



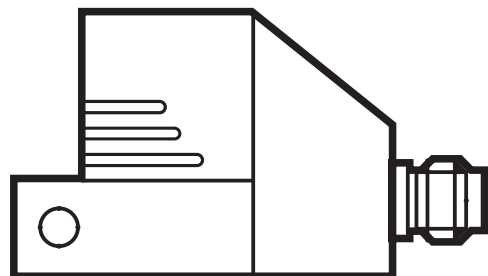
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Operating instructions  
Vibration sensor

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**VNB211**

80270676/00 12/2017



# Content

1	Preliminary note.....	4
1.1	Notes on this document.....	4
1.2	Symbols used .....	4
2	Safety instructions .....	4
2.1	General.....	4
2.2	Installation and connection .....	4
2.3	Tampering with the device .....	5
3	Functions and features .....	5
4	Installation.....	6
5	Electrical connection.....	7
5.1	M8/USB interface .....	7
5.2	History values .....	7
5.3	Real-time clock .....	8
6	Functions .....	8
6.1	Monitoring function .....	8
6.2	Input function .....	8
6.3	Output function (switching output and analogue output) .....	9
6.4	Self-test.....	9
6.5	Averaging of a vibration characteristic value .....	9
6.5.1	Calculation.....	9
6.5.2	Settings.....	10
6.5.3	Diagram averaging .....	10
6.6	Measuring function .....	10
7	Operating and display elements .....	11
7.1	LED display .....	11
7.2	7-segment display .....	12
7.3	Operating mode.....	12
7.3.1	Examples in the operating mode .....	12
7.4	Operating mode external process value.....	13
7.4.1	Example display change ( $v_{\text{rms}}$ - external process value) .....	13
8	Device configuration .....	14
8.1	Programming via pushbuttons .....	14
8.1.1	Global VNB parameters.....	14

8.1.2	Characteristic vibration value .....	14
8.1.3	External process value .....	14
9	Menu .....	14
9.1	Menu structure .....	15
9.2	Main menu .....	15
9.2.1	V1 menu .....	16
9.2.2	V2 menu .....	16
9.2.3	EV1 menu .....	16
9.2.4	EV2 menu .....	17
9.2.5	EP1 menu .....	17
9.2.6	EP2 menu .....	18
9.2.7	Ext menu .....	18
9.2.8	Out menu .....	19
9.3	Explanation of the menu .....	20
10	Parameter setting via the pushbuttons on the unit .....	22
10.1	Parameter setting in general .....	22
10.1.1	Change from menu level 1 to the sub-menu .....	23
10.1.2	Locking / unlocking .....	24
11	Maintenance, repair and disposal .....	24
12	Scale drawing .....	24
13	Time diagrams .....	25
13.1	Averaging for a characteristic vibration value .....	25
13.2	Switching delay for the upper limit monitor .....	26
13.3	Switching delay for the lower limit monitor .....	28
14	Factory setting .....	29

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# 1 Preliminary note

Technical data, approvals, accessories and further information at [www.ifm.com](http://www.ifm.com).

## 1.1 Notes on this document

This document applies to devices of the type "vibration sensor" (art. no.: VNB211). It is part of the device and contains information about the correct handling of the product.

This document is intended for qualified electricians. These specialists are people who are qualified by their training and their experience to see and to avoid possible hazards that may be caused during operation of the device.

- ▶ Read this document before using the device.
- ▶ Keep this document during the service life of the device.

## 1.2 Symbols used

- ▶ Instructions
- > Reaction, result
- Cross-reference
- LED on
- ⊗ LED flashes



Important note

Non-compliance may result in malfunction or interference.



Information

Supplementary note

# 2 Safety instructions

## 2.1 General

- ▶ Observe these operating instructions.
- ▶ Observe the warning notes in these instructions.

Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

## 2.2 Installation and connection

The device must only be installed, connected and put into operation by a qualified electrician as the safe function of the device and machinery is only guaranteed

when installation is correctly carried out. The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the device.



This is a class A product which is intended for use in industrial applications. The unit may cause radio interference in domestic areas. In this case it can be necessary for the user to take appropriate measures.

## 2.3 Tampering with the device

Tampering with the device is not allowed and will lead to an exclusion of liability and warranty. Tampering with the device can affect the safety of operators and machinery.

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## 3 Functions and features

The parameters of the device are mainly set via the VES004 PC software.



The device manual can be found at [www.ifm.com](http://www.ifm.com)

Monitoring of

- 2 sensor-internal characteristic vibration values (a/v, RMS/peak)
- 2 external characteristic vibration values (a/v, RMS/peak via VNA001 accelerometer) or two external process values (current value above and/or below limit value)

