

Manual



VMD460-NA

Network and system protection (NS protection) for monitoring the power feed-in of power generation systems

Software version: D398 V1.1x

Display software version: D403 V2.2x



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1. How to use this documentation effectively

1.1 How to use this manual

This operating manual will concern qualified experts in electrical engineering and user of the product and must be kept ready for referencing in the immediate vicinity of the device.

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 emphasised by symbols. The meaning of these symbols is explained below:



The warning symbol indicates a potential dangerous situation that may result in bodily injury and/or damage to property.

Observe the associated safety instructions.



Information intended to assist the user to make optimum use of the product are marked with the Info symbol.

Although great care has been taken in the drafting of this operating manual, it may nevertheless contain errors and mistakes.

The Bender Group cannot accept any liability for injury to persons or damage to property resulting from errors or mistakes in this manual.

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1.2 Technical support: Service and support

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- Questions about special customer applications
- Commissioning
- Troubleshooting

Tel.: +49 6401 807-760*

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only available in Germany: 0700BenderHelp (Tel. and Fax)

E-mail: support@bender-service.com

Repair service

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- Hardware and software update for Bender devices
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- Extended warranty for Bender devices with in-house repair service resp. replacement devices at no extra cost

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+49 6401 807-784**, -785** (commercial matters)

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E-mail: repair@bender-service.com

Please send the devices for repair to the following address:

Bender GmbH, Repair Service,
Londorfer Strasse 65,
35305 Gruenberg,
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+49 6401 807-753** (commercial matters)

Fax: +49 6401 807-759

E mail: fieldservice@bender-service.com

Internet: www.bender-de.com

*Available from 7.00 a.m. to 8.00 p.m. on 365 days of the year (CET/UTC+1)

**Mo-Thu 7.00 a.m. - 8.00 p.m., Fr 7.00 a.m. - 13.00 p.m

1.3 Workshops

Bender would be happy to provide training in respect of the use of the universal measuring device.

Current dates of training courses and workshops can be found on the Internet at

<http://www.bender-de.com/en/know-how/seminars>.

1.4 Delivery conditions, guarantee, warranty and liability

The conditions of sale and delivery set out by Bender apply.

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Conditions of sale and delivery can be obtained from Bender in printed or electronic format.

2. Safety

2.1 Intended use

The voltage and frequency monitoring relay VMD460-NA is used for system and network protection (NS protection) of CHPs, wind, hydroelectric and photovoltaic systems feeding power into the grid.

If inadmissible voltage and frequency values occur on the supply side, the VMD460-NA has the task of disconnecting the power generation system from the distribution network by means of a coupling switch.

The voltage and frequency monitoring relay is to be installed and connected directly at the central meter panel.

The VMD460-NA utilises a separate supply voltage connection.



Power generation systems with an output of > 6 kW require a separate asymmetry monitoring.

2.2 Electrically 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.

2.3 General safety instructions

Bender devices are designed and built in accordance with the state of the art and accepted rules in respect of technical safety. However, the use of such devices may introduce risks to the life and limb of the user or third parties and/or result in damage to Bender devices or other property.



Danger of electric shock!

*Touching live parts will cause danger of electric shock with fatal consequences. 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!***

- Only use Bender equipment:
 - as intended
 - in perfect working order
 - in compliance with the accident prevention regulations and guidelines applicable at the location of use
- Eliminate all faults immediately which may endanger safety.
- Do not make any unauthorised changes and only use replacement parts and optional accessories purchased from or recommended by the manufacturer of the equipment. Failure to observe this requirement can result in fire, electric shock and injury.
- If the device is overloaded by overvoltage or a short-circuit current load, it must be checked and replaced if necessary.
- If the device is being used in a location outside the Federal Republic of Germany, the applicable local standards and regulations must be complied with. European standard EN 50110 can be used as a guide.

Device-specific safety information



After commissioning, the essential settings of the VMD460-NA have to be protected against unauthorised changes by a password.

If the password protection is not used, the device has to be sealed.

3. Function

3.1 Device features

- Straightforward commissioning by means of default basic programs for national standards and regulations
- Single-fault safety
- Monitoring of the connected coupling switches
- Islanding detection df/dt (ROCOF)
- Service Interface RS-485 (software update)
- Test function with determination of the disconnection time
- Test button for the trigger circuit
- The last 300 distribution network faults can be recalled with time stamp/real-time clock
- Continuous monitoring of the phase voltage and line-to-line voltage
- Special connection conditions after an infringement of a limit value
- Language selection (German, English, Italian)
- Backlit graphics LC display
- Password protection for device setting
- Remote shutdown via ripple control signal receiver
- Sealable enclosure

3.2 Description of function

The power generation system is only allowed to connect to the public grid when the country-specific connection conditions are met. Mains voltage and mains frequency must be within the defined tolerance range.

The devices utilise several separately adjustable measuring channels for:

- Voltage drop protection $U <$, $U <<$
- Rise-in-voltage protection $U >>$, $U10> / U >$ (depending on standard)
- Frequency decrease protection $f <$, $f <<$
- Frequency increase protection $f >$, $f >>$

This satisfies the requirements for static and dynamic network monitoring. In case of infringements of a limit value or a remote trip signal, the relay K1 (and K2, if necessary) switch and the alarm LEDs light. Reconnection to the grid is carried out when the national connection conditions to the grid are met. Pressing the test button ensures that the relays are checked and the required test (trigger test) of the relays K1 and K2 is carried out.

3.2.1 Calculating the average value of overvoltage (VDE-AR-N 4105, CEI 0-21, C10/11)

The overvoltage $U10$ is determined by averaging the last 10-minute measuring interval. Always the highest 10-minute average value value $U10>$ of each of the three voltages monitored between L1-N, L2-N, L3-N will be indicated.

3.2.2 Self test, automatic

The device runs a continuous self test during which internal malfunctions are detected and shown on the display as error codes. The alarm relays are not switched during this test.

3.2.3 Manual self test

The self test cannot be started unless the power generation system has been started by the VMD460-NA (both alarm LEDs off) and the contact monitoring is installed and activated.

