**VMD420**

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

**Device features**
- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 0…500 V
- Asymmetry, phase failure and phase sequence monitoring
- Different monitoring functions selectable < U, > U or < U/> U, < f, > f or < 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 assignment of basic parameters)
- Power On LED, Alarm LEDs: Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (gold-plated relay contacts), 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)
- Indication of the system frequency
- RoHS-compliant

**Product description**
The multi-functional voltage relays of the VMD420 series are 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 leading to the activation of the alarm relays will be stored. Due to adjustable response times, installation-specific characteristics, such as device-specific start-up procedures, short-time voltage fluctuations, etc. can be considered. Device version VMD420 requires an external supply voltage.

**Typical applications**
- Monitoring of voltage-sensitive machines and electrical installations
- Switching on and switching 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
- Transformer protection, asymmetrical load can be recognized

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

The devices provide 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 “ton 1/2” begins.

When the response delay has elapsed, the alarm relays switch and the alarm LEDs light. If the measuring value exceeds or falls below the release value (response value plus hysteresis) after the alarm relays have switched, the selected release delay “toff” begins. When “toff” has elapsed, the alarm relays switch back to their initial position. If the fault memory is activated, the alarm relays remain in alarm state until the reset button R is pressed. If 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 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 key is pressed, a nominal system voltage is being searched cyclically (PrE run). If a key 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 applied.
1 - Power On LED “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 / Asy / 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 / Asy / PHS and flashes in the event of system fault alarm.

4 - Multi-functional LC display.

5 - Test button “T”: UP key: To change the measured value display, move downwards in the menu or change parameters. To call up the self test: Press the key > 1.5 s

6 - Reset button “R”: DOWN key: To change the measured value display, move downwards in the menu or change parameters. To delete stored insulation fault alarms: Press the key > 1.5 s.

7 - MENU key: Enter key: To confirm the measured value display or change parameters. To call up the menu system: Press the key > 1.5 s. Press the ESC key > 1.5 s: to abort an action or to return to the previous menu level

**Ordering information**

<table>
<thead>
<tr>
<th>Type</th>
<th>Supply voltage Us*</th>
<th>Nominal system voltage Un*</th>
<th>Display range</th>
<th>Response value</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMD420-D-1</td>
<td>DC 9.6…94 V / AC 42…460 Hz 16…72 V</td>
<td>AC 0…500 V</td>
<td></td>
<td>AC 0…500 V</td>
<td>B 9301 0005</td>
</tr>
<tr>
<td>VMD420-D-2</td>
<td>DC 70…300 V / AC 42…460 Hz 70…300 V</td>
<td>AC 0…500 V</td>
<td></td>
<td>AC 6…500 V</td>
<td>B 9301 0006</td>
</tr>
</tbody>
</table>

*Absolute values

**Accessories**

<table>
<thead>
<tr>
<th>Type</th>
<th>Art No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw fixing</td>
<td>B 9806 0008</td>
</tr>
</tbody>
</table>

(1 piece per device)

1 - Connection to the AC system/load to be monitored:

2 - Supply voltage Us (see ordering information)

3 - Alarm relay K1: Configurable f < U / > U / > f / Asy / PHS / ERROR

4 - Alarm relay K2: Configurable f < U / > U / > f / Asy / PHS / ERROR

5 - Fuse as line protection.

A 6 A fuse is recommended. If being supplied from an IT system, both lines have to be protected by a fuse.
Voltage relay for frequency, overvoltage, undervoltage, phase sequency, phase failure and asymmetry monitoring VMD420

**Timing diagram voltage monitoring**

- Start-up delay
- Response time
- Delay on release

**Timing diagram phase failure, phase sequence, asymmetry**

- Start-up delay
- Response time
- Delay on release

**Dimension diagram XM420**

Dimensions in mm

Open the front plate cover in direction of arrow!

**Screw fixing**

Note: The upper mounting clip must be ordered separately (see ordering information).
Technical data relay VMD420 for undervoltage, overvoltage and frequency monitoring

### 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)

### Response time tan
- tan = tae + ton/2
- tae = 140 ms
- ton = 0...99 s (0 s)*
- Resolution for setting U = 1 V

### Operating time voltage tae
- Voltage test acc. to IEC 61010-1:
  - (A1, A2) - (N, L1, L2, L3) - (11, 12, 14) - (21, 22, 24)
- Supply voltage:
  - VMD420-D-1:
    - Supply voltage (A1, A2) - (11, 12, 14) - (21, 22, 24) 2.21 kV
    - Supply voltage (N, L1, L2, L3) - (21, 22, 24) 2,21 kV
- Rated impulse voltage/pollution degree: 4 kV / III
- Rated insulation voltage: 400 V
- Insulation coordination acc. to IEC 60664-1 / IEC 60664-3
- Rated frequency fn:
  - AC 15...460 Hz
  - DC 70...300 V
- Measuring range (r.m.s. value) (L-L)
  - AC 0...500 V
  - Measuring range (r.m.s. value) (L-N)
  - AC 0...288 V
- Measuring circuit
- Power consumption ≤ 3,5 VA
- Frequency range US
  - AC 15...460 Hz
  - DC 70...300 V
- VMD420-D-2:
  - Frequency range US 15...460 Hz
  - Supply voltage US 15...460 Hz
- Measuring range (r.m.s. value) (L-N)
- AC 0...288 V
- Measuring circuit
- Frequency display range 10...500 Hz
- Relative percentage error in the frequency range 15...460 Hz ±0.2 %, ±1 digits
- Overfrequency > Hz 10...500 Hz

