EN Manual

VMD420-DM

Voltage and frequency monitor
for monitoring of 3(N)AC systems up to 0…500 V
for undervoltage and overvoltage and under and overfrequency
Software version: D238 V2.2x

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1. How to use this documentation effectively

This manual is intended for experts in electrical engineering and electronics!

In order to make it easier for you to find specific text passages or references in this manual and for reasons of comprehensibility, important information is emphasized by symbols. The meaning of these symbols is explained below:

*The signal word indicates that there is a **high risk** of danger that will result in **electrocution** or **serious injury** if not avoided.*

*This signal word indicates a **medium risk** of danger that can lead to **death** or **serious injury** if not avoided.*

*This signal word indicates a **low level risk** that can result in minor or **moderate injury** or **damage to property** if not avoided.*

*This symbol denotes information intended to assist the user to make **optimum use of the product**.*

2. Safety

2.1 General

In addition to this manual, the documentation of the device includes a document entitled "Important safety instructions for Bender products".

2.2 Intended use

The voltage monitor VMD420 monitors 3(N)AC systems in the frequency range 15…460 Hz for undervoltage, overvoltage, underfrequency and overfrequency. The devices are designed for the nominal voltage range U_n = 0…500 V. Separate supply voltage U_s is required.

2.3 Skilled person

Only electrically skilled persons are authorised to install and commission this device. Electrically skilled persons are those who have the relevant education, knowledge and experience, as well as knowledge of the relevant safety standards and who are able to perceive risks and to avoid hazards which electricity can create when work activities are carried out on electrical installations. The electrically skilled person is specially trained for carrying out work activities in his specific working environment and has a thorough knowledge of the relevant standards and regulations.

In Germany, an electrically skilled person must meet the requirements of the accident prevention regulation BGV A3. In other countries the applicable regulations have to be observed and followed.

2.4 Safety information on work activities on electrical installations

DANGER

Danger of electric shock!

Unprofessional work activities on electrical installations may result in a threat of danger to life and limb!

All work activities on electrical installations as well as installation activities, commissioning activities and work activities with the device in operation may only be carried out by electrically skilled persons!

3. Function

3.1 Device features

- The VMD420 requires a separate supply voltage U_s
- Monitoring for undervoltage and overvoltage and underfrequency and overfrequency in 3(N)AC systems of AC 0…500 V / 0…288 V
- Asymmetry, phase failure and phase sequence monitoring
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis for the voltage to be monitored
- r.m.s. value measurement AC + DC
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm1 and Alarm2
- Fault memory for the operating value
- Cyclical 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
- Available with screw-type or push-wire terminals
- User-configurable analogue interface

3.2 Function

Once the supply voltage is applied, the start-up delay "*t*" begins. Measured values changing during this time do not influence the alarm LEDs.
The devices provide two separately adjustable response values (overvoltage/undervoltage). When the measured value exceeds (Alarm 1) or falls below the response value (Alarm 2), the alarm LEDs light up. When the measured value exceeds or falls below the release value (response value plus

hysteresis), the alarm LEDs go out. When the fault memory is activated, the alarm LEDs remain in the alarm state until the reset button R is pressed.

3.2.1 Preset function

After connecting the system to be monitored for the first time, the response values for overvoltage and undervoltage (Alarm 1/2) are automatically set once to:
Response value overvoltage (> U): 1.1 U_n
Response value undervoltage (< U): 0.85 U_n
Response value overfrequency (> f) at 16.7 Hz, 50 Hz, 60 Hz: f_n + 1 Hz
Response value overfrequency (> f) at 400 Hz: f_n + 1 Hz
Response value underfrequency (< f) at 16.7 Hz, 50 Hz, 60 Hz: f_n - 1 Hz
Response value underfrequency (< f) at 400 Hz: f_n - 1 Hz

Preset VMD420-DM				
Measuring principle	**U_n**	**Preset operating range**	**Response value < U**	**Response value > U**
Phase-to-phase voltage measurement: 3Ph	400 V (L1, L2, L3)	340…440 V	340 V	440 V
	208 V (L1, L2, L3)	177…229 V	177 V	229 V
Only when the preset function (Menu/SEt/PrE) has been started manually, the following response values can be set:				
Phase-to-neutral voltage measurement: 3n	230 V (L1, L2, L3, N)	196…253 V	196 V	253 V
	120 V (L1, L2, L3, N)	102…132 V	102 V	132 V

If the measured voltage is not within the preset operating range listed in the table, the message "AL not Set“ appears on the display. In this case, it is necessary to set the response values for Alarm 1 (AL1) and Alarm 2 (AL2) manually. A detailed description of the process is given in the chapter "parameter setting“.
After restoring the factory settings, the preset function is automatically active again.
During operation the preset function can be started manually via the menu SEt.