Start of the manual self test:

1. Press the test button in the standard display (> 1.5 s) or
2. select "TEST" from the menu display

The alarm relays K1 and K2 switch during the self test and open resp. close the contacts 11/12/14 and 21/22/24.

The self test continues to run until the defined disconnection time t_{off} at undervoltage condition has elapsed.



Both coupling switches are switched off during the self test.

During the self test, the times are measured until the switching command for the coupling switches ($t_{\text{off (DEVICE)}}$) is activated or until the coupling switches ($t_{\text{off (TOTAL)}}$) trip. These periods are automatically indicated by alarm displays for the measuring channels 15 ($t_{\text{off (TOTAL)}}$) and 16 ($t_{\text{off (DEVICE)}}$). They are also available in the "Alarm/meas. value" menu.

3.2.4 Remote-Trip (RTG / RT1)

The activation of this function is optional and can be used to separate the power generation system from the supply network remotely via an external contact. After activating the remote control, the coupling switch will be switched after ≤ 50 ms.

This function can be deactivated in the "Settings / General / Remote Trip = off" menu, if not required.

3.2.5 Malfunction and messages



In case of malfunctions or messages, the power generation system will be separated from the supply network.

In the case of an internal malfunction or an error in the operation of the coupling switches, both alarm LEDs will flash. The error code or the message in plain text is indicated on the display.

If several faults or messages occur simultaneously, they will be displayed alternately at four-second-intervals.

In the case of an internal error, make a note of the error code "xx" and contact the Bender Service.

Code/ Message	LED	Meaning	Remedy
1...20	Both LEDs flash	Internal error	Make a note from the error code "xx" and contact the Bender Service.
contact monit. K1	Both LEDs flash	Error: Contact monitoring K1	After rectifying the the fault at the coupling switch/main switch (e.g. manual connection of the backup switch), the fault is automatically cleared. Should, however, a fault have occurred three times within 30 seconds, normal operation must be started again after fault rectification by pressing the "RESET" button (in the standard display).
contact monit. K2		Error: Contact monitoring K2	

Code/ Message	LED	Meaning	Remedy
23	Both LEDs flash	Internal error	Make a note from the error code "xx" and contact the Bender Service.
Remote trip	Both LEDs light continuously	Remote trip active	Activate RTG/RT1 or deactivate the input via the menu (off)
Enter norm	Both LEDs light continuously	No norm selected	Select the application norm from the menu.

3.2.6 Delay times t_{on} and t_{off}

Delay time for connection t_{on}

When all voltage and frequency values measured, meet the conditions for connection during the delay time for connection, the alarm LEDs will go out and the alarm relays will switch.

Response delay t_{off}

Minimum period for an error to exist until the alarm relays will switch.

3.2.7 Password protection

By default, the password protection is deactivated (off).

3.2.8 Factory setting

After activating the factory setting, all previously changed settings are reset to delivery status.

3.2.9 Erasable history memory

The device utilises a history memory for failsafe storing of up to 300 data records (date, time, channel, event code, measured value).

3.2.10 Passive islanding detection (df/dt)

The VMD460-NA uses a passive method for islanding detection (three-phase voltage and frequency monitoring).

df/dt

The monitoring of the rate of change of frequency "ROCOF" (df/dt) is an islanding detection function.

If a section of the network is disconnected by the energy provider, it may happen that the power generation systems located in this section unintentionally feed this section of the network.

Underfrequency and overfrequency monitoring might not be sufficient to detect this dangerous, uncontrollable state, since the generators try to keep the frequency at the nominal frequency level.

Due to the unbalance between generated and consumed energy, however, the frequency fluctuates around the nominal frequency. If this happens at a certain minimum speed, this is an indication of islanding, hence the power generation system will be disconnected by the VMD460-NA.

As soon as the rate of change of frequency is below the response value hysteresis and t_{on} has expired, the power generation system will be reconnected.

t_{off}	Response delay: the time during which a limit value (df/dt) must be violated until the power generation system is disconnected by the VMD460-NA.
t_{on}	Delay time, if df/dt disconnected the system.

Measuring window Period of time used to calculate the average of the frequency changes. The bigger the measuring window is selected the less sensitive will the df/dt function be.

4. Installation, connection and commissioning



Danger of electric shock!

Make sure that the installation area is **disconnected from any electrical source** .

Consider the data on **the rated voltage and supply voltage** as specified in the technical data!

4.1 Unpacking

- Unpack all the parts supplied with the system. Avoid sharp-edged tools that may damage the content of the packaging.
- Compare your order with our delivery note to check that you have received all products in full. The article numbers and type designation printed on the nameplates provide an easy means of uniquely identifying each device.
- Check all parts supplied for any evidence of damage in transit.
- Equipment damaged in transit must not be used. If a device has sustained damage, please contact Bender. Details of who to contact are indicated on the delivery documents.
- When storing the devices in an environment where the temperature is wintry and cold:

Leave the devices to stand for 3 to 4 hours at room temperature before connecting the power supply. When the devices are moved from a cold to a warm environment, condensation will be evident on all parts. Putting damp devices into operation risks damaging electrical components and there is a danger of electric shock on contact.

4.2 Back-up fuses

Equip the supply voltage of all system components with fuses. IEC 60364-4-43 requires protective devices to be used to protect the component in the event of a short circuit. We recommend the use of 6 A fuses.

4.3 Notes on mounting

**Danger of electric shock!**

Make sure that the installation area is **disconnected from any electrical source**.

Consider the data on **the rated voltage and supply voltage** as specified in the technical data!



The **length of the connecting cable** of the device connections DG1/2, D1, D2, DG3/4, D3, D4, RTG and RT1 is to be **limited to 3 m**.



To ensure the VMD460-NA's functionality after a power failure, it is recommended to use an **external UPS**.

