LINETRAXX® VMD461 with CD440 coupling device
Multifunctional voltage relay for AC, DC, 3(N)AC systems
Underfrequency 81<U*, overfrequency 81>O*, overvoltage 59*, undervoltage 27*, phase sequence 47*, unbalance 47*, vector shift 78*, ROCOF df/dt 81R*

* ANSI codes
Product description
The multifunctional voltage monitoring relay VMD461 monitors frequencies, undervoltages and overvoltages in DC, AC and 3(N)AC systems. The phase voltages and/or line-to-line voltages are measured as r.m.s. value and are continuously shown on the device display. The measured value required to trigger the alarm relay is stored. The VMD461 features additional measuring functions for:
• ROCOF df/dt
• Vector shift monitoring
• Unbalance monitoring
• Phase sequence monitoring

The corresponding ANSI codes for all available measuring functions are provided. Configurable delay times allow considering special installation-specific properties (e.g. device-specific start-up procedures). The VMD461 requires an external supply voltage.

The optional use of a CD440 coupling device extends the voltage range that can be monitored to DC/3AC 1200 V or 1AC/3NAC 690 V.

Application examples
• Monitoring of voltage-sensitive machines and installations
• Switching installations on and off at a certain voltage level
• Protection of three-phase motors against phase failure and phase open-circuit
• Vector shift detection for protection of electrical machines
• Islanding detection ROCOF (rate of change of frequency)
• Transformer protection by recognising asymmetrical load

Functional description
Once the supply voltage is applied, the start-up delay \( t_{\text{start-up}} \) begins. Measured voltage and frequency values changing during this time do not influence the switching state of the alarm relays K1 and K2.

The devices feature three separately adjustable limit values for overvoltage/undervoltage as well as overfrequency/underfrequency which are respectively linked to their own response delay \( t_{\text{off}} \).

If the measured quantity exceeds or falls below the set response value and the related response delay \( t_{\text{off}} \) has elapsed, the relay assigned to the response value switches and the corresponding LED lights.

Standards
The device fulfils the requirements of the following standards:
• DIN EN 60255-1:2010-9
• VDE 0435-3127: 2014-09
• UL File: E173157
Operating elements

1 - ON
Power On LED, green; lights when the voltage supply is available and the device is in operation; flashes when the device is being started or when an internal device error has occurred.

2 - ALARM1 and ALARM2
Alarm LEDs, yellow: installation switched off
Only ALARM 1 lights: alarm relay K1 has tripped
Only ALARM 2 lights: alarm relay K2 has tripped
ALARM 1 and ALARM 2 light: response value violation of voltage or frequency, df/dt, vector shift detection, unbalance, phase sequence, remote trip
ALARM 1 and ALARM2 flash: internal device error or error in contact monitoring

3 - INFO
Backlit LC display

4 - ESC
Standard display: Toggle between standard display and device information
Menu display: Exit the parameter setting menu without saving; switch to the next higher menu level

5 - TEST
Standard display: Use the TEST button (< 1.5 s) to start a manual self test which triggers both alarm relays (trigger test to check the switches/disconnectors). In addition, the switch-off times are documented.
Menu display: arrow-up button for parameter change and scrolling

6 - RESET
Standard display: (> 1.5 s) Acknowledge fault messages from contact monitoring
Menu display: arrow-down button for parameter fault messages from contact monitoring

7 - MENU
Standard display: Toggle between standard, menu and alarm display
Menu display: button Jump to setting parameter; save the changed parameters

Connection DC: VMD461 with CD440

1 - ON Power On LED, green; lights when the voltage supply is available and the device is in operation; flashes when the device is being started or when an internal device error has occurred.
2 - ALARM1 and ALARM2
Alarm LEDs, yellow: installation switched off
Only ALARM 1 lights: alarm relay K1 has tripped
Only ALARM 2 lights: alarm relay K2 has tripped
ALARM 1 and ALARM 2 light: response value violation of voltage or frequency, df/dt, vector shift detection, unbalance, phase sequence, remote trip
ALARM 1 and ALARM2 flash: internal device error or error in contact monitoring