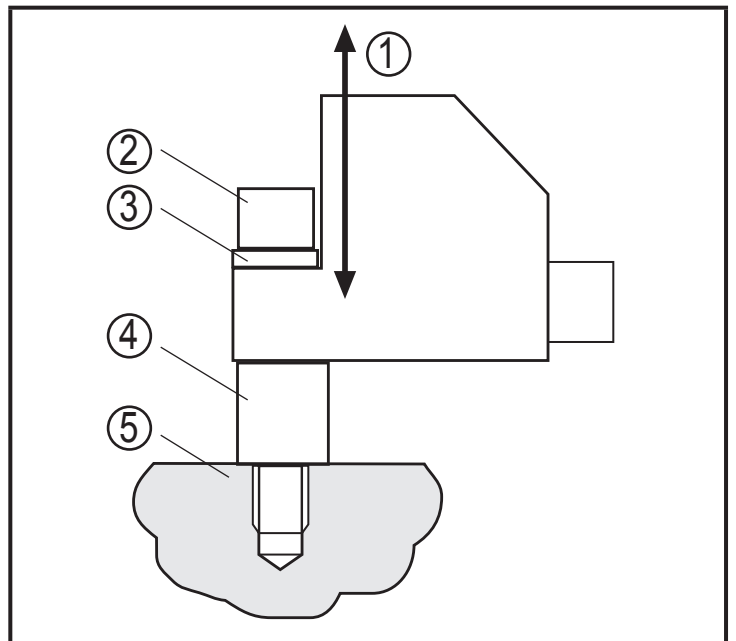
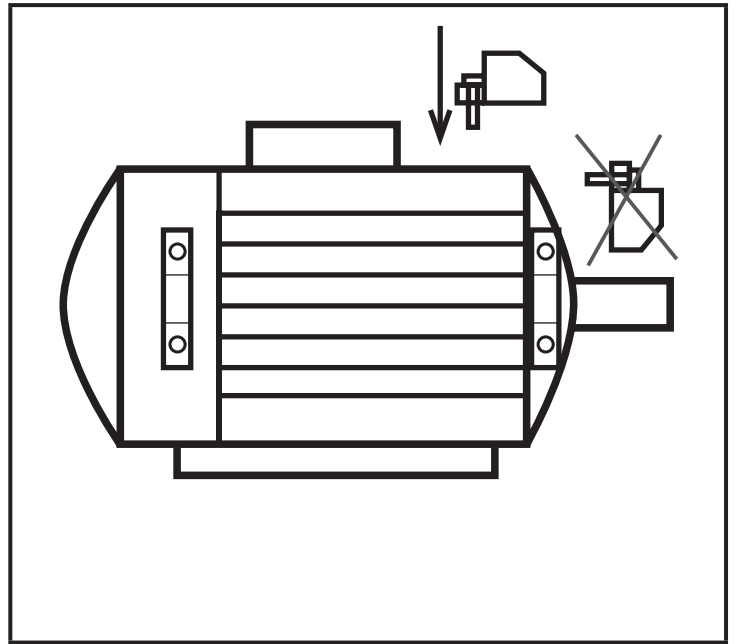
Visualisation of

- Measured values
- Switching states
- Measured data via PC software

## 4 Installation

Please note the following points when installing the unit:

- ▶ Mount only in a thick housing wall (e.g. crane hook thread).
- ▶ Mount vertically to the machine surface using the spacer adapter in the direction of the strongest vibrations. This is usually the radial direction.
- ▶ Tighten the M5 screw with a tightening torque of 7 Nm.
- ▶ Ensure a reliable vibration transmission. Avoid any elastic intermediate layers.



- 1: Measurement axis
- 2: M5 screw
- 3: Spring washer
- 4: M8 x M5 adapter
- 5: Machine surface

## 5 Electrical connection



The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply to EN 50178, SELV, PELV.

Disconnect power before connecting the unit.

<p>M12</p>	Pin 1:	L+	9.6...30 V DC
	Pin 2:	Out 1	Switching output or current output 0/4...20/22 mA (configurable)
	Pin 3:	L -	
	Pin 4:	Out 2	Switching output
	Pin 5:	IN	Current input 0/4...20 mA
<p>M8</p>	Pin 1:	VCC (5 V)	
	Pin 2:	USB D-	
	Pin 3:	L-	
	Pin 4:	USB D+	

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### 5.1 M8/USB interface

- ▶ First connect the interface cable to the device and then to the USB interface of the computer.
- Communication with the PC software for parameter setting of the objects to be monitored, to read and reset the history data and to visualise measured data.
- The devices have a serial number that can be read via the PC software.
- The sensor can also be supplied via the USB interface.



Switching and analogue outputs are not supported if a USB power supply is used.

### 5.2 History values

The unit has an internal history memory. The memory interval can be configured for each object via the PC software (min. 1 s). The maximum value and optionally the average value in this interval are stored together with the time stamp in the memory.

The memory's capacity is 685,000 values; beyond this the oldest values are overwritten (ring memory, FIFO).

The history can be configured, read and reset via the PC software.

### **5.3 Real-time clock**

The unit has an integrated real-time clock including a buffer battery for the time stamp in the history memory. The time is synchronised with the system clock when the history is reset via the PC software.

## **6 Functions**

The basic functions of the unit are set via the PC software.

Only parameters for alarming and scaling of the signals can be set via the buttons on the unit → 8.1 Programming via pushbuttons

### **6.1 Monitoring function**

The VNB211 can monitor up to two internal characteristic vibration values. The characteristic values are activated and configured via the PC software. Monitoring can be effected in acceleration or vibration velocity in a frequency range that can be set.

On delivery, the first characteristic value monitors the effective value of the vibration velocity to ISO 10816 in the frequency range of 10...1000 Hz.

On delivery, the second characteristic value monitors the maximum peak of the acceleration in the frequency range of 10...6000 Hz.

### **6.2 Input function**

Monitoring can be extended by another vibration measuring point or a process value via the external input of the VNB211.

For the external input it is also possible to monitor up to two characteristic values. With an extension by a vibration measurement point (with a VNA001 accelerometer + Y cable) the same parameters can be configured as with internal characteristic vibration values. With an extension by a process value (via an analogue 4...20 mA current signal) the process value (e.g. a storage temperature or pressure) can be monitored for exceeding and/or falling below the limit value.

On delivery, the first characteristic value for the external input is configured as temperature monitoring (e.g. connection of a TT3237).