The devices are suitable for the following types of installation:

- Standard distribution panels according to DIN 43871 or DIN rail mounting according to IEC 60715
- Screw mounting using M4 screws

4.4 Block diagram

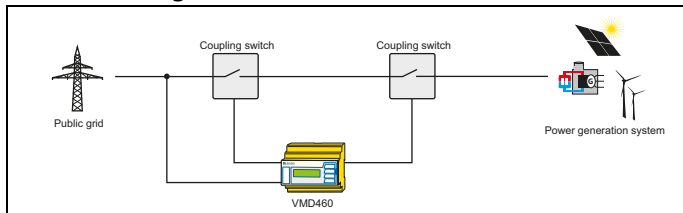


Fig. 4.1: Block diagram of a central NS protection with coupling switches

4.5 Dimension diagram VMD460-NA

All dimensions in mm

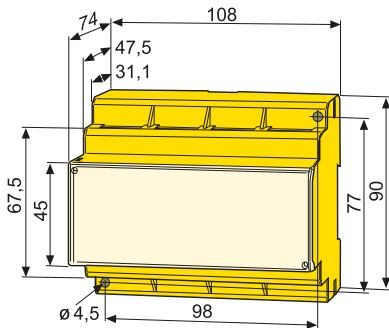


Fig. 4.2: Dimension diagram and drawing for screw fixing

4.6 DIN rail mounting:



Snap the rear mounting clip of the device into place in such a way that a safe and tight fit is ensured.

4.7 Screw mounting

1. Use the 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. Then fix the device using two M4 screws.

Key

No.	Element	Function
1	A1, A2	Supply voltage U_s (see ordering information)
2	L1, L2, L3, N	Power supply connection
3	K1, K2	Relay connections
4	DG1/2, D1, D2	Contact monitoring coupling switch DG1/2: GND D1: feedback signal contact K1 D2: feedback signal contact K2 (<i>feedback signal contacts optionally NC/NO/off</i>)*
5	RTG, RT1	RTG: GND RT1: Remote trip input (<i>optionally NC/NO/off</i>)*
6	A, B	Service interface
7	R _{on/off}	Activate or deactivate the terminating resistor of the service interface (120 Ω)
	DG3/4, D3, D4	not to be used in accordance with VDE-AR-N 4105, BDEW, C10/11

* Explanation: **NC** (in non-operating state closed) 
NO (in non-operating state open) 
off (switched off)

Single-fault safety

In order to ensure single-fault safety, the VDE-AR-N 4105 has to be realised for the power generation system. A single fault in the actuation circuit must not prevent a disconnection of the power generating system from the grid. The monitoring circuit for grid disconnection of power generation systems is to be installed at the point of supply. The relays used K1 and K2 are to be connected according to the wiring diagram.



Use the contact monitoring function to prevent the sticking of contacts!

4.8.2 CEI 0-21

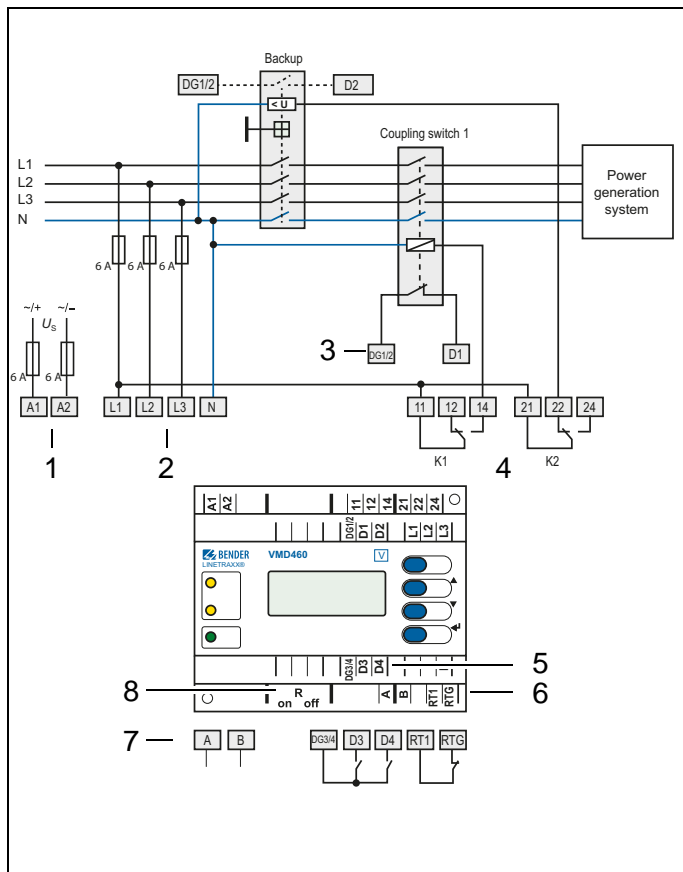





Fig. 4.4: Wiring diagram VMD460-NA (CEI 0-21)

Key

No.	Element	Function
1	A1, A2	Supply voltage U_s (see ordering information)
2	L1, L2, L3, N	Power supply connection
3	DG1/2, D1, D2	Contact monitoring coupling switch DG1/2: GND D1: feedback signal contact K1 D2: feedback signal contact K2 (Backup) (<i>optionally NC/NO/off</i>) *
4	K1, K2	Relay connections
5	DG3/4, D3, D4	Digital inputs (external monitoring) DG3/4: GND D3: Local control (CEI 0-21 8.6.2.1.1)** D4: External signal (CEI 0-21 8.6.2.1.2)** (<i>optionally NC/NO/off</i>)*
6	RTG, RT1	RTG: GND RT1: Remote trip input (<i>optionally NC/NO/off</i>)*
7	A, B	Service interface
8	R _{on/off}	Activate or deactivate the terminating resistor of the service interface (120 Ω)

* Explanation: **NC** (in non-operating state closed) 
NO (in non-operating state open) 
off (switched off) 

** For evaluation of the **inputs D3 and D4**, the mode has to be set accordingly in the menu:

Example for N/O:

Connection **D3**, menu: „local“ (D4 will not be evaluated)

D3: local control	f [Hz]	Disconnection time	Norm CEI0-21
open	49.5...50.5	0.1 s	81.S1
closed	47.5...51.5	0.1 s	81.S2

Example for N/O:

Connection **D4**, menu: „extern“ (D3 will not be evaluated)

D4: external signal	f [Hz]	Disconnection time	Norm CEI0-21
open	49.5...50.5	0.1 s	81.S1
closed	47.5...51.5	4 s; 1 s	81.S2



In the case of a failure of the coupling switch 1 (K1), the contact monitoring function will cause the backup relays to switch (K2).