3.2.2 Automatic self test

The device automatically carries out a self test after connection to the system to be monitored and later every hour. During the self test internal functional faults are detected and will appear in form of an error code on the display.

3.2.3 Manual self test

Pressing the test button for > 1.5 s causes the device to carry out a self test where the internal functional errors are determined and shown on the display as error codes.
While the test button T is pressed and held down, all device-related display elements appear on the display.

3.2.4 Functional faults

If an internal malfunction occurs, all three LEDs flash. An error code will appear on the display (E01…E32). In such a case please contact the Bender Service.

3.2.5 Fault memory

The fault memory can be activated, deactivated or can be set to continuous mode (con). If the fault memory is set to "con“ mode, the alarm parameters remain stored even on failure of the supply voltage.

3.2.6 Start-up delay t

Once the supply voltage U_s has been switched on, the alarm indication is delayed by the preset time t (0…300 s).

3.2.7 Password protection (on, OFF)

When password protection is enabled (on), settings can only be carried out after entering the password (0…999). If you cannot operate your device because you cannot remember your password, please contact info@bender-service.com.

3.2.8 Factory setting FAC

After activating the factory setting, all settings previously changed are reset to delivery status. In addition, the preset function allows automatic adaptation of the response values in relation to the nominal voltage U_n.

3.2.9 Erasable history memory

The first alarm value to occur is saved in this memory. Subsequent alarms do not overwrite this "old“ value. The memory can be cleared using the Clr key in the menu HiS.

3.2.10 Interface option M

This option provides an analogue interface with galvanic isolation, but does not provide an alarm relay. One of three output signals can be selected from the associated menu. Only the output that has been selected via software may be connected:

Output signal	Purpose of use
DC 0…400 µA	Current output for Bender measuring instruments of the 96.. series
DC 0/4…20 mA	Standardised current output with selectable current ranges
DC 0…10 V	Standardised voltage signal

3.2.11 Menu item AnA for interface configuration

Display		Measured variable	100 % value
< L1L2L3	500 V	lowest voltage of all 3 phases	adjustable in the range of 7…500 V
> L1L2L3	500 V	highest voltage of all 3 phases	adjustable in the range of 7…500 V
L1	500 V	voltage L1	adjustable in the range of 7…500 V
L2	500 V	voltage L2	adjustable in the range of 7…500 V
L3	500 V	voltage L3	adjustable in the range of 7…500 V
ASY	50 %	asymmetry	adjustable in the range of 10…100 %
	100 Hz	frequency	adjustable in the range of 10…2000 Hz
PHS	I	phase sequence	anticlockwise field
> L1L2L3	U AL	highest voltage of all 3 phases	response value >U overvoltage
> L1	U AL	voltage L1	response value >U overvoltage
> L2	U AL	voltage L2	response value >U overvoltage
> L3	U AL	voltage L3	response value >U overvoltage
> ASY	AL	asymmetry	response value ASY

For details about the setting of the analogue interface via software refer to page 32.

4. Installation, connection and commissioning

DANGER

Danger of electric shock!
Make sure that the installation area is disconnected from any electrical source before starting installation works and that the nominal voltage and supply voltage specified in the relevant data sheet are observed!

4.1 Fast commissioning for U_n = 400 V, 50 Hz

If you are already familiar with voltage monitors, you can reduce the time for commissioning and connection using this brief description.

1. Check that the three-phase system being monitored is operated with a nominal voltage of U_n = 400 V and 50 Hz. This is the precondition for an automatic setting of the response values (Preset) after the first connection to the nominal voltage.
2. Make sure that the voltage monitor is in the delivery status (factory setting has not been changed).
3. When the conditions 1 and 2 are satisfied, you can connect the voltage monitor to the three-phase system to be monitored according to the wiring diagram (page 18). The following predefined response values will be set automatically:

VMD420			
U_n, f_n	Preset operating range	Response value < U, < f	Response value > U, > f
400 V (L1, L2, L3)	340 V…440 V	340 V	440 V
50 Hz	47…53 Hz	49 Hz	51 Hz

4. The currently measured phase-to-phase voltage between L1 and L2 appears on the display. Use the UP and DOWN keys to query other parameters:
   – phase-to-phase voltage L2, L3
   – phase-to-phase voltage L1, L3
   – asymmetry
   – system frequency
   – phase sequence

For detailed information about the preset function and other voltage ranges refer to page 10.
For resetting the voltage monitor to its factory settings refer to page 12.