The second characteristic value is deactivated on delivery.



## 6.3 Output function (switching output and analogue output)

The two outputs of the VNB211 are used for the alarm (pre-alarm, main alarm). The first output (OU1) can be used as digital or analogue output. The switching logic (which characteristic values are alarmed in which way) can be set only in the PC software.

System errors (e.g. a failed self-test) are also signalled on the first output (OU1). If the output is used as digital output, the output pulses with a frequency of 1 Hz in case of a fault. A current of 22 mA is provided as analogue output in case of a system error.

## 6.4 Self-test

The self-test checks the function of the VNB's measuring cell. The self-test is made during power-on and can in addition be started manually via the PC software or the buttons on the unit.

Displays on the unit:

- Self-test passed → [PASS]
- Self-test failed → [FAIL]
- > LED OU1 flashes

Output OU1

- pulsing if "digital" output function (NC, NO)
- supplies 22 mA if "analogue" output function

## 6.5 Averaging of a vibration characteristic value

### 6.5.1 Calculation

Formula to determine the new diagnostic value:

("previous diagnostic value" x (1 - averaging)) + ("new measurement" x averaging)  
= new diagnostic value

Example

Averaging 0.25; "previous diagnostic value" 17.3 mm/s;

"new measurement" 14.7 mm/s

$(17.3 \text{ mm/s} \times (1 - 0.25)) + (14.7 \text{ mm/s} \times 0.25) = 16.65 \text{ mm/s}$



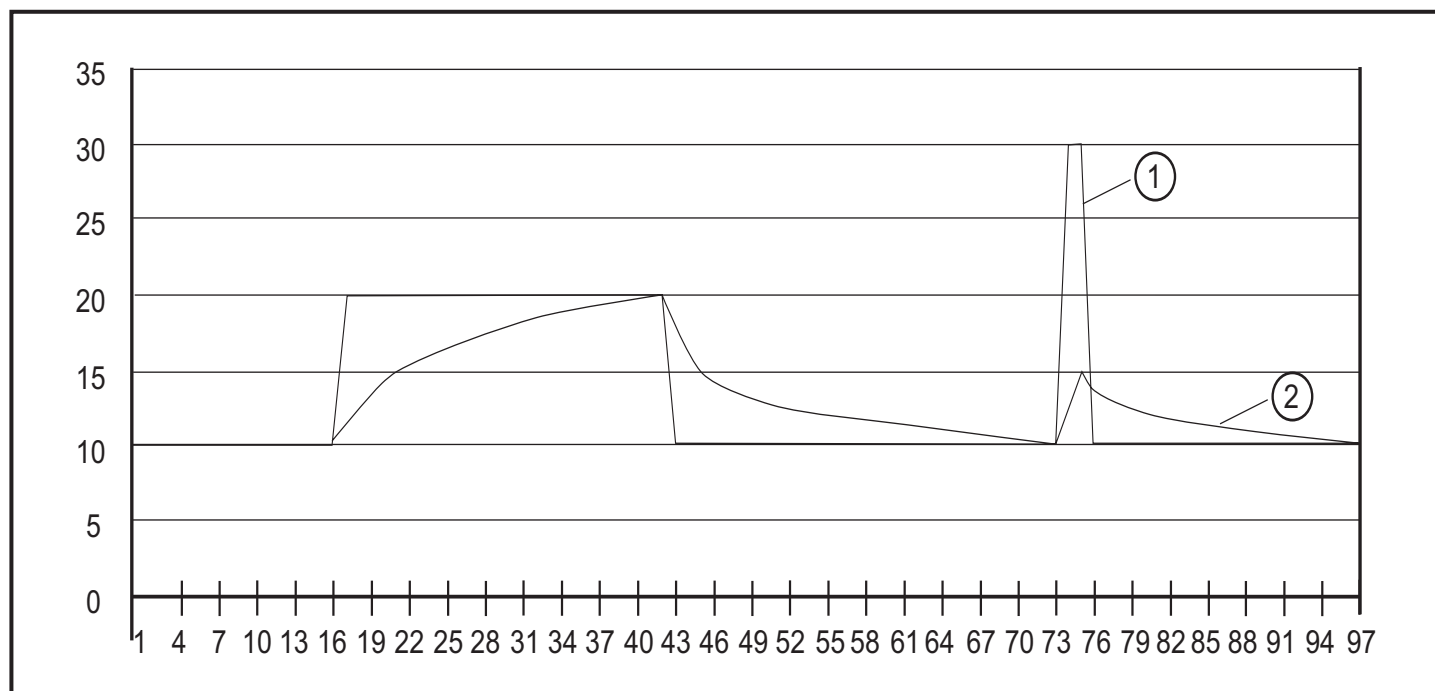
For the VNB211 the measurement time between "previous diagnostic value" and "new measurement" can be configured via the PC software.