4.8.3 Details regarding the digital inputs (D1...D4, RT1)

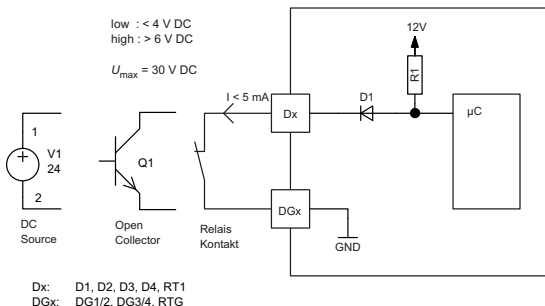


Fig. 4.5: Block diagram (simplified representation)

4.9 Standards, selectable

The VMD460-NA includes the following standards:

- VDE-AR-N 4105
- CEI 0-21
- BDEW
- C10/11

Menu: "Settings" --> "General" --> "Norm".

4.10 Commissioning



Danger of electric shock!

Improper connection can lead to injury to persons and damage to the device!

*Prior to commissioning **make sure that the device is properly connected!***

Initial commissioning

When commissioning the device for the first time

- Select a **language** (English, German, Italian).
- Select a **standard** (VDE-AR-N 4105, CEI 0-21, BDEW, C10/11).
- In addition, you have to set the **date** and the **time**.

You can only change settings in the menus after settings listed above have been carried out.

The **contrast of the LC display** can be adjusted to any ambient brightness.



Select the contrast ratio from an infinite loop display. After reaching a black display, the contrast setting process starts again with a white display. Simultaneously press and hold down the buttons "INFO" and "MENU" until the display text is clearly readable.

When switching to another application standard, the associated factory settings will be loaded.



Existing user-defined settings will not be saved when switching from one standard to another.

4.11 Trigger circuit test by the system erector

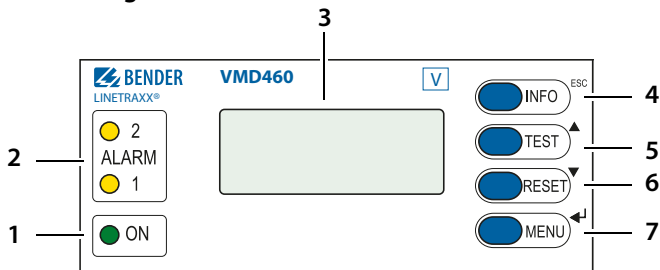
During commissioning, the system erector has to check the correct function of the trigger circuit NS protection/coupling switch, as illustrated in the wiring diagram in this operating manual, consisting of K1/K2 and coupling switch 1/ coupling switch 2.

- Press the test button to activate the coupling switch.
- Successful activation must be visualised by the coupling switch.
- Contact monitoring of the coupling switch (optional, depending on the standard)

Note the information about recurrent tests on page 41.

5. Operation and configuration

5.1 Getting to know the user interface



Key

No.	Element	Function
1	ON	Power On LED, green; lights when the power supply is available and the device is in operation; flashes in case of system fault alarm (external watchdog)
2	ALARM1 and ALARM2	Generation system disconnected: Both LEDs light (yellow) in the case of limit value violation of voltage, frequency, remote disconnection df/dt (optional), asymmetry (optional); Both LEDs flash (yellow) in the case of an internal device error or a contact monitoring fault; Only ALARM 1 lights: Delay time for connection t_{on} active
3		Backlit LC display

4	Info ESC	Standard display: Toggling between standard display and device information Menu display: To exit the parameter setting menu without storing; to go to the next higher menu level
5	TEST ▲	Standard display: A manual test is carried out using the test button (> 1.5 s), during which both alarm relays are triggered (trigger test for testing the coupling switches). In addition, fault simulation will be carried out (disconnection time documented) Menu display: Arrow up button for parameter change and scrolling
6	RESET ▼	Standard display: (> 1.5 s) Acknowledgement of fault messages from contact monitoring Menu display: Arrow down button for parameter change/scrolling
7	MENU ←↵	Standard display: Toggling between standard, menu and alarm display Menu display: ↵ button Jump to parameter settings; saving the changed parameters

5.2 Various displays

5.2.1 Standard display

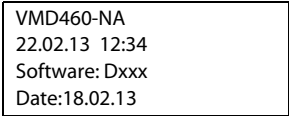
In the standard display, phase voltages, line conductor voltages, the maximum 10-minute average value (depending on standard) and the frequency are indicated on the display.

L1-N 229.9V	L1-L2 397.2V
L2-N 229.5V	L2-L3 401.9V
L3-N 232.9V	L3-L1 400.1V
U10 57.3V	f 50.00Hz

Fig. 5.1: Standard display

5.2.2 Info display

Device-specific information is available in the info display.



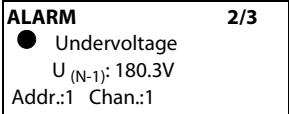
```
VMD460-NA
22.02.13 12:34
Software: Dxxx
Date:18.02.13
```

Fig. 5.2: Info display

For detailed information refer to page 33.

5.2.3 Alarm display

Type and source of alarms are indicated on the alarm display in plain text format.



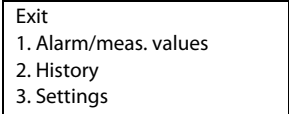
```
ALARM 2/3
● Undervoltage
  U(N-1): 180.3V
  Addr.:1 Chan.:1
```

Fig. 5.3: Alarm display

Explanation: In the example above, the second message of three is being indicated (2/3). The address "Addr" currently is of no significance. The alarm is outputted on measuring channel 1 and can be accessed via channel number 1 in the "Alarm/meas. values" menu.

5.2.4 Menu display

Alarms, currently measured values as well as the history memory can be called up via the menu display. Settings can also be changed in this display.



```
Exit
1. Alarm/meas. values
2. History
3. Settings
```

Fig. 5.4: Menu display

5.2.5 Toggling between the displays

You can toggle between the different displays by using the four device buttons. Depending on the type of display (standard display, alarm display, menu display, info display), the meaning of the buttons is different. The picture below illustrates which button is to be pressed for accessing the individual display. First, it is necessary to determine whether an alarm exists or not.