3 - INFO
Backlit LC display

4 - ESC
Standard display: Toggle between standard display and device information
Menu display: Exit the parameter setting menu without saving; switch to the next higher menu level

5 - TEST
Standard display: Use the TEST button (< 1.5 s) to start a manual self test which triggers both alarm relays (trigger test to check the switches/disconnectors). In addition, the switch-off times are documented.
Menu display: arrow-up button for parameter change and scrolling

6 - RESET
Standard display: (> 1.5 s) Acknowledge fault messages from contact monitoring
Menu display: arrow-down button for parameter fault messages from contact monitoring

7 - MENU
Standard display: Toggle between standard, menu and alarm display
Menu display: button Jump to setting parameter; save the changed parameters
Connection AC: VMD461 with CD440 (earthed system)

Connection AC: VMD461 with CD440 (unearthed system)

- CD440 optional
Connection 3(N)AC: VMD461 with CD440 (earthed system)

Connection 3(N)AC: VMD461 with CD440 (unearthed system)

Legend wiring diagrams

1 - A1, A2  Supply voltage $U_S$ (see ordering details)
2 - L1, L2/DC+, L3, N/DC-  Power supply connection
3 - 11, 12, 14  Connection to alarm relay K1
4 - 21, 22, 24  Connection to alarm relay K2
5 - DG1/2, D1, D2  Contact monitoring
DG1/2: GND
D1: Feedback signal contact to alarm relay K1
D2: Feedback signal contact to alarm relay K2 (feedback signal contacts optionally NC/NO/off)*
6 - RTG, RT1  RTG: GND
RT1: Remote-trip input (optionally NC/NO/off)*
7 - A, B  Connection to communication interface BMS bus
8 - $R_{on/off}$  Activate or deactivate the terminating resistor of the BMS bus (120 $\Omega$)

* Explanation:
NC (closed in non-operating state)
NO (open in non-operating state)
aus (switched off)
Possible wiring diagram with 2 circuit breakers

1 - A1, A2  Supply voltage $U_s$ (see ordering details)
2 - L1, L2/DC+, L3, N/DC-  Power supply connection
3 - 11, 12, 14  Connection to alarm relay K1
4 - 21, 22, 24  Connection to alarm relay K2
5 - Q1, Q2  Circuit breakers
6 - DG1/2, D1, D2  Contact monitoring circuit breakers Q1/Q2
   DG1/2: GND
   D1: Feedback signal contact to alarm relay K1
   D2: Feedback signal contact to alarm relay K2
   (feedback signal contacts optionally NC/NO/off)*
7 - RTG, RT1  RTG: GND
   RT1: Remote-trip input (optionally NC/NO/off)*
8 - A, B  Connection to communication interface BMS bus
9 - $R_{on/off}$  Activate or deactivate the terminating resistor of the BMS bus (120 Ω)

* Explanation:
   NC (in non-operating state closed)
   NO (in non-operating state closed)
   off (switched off)
Schematic diagram with circuit breakers

Public grid

Circuit breaker

CD440 (optional)

VMD461

Example for a system design

VMD461

VMD461 (optional)

COM465IP

120 Ω
(DIP switch VMD461)

120 Ω
(DIP switch COM465IP)

Dimension diagram VMD461

Dimensions in mm

Dimension diagram CD440

Dimensions in mm
### Technical data

#### Insulation coordination of the device combination VMD461/CD440:

| Voltage | Coordination
|---------|----------------|
| ≤ 1000 V | acc. to IEC 60664-1/IEC 60664-3
| > 1000 V | acc. to EN 50178:1998