## 6.5.2 Settings

Averaging = 1: averaging deactivated

Averaging 0.01; strong averaging

## 6.5.3 Diagram averaging



1: Measured value

2: Averaged diagnostic value (averaging = 0.125)

## 6.6 Measuring function

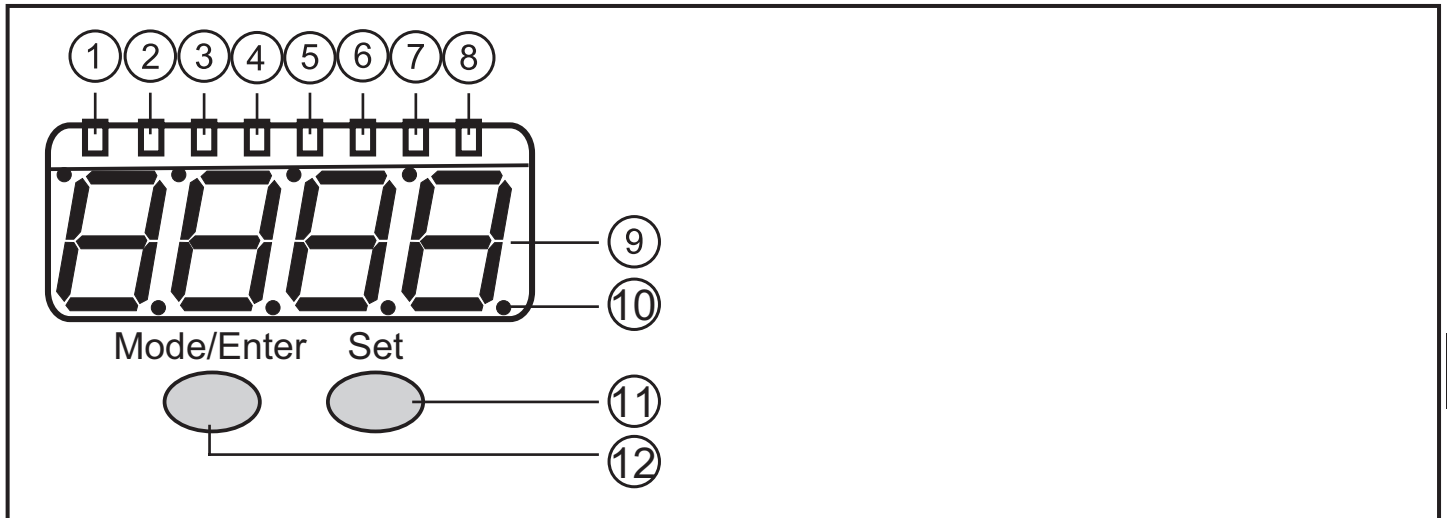
The device can be set to the measurement mode via the VES004 software. In this mode, you have access to the raw data (time signal) of the acceleration or of the external input (4...20 mA). The data can be visualised, recorded, analysed and processed in the software.

If the device remains connected to the software, the user has to actively (manually) finish the time signal monitoring. If the device is separated from the software, it automatically returns to the monitoring function.

If the unit is in the measurement mode, there is no monitoring. "rSc3" is displayed on the unit.

# 7 Operating and display elements

## 7.1 LED display



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### 1...8: LED display

- 1: LED green a = vibration velocity a [g] or [m/s<sup>2</sup>]
- 2: LED green v = vibration velocity v [mm/s] or [in/s]
- 3: LED green d = not used
- 4: LED green RMS = average value
- 5: LED green Pk = peak value
- 6: LED green Ext = process value of the external transducer
- 7: LED yellow OU1 = pre-alarm active \*)
- 8: LED red OU2 = main alarm active \*)

\*) The LED indicates the current alarm state (warning alarm, damage alarm). The configuration of the corresponding output (OU1, OU2) as "normally closed" or "normally open" is ignored.

### 9: 7-segment display green, yellow and red, 4 digits

- Display of the measured values

### 10: Points

- Lower points as decimal separators

### 11: Set button

Parameter setting mode

- Setting of the parameter values
- Change of display between the configured characteristic values

### 12: Mode/Enter button

- Selection of the parameters and acknowledgement of the parameter values.

## 7.2 7-segment display

- Displays the damage level (green, yellow, red)

If the segment display changes the colour, the switch-on and switch-off delays or the hysteresis are not considered.

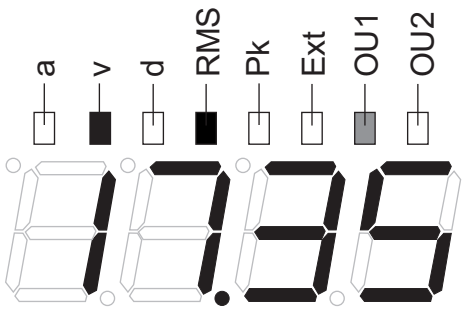
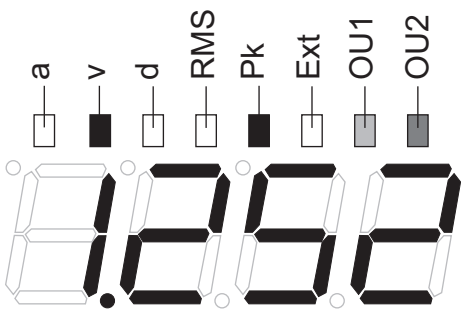
- Display of the current measured value for the selected object
- Display of the configuration menu and its parameters

## 7.3 Operating mode



The user must know the objects configured in the vibration sensor and in the external sensor. The display allows no indication of the unit if the external input is used for process value monitoring.

