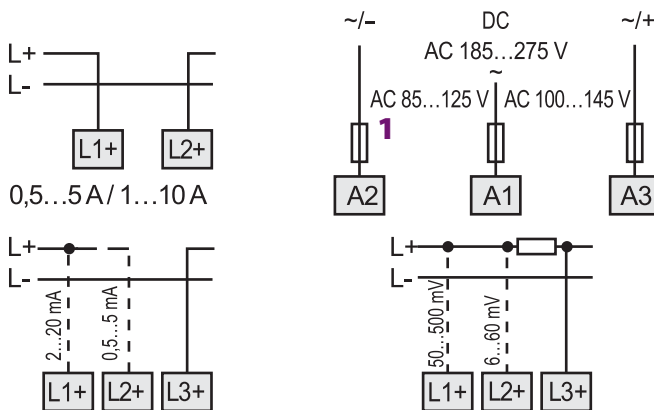


### Accessories

Mounting rail for screw mounting	B974728
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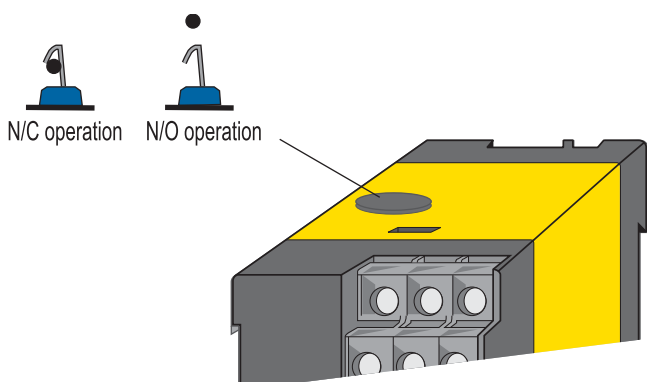


Wiring diagram



- 1 - 6 A fuse
- 2 - Power On LED "ON"
- 3 - Alarm LED
- 4 - Adjustable response value
- 5 - Adjustable hysteresis
- 6 - Adjustable response delay
- 7 - Alarm relay

Setting of the operating principle of the alarm relay



Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	DC 300 V
Rated impulse withstand voltage/pollution degree	4 kV/3

Supply voltage

Supply voltage $U_s$	see ordering information
Power consumption	$\leq 3$ VA

Measuring circuit

Response values	DC 0.5...5 A
	DC 0.5...5 / 2...20 mA
	DC 1...10 A
	DC 6...60 / 50...500 mV

Overload capability measuring input

Response value	0.5...5 mA	2...20 mA	6...60 mV	50...500 mV	0.5...5 A	1...10 A
Load	12 $\Omega$	3 $\Omega$	1 k $\Omega$	8,2 k $\Omega$	10 m $\Omega$	10 m $\Omega$
Overload capability	0.5 A 1s	0.5 A 1s	30 V 1s	100 V 1s	40 A 1s	40 A 1s
	0.2 A DB	0.2 A DB	6 V DB	50 V DB	12 A DB	12 A DB

Response delay $t$	0.1...10 s (0.1)*
Hysteresis	2...10 % (2 %)*
Delay on release	approx. 70 ms
Repetition accuracy	$\pm 1,5$ %
Temperature influence	$< 0.05$ % / $^{\circ}\text{C}$
Recovery time $t_b$	$\leq 200$ ms

Switching elements

Number of changeover contacts	1 x 2
Operating principle	NC / N/O operation (N/O operation)*
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi 0.4 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-15...+50 $^{\circ}\text{C}$
Ambient temperature, during storage	-20...+70 $^{\circ}\text{C}$
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

Other

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
Screw mounting	with mounting rail
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	IEC 60255-6
Operating manual	BP307001
Weight approx.	$\leq 250$ g

( \*) factory setting



CSG140

**Device features**

- Overcurrent relay for DC currents
- External supply voltage
- 4 device variants with adjustable response values: 0.5...5/2...20 mA, 0.5...5 A, 1...10 A, 6...60/50...500 mV
- Adjustable response delay: 0.1...10 s
- Adjustable hysteresis: 2...10 %
- Power On LED, Alarm LED
- Alarm relay with two potential-free changeover contacts
- 45 mm enclosure

**Note**

In case of new installations refer to CME420

**Approvals and certifications**



**Product description**

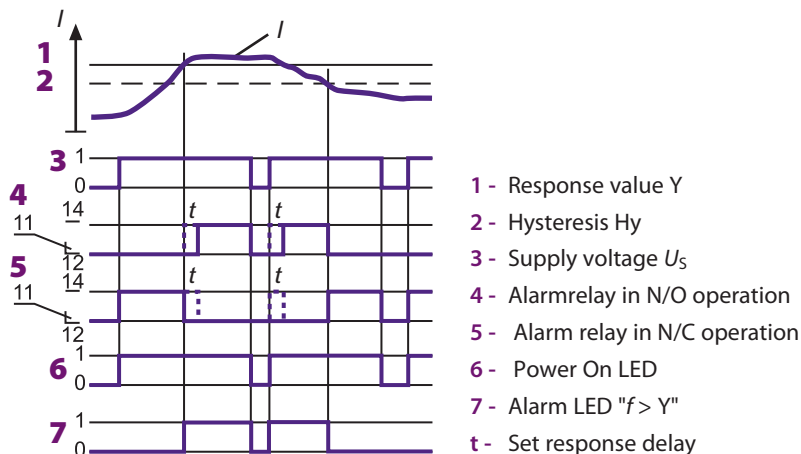
The CSG141 series relays are designed to monitor DC currents (DC voltage) for overcurrent. The current is measured directly or by means of a shunt. External supply voltage is required. The response value, response delay and hysteresis are set via potentiometers.

**Typical applications**

- Monitoring the load and functionality of electric loads
- Power consumption monitoring
- Monitoring of emergency lighting

**Function**

The current to be monitored has to be connected to the terminals L1+ or L2+ or L3+. If the current exceeds the set response value, the alarm relay switches after the response delay has elapsed and the alarm LED lights up. When the measured quantity drops below the set response value plus hysteresis, the alarm relay switches back to its original state after approximately 70 ms. The operating principle of the alarm relay can be set to N/O or N/C operation.

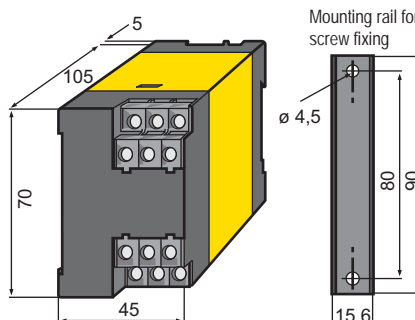


Ordering information			
Type	Supply voltage $U_s$	Response value	Art. No.
CSG141	AC 50...60 Hz 85...275 V	0.5...5 A	B 943 605
CSG141	AC 50...60 Hz 85...275 V	0.5...5 mA / 2...20 mA	B 943 602
CSG141	AC 50...60 Hz 85...275 V	1...10 A	B 943 603
CSG141	AC 50...60 Hz 85...275 V	6...60 mV / 50...500 mV	B 943 607
CSG141	DC 9.6...84 V	0.5...5 mA / 2...20 mA	B 943 617
CSG141	DC 9.6...84 V	DC 1...10 A	B 943 618
CSG141	DC 9.6...84 V	6...60 mV / 50...500 mV	B 943 251
CSG141	DC 77...286 V	0.5...5 mA / 2...20 mA	B 943 612
CSG141	DC 77...286 V	6...60 mV / 50...500 mV	B 943 624

Accessories	
Mounting rail for screw mounting	B974728

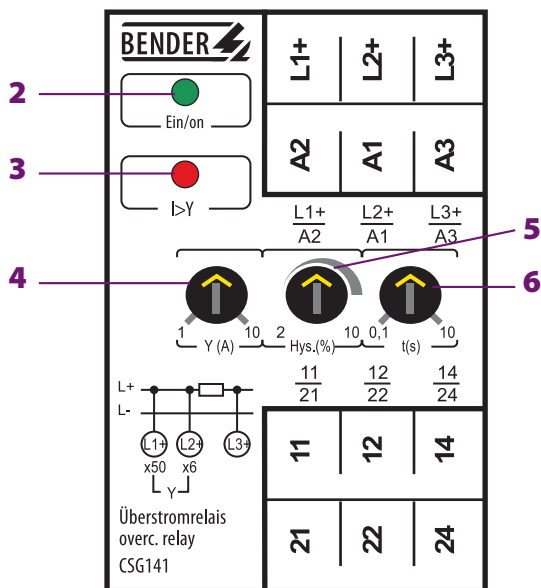
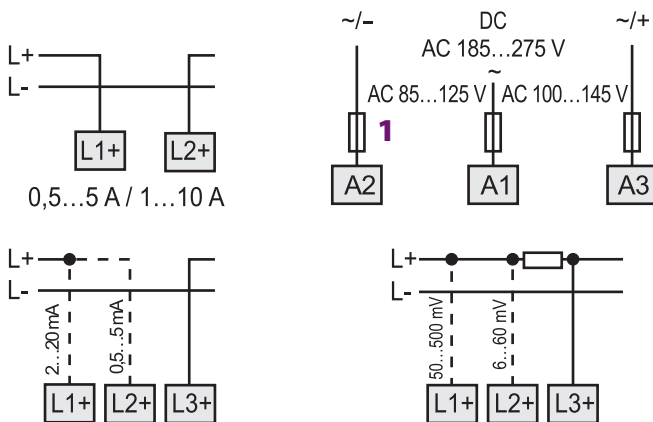
**Dimension diagram X140**