4.2 Installing the device

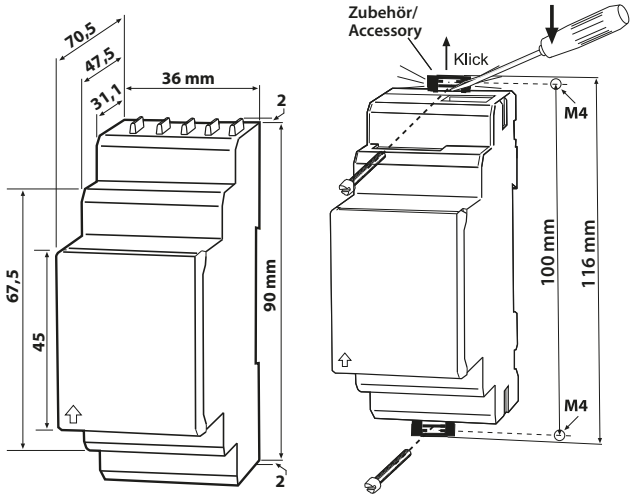


Fig. 4.1: Dimension diagram and drawing for screw fixing

4.2.1 DIN rail mounting

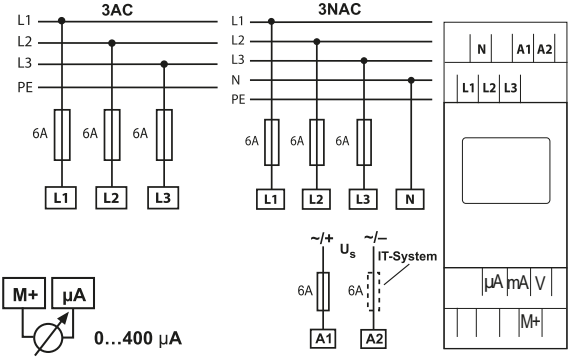
1. Open the front plate cover at the lower part marked by an arrow.
2. Snap the rear mounting clip of the device into place in such a way that a safe and tight fit is ensured.

4.2.2 Screw fixing

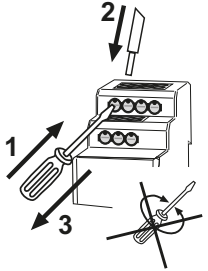
1. Use a tool to move the rear mounting clips (a second mounting clip required, see ordering information) to a position that it projects beyond the enclosure.
2. Fix the device using two M4 screws.

4.3 Wiring of the device

Connect the device according the wiring diagram.



Connect the conductor to the push-wire terminals according to the drawing.



Terminal	Connections
A1, A2	Connection to the supply voltage U_s
L1, L2, L3, (N)	Connection to the system to be monitored
M+	(common) positive pole of the analogue interface
µA	Current output 0…400 µA
mA	Current output 0/4…20 mA
V	Voltage output 0…10 V

4.4 Commissioning preset function/factory setting

CAUTION

Material damage by improper connection of the device! Prior to commissioning make sure that the device is properly connected!

After connecting a brand-new VMD420… to a standard system of U_n = 400 V 50 Hz, the response values are automatically set by the internal preset function:
Overvoltage = 440 V (400 V + 10 %) (50 Hz + 1 Hz)
Undervoltage = 340 V (400 V - 15 %) (50 Hz - 1 Hz)
Other operating ranges of the preset function are given in the technical data "response values" and in the description of the function.