#### Definitions

- Measuring circuit (IC1): CD440 (L1, L2/DC+, L3, N/DC–)
- Measuring circuit (IC2): VMD461 (L1, L2/DC+, L3, N/DC–)
- Supply circuit (IC3): VMD461 (A1, A2)
- Control circuit (IC4): VMD461 (D1, D2, DG1/2, RTG, RT1)
- Output circuit 1 (IC5): VMD461 (11, 12, 14)
- Output circuit 2 (IC6): VMD461 (21, 22, 24)
- Output circuit 3 (IC7): VMD461 (A, B)

#### Rated voltage

<table>
<thead>
<tr>
<th>Circuit</th>
<th>DC, 3AC</th>
<th>1AC, 3NAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1</td>
<td>1200 V</td>
<td>690 V</td>
</tr>
<tr>
<td>IC2</td>
<td>400 V</td>
<td></td>
</tr>
<tr>
<td>IC3, IC6</td>
<td>250 V</td>
<td></td>
</tr>
</tbody>
</table>

#### Rated impulse voltage

- Overvoltage category III
- Max. altitude 2000 m
- IC1/(IC2…6): 10.5 kV
- IC2/IC3…6: 4 kV
- IC3/IC4…6: 4 kV
- IC4/IC5…6: 4 kV
- IC5/IC6: 4 kV

#### Rated insulation voltage

<table>
<thead>
<tr>
<th>Circuit</th>
<th>DC, 3AC</th>
<th>1AC, 3NAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/(IC2…6)</td>
<td>1250 V</td>
<td>1000 V</td>
</tr>
<tr>
<td>IC2/IC3…6</td>
<td>400 V</td>
<td></td>
</tr>
<tr>
<td>IC3/IC4…6</td>
<td>400 V</td>
<td></td>
</tr>
<tr>
<td>IC4/IC5…6</td>
<td>400 V</td>
<td></td>
</tr>
<tr>
<td>IC5/IC6</td>
<td>4 kV</td>
<td></td>
</tr>
</tbody>
</table>

#### Protective separation (reinforced insulation):

<table>
<thead>
<tr>
<th>Circuit</th>
<th>DC, 3AC</th>
<th>1AC, 3NAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC1/(IC2…6)</td>
<td>1250 V</td>
<td>1000 V</td>
</tr>
<tr>
<td>IC2/IC3…6</td>
<td>300 V</td>
<td></td>
</tr>
<tr>
<td>IC3/IC4…6</td>
<td>300 V</td>
<td></td>
</tr>
<tr>
<td>IC4/IC5…6</td>
<td>300 V</td>
<td></td>
</tr>
<tr>
<td>IC5/IC6</td>
<td>300 V</td>
<td></td>
</tr>
</tbody>
</table>

#### Voltage test (routine test) acc. to IEC 60255-27/DIN EN 50178:1998

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC2/IC3…6</td>
<td>2.21 kV</td>
</tr>
<tr>
<td>IC3/IC4…6</td>
<td>2.21 kV</td>
</tr>
<tr>
<td>IC4/IC5…6</td>
<td>2.21 kV</td>
</tr>
<tr>
<td>IC5/IC6</td>
<td>2.21 kV</td>
</tr>
</tbody>
</table>

#### Supply voltage

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Tolerance</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC, 50/60 Hz</td>
<td>±25 %</td>
<td>100…240 V</td>
</tr>
</tbody>
</table>

#### Measuring circuit

**VMD461**

- System type: DC, 1AC, 3AC, 3NAC
- Nominal voltage $U_n$
  - (L-N): AC 50…260 V
  - (L-L): AC 87…450 V
  - (DC+/DC–): DC 50…450 V
- Measuring range: 0…1.15 $U_n$
- Overload capacity: 1.5 $U_n$ max for 5 s
- Response values: 1…150 %
- Resolution of setting $U_n$ ≤ ±1 %
- Rated frequency: DC, 50/60 Hz
- Frequency range: DC 45…65 Hz
- Resolution of setting $f$: 0.05 Hz
- Relative uncertainty $f$ ≤ ±0.1 %