Dimensions in mm



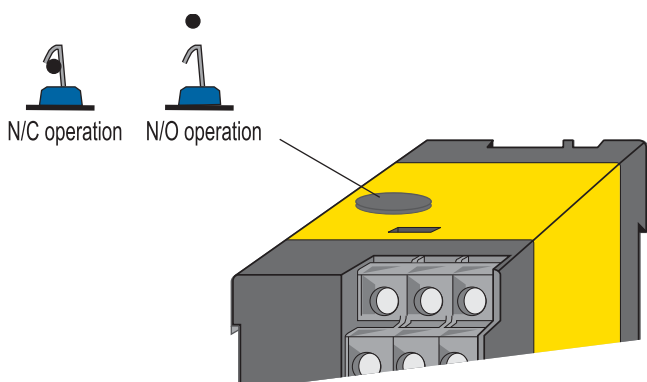


Wiring diagram



- 1 - 6 A fuse
- 2 - Power On LED "ON"
- 3 - Alarm LED
- 4 - Adjustable response value
- 5 - Adjustable hysteresis
- 6 - Adjustable response delay
- 7 - Alarm relay

Setting of the operating principle of the alarm relay



Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	DC 300 V
Rated impulse withstand voltage/pollution degree	4 kV/3

Supply voltage

Supply voltage $U_s$	see ordering information
Power consumption	$\leq 3$ VA

Measuring circuit

Response values	DC 0.5...5 A
	DC 0.5...5 / 2...20 mA
	DC 1...10 A
	DC 6...60 / 50...500 mV

Overload capability measuring input

Response value	0.5...5 mA	2...20 mA	6...60 mV	50...500 mV	0.5...5 A	1...10 A
Load	12 $\Omega$	3 $\Omega$	1 k $\Omega$	8,2 k $\Omega$	10 m $\Omega$	10 m $\Omega$
Overload capability	0.5 A 1s	0.5 A 1s	30 V 1s	100 V 1s	40 A 1s	40 A 1s
	0.2 A DB	0.2 A DB	6 V DB	50 V DB	12 A DB	12 A DB

Response delay $t$	0.1...10 s (0.1)*
Hysteresis, adjustable	2...10 % (2%)*
Delay on release	approx. 70 ms
Repitition accuracy	$\pm 1.5$ %
Temperature influence	$< 0.05$ % / $^{\circ}\text{C}$
Recovery time $t_b$	$\leq 200$ ms

Switching elements

Number of changeover contacts	1 x 2
Operating principle	NC / N/O operation (N/O operation)*
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \phi$ 0.4 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g/10...150 Hz
Ambient temperature, during operation	-15...+50 $^{\circ}\text{C}$
Ambient temperature, during storage	-20...+70 $^{\circ}\text{C}$
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

Other

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
Screw mounting	with mounting rail
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	IEC 60255-6
Operating manual	BP307002
Weight	$\leq 250$ g

( \*) factory setting







ZUE150

### Device features

- Adjustable power up delay time and drop-out delay time
- Alarm relay with one N/O contact
- 45 mm enclosure

### Product description

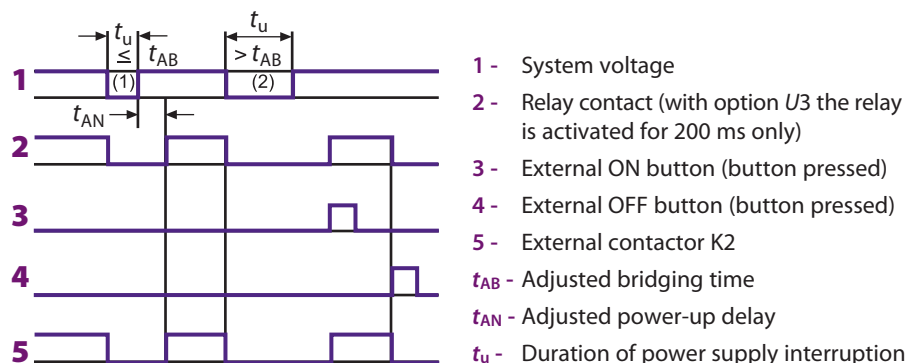
A voltage drop or interruption in control circuits of production lines or conveying systems the processes of which are susceptible to interruptions may cause considerable costs. Therefore, it is often desired to restart the loads automatically after voltage interruptions. In order to avoid that all loads are connected to supply at the same time, the loads have to be connected staggered in time. When the duration of undervoltage (power supply failure) exceeds the adjusted maximum bridging time, an automatic restart must be prevented. The automatic restart relay ZUE150 meets these requirements by measuring the voltage value and by giving a start signal after the continuously adjustable power-up delay has elapsed.

### Typical applications

- Chemical and und petrochemical industries
- Plastics processing
- Industrial mills
- Mechanical engineering
- Lighting equipment

### Function

When the power supply is interrupted or when the voltage falls below the response value, for a period not exceeding the adjusted bridging time, the contact 11/14 closes on voltage recovery after the adjusted power-up delay has elapsed, enabling the external contactor to operate, if wired accordingly. If the duration of power supply failure exceeds the adjusted bridging time, there will be no automatic restart. The device can be switched on manually at any time, independent of the power-up delay. Pressing the external OFF button will cause a tripping of the external contactor so that an automatic restart is prevented even in the case of voltage failure.



If the duration of  $t_u$  (1) is below the adjusted bridging time, the relay contact K1 closes when the power-up delay  $t_{AN}$  has elapsed.

If  $t_u$  (2) exceeds the adjusted bridging time, no automatic restart signal is sent by the restart relay.

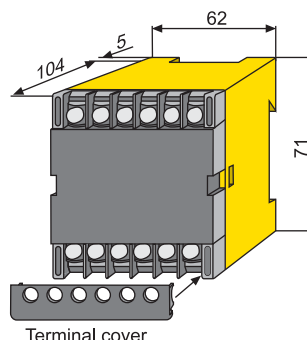
The limit values for voltage drop or voltage recovery are set to 65 % resp. 80 % of the respective nominal voltage (internal device setting).

Ordering information			
Type	Nominal system voltage $U_n$	Option	Art. No.
ZUE150	AC 50 Hz 230 V		B 936 156
ZUE150	AC 50 Hz 110 V		B 936 600
ZUE150-U2	AC 50 Hz 220 V	U2	B 936 152
ZUE150	AC 50 Hz 240 V		B 936 601
ZUE150	AC 60 Hz 110 V		B 936 604
ZUE150-U3	AC 50 Hz 230 V	U3	B 936 158
ZUE150	AC 60 Hz 110 V	U1 + U3	B 936 202

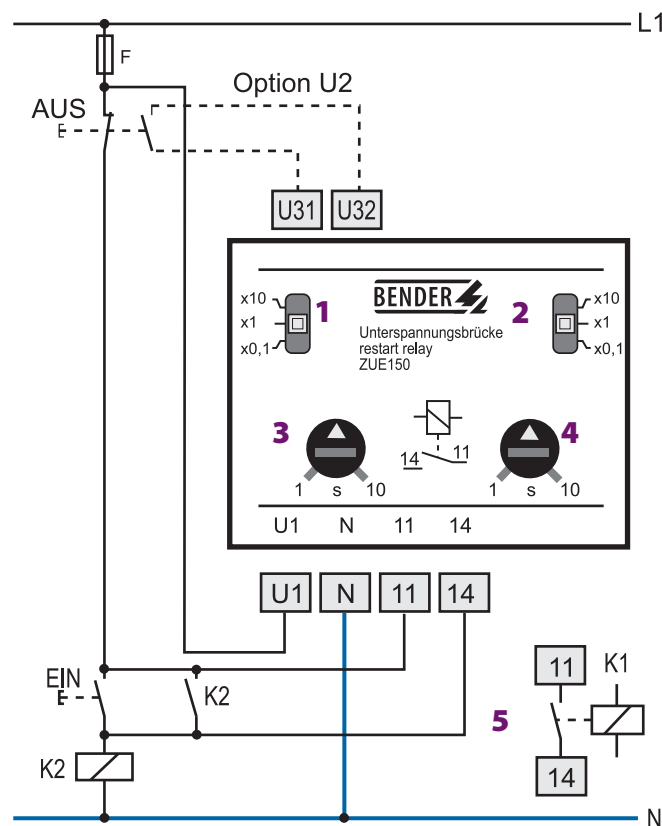
Accessories	
Mounting rail for screw mounting	B 974 728

### Dimension diagram X150

Dimensions in mm



Wiring diagram



- 1 - Three-position switch to set the multiplying factor for  $t_{AN}$
- 2 - Three-position switch to set the multiplying factor for  $t_{AB}$
- 3 - Potentiometer for setting the power-up delay  $t_{AN}$
- 4 - Continuously adjustable potentiometer for setting the drop-out delay time  $t_{AB}$
- 5 - Alarm relay with one N/O contact
- F - 6 A fuse is recommended
- $t_{AB}$  - Potentiometer for setting the continuous bridging time, scale division 1...10. By means of a three-position switch, the time range can be selected between 0.1...1s (x 0.1), 1...10 s (x 1) and 10...100 s (x 10).
- $t_{AB}$  - Potentiometer for setting the continuous bridging time 1...10. The time domain can be selected in the same way as described for  $t_{AN}$ . When the duration of undervoltage/voltage interruption exceeds the adjusted time  $t_{AB}$ , an automatic restart is prevented.