During the first start-up process the following response values are automatically set related to U_n:
Response value: overvoltage (> U): 1.1 U_n
Response value: undervoltage (< U): 0.85 U_n

Factory setting

Hysteresis U:	*5 %*
Underfrequency < Hz	*OFF*
Overfrequency > Hz	*OFF*
Hysteresis frequency (Hys Hz):	*0.2 Hz*
Fault memory M:	*on*
Interface type	*0…20 mA*
100 % reference:	*U > 500 V*
Asymmetry:	*30 %*
Phase sequence monitoring:	*OFF*
Start-up delay:	*t = 0 s*
Method of measurement:	*3Ph (phase-to-phase voltage measurement)*
Password:	*0, Off*

5. Operation and setting

5.1 Getting to know the user interface

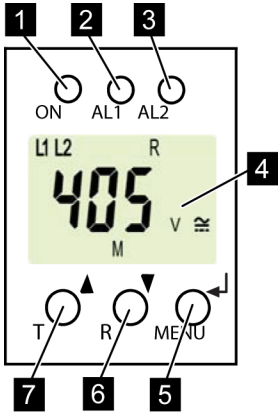


Fig. 5.1: User interface

1 POWER ON LED:
Lights up when voltage is available and when the device is in operation.

2 LED ALARM 1:
Lights when the response value of overvoltage is exceeded.

3 LED ALARM 2:
Lights when the response value of undervoltage is exceeded.
LEDs AL1and AL2:
Light when the response values over-frequency and underfrequency are reached.

4 DISPLAY:
Displays information on operation.

5 ENTER key:
The ENTER key is used to save input data and changed data or to open the menu.

6 DOWN key:
The DOWN key is used to decrease input values or to navigate through the menu.

7 UP key:
The UP key is used to increase input values or to navigate through the

5.2 Understanding of standard display indications

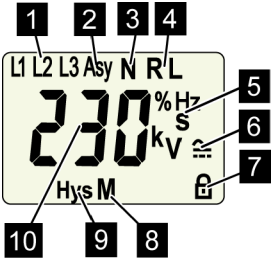


Fig. 5.2: Standard displays

1 DISPLAY LINE CONDUCTORS L1-L3:
Displays active line conductors.

2 DISPLAY ASYMMETRY:
Displays the asymmetry value as %.

3 DISPLAY NEUTRAL CONDUCTOR:
Neutral conductor is active.

4 DISPLAY PHASE SEQUENCE:
R = clockwise
L = anticlockwise

5 DISPLAY AREA FOR UNITS:
Displays the value of a unit.
% = per cent (asymmetry and hysteresis)
Hz = frequency in hertz
s = seconds
k = kilo
V = volt

6 DISPLAY TYPE OF VOLTAGE:
Displays the type of voltage.

7 PASSWORD PROTECTION ENABLED:
Indicates that password protection is activated.

8 FAULT MEMORY ACTIVATED:
Indicates that the fault memory is activated.

9 DISPLAY HYSTERESIS:
Displays hysteresis as %.

10 DISPLAY VALUE:
Displays values.

5.3 Getting to know keys and key functions

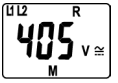
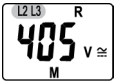
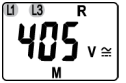
The following table shows the functions of the keys for navigation on the display, navigation through the menu and parameter setting. From "Chapter 5.4 Querying values" onwards, only the respective key symbols are used for querying values.

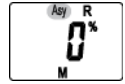
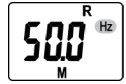
Key	Key symbol	Function
UP		• Call up the next display • Move to the next menu, sub menu or category • Activate parameters • Change the parameter value (increase) • Keep key pressed for more than 1.5 seconds: Carry out the manual self test.
DOWN		• Call up the next display • Move to the next menu, sub menu • Deactivate parameters • Change parameters (decrease) • Keep key pressed for more than 1.5 seconds: Clear fault memory.
ENTER		• Call up menu, submenu. • Save changed parameter value. • Keep key pressed for more than 1.5 seconds: Call up/leave the menu/ move to the next higher submenu item.

5.4 Querying values

By default, the display shows the phase-to-phase voltage between L1 and L2. By pressing the UP and DOWN key, the phase-to-phase voltage between L1 and L3, L2 and L3 as well as asymmetry, system frequency and phase sequence can be queried

The flashing elements in the display indications below are highlighted as grey-shaded fields.

Query	Display indication
1. Query phase-to-phase voltage L1/L2	
2. Change display indication	
3. Query phase-to-phase voltage L2/L3	
4. Change display indication	
5. Query phase-to-phase voltage L1/L3	
6. Change display indication	

Query	Display indication
7. Query asymmetry	
8. Change display indication	
9. Query system frequency	
10. Change display indication	
11. Query phase sequence	

5.5 Starting the self test manually

The self test described in "Chapter 3.2.2 Automatic self test" can also be started manually. During the self test, internal functional faults are detected and are indicated as error codes on the display.
In order to start the self test manually:

1. Keep the test button T (UP) pressed for more than 1.5 seconds.

On the display the text "tes" and all applicable display elements will appear.