**VMD461 with CD440**

- System type: DC, 1AC, 3AC, 3NAC
- Nominal voltage $U_n$
  - (L-N): AC 250…690 V
  - (L-L): AC 440…1200 V
- Measuring range: 0…1.15 $U_n$
- Overload capacity: 1.5 $U_n$ max for 5 s
- Response values: 1…150 %
- Operating uncertainty $U_n$ ≤ ±2 %
- Resolution of setting $U_n$: 1 %
- Rated frequency: DC, 50/60 Hz
- Frequency range: DC 45…65 Hz
- Resolution of setting $f$: 0.05 Hz
- Relative uncertainty $f$ ≤ ±1 %

#### Recording of measurement values, switch-on condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U&lt;, U&lt;&lt;, U&lt;&lt;&lt;</td>
<td>1…100 %</td>
</tr>
<tr>
<td>U&gt;, U&gt;&gt;, U&gt;&gt;&gt;</td>
<td>100…150 %</td>
</tr>
<tr>
<td>f&lt;, f&lt;&lt;, f&lt;&lt;&lt;</td>
<td>45…60 Hz</td>
</tr>
<tr>
<td>f&gt;, f&gt;&gt;, f&gt;&gt;&gt;</td>
<td>50…65 Hz</td>
</tr>
</tbody>
</table>

#### Recording of measurement value, switch-off condition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U&lt;, U&lt;&lt;, U&lt;&lt;&lt;</td>
<td>1…100 %</td>
</tr>
<tr>
<td>U&gt;, U&gt;&gt;, U&gt;&gt;&gt;</td>
<td>100…150 %</td>
</tr>
<tr>
<td>f&lt;, f&lt;&lt;, f&lt;&lt;&lt;</td>
<td>45…60 Hz</td>
</tr>
<tr>
<td>f&gt;, f&gt;&gt;, f&gt;&gt;&gt;</td>
<td>50…65 Hz</td>
</tr>
</tbody>
</table>

- df/dt: 0.05…9.95 Hz/s
- Vector shift: right, left

#### Time response

- Start-up delay $t_{start-up}$: 200 ms…60 min (200 ms)*
- Switch-on delay $t_{on}$: off, 50 ms…60 min (100 ms)*
- Response delay $t_{delay}$: off, 50 ms…60 min (100 ms)*
- Operating time voltage $t_{ae}$: half a supply period
- Operating time, frequency $t_{ae}$: ≤ 40 ms
- Recovery time $t_{b}$: 300 ms
Technical data (continued)

Digital inputs
Monitoring of potential-free contacts or voltage inputs:
- closed: 0...4 V; \( I_{\text{in}} < -5 \text{ mA} \)
- open: > 6...≤ 30 V

D1  Feedback signal contact of alarm relay K1
D2  Feedback signal contact of alarm relay K2
RT1  remote trip
DG1/2, RTG  GND

max. length of the connecting cables of the digital inputs
(shielded cable recommended)  10 m
Cable length for external test/reset button  0...10 m

Displays, Memory
Display  LC display, multi-functional, illuminated
Display range, measured value  0...9.99 kV
History memory for the last 300 messages  per 1 data record measured values
Password  on/off/0...999 (off*)

Interface
Interface/protocol  RS-485/BMS
Baud rate  9.6 kBit/s
Cable length  0...1200 m
Recommended cable (shielded, shield connected to PE on one side)  min. J-Y(St)Y min. 2 x 0.8
Terminating resistor  120 \( \Omega \) (0.25 W) connectable via DIP switch
Device address, BMS bus  1...90 (2)*

Switching elements
Number of changeover contacts  2 x 1 (K1, K2)
Operating principle K1, K2  N/C operation or N/O operation (N/C)*
Electrical endurance under rated operating conditions, 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