Option U1

Terminals U21 and U22: Potential-free optocoupler output for signalling the restart impulse.

$U_{max}$ : AC 140 V / DC 200 V

$U_{low max}$  at 30 mA = 0.5 V

Option U2

If the terminals U31 and U32 are connected to an N/O contact of the OFF button, it is possible to switchoff in a deenergised system (no automatic restart).

Option U3

Restart contact with 200 ms contact making.

Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	2.5 kV/3

System being monitored

Power consumption	
Terminal U1	≤ 3 VA
Terminal 11, 14	≤ 0.5 VA

Measuring circuit

Nominal system voltage	see ordering information
Rated frequency $f_n$	AC 50/60 Hz
Operating range	0.65...1.15 $U_n$

Response values

Undervoltage threshold	0.65 x $U_n$
Threshold value for voltage return	0.8 x $U_n$
Time setting scale continuously adjustable	1...10
Timing ranges for power-on delay $t_{AN}$ and bridging time $t_{AB}$	x 0.1 (0.1...1 s) x 1 (1...10 s) x 10 (10...100 s)

Switching elements

Number of contacts	1 N/O contact
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi 0.4 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g/10...150 Hz
Ambient temperature, during operation	-10...+60 °C
Ambient temperature, during storage	-20...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

Other

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection, terminals/with terminal covers (IEC 60529)	IP10/IP20
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Operating manual	BP308005
Weight	≤ 400 g

# Loop monitor GM420

Relay to monitor loop resistances or PE conductor connections



GM420

## Device features

- Loop monitoring of the PE conductor in AC systems
- Measuring and indication of extraneous voltages, measuring circuit resistant to extraneous voltage
- Adjustable start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays with one changeover contact each
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

## Approvals and certifications



## Product description

The GM420 series loop monitor is designed to monitor the resistance of PE conductor connections in AC systems and in de-energised systems. The extraneous voltage  $U_f$  between the terminals E and KE must not exceed AC 12 V. The ohmic resistance of the conductor loop and the AC extraneous voltage  $U_f$ , if existing, will be indicated on the display. The currently measured value is continuously indicated on the LC display. If the measured resistance value increases above the set response value, the alarm will be activated and stored. Adjustable time delays allow installation-specific requirements to be considered.

## Typical applications

- Loop monitoring of motors
- Loop monitoring of PE conductor connections for wire interruptions in electrical installations
- Monitoring of earthing systems

## Function

Once the supply voltage is applied, the start-up delay begins. Values of the resistance and extraneous voltage changing during this time do not influence the switching state of the alarm relays. The device provides two individually adjustable measuring channels (loop resistance / extraneous voltage  $U_f$ ). When the measuring value exceeds the response value  $> R$  (Alarm 1) or  $> U_f$  (Alarm 2), the time of the response delay  $t_{on1/2}$  begins. Once the response delay has elapsed, the alarm relays switch and the alarm LEDs light up. If the measuring quantity falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release time " $t_{off}$ " begins. When " $t_{off}$ " has elapsed, the alarm relays switch back to their initial position. If the fault memory is enabled, the alarm relays will remain in alarm position until the reset button is pressed.

## Preset function

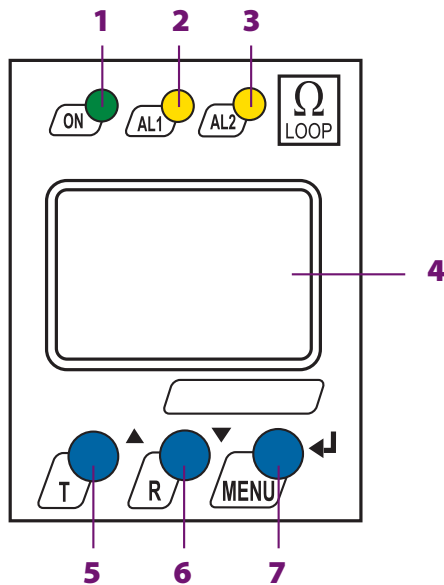
After connecting the relay to the power supply for the first time, the response value for the loop resistance (Alarm 1) is automatically set only once to the following value:

$$\text{Response value loop resistance } (> R) = (R_{\text{mess}} + 0.5 \Omega) \times 1.5$$

If the measured resistance value is  $> 66 \Omega$ , the response value will automatically be set to  $100 \Omega$ . After restoring the factory settings, the preset function is automatically active again.

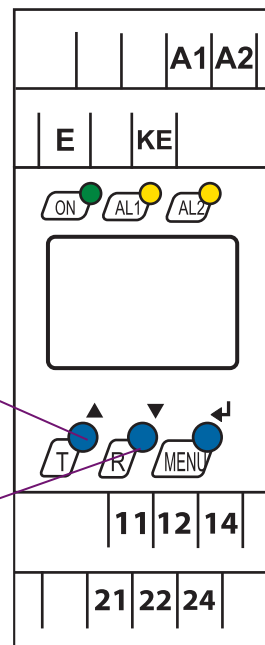
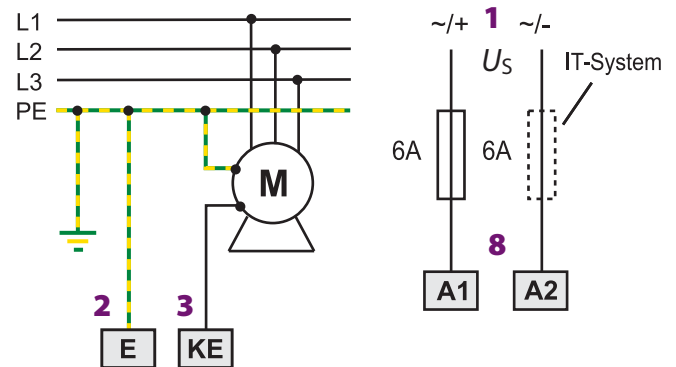


Operating elements



- 1 - LED Power On "ON" (green), lights when the supply voltage is applied or flashes in the event of system fault alarm.
- 2 - Alarm LED "AL1" (yellow), lights when the response value has been exceeded > R or flashes in the event of system fault alarm.
- 3 - Alarm LED "AL2" (yellow), lights when > U<sub>f</sub> has been exceeded or flashes in the event of system fault alarm.
- 4 - Multi functional LC display
- 5 - Test button "T": to call up the self test: press the button > 1.5 s.  
Up button: Parameter change, to move up in the menu.
- 6 - Reset button "R": to delete stored alarms: press the button > 1.5 s  
Down button: Parameter change, to move down in the menu.
- 7 - "MENU" button: to call up the menu system: press the button > 1.5 seconds.  
Enter button: to confirm parameter change.  
Press the ESC button > 1.5 s to abort an action or to return to the previous menu level.

Wiring diagram



- 1 - Supply voltage  $U_s$  (see ordering information) via fuse
- 2 - Connection of E to the PE conductor
- 3 - Connection of KE to the loads resp. to the monitoring conductor
- 4 - Alarm relay K1: Alarm 1 configurable for ERROR, > R, OL, > U<sub>f</sub>, TEST
- 5 - Alarm relay K2: Alarm 2 configurable for ERROR, > R, OL, > U<sub>f</sub>, TEST
- 6 - Test button "T"
- 7 - Reset button "R"
- 8 - Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.