### 7.3.1 Examples in the operating mode

<p>Colour segment display: yellow</p>  <p>The display shows the value 17.35. Above the digits are indicators for 'a', 'v', 'd', 'RMS', 'Pk', 'Ext', 'OU1', and 'OU2'. The 'v' indicator is lit, and the 'OU1' indicator is lit with a grey bar. The 'RMS' indicator is also lit.</p>	<p>Current measured value of the 1st object, e.g. vibration velocity <math>v_{\text{rms}} = 17.35 \text{ mm/s}</math>.</p> <p>Parameters</p> <ul style="list-style-type: none"> <li>- Pre-alarm SP1 = 10 mm/s</li> <li>- Main alarm SP2 = 20 mm/s</li> </ul> <p>&gt; Output OU1 is active</p>
<p>Colour segment display: red</p>  <p>The display shows the value 1.252. Above the digits are indicators for 'a', 'v', 'd', 'RMS', 'Pk', 'Ext', 'OU1', and 'OU2'. The 'v' indicator is lit, and the 'RMS', 'Pk', 'Ext', 'OU1', and 'OU2' indicators are all lit with grey bars.</p>	<p>Current measured value of the 2nd object, e.g. imbalance (<math>v_{\text{peak}} = 1.252 \text{ in/s}</math>)</p> <p>Parameters</p> <ul style="list-style-type: none"> <li>- Unit uni = in/s</li> <li>- Early warning SP1 = 0.5 in/s</li> <li>- Main alarm SP2 = 1 in/s</li> </ul> <p>&gt; Outputs OU1 and OU2 are active</p>

Colour segment display: red	
	<p>Current measured value external analogue sensor, temperature <math>\vartheta = 95\text{ }^{\circ}\text{C}</math></p> <p>Parameters</p> <ul style="list-style-type: none"> <li>- Pre-alarm ESP1 = <math>50\text{ }^{\circ}\text{C}</math></li> <li>- Main alarm ESP2 = <math>90\text{ }^{\circ}\text{C}</math></li> </ul> <p>&gt; Outputs OU1 and OU2 are active</p>



The LEDs OU1 and OU2 indicate the alarm condition, not the voltage level (high, low) at the output.  
The level can be inverted via the parameters OU1 and OU2 (NC, NO).

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## 7.4 Operating mode external process value

In the operating mode "external process value" measured values are displayed, e.g. temperatures, pressure values or other characteristic vibration values.

The detected values are transferred via the measured value input (pin 5).

> LED "Ext" lights.

### 7.4.1 Example display change ( $v_{rms}$ - external process value)

	<p>Configuration</p> <p>1 characteristic vibration value + 1 external process value</p> <p>Normal operating mode Vibration velocity <math>17.35\text{ mm/s } v_{rms}</math> [Set]</p> <p>Operating mode external process value e.g. temperature <math>42.61\text{ }^{\circ}\text{C}</math> [Set]</p> <p>Normal operating mode Vibration velocity <math>17.35\text{ mm/s } v_{rms}</math></p>
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# 8 Device configuration

## 8.1 Programming via pushbuttons

The following settings can be made via the pushbuttons on the unit.

### 8.1.1 Global VNB parameters

- Scaling of the input (4...20 mA, for use for the external process value)
- Scaling of the output (4...20 mA, if OU1 = analogue)
- Switching function of the outputs (NC, NO)
- Switch-on and switch-off delays
- Self-test
- Unit (mm/s, inch/s)

### 8.1.2 Characteristic vibration value

- Averaging
- Switchpoints (pre-alarm and main alarm)

### 8.1.3 External process value

- Switch points
- Hysteresis

All other settings of the sensor are made via the PC software. There it is defined how many and which characteristic values (characteristic vibration values and/or process values) are to be monitored → device manual.

# 9 Menu

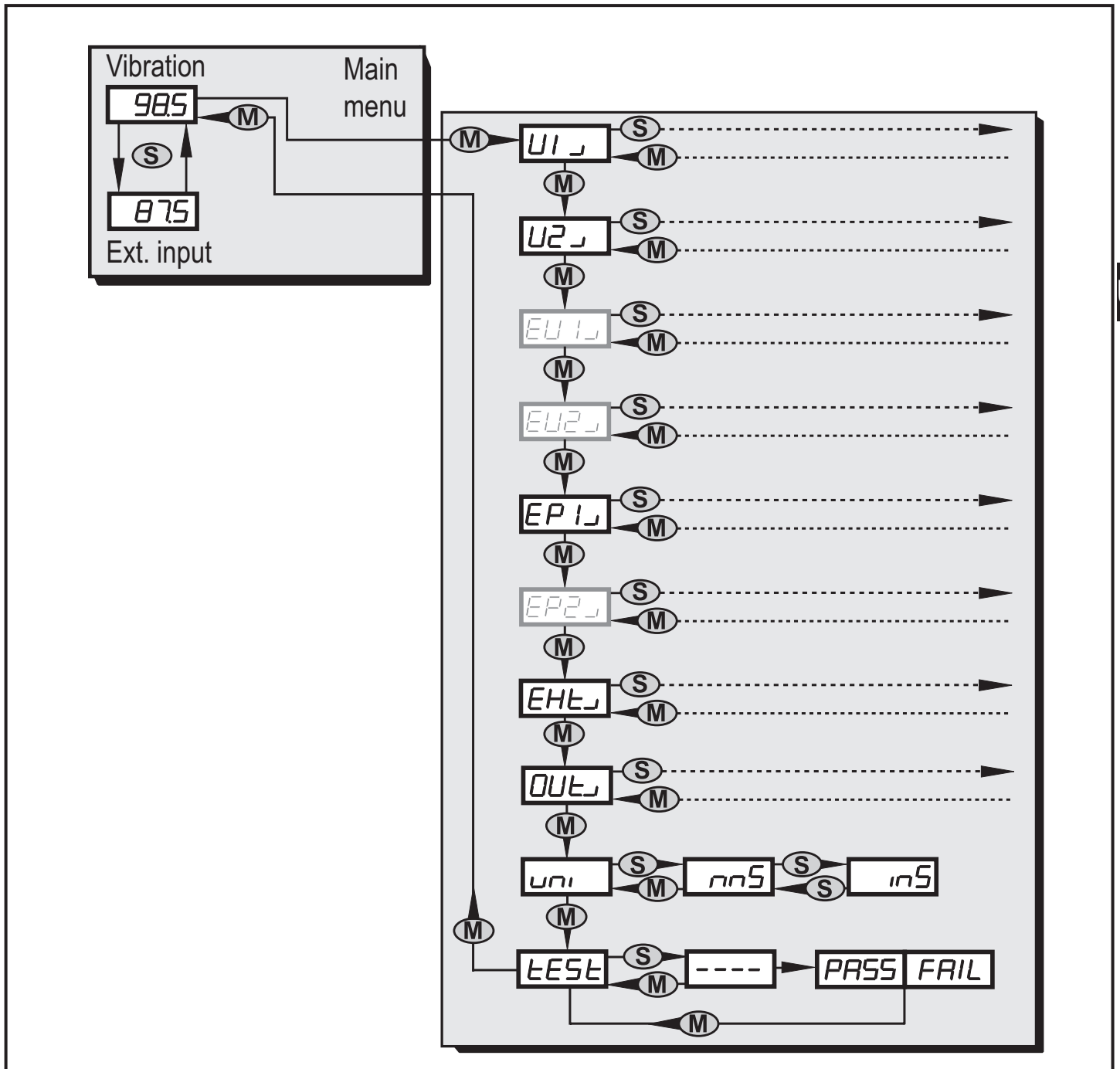
Depending on the configuration of the sensor the menu level 1 is adapted via the PC software. There are only menu items whose characteristic values were configured via the PC software.