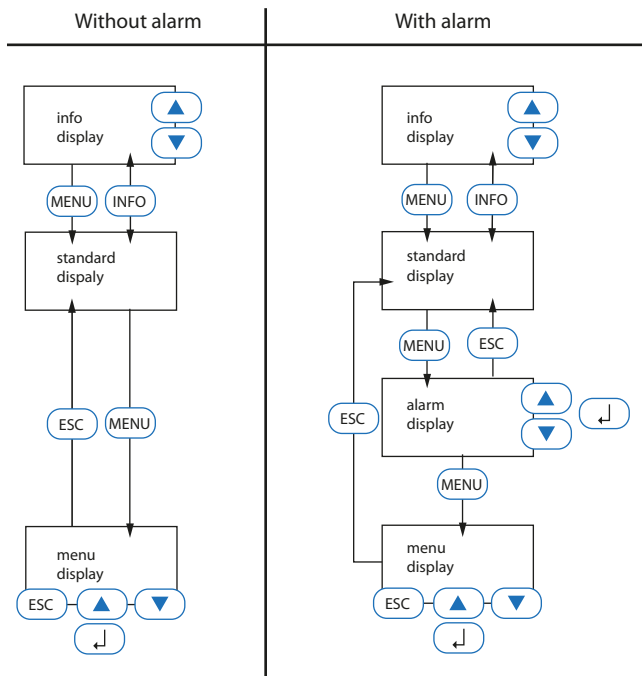


Fig. 5.5: Toggling between the displays (with or without alarm)

5.3 INFO button

Device information in clear text format (Info display) can be called up with the "INFO" button. For this purpose press the "INFO" button in the standard display once. Scroll through the individual lines using the arrow buttons ▲▼ :

Device type
Current date, current time
Address BMS-Bus
Software version (measurement technique)
Date of software (measurement technique)
Software version (display)
Date of software (display)
Manufacturer of the device
Address of the manufacturer
Internet address of the manufacturer

Return to standard display via "ESC" resp. ↵.

5.4 Menu button


Toggling between the standard, alarm and menu display (see page 32). The individual entries in the menu display can be accessed using the arrow buttons ▲▼ :

The **menu display** provides the following submenus

Exit

1. Alarm/meas. values
2. History
3. Settings
4. System
5. Info

5.4.1 Alarm/meas. values

For detailed information about the value, select the "Alarm/meas. values" menu item (select the menu item using ).

Select the individual entries by means of the   buttons.

Exit

1. U(1-N): Value
2. U(2-N): Value
3. U(3-N): Value
4. U10: Value
5. U(1-2): Value
6. U(2-3): Value
7. U(3-1): Value
8. Frequency: Value
9. df/dt: Value
10. Status*
11. T(ON) : Value
12. Asymmetry: Value
13. Vect. shift**: Value
14. Phase sequ.: Value
15. T(OFF)TOTAL: Value
16. T(OFF)DEVICE: Value

For each of these entries you can check whether an alarm exists or not:

= no alarm

= alarm

* *Measuring channel 10*: The text depends on the existing message. If several messages exist, the individual messages appear automatically on the display every four seconds.

Measuring channel 15: Indicates the total time passed during the self test between the simulation of 0 V on L1 to the **disconnection** of coupling switch 1.

Measuring channel 16: Indicates the total time passed during the self test between the simulation of 0 V on L1 to the **disconnection command** for coupling switch 1.

** not used

5.4.2 History

The fail-safe history memory stores up to 300 events (alarms, tests) with information about alarms and acknowledgements and the time the event happened. If the history memory is full, the oldest entry will be deleted in the event of an alarm to create space for the new entry (FIFO principle).

For details about erasing the entire history memory manually, refer to "Chapter 5.4.4 System" on page 38.

History No. 297
Start: 01.02.13 / 15:57:00
Quit:
End: 01.02.13 / 16:07:03

Fig. 5.6: History (overview)

Key


Line 1: Event number

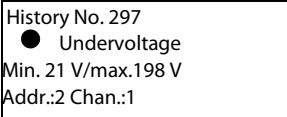
Line 2: Event start: Date/time

Line 3: Acknowledgement of the event: Date/time

Line 4: Event end: Date/time

Possibilities:

1. If you are searching for an event that occurred at a specific time, use the arrow buttons to scroll to the required entry.
2. Call up details: Use the  button to call up the current history memory entry.



History No. 297
● Undervoltage
Min. 21 V/max.198 V
Addr.:2 Chan.:1

Fig. 5.7: History (detail)

Key

Line 1: Data record number

Line 2: Alarm status and alarm text (e.g. undervoltage, transformer error,...)

○ = no alarm

● = alarm, fault

Line 3: Minimum and maximum measured value after the occurrence of an alarm

Line 4: RS-485 address and measuring channel of the device sending the message

5.4.3 Settings



Response values for NS protection may only be changed in consultation with the network operator!

Settings can be password protected. If the password is activated (enabled), all settings continue to be displayed. When an attempt is made to change settings, the password entry screen appears automatically:

Please enter password: 0 0 0

Once a valid password has been entered, access will be granted to settings in all menus (except the Service menu) until menu mode is exited.

If you can't remember your password, contact the Bender Service.

In principle, all preset response values can be changed, if this should be necessary. The values can be changed in the third level of the menu (column "twice ←↓") using ▲▼.

There are two different ways to exit the setting menu:

- **Save** and exit: „ ←↓ “
- Exit **without saving**: "ESC"

The menu structures in the settings contain different entries for each individual standard. These are listed in detail in "**Chapter 7. Selectable default settings**".