3.4

## Technical data

### Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV / III
Protective separation (reinforced insulation) between: (A1, A2) - (E, KE) - (11-12-14) - (21-22-24)	
Voltage test acc. to IEC 61010-1: (E, KE) - [(A1-A2), (11-12-14)]	3.32 kV
(E, KE) - (21-22-24)	2.21 kV
(A1 - A2) - (11-12-14) - (21-22-24)	2.21 kV

### Supply voltage

Supply voltage $U_S$	see ordering information
Frequency range $U_S$	see ordering information
Power consumption	$\leq 3.5$ VA

### Measuring circuit

#### Loop resistance $R_m$ :

Measuring range $R_m$	0...100 $\Omega$
Measuring current $I_m$	DC 20 mA
Measuring voltage $U_m$	$\leq$ DC 24 V

#### Extraneous voltage $U_f$ :

Measuring range $U_f$	AC 0...50 V
Rated frequency $f_n$	42...460 Hz
Disconnection of the measuring loop at $U_f$	$\geq 12$ V
Reconnection of the measuring loop	$\leq 10$ V
Permissible extraneous voltage $U_f$	$\leq 440$ V
Permissible extraneous DC voltage, without influence on the measurement	DC 0 V

### Response values

Loop resistance $> R$ (Alarm 1)	0.1...100 $\Omega$
Resolution of setting $R = 0...10$ $\Omega$	0.1 $\Omega$
Resolution of setting $R = 10...100$ $\Omega$	1 $\Omega$

### Preset function:

Loop resistance ( $> R$ ) =	$((R_m + 0.5 \Omega) \times 1.5)^*$
Relative uncertainty 0...1 $\Omega$	$\pm 20\%$ , $\pm 1$ digit
Relative uncertainty 1...100 $\Omega$	$\pm 5\%$ , $\pm 1$ digit
Hysteresis $> R$	1...40% (25%)*
Extraneous voltage $> U$ (Alarm 2)	1...50 V (25 V)*
Resolution of setting $U_f$ 1...50 V	0.5 V
Relative uncertainty $U_f (> U)$ in the range of 50/60 Hz	$\pm 2\%$ , $\pm 1$ digit
Relative uncertainty $U_f (> U)$ in the range of 42...460 Hz	$\pm 10\%$ , $\pm 1$ digit
Hysteresis $> U$	1...40% (5%)*

### Specified time

Start-up delay $t$	0...99 s (0 s)*
Response delay $t_{on1/2}$	0...99 s (0 s)*
Delay on release $t_{off}$	0...99 s (0.5 s)*

### Operating time

in case of open loop connection ( $R > 50$ k $\Omega$ ) $t_{ae}$	$\leq 40$ ms
in case of closed loop connection ( $> R$ ) $t_{ae}$	$\leq 500$ ms
in case of extraneous voltage ( $> U$ ) and overload (OL) $t_{ae}$	$\leq 100$ ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time $t_b$	$\leq 300$ ms
Recovery time $t_b$ after safety shutdown	$\leq 1$ s

### Displays, memory

Display	LC display, multifunctional, not illuminated
Display range, measuring value $R_m$	0...100 $\Omega$
Display range, measuring value $U_f$	AC 0...50 V
Operating uncertainty loop resistance 0...1 $\Omega$	$\pm 20\%$ , $\pm 1$ digit
Operating uncertainty loop resistance 1...100 $\Omega$	$\pm 5\%$ , $\pm 1$ digit
Operating uncertainty, voltage in the range of 50/60 Hz	$\pm 2\%$ , $\pm 1$ digit
Operating uncertainty, in the voltage range 42...460 Hz	$\pm 10\%$ , $\pm 1$ digits
History memory (HiS) for the first alarm value	data record measured values
Password	off / 0...999 (off)*
Fault memory (M) alarm relay	on / off (on)*

### Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation / N/O operation
	K1: Err, $> R$ , OL, $> U$ , $t_{ES}$ (device error, loop resistance, measuring current disconnection: N/O operation n.o.)*
	K2: Err, $> R$ , OL, $> U$ , $t_{ES}$ (overvoltage: N/O operation n.o.)*
Electrical endurance, number of cycles	10000
Contact data acc. to IEC 60947-5-1	
Utilisation category	AC13 AC14 DC-12 DC-12 DC-12
Rated operational voltage	230 V 230 V 24 V 110 V 220 V
Rated operational current	5 A 3 A 1 A 0.2 A 0.1 A
Minimum contact rating	1 mA at AC/DC $\geq 10$ V

### Environment/EMC

EMC	IEC 61326
Operating temperature	-25 °C...+55 °C
Climatic class acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Climatic class acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

### Connection

Connection	push-wire terminals
Connection properties:	
rigid	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible without ferrule	0.2...2.5 mm <sup>2</sup> / AWG 24...14
flexible with ferrule	0.2...1.5 mm <sup>2</sup> / AWG 24...16
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

### Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Software version	D268 V1.0x
Weight	$\leq 150$ g

( )\* = factory setting

<b>Ordering information</b>				
<b>Device type</b>	<b>Measuring range loop resistance</b>	<b>Measuring range interference voltage</b>	<b>Supply voltage <math>U_5</math></b>	<b>Art. No.</b>
GM420-D-1	0...100 $\Omega$	AC 0...50 V	DC 9.6 V...94 V / AC 15...460 Hz, 16...72 V	B 7308 2001
GM420-D-2	0...100 $\Omega$	AC 0...50 V	DC 70...300 V / AC 15...460 Hz, 70...300 V	B 7308 2002
Mounting clip for screw mounting (1 piece per device, accessories)				B 9806 0008

Device version with screw terminals on request

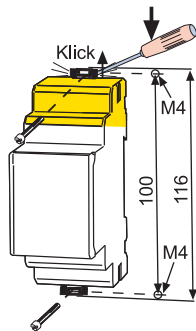
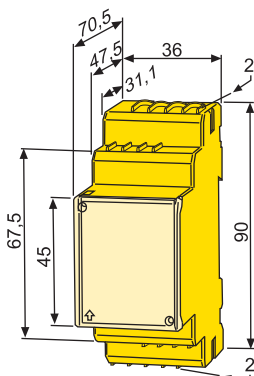
**Dimension diagram XM420**

Dimensions in mm

Open the front plate cover in direction of arrow!

**Screw mounting**

Note: The upper mounting clip must be ordered separately (see ordering information).



**RM475 / RM475LY****RM475LY****Device features**

- RM475 – permanently set response value  
Series resistance 200  $\Omega$   
Cross resistance 1000  $\Omega$
- RM475LY  
Series resistance, adjustable  
50...500  $\Omega$   
Cross resistance 1000  $\Omega$
- Adjustable response delay 1...10 s (RM475LY)
- N/O or N/C operation, selectable
- Fault memory behaviour selectable
- Internal/external test/reset button
- LEDs: Power On, alarm, extraneous voltage
- LED bar graph for series resistance
- 2 potential-free changeover contacts
- Modular DIN rail enclosure

**Product description**

The RM475 series relays in conjunction with a terminating device monitor a closed and voltage-free loop for interruption (series resistance) and for short-circuit (cross resistance). The RM475 version has a continuously set response value for series and cross resistance. The response delay is max. 1 s.

The response value for the series resistance of device version RM475LY can be adjusted between 50...500  $\Omega$ . The response value for the cross resistance for this version is also continuously set. The response delay can be set between 1...10 s.