If the external input in the PC software is configured for an analogue current signal, the menu items EV1) and EV2) are not available.

If the external input in the PC software is configured for an accelerometer (VNA001), the menu items EP1) and EP2) are not available.

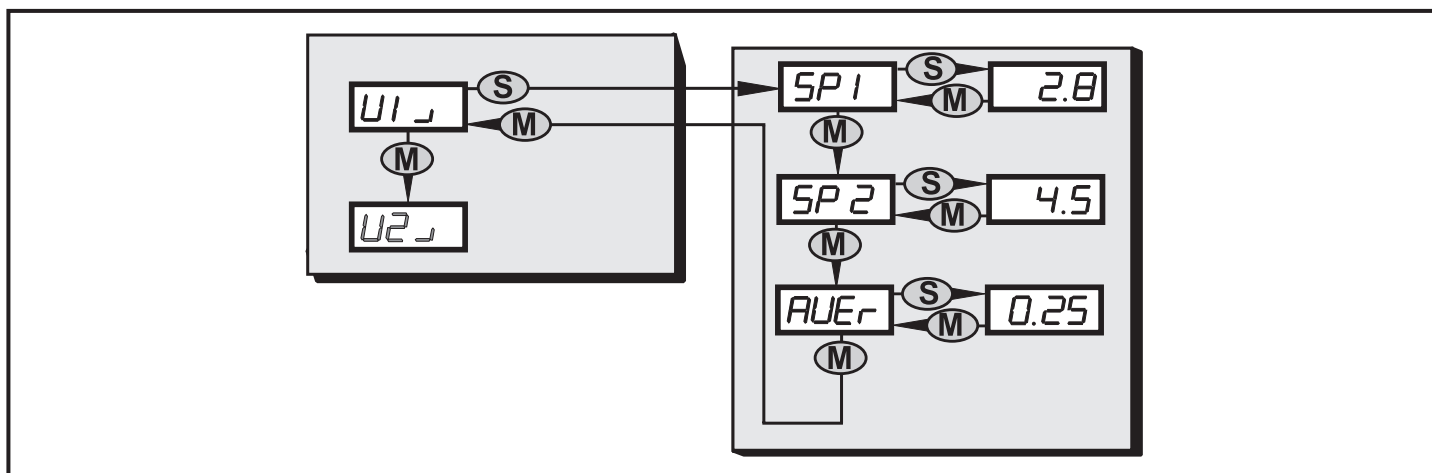