Environment/EMC
- EMC  DIN EN 60255-26
- Operating temperature  \(-25\ldots+55^\circ\text{C}\)

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
- 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 VMD461
- Connection  push-wire terminals
- Connection properties: Rigid  0.2...2.5 mm² (AWG 24...14)
- Flexible without ferrule  0.75...2.5 mm² (AWG 19...14)
- Flexible with ferrule  0.2...1.5 mm² (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 (DIN EN 60529)  IP30
- Degree of protection, terminals (DIN EN 60529)  IP20
- Enclosure material  polycarbonate
- Flammability class  UL94 V-0
- DIN rail mounting acc. to  IEC 60715
- Screw mounting CD440  2 x M4 with mounting clip
- Screw mounting VMD461  2 x M4
- Software version, measurement technology  D570 V1.2x
- Software version, display  D256 V2.3x
- Weight  VMD461  ≤ 360 g
CD440  ≤ 125 g

(*) Factory setting
## Ordering details

<table>
<thead>
<tr>
<th>Description</th>
<th>Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifunctional voltage relay</td>
<td>AC/DC 100...240 V</td>
<td>VMD461-D-2</td>
<td>B93010047</td>
</tr>
<tr>
<td>Coupling device</td>
<td>--</td>
<td>CD440</td>
<td>B73010046</td>
</tr>
</tbody>
</table>

## Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting clip for screw mounting (1 piece per device)</td>
<td>B98060008</td>
</tr>
</tbody>
</table>

## Suitable system components

<table>
<thead>
<tr>
<th>Description</th>
<th>Device variants / Supply voltage U_s</th>
<th>Type</th>
<th>Art. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition Monitor</td>
<td>with an integrated gateway: Bender system/Ethernet AC/DC 24...240 V, DC, 50...60 Hz</td>
<td>COM465IP</td>
<td>B95061065</td>
</tr>
<tr>
<td></td>
<td>with an integrated gateway: Bender system/Ethernet DC 24 V</td>
<td>COM465IP-24 V</td>
<td>B95061066</td>
</tr>
<tr>
<td></td>
<td>Individual texts for devices/channels, device failure monitoring, e-mail in the event of an alarm</td>
<td>COM465IP function module A</td>
<td>B75061011</td>
</tr>
<tr>
<td></td>
<td>Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM devices and universal measuring devices, SNMP server</td>
<td>COM465IP function module B</td>
<td>B75061012</td>
</tr>
<tr>
<td></td>
<td>Parameter setting for BMS devices as well as BCOM and universal measuring devices</td>
<td>COM465IP function module C</td>
<td>B75061013</td>
</tr>
<tr>
<td></td>
<td>Visualisation of Bender systems, system visualisation</td>
<td>COM465IP function module D</td>
<td>B75061014</td>
</tr>
<tr>
<td></td>
<td>Virtual devices</td>
<td>COM465IP function module E</td>
<td>B75061015</td>
</tr>
<tr>
<td></td>
<td>Integrating third-party devices</td>
<td>COM465IP function module F</td>
<td>B75061016</td>
</tr>
<tr>
<td></td>
<td>for the connection of Bender BMS devices and universal measuring devices to TCP/IP systems</td>
<td>CP700</td>
<td>B95061030</td>
</tr>
<tr>
<td>RS-485 repeater</td>
<td>DC 10...30 V</td>
<td>DI-1</td>
<td>B95012015</td>
</tr>
<tr>
<td></td>
<td>AC/DC 24 V ± 20 %</td>
<td>DI-1PSM</td>
<td>B95012044</td>
</tr>
<tr>
<td>Power supply unit for DI-1</td>
<td>AC 230 V, 50...60 Hz / AC/DC 20 V</td>
<td>AN471</td>
<td>B924189</td>
</tr>
</tbody>
</table>

---

**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 • www.bender.de