5.6 Clearing the fault memory

The device utilises an erasable fault memory.
In order to clear the fault memory:

- Keep the UP key pressed for more than 1.5 seconds.

5.7 Calling up or leaving the menu

In order to call up the menu:

- Keep the ENTER key pressed for more than 1.5 seconds.

For leaving the menu:

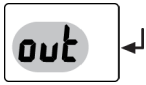
- Keep the ENTER key pressed again for more than 1.5 seconds.

5.8 Carrying out settings in the menu

5.8.1 Selecting menu items

Press the ENTER key for more than 1.5 seconds to call up the menu. Menu items for different settings are available. Some menu items consist of several submenu items. The UP/DOWN keys can be used to navigate through the menu items. Keep the ENTER key pressed no longer than 1.5 seconds to call up the menu item. Keep the ENTER key pressed for more than 1.5 seconds to return to the next higher menu level.

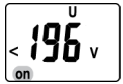
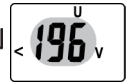
Menu item/Key to call up	Description/parameter setting
	Querying and setting response values: • Undervoltage: < U (AL2) • Overvoltage: > U (AL1) • Hysteresis of the voltage response values: Hys U • Asymmetry: Asy (AL1 and AL2) • Underfrequency: < Hz (AL1 and AL2) • Overfrequency: > Hz (AL1 and AL2) • Hysteresis of the frequency response values: Hys Hz • Phase sequence: PHS (AL1 and AL2)

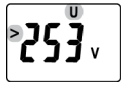
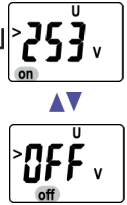
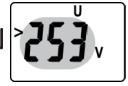
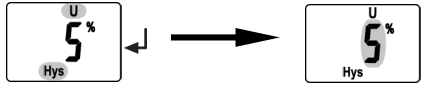
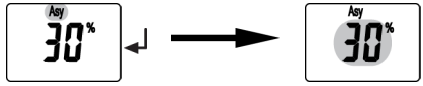
Menu item/Key to call up	Description/parameter setting
▲▼	1. Press the UP/DOWN key to select the next menu item.
	Configuring the fault memory and the analogue interface: • Fault memory: activate/deactivate or select con mode • Selection of the type of the analogue interface: 0…400 µA, 0/4…20 mA, 0…10 V • Determine 100 % reference related to the analogue output signal (submenu AnA)
▲▼	2. Press the UP/DOWN key to select the next menu item.
	• Setting the start-up delay t
▲▼	3. Press the UP/DOWN key to select the next menu item.
	Setting the parameters for device control • Select method of measurement 3Ph or 3n • Enable or disable password protection, change password • Re-establish factory setting • Start the preset function PrE manually. • Service menu SyS blocked
▲▼	4. Press the UP/DOWN key to select the next menu item.
	Query hard and software version
▲▼	5. Press the UP/DOWN key to select the next menu item.

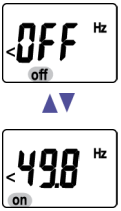
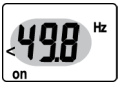
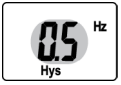
Menu item/Key to call up	Description/parameter setting
	Query stored alarm values
	6. Press the UP/DOWN key to select the next menu item.
	Move to the next higher menu level (return)

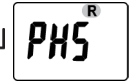
5.8.2 Carrying out settings in the menu item AL

1. Select menu item AL.
2. Carry out parameter change as illustrated below.
3. Keep the ENTER key pressed for more than 1.5 seconds to return to the menu item level after parameter change.

Menu item AL	Select submenu item	Activate/deactivate parameters	Change display parameter value	Change/save param.
1. Set the response value for undervoltage		  		
2. Select submenu item				

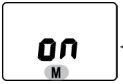
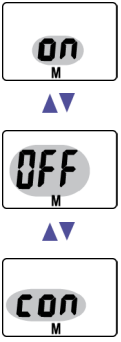
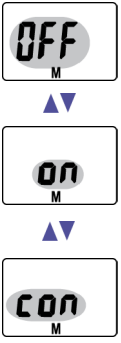
Menu item AL	Select submenu item	Activate/deactivate parameters	Change display parameter value	Change/save param.
3. Set the response value for overvoltage				
4. Select submenu item				
5. Set the hysteresis for voltage response values				
6. Select submenu item				
7. Set the asymmetry response value				
8. Select submenu item				