## 9.1 Menu structure

## 9.2 Main menu

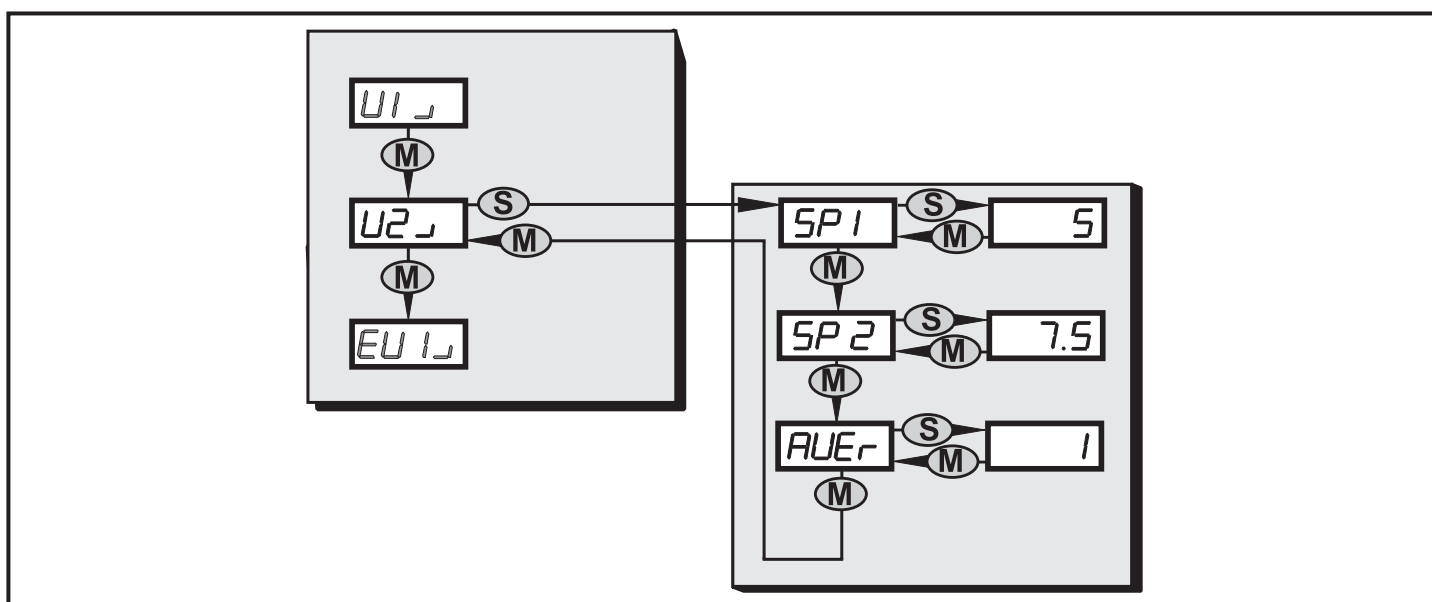


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## 9.2.1 V1 menu

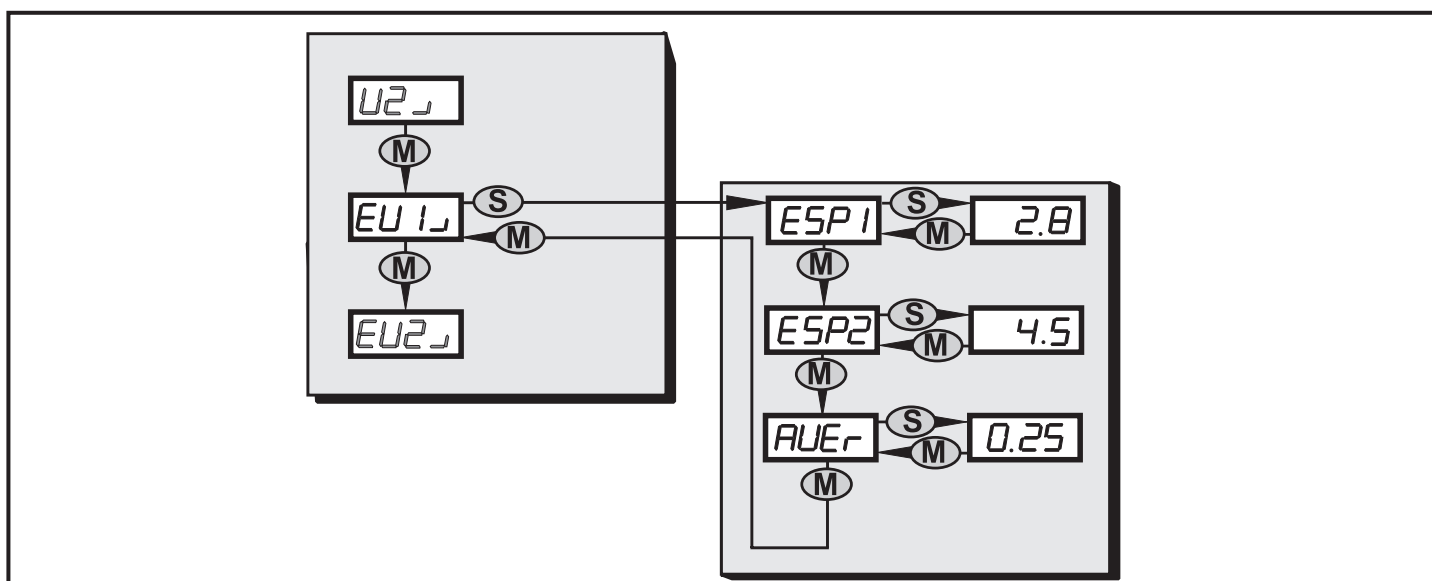


## 9.2.2 V2 menu



## 9.2.3 EV1 menu

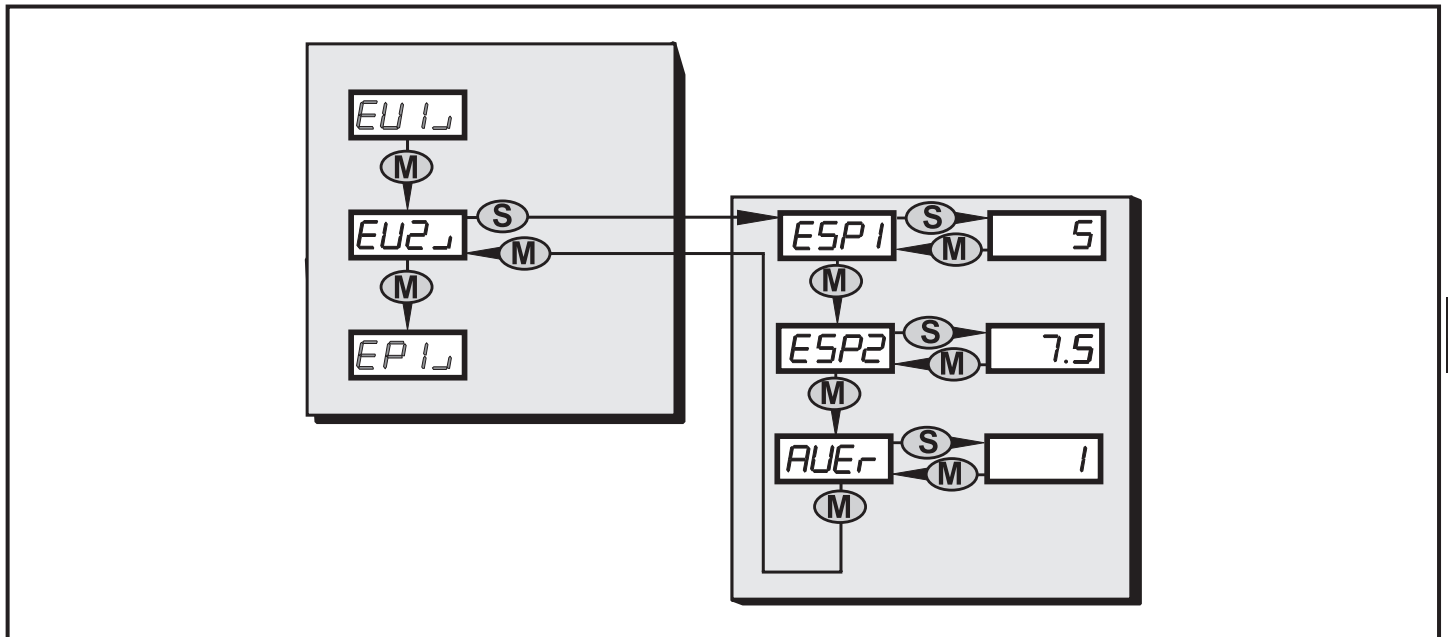