5.4.4 System

The following table gives an overview of the menu structure. The values can be changed in the third level of the menu (column "twice ⏏") using ▲▼. There are two different ways to exit the system menu:

- Save and exit: „⏏“
- Exit without saving: "ESC"

Menu: System	once ⏏	twice ⏏
1. History	Exit	
	Delete	Delete Cancel
2. Language	Exit	
	English English Italiano	
3. Clock	Exit	
	Format	d.m.y m-d-y
	Date	Toggle between the date elements ⏏
	Time	Toggle between hour and minute with ⏏
	CEST	auto off

Menu: System	once ↵	twice ↵
4. Password	Exit	
	Password	* * * Toggling between positions with ↵
	Status	off on
5. Interface	Exit Address	1...90 1: MASTER 2...90: Slave
6. Alarm addresses	Exit Address xxx	1...150: off/on
7. TEST	Cancel TEST	Test will be carried out
8. RESET	Cancel RESET	Reset will be carried out
9. Test communication	Exit 1. Chan.	Channel (1...12)
10. External devices	Exit List of the devices con- nected	1: Own address 2...150: External devices
11. Factory setting	Cancel Factory set- tings	Restore factory settings

5.4.5 Info

The following table gives an overview of the information to be called up. Scroll through the individual lines using the arrow buttons ▲▼ :

- Device type
- Current date, current time
- Address BMS-Bus
- Software version (measurement technique)
- Date of software (measurement technique)
- Software version (display)
- Date of software (display)
- Manufacturer of the device
- Address of the manufacturer
- Internet address of the manufacturer

6. Maintenance

Repeat test of the trigger circuit by the system operator

The system operator must ensure that the equipment required for parallel operation with the low-voltage network is always in proper technical condition. To this end, it is required to have an electrically skilled person check the protective devices for proper functioning at regular intervals. This requirement is deemed to be satisfied for normal and environmental conditions if the test intervals mentioned in BGV A3 are adhered to. The repeat test shall include at least the following:

- Check of the environmental conditions (pollution, mechanical or isolation damage).
- A tripping control of the coupling switch.
- Press the "TEST" button to trigger the coupling switch.
- Tripping must be visualised by the coupling switch.

The trigger circuit NS protection/coupling switch, in the wiring diagram of this operating manual consisting of K1/K2 and coupling switch 1/coupling switch 2, separates the power generation system from the public low-voltage grid. By checking the trigger circuit regularly, sticking of the contactors can be detected at an early stage.




7. Selectable default settings




Response values for NS protection may only be changed in consultation with the system operator!

The following standards are implemented in the factory settings of the VMD460-NA:

- VDE-AR-N 4105
- CEI 0-21
- BDEW guideline
- C10/11
- In preparation
 - G59/2
 - G83/2
 - DIN V VDE V 0126-1-1

The following tables give an overview about the menu structure for each pre-set standard. The values can be changed in the third level of the menu (column "twice ") using   .

The respective menu item can be exited with ESC (= without saving changed parameters)
 (= saving the changed parameters)



When switching to another application standard, the associated factory settings will be loaded.

Existing user-defined settings will not be saved when switching from one standard to another.

7.1 VDE-AR-N 4105

4105 Menu : Settings	once ↙	twice ↙	Factory setting
Exit			
General	Exit		
	norm	CEI021 4105	
	coupling	1 AC 3N AC 3 AC	3N AC
	U(L-N) U(L-L)	50...250 V 87...433 V	U(L-N) 230 V
	t SHORT INT.	1...300 s 6...60.0 min	3 s
	t (ON) SHORT INT.	1 s...60 min	5 s
	t (ON) NORMAL	1 s...60 min	60 s
	Remote Trip	N/C N/O off	off
Voltage	Exit		
	U>>	off/100...130 %	115 %
	U>	off/100...130 %	110 %
	U (ON) MAX	off/100...130 %	110 %
	U (ON) MIN	off/1...100 %	85 %
	U<	off/1...100%	80 %

4105 Menu : Settings	once ↵	twice ↵	Factory setting
Frequency	Exit		
	f>	off/50.00...65.00 Hz	51.50 Hz
	f (ON) MAX	off/50.00...65.00 Hz	50.05 Hz
	f (ON) MIN	off/45.00...60.00 Hz	47.50 Hz
	f<	off/45.00...60.00 Hz	47.50 Hz
df/dt	Exit		
	Mode	off/on	off
	Resp. value	0.1...9.9 Hz/s	1.0 Hz/s
	Hysteresis	1.0...50.0 %	20.0 %
	Meas. window	0.05...1.0 s	200 ms
	T (OFF)	0.04...30.0 s	100 ms
	T (ON)	1 s...60 min	60 s
Asymmetry	Exit		
	Mode	off/on	off
	Resp. value	1.0...50.0 %	5.0 %
	Hysteresis	1.0...50.0 %	20.0 %
	T (OFF)	0.04...30.0 s	100 ms
Relay	Exit		
	Relay mode	N/C N/O	K1: N/C K2: N/C

4105 Menu : Settings	once ↙	twice ↙	Factory setting
Digital Input	Exit		
	Relay mode	N/C; N/O; off	D1: N/C D2: N/C D3: off* D4: off*

* not used in VDE-AR-N 4105

7.2 CEI 0-21

CEI 0-21 menu: Settings	once ↙	twice ↙	Factory setting
Exit			
General	Exit		
	norm	CEI021, 4105, BDEW, C10/11	
	coupling	3N AC 1 AC 3 AC	3N AC
	U(L-N) U(L-L)	50...250 V 87...433 V	U(L-N) 230 V
	Mode	off/extern ¹⁾ /local ²⁾	off
	T (ON)	0.04...30.0 s	70 ms
	Remote trip	N/C; N/O; off	N/C

¹⁾ Analysis of digital input D4 (external signal)

²⁾ Analysis of digital input D3 (local control)