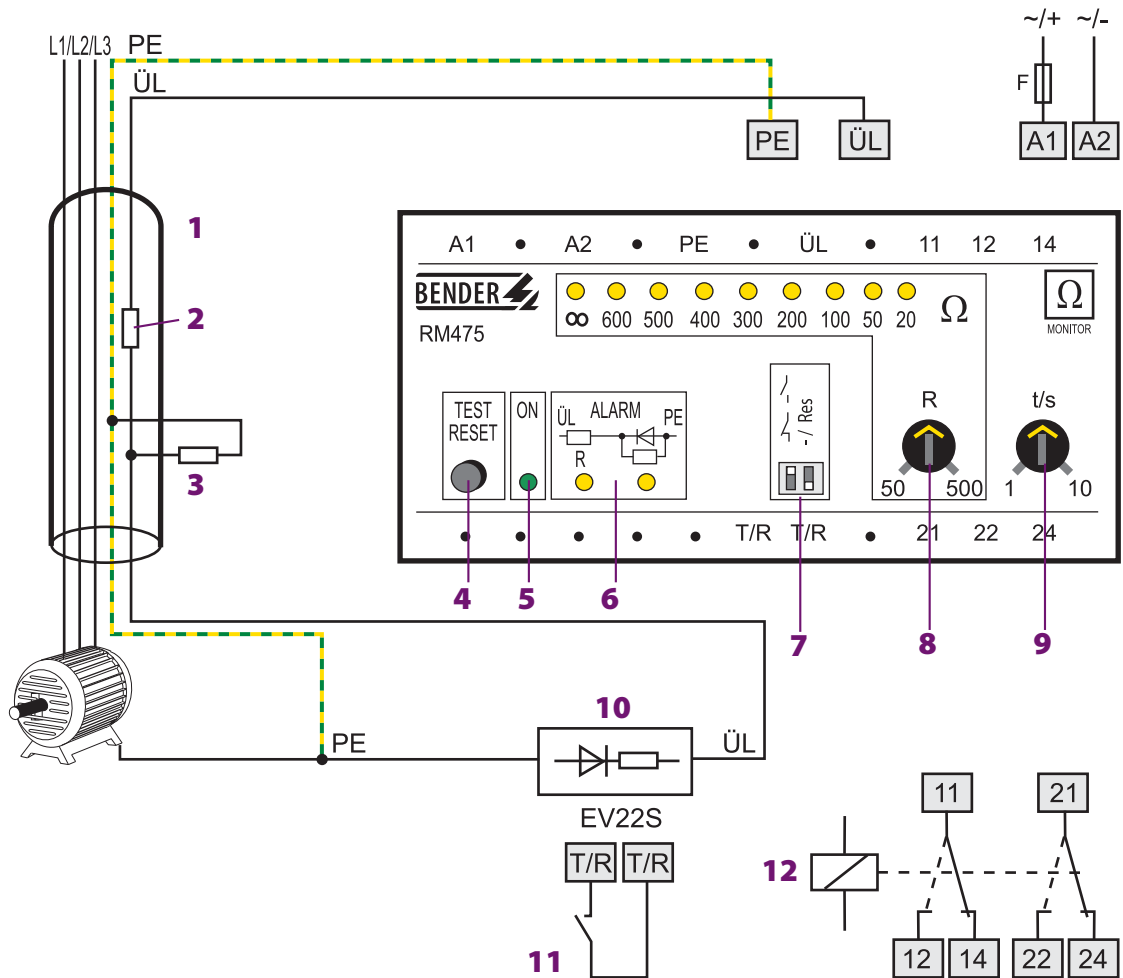
**Application**

- Monitoring of conductors and cables by means of a monitoring conductor
- Monitoring of PE loops

**Function**

The conductor loop to be monitored is connected to the terminals  $\ddot{U}L$  and PE. The end of the conductor loop is bridged by the terminating device (EV22S). A measuring voltage is superimposed on the conductor loop. When the series or cross resistance exceeds the response value, the alarm relay switches and the alarm LEDs light up after the response delay  $t_v$  has elapsed. The alarm LEDs also light when the connection  $\ddot{U}L/PE$  (connection terminating resistor) is open while switching on. If extraneous voltage occurs on the measuring circuit, e.g. in the case of an open circuit, e.g. (PE interrupted) the alarm LED lights as well and the alarm relay switches.

Wiring diagram



- 1 - Conductor
- 2 - Series resistance
- 3 - Cross resistance
- 4 - Test and reset button "TEST/RESET"
- 5 - LED Power On
- 6 - Alarm LEDs: light when series or cross resistance errors occur and flashes in case of extraneous voltage
- 7 - DIP switch for setting the operating principle
  - N/C or N/O operation
  - Fault memory behaviour ON/OFF
- 8 - Adjustable response value: series resistance "R" 50...500 Ω (RM475LY only)
- 9 - Adjustable time delay 1...10 s (RM475LY only)
- 10 - Terminating device
- 11 - External test and reset button "T/R"
- 12 - Alarm relay:
  - N/C operation
  - - - N/O operation
- F - Short-circuit protection supply voltage 6 A fuse is recommended

## Technical data

### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse withstand voltage/pollution degree	4 kV/3

### Supply voltage

Supply voltage $U_S$	see ordering information
Operating range $U_S$	0.85...1.1 x $U_S$
Power consumption	≤ 3 VA

### Measuring circuit

#### RM475

Response value, series resistance	200 Ω
Response value, cross resistance	1000 Ω
Response time $t_{an}$	< 1 s

#### RM475LY

Response value, series resistance	50...500 Ω (200 Ω)*
Response value, cross resistance	1000 Ω
Response time $t_V$	1...10 s
Max. extraneous voltage measuring circuit	≤ AC 30 V
Terminating resistor conductor loop EV22S	AC 500 V 1 s

### Switching elements

Number of changeover contacts	1 x 2
Operating principle	N/C operation / N/O operation (N/C operation)*
Fault memory behaviour selectable	ON/OFF
Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi 0.4 0.2 A, DC 220 V, L/R = 0.04 s

### Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-10...+55 °C
Ambient temperature (storage)	-40...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

### Other

Operating mode	continuous operation
Mounting	any position
Connection type	modular terminals
Connection properties	
single wire	0.2...4 mm <sup>2</sup>
flexible	0.25...2.5 mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Screw mounting	2 x M4
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Operating manual	BP702001
Weight	≤ 400 g

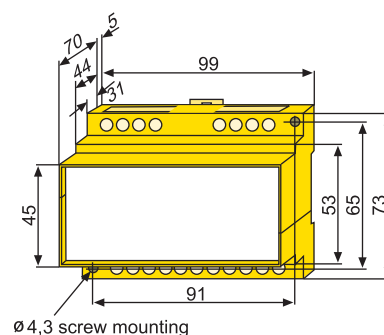
( ) \* factory setting

## Ordering information

Type	Supply voltage $U_S$	Art. No.
RM475	AC 50...60 Hz 230 V	B 9702 2001
RM475-13	AC 90...132 V 50...60 Hz	B 9702 2002
RM475-15	AC 50...60 Hz 400 V	B 9702 2003
RM475-16	AC 50...60 Hz 500 V	B 9702 2004
RM475-21	DC 9.8...84 V	B 9702 2005
RM475-23	DC 77...286 V	B 9702 2006
RM475LY	AC 50...60 Hz 230 V	B 9702 2007
RM475LY-13	AC 90...132 V 50...60 Hz	B 9702 2008
RM475LY-15	AC 50...60 Hz 400 V	B 9702 2009
RM475LY-16	AC 50...60 Hz 500 V	B 9702 2010
RM475LY-21	DC 9.8...84 V	B 9702 2011
RM475LY-23	DC 77...286 V	B 9702 2012
EV22S	Terminating resistor	B 984 800

## Dimension diagram

Dimensions in mm





# SB146


**SB146**
**Device features:**

- Voltage monitoring of 6 secondary circuits of welding transformers
- Alarm LEDs for fault voltage per channel, PE/KE interruption of the measuring line
- Connection monitoring of measuring line and earth connection
- Fault memory
- Reset button
- 1 potential-free changeover contact
- 45 mm enclosure

**Product description**

The relays of the SB146 series monitor the secondary circuits of welding transformers for fault voltages. A total of six secondary circuits can be monitored.

**Function**

Both measuring connections (z.B. E1/E2) are connected to different points on the same secondary circuit. Also the two earth connection terminals are connected to the PE conductor (PE) at different points. If the measured fault voltage value exceeds the response value, the alarm LED of the respective measuring circuit lights up and the alarm relay switches.

The alarm relay works in N/C operation so that in the event of supply voltage failure a message is ensured.

When the fault (touch voltage) has been eliminated, the alarm relay switches back to its original state and the alarm LED goes out after pressing the reset button.

To ensure a safe condition, the connecting leads to the welding circuits being monitored and the connecting leads to earth are continuously monitored. If one or several measurement or earth connections are interrupted, the alarm relay switches.

In addition, the alarm LED ON (interruption earth connection) and/or-the alarm LED of the respective channel flashes.

The device function can be tested by pressing the test button.

**Alarm messages**

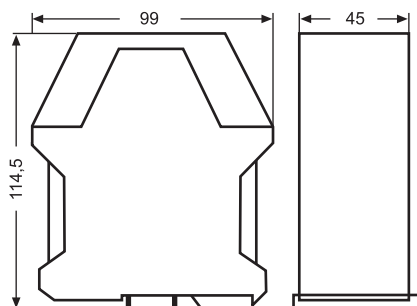
Condition				Messages		
$U_S$	$U_F >$	Connection system	Connection PE	LED "ON"	LED "E...K"	Relay
on		ok	ok	×		on
on		open	ok	×	flashes	de-energised
on	×	ok	ok	×	on	de-energised
on		ok	open	flashes		de-energised
off						de-energised

