

## LINETRAXX® VMD421H

Multi-functional voltage relay for 3(N)AC systems,  
frequency/overvoltage/undervoltage, phase, phase failure, asymmetry



# LINETRAXX® VMD421H

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



LINETRAXX® 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+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



## 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
- 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<sub>on1/2</sub>" 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<sub>off</sub>" begins. When "t<sub>off</sub>" 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

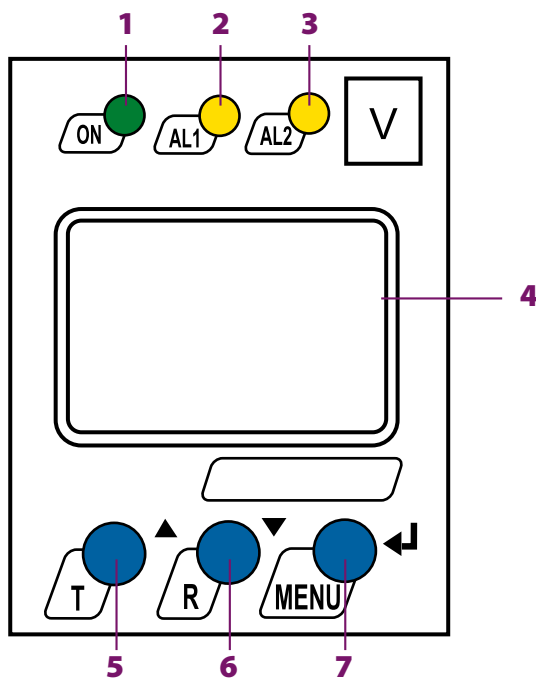
Also in the event of complete power failure of the system being monitored, the delay times are effective during the energy backup time. When the fault memory is set to continuous mode, the alarm parameters remain stored, even on failure of the supply voltage.