CEI 0-21 menu: Settings	once ↵	twice ↵	Factory setting
Voltage	Exit		
	U>> (59.S2)	off/100...130 %	115 %
	T (OFF) (59.S2)	0.04...30.0 s	200 ms
	U> (59.S1)	off/100...130 %	110 %
	T (OFF) (59.S1)	0.04...30.0 s	3.00 s
	U< (27.S1)	off/1...100 %	85 %
	T (OFF)(27.S1)	0.04...30.0 s	400 ms
	U<< (27.S2)	off/1...100 %	40 %
	T (OFF)(27.S2)	0.04...30.0 s	200 ms
Frequency	Exit		
	f> (81>.S1)	off/50.00...65.00 Hz	50.50 Hz
	T (OFF) (81>.S1)	0.04...30.0 s	100 ms
	f< (81<.S1)	off/45.00...60.00 Hz	49.50 Hz
	T (OFF) (81<.S1)	0.04...30.0 s	100 ms
	f> (81>.S2)	off/50.00...65.00 Hz	51.50 Hz
	f< (81<.S2)	off/45.00...60.00 Hz	47.50 Hz
	Tlc (OFF) (81>.S2)	0.04...30.0 s	100 ms
	Tlc (OFF) (81<.S2)	0.04...30.0 s	100 ms
	Tex (OFF) (81>.S2)	0.04...30.0 s	1.00 s
	Tex (OFF) (81<.S2)	0.04...30.0 s	4.00 s

CEI 0-21 menu: Settings	once ↵	twice ↵	Factory setting
df/dt	Exit		
	Mode	off on	off
	Resp. value	0.1...9.9 Hz/s	1.0 Hz/s
	Hysteresis	1.0...50 %	20%
	Meas. window	0.05...1 s	200 ms
	T (OFF)	0.04...30.0 s	100 ms
	T (ON)	1 s...60 min	60 s
Asymmetry	Exit		
	Mode	off/on	off
	Resp. value	1.0...50.0 %	5.0 %
	Hysteresis	1.0...50.0 %	20.0 %
	T (OFF)	0.04...30.0 s	100 ms
Relay	Exit		
	Relay mode	N/C N/O	K1: N/C K2: N/O
Digital Input*	Exit		
	Relay mode	N/C N/O off	D1: N/C D2: off D3: N/O D4: N/O

*D1: Coupling switch K1

D2: Coupling switch K2 (Backup)

D3: local control

D4: external signal

7.3 BDEW-guideline

BDEW menu: Settings	once ↙	twice ↙	Factory setting
Exit			
General	Exit		
	norm	CEI021, 4105, BDEW, C10/11	
	coupling	1 AC 3N AC 3 AC	3N AC
	U(L-N) U(L-L)	50...250 V 87...433 V	U(L-N) 230 V
	t (ON)	1 s...60 min	30 s
	Remote Trip	N/C; N/O; off	off
Voltage	Exit		
	U>>	off/100...130 %	120 %
	T (OFF)	0.04...30.0 s	100ms
	U>	off/100...130 %	108 %
	T (OFF)	1 s...60 min	60 s
	U (ON) MAX	off/100...130 %	108 %
	U (ON) MIN	off/1...100%	95 %
	U<	off/1...100%	80 %
	T (OFF)	0.04...30.0 s	2.40 s
	U<<	off/1...100%	45 %
	T (OFF)	0.04...30.0 s	300 ms

BDEW menu: Settings	once ↵	twice ↵	Factory setting
Frequency	Exit		
	f>>	off/50.00...65.00 Hz	off
	T(OFF)	0.04...30.0 s	100 ms
	f>	off/50.00...65.00 Hz	51.50 Hz
	T(OFF)	0.04...30.0 s	100 ms
	f(ON) MAX	off/1...65 Hz	50.05 Hz
	f(ON) MIN	off/45.00...60.00 Hz	47.50 Hz
	f<	off/45.00...60.00 Hz	47.50 Hz
	T(OFF)	0.04...30.0 s	100 ms
	f<<	off/45.00...60.00 Hz	off
T(OFF)	0.04...30.0 s	100 ms	
df/dt	Exit		
	Mode	off/on	off
	Resp. value	0.1...9.9 Hz/s	1.0 Hz/s
	Hysteresis	1.0...50.0 %	20.0 %
	Meas. window	0.05...1 s	200 ms
	T(OFF)	0.04...30.0 s	100 ms
	T(ON)	1 s...60 min	60 s

BDEW menu: Settings	once ↙	twice ↙	Factory setting
Asymmetry	Exit		
	Mode	off/on	off
	Resp. value	1.0...50.0 %	5.0 %
	Hysteresis	1.0...50.0 %	20.0 %
	T (OFF)	0.04...30.0 s	100 ms
Relay	Exit		
	Relay mode	N/C N/O	K1: N/C K2: N/C
Digital Input*	Exit		
	Relay mode	N/C N/O off	D1: off D2: off D3: off* D4: off*

* not used in BDEW

7.4 C10/11

C10/11 menu: Settings	once ↵	twice ↵	Factory setting
Exit			
General	Exit		
	norm	CEI021, 4105, BDEW, C10/11	
	coupling	1 AC 3N AC 3 AC	3N AC
	U(L-N) U(L-L)	50...250 V 87...433 V	U(L-N) 230 V
	t SHORT INT.	1 s...60 min	3 s
	t (ON) SHORT INT.	1 s...60 min	5 s
	t (ON) NORMAL	1 s...60 min	60 s
	Remote Trip	N/C; N/O; off	off

C10/11 menu: Settings	once ↙	twice ↙	Factory setting
Voltage	Exit		
	U>>	off/100...130 %	115 %
	T (OFF)	0.04...30.0 s	100 ms
	U>	off/100...130 %	110 %
	T (OFF)	0.04...30.0 s	100 ms
	U (ON) MAX	off/100...130 %	110 %
	U (ON) MIN	off/1...100%	85 %
	U<	off/1...100%	80 %
	T (OFF)	0.04...30.0 s	100 ms
	U<<	off/1...100%	off
	T (OFF)	0.04...30.0 s	100 ms
Frequency	Exit		
	f>>	off/50.00...65.00 Hz	off
	T (OFF)	0.04...30.0 s	100 ms
	f>	off/50.00...65.00 Hz	51.50 Hz
	T (OFF)	0.04...30.0 s	100 ms
	f (ON) MAX	off/50.00...65.00 Hz	50.05 Hz
	f (ON) MIN	off/45.00...60.00 Hz	47.50 Hz
	f<	off/45.00...60.00 Hz	47.50 Hz
	T (OFF)	0.04...30.0 s	100 ms
	f<<	off/50.00...65.00 Hz	off
	T (OFF)	0.04...30.0 s	100 ms