**Ordering information**

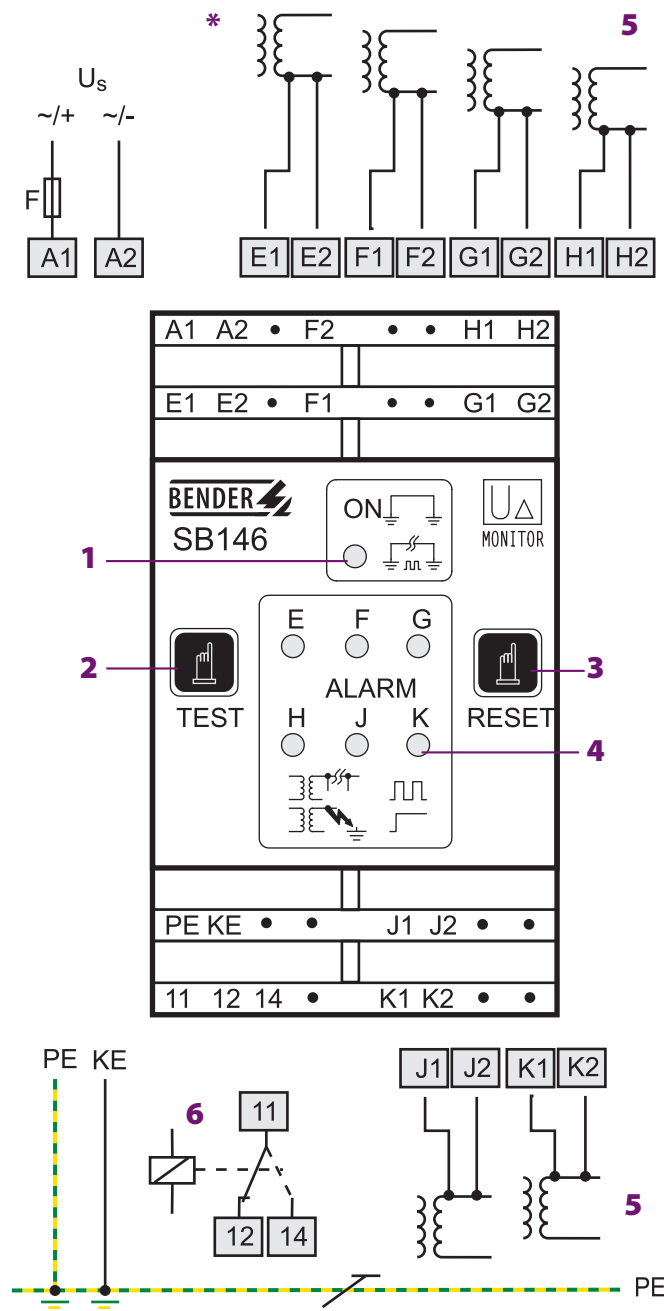
Type	Supply voltage $U_S$	Art. No.
SB146-34	AC 10...65 V, DC 10...90 V	B 9308 3017
SB146-35	AC 65...276 V, DC 90...308 V	B 9308 3018

**Dimension diagram**

Dimensions in mm



Wiring diagram



- 1 - LED Power On  
– lights during operating mode  
– flashes in case of interruption of the connection PE/KE
- 2 - Test button "TEST"
- 3 - Reset button "RESET"
- 4 - Alarm LEDs "E", "F", "G", "H", "J" and "K"  
– light in the event of fault voltage  
– flash in the event of a connection fault monitoring
- 5 - Welding transformers being monitored
- 6 - Alarm relay in N/C operation  
(dotted: without fault voltage)
- F - 6 A fuse recommended
- \* - Unassigned inputs have to be bridged individually

Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	6 kV/3

Supply voltage

Supply voltage $U_s$	see ordering information
Power consumption	$\leq 3$ VA

Measuring circuit

Nominal system voltage $U_n$	600 V
Nominal voltage range	0...1.15 x $U_n$
Response value	
$U_f$ for sinusoidal voltages	AC 50...1000 Hz 21.6...24 V
$U_f$ for DC voltages	DC 19...24 V
Response time $t_{an}$ at $1.1 \times U_{fmax}$	$\leq 100$ ms
Response time for coupling monitoring	$\leq 5$ s
Recovery time $t_b$	$\leq 500$ ms

Switching elements

Number of changeover contacts	1 x 1
Operating principle	N/C operation

Fault memory behaviour

Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \phi 0.4$ 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-10...+55 °C
Ambient temperature, during storage	-45...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

Other

Operating mode	continuous operation
Mounting	any position
Connection type	modular terminals
Connection properties single wire / flexible	0.14...2.5 mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Screw mounting	no
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	DIN VDE 0545-1
Operating manual	BP308008
Weight	$\leq 210$ g

# SB471 / SB473 / SB476


**SB476**

### Device features

- Voltage monitoring of 1, 3 or 6 secondary circuits
- Messages of several SB47x devices are combined to one common alarm
- Alarm LEDs for fault voltage per channel, PE/KE interruption interruption of the measuring lead
- Connection monitoring of measuring lead and earth connection
- Fault memory
- Reset button
- 1 potential-free changeover contact (SB476)
- 2 potential-free changeover contacts (SB471, SB473)
- Modular DIN rail enclosure

### Approvals and certifications



### Product description

The relays of the SB47x series monitor the secondary circuits of welding transformers for fault voltages. A total of six secondary circuits can be monitored. The versions SB473 and SB476 can be linked for common alarm messages.

### Application

- Monitoring of welding equipment

### Function

Both measuring connections (z.B. E1/E2) are connected to different points on the same secondary circuit. Also the two earth connection terminals are connected to the PE conductor (PE) at different points. If the measured fault voltage value exceeds the response value, the alarm LED of the respective measuring circuit lights up and the alarm relay switches.

The alarm relay is in N/C operation so that in the event of supply voltage failure a message is ensured.

When the fault (touch voltage) has been eliminated, the alarm relay switches back to its original state and the alarm LED goes out after pressing the reset button.

To ensure a safe condition, the connecting wires to the welding circuits being monitored and the connecting wires to earth are continuously monitored. If one or several measurement or earth connections are interrupted, the alarm relay switches.

In addition, the alarm LED ON (interruption earth connection) and/or the alarm LED of the respective channel flashes.

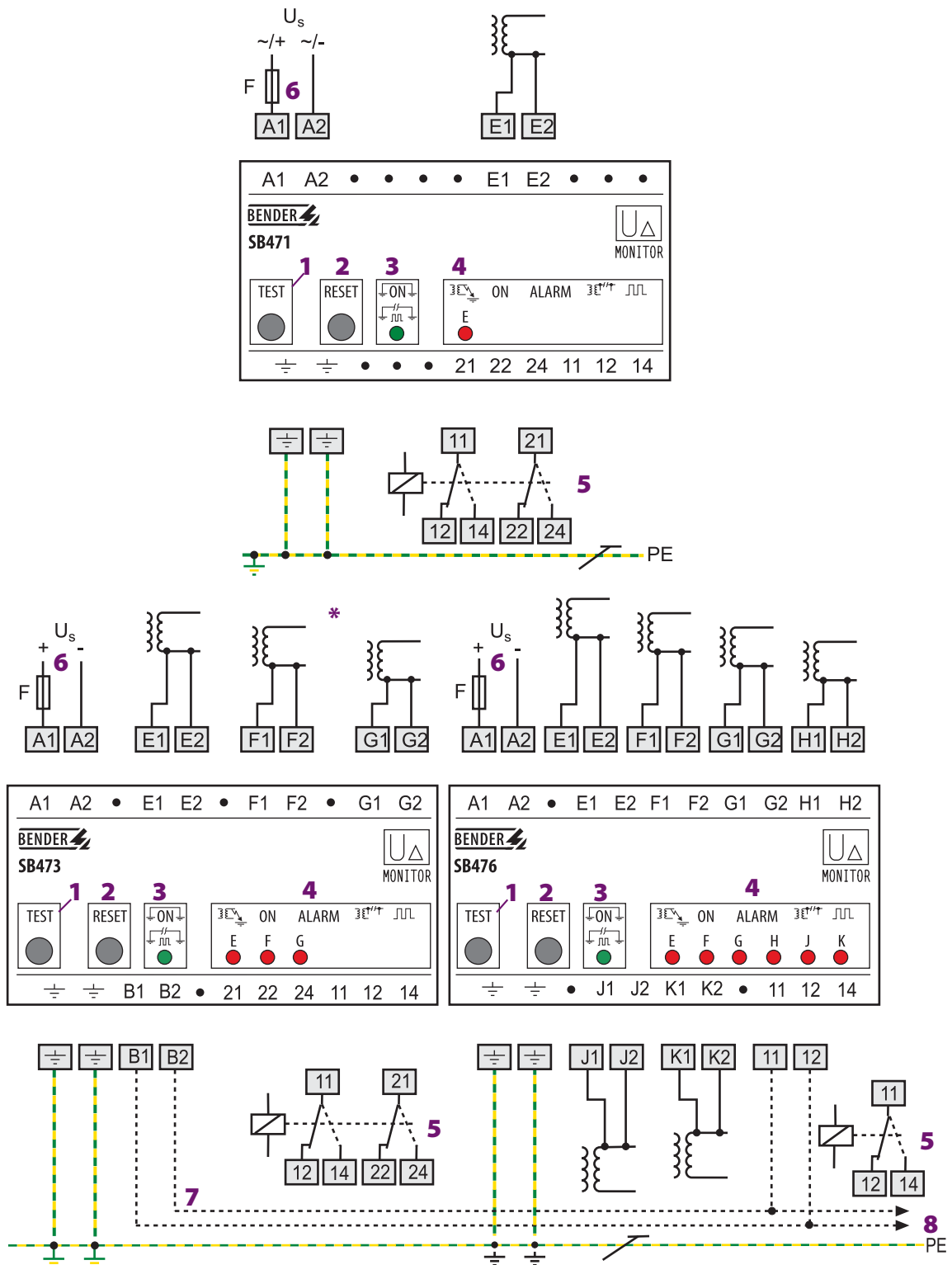
The device function can be tested by pressing the test button.