## 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.

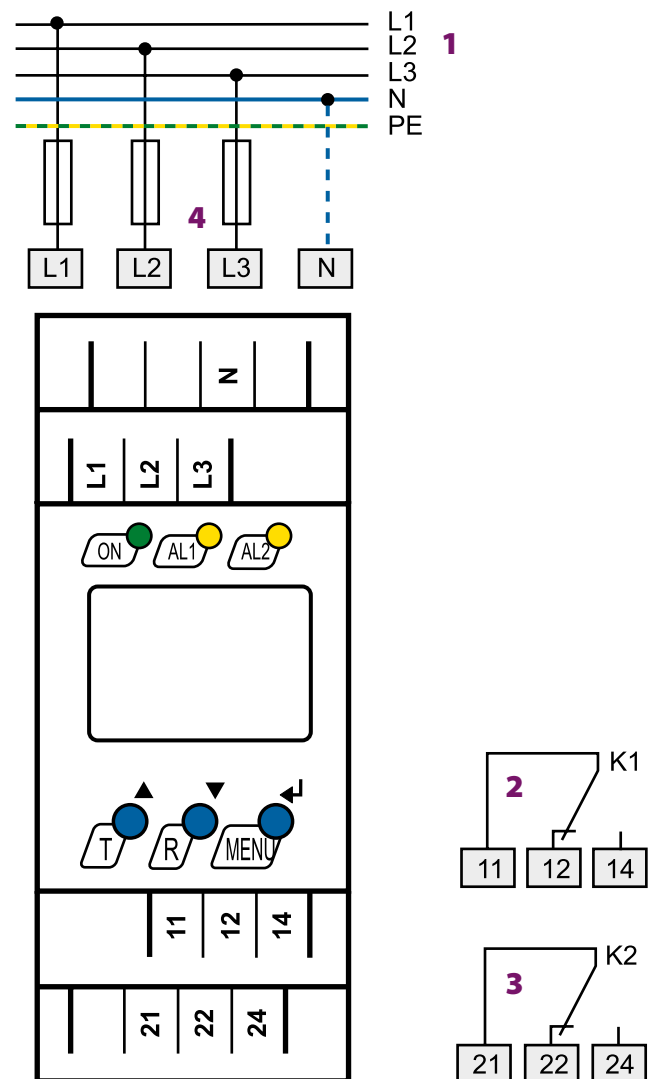


**Operating elements**



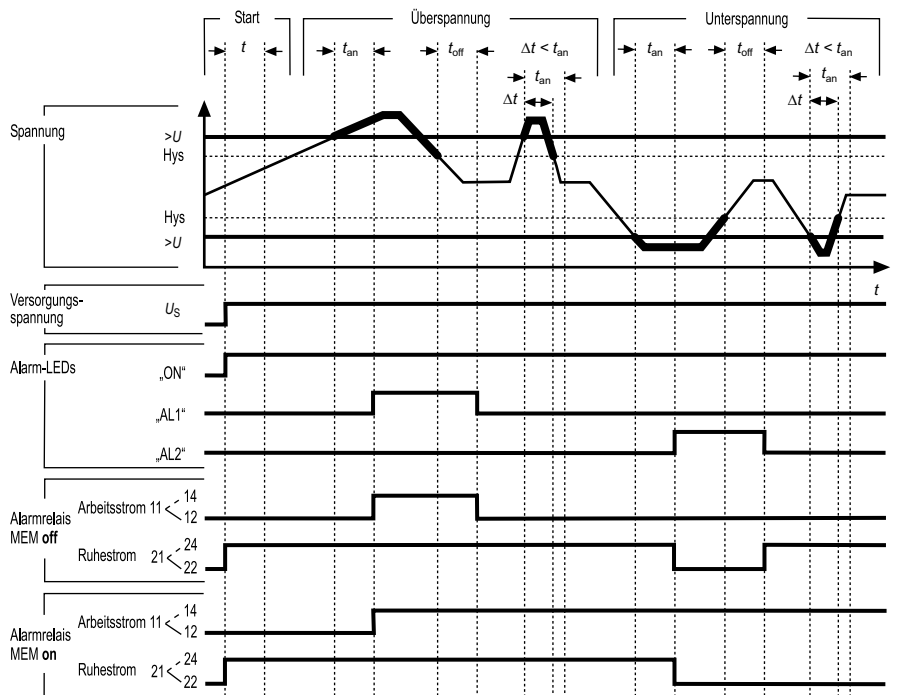
- 1 - Power On LED "ON" (green), lights when the supply voltage is applied or flashes in the event of system fault alarm
- 2 - Alarm LED "AL1" (yellow), lights when the set response value  $>U/<f/>f/Asy/PHS$  is exceeded and flashes in the event of system fault alarm
- 3 - Alarm LED "AL2" (yellow), lights when value falls below the set response value  $>U/<f/>f/Asy/PHS$  and flashes in the event of system fault alarm
- 4 - Multi-functional LC display
- 5 - Test button "T":  
Arrow 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":  
Arrow down button: to change the measured value indication, move downwards in the menu or to change parameters  
To delete stored alarms: press the button "T"  $>1.5$  s
- 7 - "MENU" button:  
Enter button: to confirm the measured value indication or to confirm changed parameters press the button "T"  $>1.5$  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 to be monitored
- 2 - Alarm relay "K1":  
Configurable for  $<U/>U/<f/>f/Asy/PHS/ERROR$
- 3 - Alarm relay "K2":  
Configurable for  $<U/>U/<f/>f/Asy/PHS/ERROR$
- 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.