Menu item AL	Select submenu item	Activate/deactivate parameters	Change display parameter value	Change/save param.
9. Set the response value for underfrequency				
10. Select submenu item				
11. Set the response value for overfrequency				
12. Select submenu item				
13. Set the hysteresis for frequency response value				
14. Select submenu item				

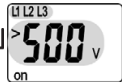
Menu item AL	Select submenu item	Activate/deactivate parameters	Change display parameter value	Change/save param.
15. Set the response value for phase sequence				
				
16. Select submenu item				
17. Return to menu item AL				

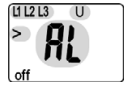
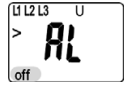
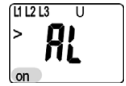
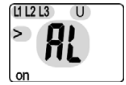
5.8.3 Carrying out settings in the menu item out

1. Select menu item out. Carry out parameter change as illustrated below.
2. Keep the ENTER key pressed for more than 1.5 seconds to return to the menu item level after parameter change.

Menu item OUT	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.
1. Activate/ deactivate fault memory or select con mode				
2. Reactivate fault memory/select con mode				

Menu item OUT	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.
3. Select submenu item				
4. Select current output 0…20 mA				
5. Change parameter				
6. Select current output 0…400 µA				
7. Change parameter				
8. Select voltage output 0…10 V				
9. Change parameter				
10. Select current output 4…20 mA				
11. Select submenu item				

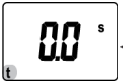
Menu item OUT	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.
12. Set the 100 % reference of the analogue output to: highest voltage of all 3 phases				
13. Change parameter				
14. Set the 100 % reference to: voltage at L1				
15. Activate parameter L1		 	The activation of L1 will result in deactivation of all other parameters in the AnA submenu!	
16. Set the value of parameter AL1				
	Select and activate the parameters L2, L3, Asy, Hz and PHS as illustrated above.			
17. Change parameter				

Menu item OUT	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.
18. Set the 100 % reference to: response value overvoltage of all 3 phases				
				
19. Activate parameter AL (L1 L2 L3)		▲▼	The activation of AL (L1 L2 L3) will result in deactivation of all other parameters in the AnA submenu!	
				▲▼
				
	Select and activate the parameters L1, L2, L3 and Asy as illustrated above.			
20. Change parameter		▲▼		

Page 13 provides a complete list of all selectable parameters for the analogue interface.

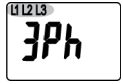
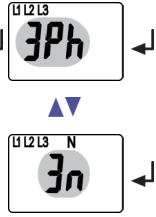
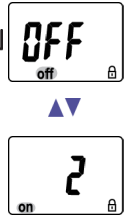
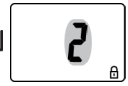
5.8.4 Carrying out settings in the menu item t

1. Select menu item t
2. Carry out parameter change as illustrated below.
3. Keep the ENTER key pressed for more than 1.5 seconds to return to the menu item level after parameter change.

Menu item t	Select submenu item	Activate/deactivate parameters	Change display parameter value	Change/save param.
1. Set start-up delay for device start				
2. Select sub-menu item				
3. Return to menu item t				

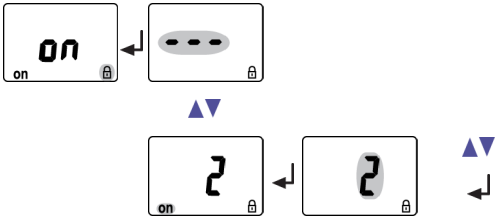
5.8.5 Carrying out settings in the menu item SEt

1. Select menu item SEt.
2. Carry out parameter change as illustrated below.
3. Keep the ENTER key pressed for more than 1.5 seconds to return to the menu item level after parameter change.

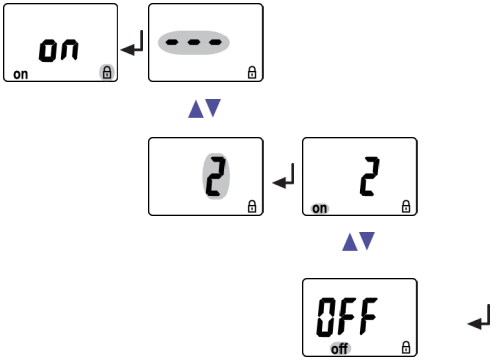
Menu item SET	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.
1. Set method of measurement for phase				
2. Select submenu item				
3. Enable password protection and enter password (3-digit numerical code)				

Menu item SET	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.