If the SB476 is used in combination with SB473, the SB473 will output a common alarm for all of the three welding circuits as well as for all connected SB476. The cable length must not exceed 50 m.

### Alarm messages

Condition				Messages		
$U_s$	$U_f >$	Connection system	Connection PE	LED "ON"	LED "E...K"	Relay
on		ok	ok	×		on
on		open	ok	×	flashes	de-energised
on	×	ok	ok	×	on	de-energised
on		ok	open	flashes		de-energised
off						de-energised

Wiring diagram



- 1 - Test button "TEST"
- 2 - Reset button "RESET"
- 3 - LED Power On flashes in the event of connection interruption
- 4 - One Alarm LED per measuring circuit
- 5 - Alarm relay in N/C operation Contact position in operating mode is marked by dotted lines. (without fault voltage)
- 6 -  $U_s$  6 A fuse
- 7 - Connection possibility for one or several SB476. In this case, the SB473 will output a common alarm message
- 8 - Additional SB476 devices (max. cable length 50 m)
- F - 6 A fuse is recommended
- \* - Unassigned inputs have to be bridged individually

## Technical data

### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 500 V
Rated impulse voltage/pollution degree	
SB471 / SB473	6 kV/3
SB476	4 kV/3

### Supply voltage

Supply voltage $U_S$	see ordering information
Power consumption	$\leq 3$ VA

### Measuring circuit

Number of welding transformers SB471	1
Number of welding transformers SB473	3
Number of welding transformers SB476	6
Response value	
$U_F$ for sinusoidal voltages	AC 50...1000 Hz 21.6...24 V
$U_F$ for DC voltages	DC 19...24 V
Response time $t_{an}$ at $1.1 \times U_{Fmax}$	$\leq 100$ ms
Response time for coupling monitoring	$\leq 5$ s
Recovery time $t_b$	$\leq 500$ ms

### Switching elements

Number of switching elements	1 x 2 (471/473), 1 x 1 (476)
Operating principle	N/C operation

### Fault memory behaviour

Electrical endurance, number of cycles	12000
Contact class	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, $\cos \phi$ 0.4 0.2 A, DC 220 V, L/R = 0.04 s

### Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-10...+55 °C
Ambient temperature, during storage	-45...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

### Other

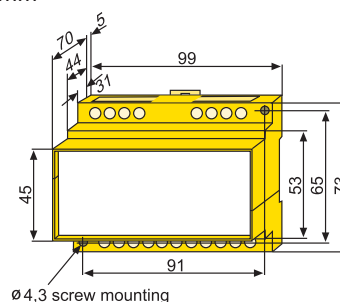
Operating mode	continuous operation
Mounting	any position
Connection type	modular terminals
Connection properties	
single wire	0.2...4 mm <sup>2</sup>
flexible with end ferrules with end ferrules	0.25...2.5 mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Screw mounting	2 x M4
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Product standard	DIN VDE 0545-1
Operating manual	BP308001
Weight	$\leq 360$ g

## Ordering information

Type	Supply voltage $U_S$	Art. No.
SB471-34	AC 10...65 V, DC 10...90 V	B 9308 3006
SB471-35	AC 65...276 V, DC 90...308 V	B 9308 3007
SB473-34	AC 10...65 V, DC 10...90 V	B 9308 3001
SB473-35	AC 65...276 V, DC 90...308 V	B 9308 3003
SB476-34	AC 10...65 V, DC 10...90 V	B 9308 3002
SB476-35	AC 65...276 V, DC 90...308 V	B 9308 3004

## Dimension diagram

Dimensions in mm







SP100

**Product description**

The energy backup of the SP100 series is a supplementary device for measuring and monitoring relays featuring a time function, if these are operated without external supply voltage. It provides the electronics of the connected monitoring relay with the necessary energy, to cover the duration of the maximum time delay after power supply failure.

**Function**

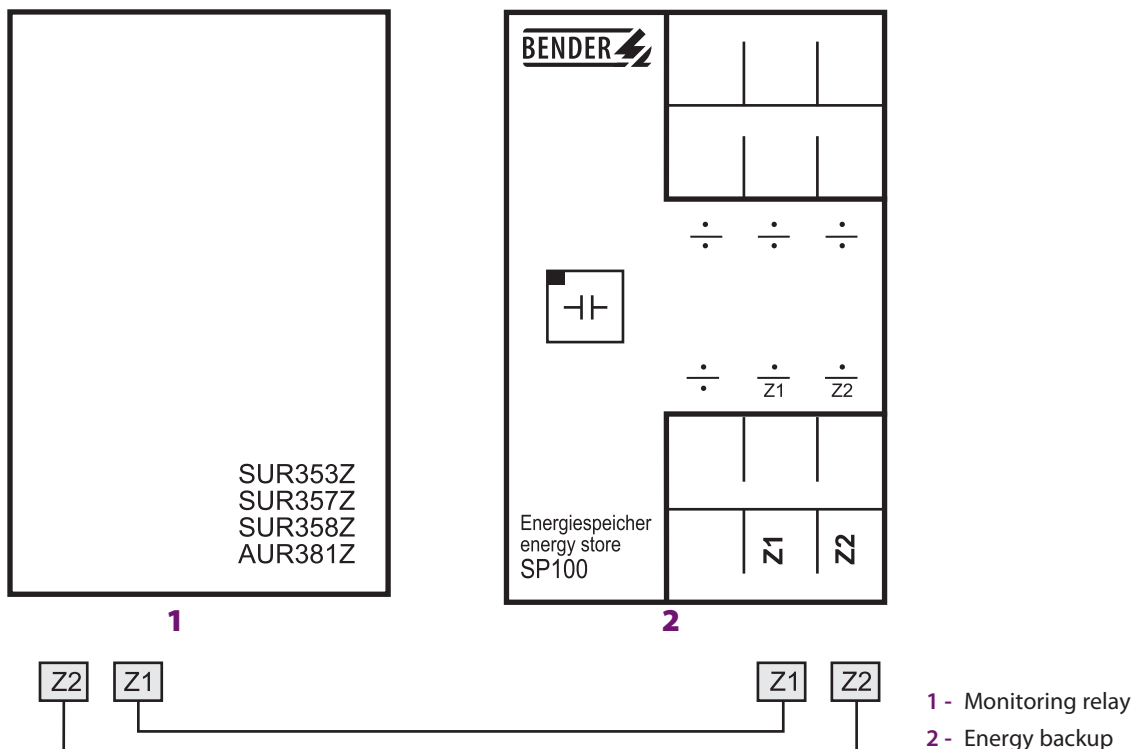
After commissioning of the measuring and monitoring relay, the capacitor of the SP100 is charged from the connected relay. If the supply voltage of the measuring and monitoring relay or the system being monitored fails, the SP100 supplies the respective devices with energy so that the set response delay of the relay will be effective.

**Device features**

- Energy backup for measuring and monitoring relays of the SUR353Z, SUR357Z, SUR358Z, AUR381Z series
- 45 mm enclosure

3.4

**Wiring diagram**



**Technical data**

**Insulation coordination acc. to IEC 60664-1**

Rated insulation voltage	DC 50 V
Rated impulse voltage/pollution degree	1.5 kV/3

**Output Z1/Z2**

Supply voltage	DC 27 V
Storage capacity to supply the measuring and monitoring relays below	< 5 s
Recovery time	< 30 s
Internal fuse, triggered in case of incorrect connection	0.05 A slow fuse

**Environment/EMC**

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10...150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g / 10...150 Hz
Ambient temperature, during operation	-10...+50 °C
Ambient temperature, during storage	-40...+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

**Other**

Operating mode	continuous operation
Mounting	any position
Connection	flat terminals with self-lifting clamp washers
Connection properties	
single wire	2 x (1...1.5) mm <sup>2</sup>
flexible with end ferrule	2 x (0.75...1.5) mm <sup>2</sup>
Degree of protection, internal components (IEC 60529)	IP50
Degree of protection terminals (IEC 60529)/with terminal covers	IP10/IP20
Screw mounting	with mounting rail
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Operating manual	BP309001
Weight	≤ 290 g

**Ordering information**

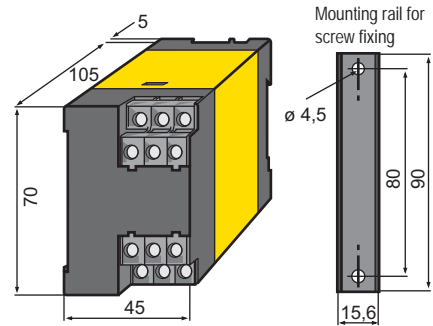
Type	Art. No.
SP100	B 935 700

**Accessories**

Mounting rail for screw mounting	B 974 728
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**Dimension diagram**

Dimensions in mm







## Technical aspects – Application of electronic measuring and monitoring relays

Technical processes in automation and systems engineering are getting more and more complex. This also applies to power generation and distribution. That's exactly why the significance of reliable electronic monitoring and control of machines and electrical installations is growing steadily.