### Timing diagram voltage monitoring

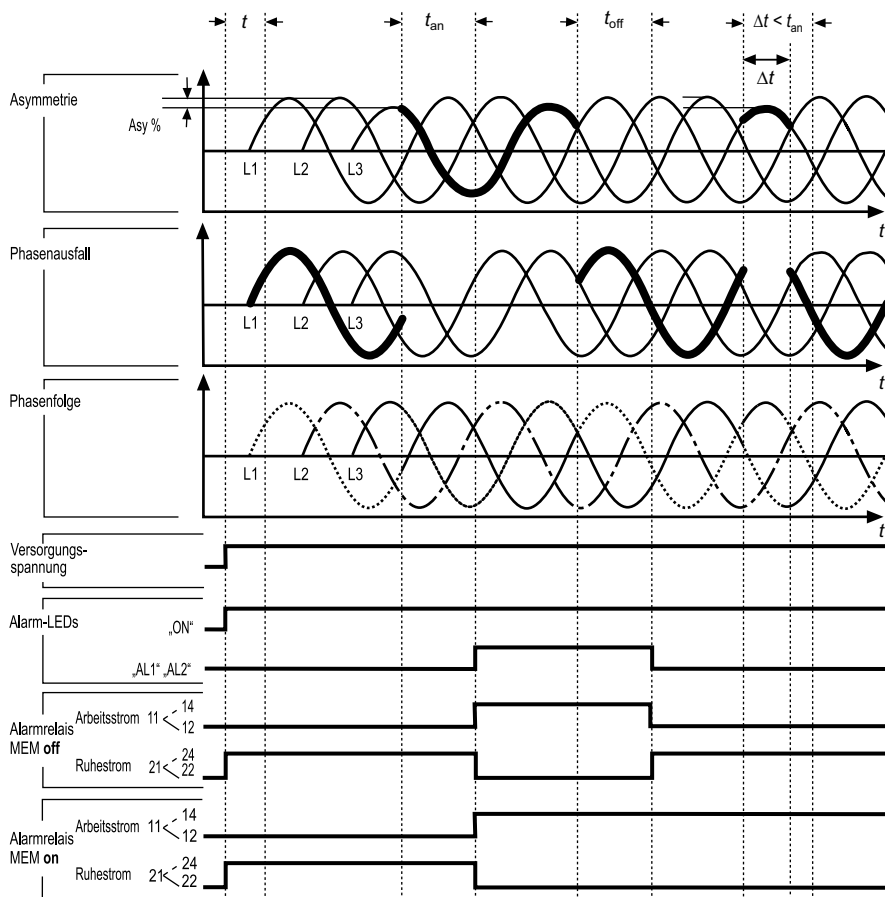


$t$  - Start-up delay

$t_{an}$  - Response time

$t_{off}$  - Delay on release

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



$t$  - Start-up delay

$t_{an}$  - Response time

$t_{off}$  - Delay on release

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

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	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	≤ 6 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/3AC (3AC)*
Undervoltage < $U$ (Alarm 2) (measurement method: 3Ph/3n)	AC 70...500/70...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 3AC measurement:	
Undervoltage < $U$ ( $0.85 U_n$ )* for $U_n = 400/208$ V	340/177 V
Overvoltage > $U$ ( $1.1 U_n$ )* for $U_n = 400/208$ V	440/229 V
Preset function for 3(N)AC measurement:	
Undervoltage < $U$ ( $0.85 U_n$ )* for $U_n = 230/120$ V	196/102 V
Overvoltage > $U$ ( $1.1 U_n$ )* for $U_n = 230/120$ V	253/132 V
Asymmetry	5...30 % (30 %)*
Phase failure	by setting the asymmetry
Phase sequence	clockwise/anticlockwise rotation (off)*
Relative uncertainty, voltage at 50/60 Hz	± 1.5 %, ± 2 digits
Relative uncertainty voltage in the 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
By preset function :	
Underfrequency for $f_n = 400/60/50/16.7$ Hz	399/59.5/49.5/16.2 Hz
Overfrequency for $f_n = 400/60/50/16.7$ Hz	401/60.5/50.5/17.2 Hz
Hysteresis frequency Hys Hz	0.2...2 Hz (0.2 Hz)*
Relative uncertainty, frequency in the range of 15...460 Hz	± 0.2 %, ± 1 digit

**Time response**

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)*
Operating time, voltage $t_{ae}$	≤ 140 ms
Operating time, frequency $t_{ae}$	≤ 335 ms
Response time $t_{an}$	$t_{an} = t_{ae} + t_{on1/2}$
Discharging time energy backup on power failure	2.5 s
Charging time energy storage	60 s
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 50/60 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)*
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 (undervoltage < U, asymmetry Asy, N/C operation n.c.)*				
	K1: Err, < U, > U, Asy, < Hz, > Hz, PHS (overvoltage > U, asymmetry Asy, N/O operation n.o.)*				
Electrical endurance, number of cycles	10000				
Fault memory	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 ≥ 10 V				

**Environment/EMC**

EMC	IEC 61326-1
Operating temperature	-25...+55 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term 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	0.75...2.5 mm <sup>2</sup> (AWG 19...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)	IP30
Enclosure material	polycarbonate
Screw mounting	2 x M4 with mounting clip
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00138
Weight	≤ 240 g

( )\* = factory setting

## Ordering information

Nominal system voltage <sup>1)</sup> U <sub>n</sub>	Type	Art. No.
3(N)AC	VMD421H-D-3	B 7301 0007
70...500 V, 15...460 Hz		

Device version with screw terminals on request.

<sup>1)</sup> Absolute values

## Accessories

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

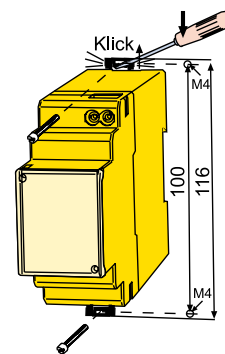
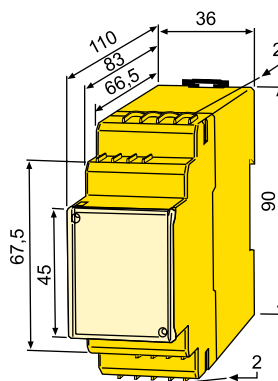
## Dimension diagram XM421

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).



### Bender GmbH & Co. KG

P.O. Box 1161 • 35301 Gruenberg • Germany  
 Londorfer Strasse 65 • 35305 Gruenberg • Germany  
 Tel.: +49 6401 807-0 • Fax: +49 6401 807-259  
 E-Mail: info@bender.de • www.bender.de



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