### Undervoltage
- < U (0.85 Un)* for Un = 400 V / 208 V 340 V / 177 V

### Overvoltage
- > U (Alarm 1) (measuring method: 3Ph / 3n) AC 6...500 V / 6...288 V
- > U (1.1 Un)* for Un = 400 V / 208 V 440 V / 229 V

### Type of distribution system
- 3(N) AC / 3 AC (3 AC)*
- Asymmetry 5...30 % (30 %)*

### Phase failure
- by setting of the asymmetry
- Hysteresis U 1...30 % (5 %)*

### Relative percentage error, voltage at 50 Hz / 60 Hz ±1.5 %, ±2 digits

### Hysteresis U 1...30 % (5 %)*

### Resolution for setting U 15...460 Hz
- Frequency display range 10...500 Hz

### Fault memory (M)
- alarm relay on / off / con (on)*
- on / off (on)*

### Operating error
- voltage at 50 Hz / 60 Hz ±1.5 %, ±2 digits

### Relative percentage error in the frequency range 15...460 Hz ±0.2 %, ±1 digits

### Operating mode
- continuous operation
- Number of changeover contacts 2 x 1 (K1, K2)

### Operating principle
- N/C operation n.c. or N/O operation n.o.
- K2 Err, < U, > Hz, > Hz, PHS (undervoltage < U, asymmetry Asy, N/O operation n.o.)*
- K1: Err, > U, > Hz, > Hz, PHS (overvoltage > U, asymmetry Asy, N/O operation n.o.)*

### Electrical service life under rated operating conditions, number of cycles 10 000

### Other
- Flammability class UL94 V-0
- Tightening torque 0.5...0.6 Nm
- Stripping length 8...9 mm

### Connection
- screw terminals
- Connection properties:
  - rigid / flexible / conductor sizes 0.2...4 / 0.2...2.5 mm² / AWG 24...12

### Multi-conductor connection (2 conductors with the same cross section):
- rigid / flexible 0.2...1.5 mm² / 0.2...1.5 mm²

### Multi-conductor connection (2 conductors with the same cross section):
- rigid / flexible 0.2...2.5 mm² / 0.2...2.5 mm²

### Multiphase measurement (3 conductors with different cross sections):
- rigid / flexible 0.2...1.5 mm² / 0.2...1.5 mm²

### Display range measured value
- AC/DC 0...500 V

### Operating error, voltage at 50 Hz / 60 Hz ±1.5 %, ±2 digits

### Relative percentage error, voltage at 50 Hz / 60 Hz ±1.5 %, ±2 digits

### Relative percentage error in the frequency range 15...460 Hz ±0.2 %, ±1 digits

### History memory (HIS) for the first alarm value data record measured values
- Password off / 0...999 (off)*

### Environmental conditions
- Operating temperature -25 ºC...+55 ºC
- Degree of protection, terminals (IEC 60529) IP20
- Degree of protection, internal components (IEC 60529) IP30
- Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
- Storage (IEC 60721-3-3) 1K4 (except condensation and formation of ice)
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3) 3M4
  - Storage (IEC 60721-3-3) 1M3

### Classification of mechanical conditions acc. to IEC 60721:
- Operating error, voltage at 50 Hz / 60 Hz ±1.5 %, ±2 digits

### Terminal block properties:
- Rated contact load 1 mA at AC / DC 10 V

### Display properties:
- LC display, multi-functional, not illuminated

### Operating manual
- TGH1396

### Product standard
- IEC 61010-1 and according to IEC 60255-6

### Screw fixing
- 2 x M4 with mounting clip
- DIN rail mounting acc. to IEC 60715

### Environment / EMC
- EMC IEC 61326-1
- Operating temperature -25 ºC...+55 ºC
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3) 3K5 (except condensation and formation of ice)
  - Storage (IEC 60721-3-3) 1K4 (except condensation and formation of ice)
  - Classification of mechanical conditions acc. to IEC 60721:
    - Stationary use (IEC 60721-3-3) 3M4
    - Storage (IEC 60721-3-3) 1M3

### 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 fixing
- 2 x M4 with mounting clip

### Fault memory
- on / off / con (on)*

### Switching elements
- Number of changeover contacts 2 x 1 (K1, K2)
- Operating principle
  - N/C operation n.c. or N/O operation n.o.
- K2 Err, < U, > Hz, > Hz, PHS (undervoltage < U, asymmetry Asy, N/O operation n.o.)*
- K1: Err, > U, > Hz, > Hz, PHS (overvoltage > U, asymmetry Asy, N/O operation n.o.)*

### Electrical service life under rated operating conditions, number of cycles 10 000

### Fault memory
- on / off (on)*

### Contact data acc. to IEC 60947-5-1:
- Utilization category
  - AC-13 / AC-14 / DC-12 / DC-12
  - Rated operational voltage
  - Rated operational current
    - 5 A / 3 A / 1 A / 0,2 A / 0,1 A

### Minimum contact load 1 mA at AC / DC 10 V