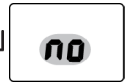
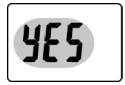
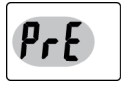
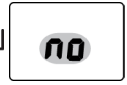
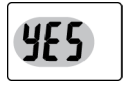
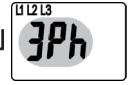
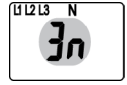
4. Changing the password

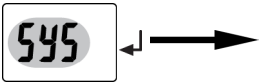
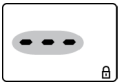


5. Disable password protection



6. Select submenu item

Menu item SET	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.
7. Re-establish factory setting		 	The text "run" will appear on the display and the device will automatically reset to factory setting.	
8. Select submenu item				
9. Activate preset function for 3Ph and 3n manually.		 	 	
			The texts "run" and "PrE" will alternately appear on the display. If the text "rdY" appears on the display, the preset function has been carried out for 3n resp. 3Ph.	

Menu item SET	Select submenu item	Activate/deactivate/change param.	Change display parameter value	Change/save param.
10. Select submenu item				
11. System menu locked				
12. Select submenu item				
13. Return to menu item SEt				

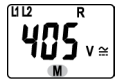
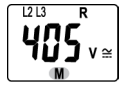
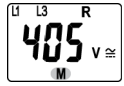
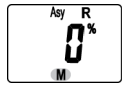
5.8.6 Querying information in menu item INF

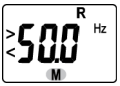
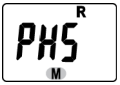
1. Select menu item INF.

Information such as software version and hardware version will alternately appear on the display. Select the respective information from the text indicated on the display using the UP/DOWN keys.

5.8.7 Querying and clearing fault memory in the menu item HIS

1. Select menu item HIS.
2. Change parameters according to table.
3. Keep the ENTER key pressed for more than 1.5 seconds to return to the menu item level after parameter change.

Menu item HIS	Fault indication /Submenu item
1. Query voltage faults L1/L2	
2. Select fault indication	
3. Query voltage faults L2/L3	
4. Select fault indication	
5. Query voltage faults L1/L3	
6. Select fault indication	
7. Query asymmetry faults	
8. Select fault indication	

Menu item HIS	Fault indication /Submenu item
9. Query frequency faults	
10. Select fault indication	
11. Query phase faults	
12. Select fault indication	
13. To clear the fault memory	 
14. Select fault indication	
15. Return to menu item HiS	 

6. Technical data

6.1 Data in tabular form

( )* = factory setting

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) - (M+, µA, mA, V)
Voltage test acc. to IEC 61010-1:
(N, L1, L2, L3) - (A1, A2), (M+, µA, mA, V) ..... 3.32 kV
(N, L1, L2, L3) - (M+, µA, mA, V) ..... 2.21 kV
(A1, A2) - (M+, µA, mA, V) ..... 2.21 kV

Supply voltage

VMD420-DM-1:
Supply voltage U_s ..... AC 16...72 V / DC 9.6...94 V
Frequency range U_s ..... 15...460 Hz
VMD420-DM-2:
Supply voltage U_s ..... AC/DC 70...300 V
Frequency range U_s ..... 15...460 Hz
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 ..... 15...460 Hz
Frequency 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) (measuring 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
Hysteresis U ..... 1 . . . 40 % (5 %)*
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 ..... ±1.5 %, ±2 digit
Relative uncertainty: voltage in the range of 15 Hz…460 Hz ..... ±3 %, ±2 digit
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 = 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 ..... 0 . . . 300 s (0 s)*
Resolution of setting t (0…10 s) ..... 0.1 s
Resolution of setting t (10…99 s) ..... 1 s
Resolution of setting t (100…300 s) ..... 10 s
Operating time voltage t_{ae} ..... ≤ 140 ms
Operating time frequency t_{ae} ..... ≤ 335 ms
Response time t_{an} ..... $t_{an} = t_{ae}$
Recovery time t_b ..... 300 ms

Displays, memory

Display ..... LC display, multi-functional, not illuminated
Display range, measured value ..... AC 0 . . . 500 V
Operating uncertainty: voltage at 50 Hz/60 Hz ..... ±1.5 %, ±2 digit