C10/11 menu: Settings	once ↵	twice ↵	Factory setting
df/dt	Exit		
	Mode	off/on	on
	Resp. value	0.1...9.9 Hz/s	1.0 Hz/s
	Hysteresis	1.0...50.0 %	20.0 %
	Meas. window	0.05...1 s	200 ms
	T (OFF)	0.04...30.0 s	100 ms
	T (ON)	1 s...60 min	60 s
Asymmetry	Exit		
	Mode	off/on	off
	Resp. value	1.0...50.0 %	5.0 %
	Hysteresis	1.0...50.0 %	20.0 %
	T (OFF)	0.04...30.0 s	100 ms
Relay	Exit		
	Relay mode	N/C N/O	K1: N/C K2: N/C
Digital Input*	Exit		
	Relay mode	N/C N/O off	D1: N/C D2: N/C D3: off* D4: off*

* not used in C10/11

8. Technical data VMD460-NA

() * = factory setting

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

Rated insulation voltage	400 V
Overvoltage category.....	III
Rated impulse voltage/pollution degree.....	6 kV/2
Protective separation (reinforced insulation) between.....	(A1, A2) - (L1, L2, L3, N) - (11, 12, 14, 21, 22, 24) (D1, D2, D3, D4, DG1/2, DG3/4, RTG, RT1)-(A1, A2, L1, L2, L3, N)
Voltage test according to IEC 61010-1: (N, L1, L2, L3) - (A1, A2), (11, 12, 14, 21, 22, 24)	3.32 kV

Supply voltage

Rated supply voltage U_s	AC/DC 100... 240 VDC / 50/60 Hz
Operating range U_s	AC/DC 75... 300 VDC / 40... 70 Hz
Power consumption at AC 230 V	< 7,5 VA / < 3,5 W max.9 VA / 3,5 W

Measuring circuit

Nominal system voltage U_n (r.m.s. value) (L-N)	AC 0... 300 V
Nominal system voltage U_n (r.m.s. value) (L-L)	AC 0... 520 V
Rated frequency f_n ($U_n > 20$ V)	45... 65 Hz

Response values

Type of distribution system	1 AC: 230 V, 50 Hz3(N)AC: 400/230 V, 50 Hz
Relative uncertainty, voltage	$U \leq 280$ V: $\leq \pm 1$ % $U > 280$ V: ± 3 %
Resolution of setting voltage.....	1 %
Rated frequency	50 Hz
Relative uncertainty, frequency.....	$\leq \pm 0.1$ %
Resolution of setting f	0.05 Hz

Recording of measurement values, condition for connection

L-N, L-L	0...1.3 U_n
< f	45...60 Hz
> f	50...65 Hz

Recording of measurement value, condition for disconnection

L-N, L-L	0...1.3 U_n
< f	45...60 Hz
> f	50...65 Hz
df/dt	0.1...9.9 Hz/s

Time response

Delay time for connection t_{on}	40 ms...30 s / 1...3600 s
Resolution of setting t_{on}	< 10 s: 0.1 s
.....	> 10 s: 1 s
Operating time, voltage t_{ae}	≤ 15 ms
Operating time, frequency t_{ae}	≤ 15 ms
Recovery time t_b	≤ 300 ms

Digital inputs

Monitoring of potential-free contacts or voltage inputs:	closed = low; 0...4 V; $I_m < -5$ mA
.....	open = high; > 6...≤ 30 V
D1	feedback signal contact K1
D2	feedback signal contact K2
D3	local control (mode)
D4	external signal (mode)
RT1	remote trip
DG1/2, DG3/4, RTG	GND
max. length of the connecting cables of digital inputs	3 m

Displays, memory

Display	LC display, multi-functional, illuminated
Display range measured value	AC 0...520 V
Operating uncertainty, voltage	$U \leq 280$ V: ≤ ±1 %
.....	$U > 280$ V: ±3 %
Operating uncertainty, frequency	≤ ±0.1 %

History memory for the last 300 messages per data record measured values
 Password.....on/off / 0...999 (off*)

Switching elements

Number of changeover contacts 2 x 1 (K1, K2)
 Operating mode N/C operation / N/O operation
 Electrical service life under rated operating conditions 10.000 switching operations
 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 / CEI 0-21
 Operating temperature.....-25...+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 type..... screw-type terminals (or push-wire terminals)
 Connection properties:
 Rigid 0.2...4 mm² (AWG 24...12)
 Flexible 0.2...2.5 mm² (AWG 24...14)
 Stripping length 8...9 mm
 Tightening torque 0.5...0.6 Nm

Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, built-in 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 fixing	2 x M4 with mounting clip
Software version	D398 V1.1x
Weight.....	≤ 360 g

()* = factory setting

8.1 Standards, approvals and certifications

The VMD460-NA fulfils the requirements of the following standards:

- **VDE-AR-N 4105** (Technical minimum requirements for the connection to and parallel operation with low-voltage distribution networks)
- **CEI 0-21** (Regola tecnica di riferimento per la connessione di utenti attivi e passivi alle reti BT delle imprese distributrici di energia elettrica)
- **C10/11** (Prescriptions techniques spécifiques de raccordement d'installations de production décentralisée fonctionnant en parallèle sur le réseau de distribution; June 2012)
- **BDEW** (Technische Richtlinie Erzeugungsanlagen am Mittelspannungsnetz; Bundesverband der Energie- und Wasserwirtschaft e.V., Berlin, June 2008)

VMD460-NA is certified by Bureau Veritas.



8.2 Ordering information

Device type	Nominal voltage U_n	Supply voltage U_S	Art. No.
VMD460-NA-D-2	3(N) AC, 400/230 V, 50 Hz	AC/DC 100...240 V DC / 50/60 Hz	B 9301 0045
Mounting clip for screw mounting (1 piece per device, accessories)			B 9806 0008

Device version with push-wire terminals on request.

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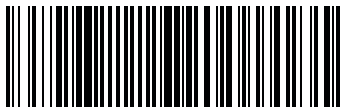
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