Bender measuring and monitoring relays indicate a sudden reduction or increase of the current or system voltage below or above the permissible value and prevent damage to electrical installations. The frequency, asymmetry and phase sequence in three and four wire systems can also be monitored. In addition, devices for special monitoring tasks, such as fault voltage monitoring, loop monitoring and earth fault monitoring in medium and high-voltage systems are available.

### Voltage monitoring, phase monitoring

Multi-functional voltage relays, asymmetry relays and phase sequence relays are available for parameter monitoring in main and auxiliary circuit. This provides you with the necessary information sufficiently well in advance to detect operational problems early on. This means that the appropriate actions can be taken before far more significant damage can occur.



Examples of application		
Measured quantity	Possible cause of faults	Possible effects
Undervoltage	Voltage fluctuations Blowing of fuses Open circuit	Failure and destruction of motors due to overheating Undesirable resetting of a device, Undefined switching states and conditions in the electrical installation, Accidental start-up
Overvoltage	Voltage fluctuations	Damaged installation parts due to overvoltage , Accidental start-up of a device/system
Phase sequence	Reversed conductors, Defective extension cordes	Wrong rotational direction of a motor, destruction of roller drives, hazards to persons and machines when using mobile devices and systems
Phase failure	Blowing of fuse(s)/control voltage failure Open circuit	Overheating of motors due to single-phase operation
Phase asymmetry	Asymmetrical distribution of the load Phase failure with reverse fed voltage	Overheating of motors due to asymmetrical voltage Failure of system parts



**Current monitoring**

Current relays are mainly used for load current monitoring of motors and other electric loads. Current relays also provides you with the necessary information sufficiently well in advance to detect operational problems early on. This means that the appropriate actions can be taken before far more significant damage can occur.

**Special monitoring tasks**

Fault voltage relays are intended to be used as a protective measure for welding systems. The relays monitor the secondary windings of welding transformers in accordance with EN 50063: 1989 “Safety requirements for the construction and the installation of equipment for resistance welding and allied processes”.

Earth fault relays are used for monitoring medium and high voltage systems for resistive, single-pole earth faults. The devices are connected to auxiliary windings in open delta connection of standard earth voltage transformers using  $U_n$  100 V or 110 V.

Loop monitors are designed to monitor conductor loops for interruptions and short-circuits, for example, supply leads of mobile machines and devices.

Examples of application	
Measured variable	Application
Current monitoring	Power consumption of motors, e.g. in cranes, pumps, elevators Monitoring of lighting systems, heating circuits, charging stations Overload control of hoisting gear and means of transportation Monitoring of locking devices, driving onto terminal racks Monitoring of emergency lighting Monitoring of navigation lighting on high-rise building Monitoring of screw conveyors, for example, in sewage plants, in case of blocking of conveyor systems Dust removal in wood working Monitoring of small currents, for example, low-power motors, indicator lamps

## Applied product standards and guidelines

Device family	International (IEC)	European (EN)	National standards (DIN VDE / DIN EN)	Others
Insulation monitoring devices and coupling devices (A-ISOMETER® and AKG)	IEC 61557-8: 2007-05	EN 61557-8: 2007	DIN EN 61557-8 (VDE 0413-8): 2007-12	ASTM F1207M-96 (2007) (for AC) ASTM F1669M-96 (2007) (for AC, AC / DC, DC) ASTM F1134-94 (2007) (for offline monitor)
	<b>E</b> IEC 61326-1: 2005-12 <b>M</b> <b>C</b> IEC 61326-2-4: 2006-06	EN 61326-1: 2006	DIN EN 61326-1 (VDE 0843-20-1): 2006-10	
Insulation fault location systems (EDS)	IEC 61557-9: 2009-01	EN 61557-9: 2009	DIN EN 61557-9 (VDE 0413-9): 2009-11	
	<b>E</b> IEC 61326-1: 2005-12 <b>M</b> <b>C</b> IEC 61326-2-4: 2006-06	EN 61326-1: 2006 EN 61326-2-4: 2006	DIN EN 61326-1 (VDE 0843-20-1): 2006-10 DIN EN 61326-2-4 (VDE 0843-20-2-4): 2007-05	
Residual current monitors and residual current monitoring systems (RCM, RCMS, RCMA)	IEC 62020: 2003-11 and according to IEC 60947-2: 2009-05	EN 62020: 1998 and EN 62020 / A1: 2005 EN 60947-2: 2006	DIN EN 62020 (VDE0663): 2005-11 DIN EN 60947-2 (VDE 0660-101): 2010-04	
Measuring and monitoring relays	IEC 61010-1: 2010-06	EN 61010-1: 2010	DIN EN 61010-1 (VDE 0411-1): 2009-06	
	<b>EMC</b> IEC 61326-1: 2005-12	EN 61326-1: 2006	DIN EN 61326-1 (VDE 0843-20-1): 2006-10	
Power supply units, energy backup, communication modules (FTCs) and the like, alarm indicator and test combinations (MK), operator and indicator panels	IEC 61010-1: 2010-06	EN 61010-1: 2010	DIN EN 61010-1 (VDE 0411-1): 2009-06	
	<b>E</b> IEC 61326-1: 2005-12 <b>M</b> <b>C</b>	EN 61326-1: 2006	DIN EN 61326-1 (VDE 0843-20-1): 2006-10	
<b>Pertains to all devices</b>				
Insulation coordination	IEC 60664-1: 2007-04	EN 60664-1: 2007	DIN EN 60664-1 (VDE0110-1): 2008-01	
	IEC 60664-3: 2003-02	EN 60664-3: 2003	DIN EN 60664-3 (VDE0110-3): 2010-10	
Classification of climatic conditions	IEC 60721-3-1: 1997-02	EN 60721-3-1: 1997		
	IEC 60721-3-2: 1997-03	EN 60721-3-2: 1997		
	IEC 60721-3-3: 2002-10	EN 60721-3-3: 1995		
	IEC 60721-3-3 Corrig. 1: 2008-06	and EN 60721-3-3 / A2: 1997		
Classification of mechanical conditions	IEC 60721-3-1: 1997-02	EN 60721-3-1: 1997		
	IEC 60721-3-2: 1997-03	EN 60721-3-2: 1997		
	IEC 60721-3-3: 2002-10	EN 60721-3-3: 1995		
		and EN 60721-3-3 / A2: 1997		
Classification of degrees of protection	IEC 60529: 2001-02	EN 60529: 1991 and EN 60529 / A1: 2000	DIN EN 60529 (VDE 0470-1): 2000-09	

The standard edition provided are current up to the time of publishing this catalogue.

## Service and project planning

### Service & Support

Planning & Concept	Selection of Devices & Project Scheduling	Commissioning	Operation & Maintenance	Expansion & Modernization
<p><b>From support to customized solutions</b></p> <ul style="list-style-type: none"> <li>• Detailed as-is analysis</li> <li>• Technical support for products and systems</li> <li>• Application assistance</li> <li>• Seminars, training and presentations</li> </ul>	<p><b>From the selection of the device to project scheduling</b></p> <ul style="list-style-type: none"> <li>• Selection of the appropriate components and systems</li> <li>• Working out a detailed solution</li> <li>• Assistance in tender invitations and project awarding</li> </ul>	<p><b>From installation to final inspection</b></p> <ul style="list-style-type: none"> <li>• Installation check</li> <li>• Parameter settings and adjustments</li> <li>• Test run and final inspection</li> <li>• Operator instruction/ training</li> </ul>	<p><b>From maintenance to repair</b></p> <ul style="list-style-type: none"> <li>• Repairs / troubleshooting</li> <li>• Maintenance, repairs, spare parts</li> <li>• Maintenance / repair works</li> </ul>	<p><b>From expansion to modernization</b></p> <ul style="list-style-type: none"> <li>• Technical advice on the improvement and modernization</li> <li>• Planning and implementation of retrofitting</li> <li>• Optimization of installations and installation sections</li> </ul>

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- Optimum assistance facilitates implementation
- High plant availability and productivity

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**Dipl.-Ing. W. Bender GmbH & Co. KG**  
P.O. Box 1161 • 35301 Grünberg • Germany  
Londorfer Straße 65 • 35305 Grünberg • Germany  
Tel.: +49 6401 807-0 • Fax: +49 6401 807-259  
E-Mail: [info@bender-de.com](mailto:info@bender-de.com) • [www.bender-de.com](http://www.bender-de.com)

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