Operating uncertainty: voltage in the range of 15…460 Hz ..... ±3 %, ±2 digit
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)*

Analog output

Voltage output:
Open circuit voltage (terminals open) ..... ≤ DC 20 V
Voltage output ..... DC 0…10 V
Burden ..... ≥ 1 kΩ
Current outputs:
Short-circuit current ..... ≤ 30 mA, short-circuit proof
Current output ..... DC 0/4…20 mA
Burden ..... ≤ 500 Ω
Current output ..... DC 0…400 µA
Burden ..... ≤ 12.5 kΩ

Environment/EMC

EMC ..... EN 61326-1
Ambient temperatures:
Operating temperature ..... -25…+55 °C
Transport ..... -25…+70 °C
Long-term storage ..... -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 ..... **screw-type terminals**
Connection properties:
Rigid/ flexible ..... 0.2…4 / 0.2…2.5 mm^2 / AWG 24…12
Multi-conductor connection (2 conductors with the same cross section):
Rigid, flexible ..... 0.2…1.5 / 0.2…1.5 mm^2
Stripping length ..... 8…9 mm
Tightening torque ..... 0.5…0.6 Nm
Connection ..... **push-wire terminals**
Connection properties:
Rigid ..... 0.2…2.5 mm^2 (AWG 24…14)
Flexible without ferrules ..... 0.2…2.5 mm^2 (AWG 24…14)
Flexible with ferrules ..... 0.2…1.5 mm^2 (AWG 24…16)
Stripping length ..... 10 mm
Opening force ..... 50 N
Test opening, diameter ..... 2.1 mm

General data

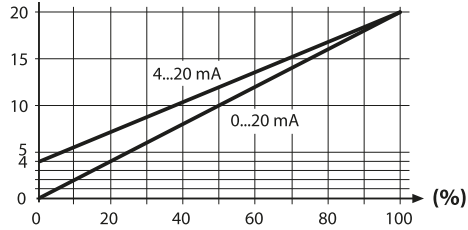
Operating mode ..... continuous operation
Mounting ..... any position
Degree of protection, internal components (IEC 60529) IP30
Degree of protection, terminals (IEC 60529) IP20
Enclosure material ..... polycarbonate
Flammability class UL94 V-0
DIN rail mounting acc. to ..... IEC 60715
Screw fixing .....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

( )* = factory setting

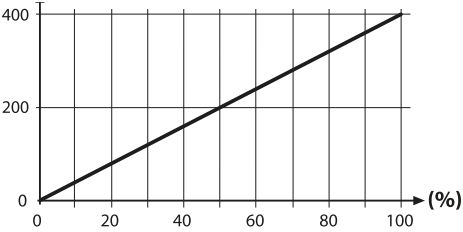
** = The technical data only applies to the operating range of the rated frequency (15 . . .460 Hz).

6.2 Current and voltage curves of the analogue interface

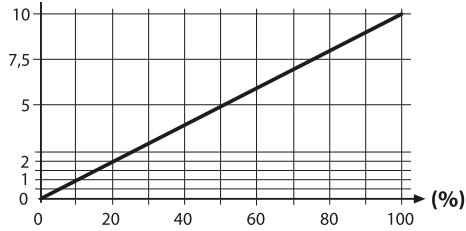
Current output 0/4…20 mA



Current output 0…400 µA



Current output 0…10 V



6.3 Standards, approvals and certifications

6.4 Ordering information

Device type	Nominal voltage U_n*	Supply voltage U_S*	Art. No.
VMD420-DM-1 (push-wire terminals)	3(N)AC 0…500 V/ 288 V 15…460 Hz	AC 16…72 V / DC 9.6 V…94 V DC, 15…460 Hz	B 7301 0017
VMD420-DM-1	3(N)AC 0…500 V/ 288 V 15…460 Hz	AC 16…72 V / DC 9.6 V…94 V DC, 15…460 Hz	B 9301 0017
VMD420-DM-2 (push-wire terminals)	3(N)AC 0…500 V/ 288 V 15…460 Hz	AC/DC 70…300 V DC, 15…460 Hz	B 7301 0018
VMD420-DM-2	3(N)AC 0…500 V/ 288 V 15…460 Hz	AC/DC 70…300 V DC, 15…460 Hz	B 9301 0018
*Absolute values of the voltage range			
Mounting clip for screw fixing (1 piece per device, accessories)			B 9806 0008

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