The menu for the external characteristic vibration value 1 is only available if it was configured in the PC software.





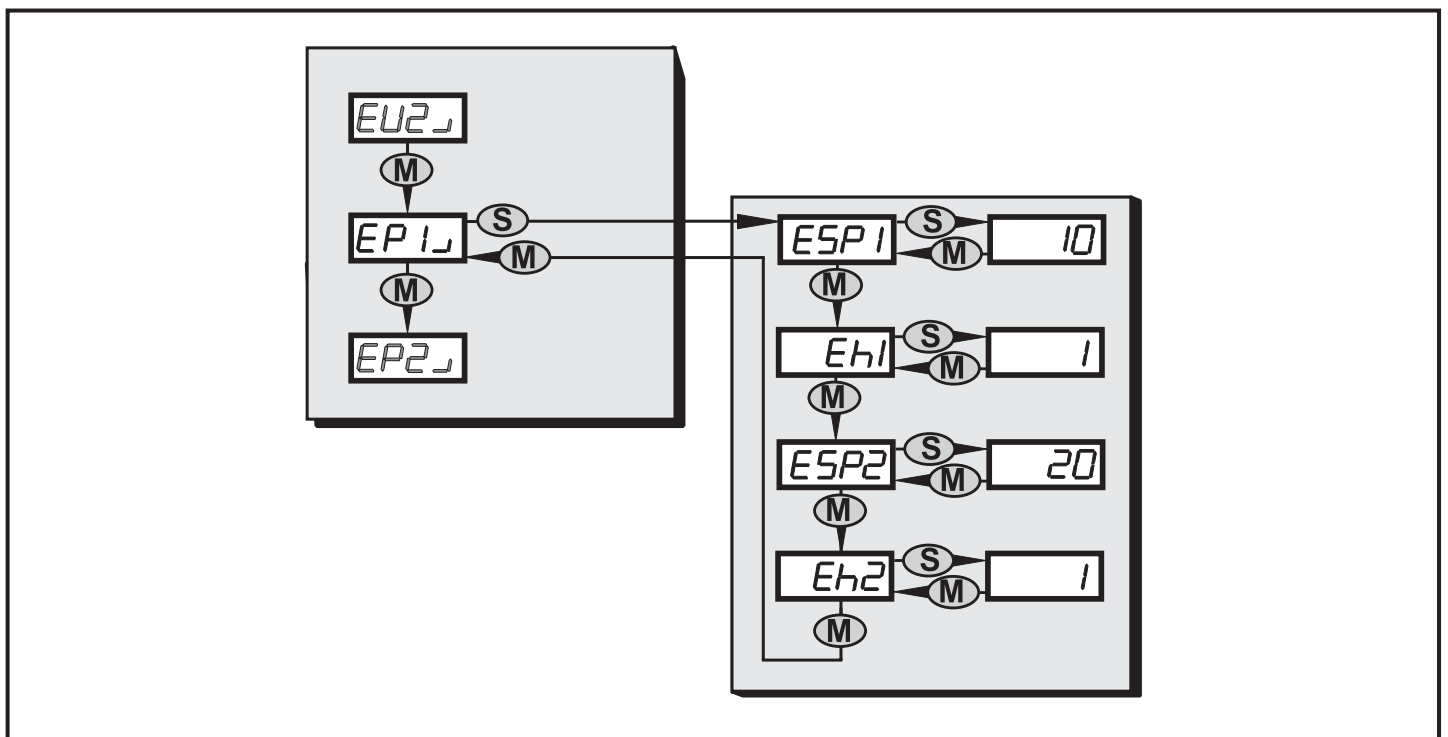
## 9.2.4 EV2 menu

The menu for the external characteristic vibration value 2 is only available if it was configured in the PC software.



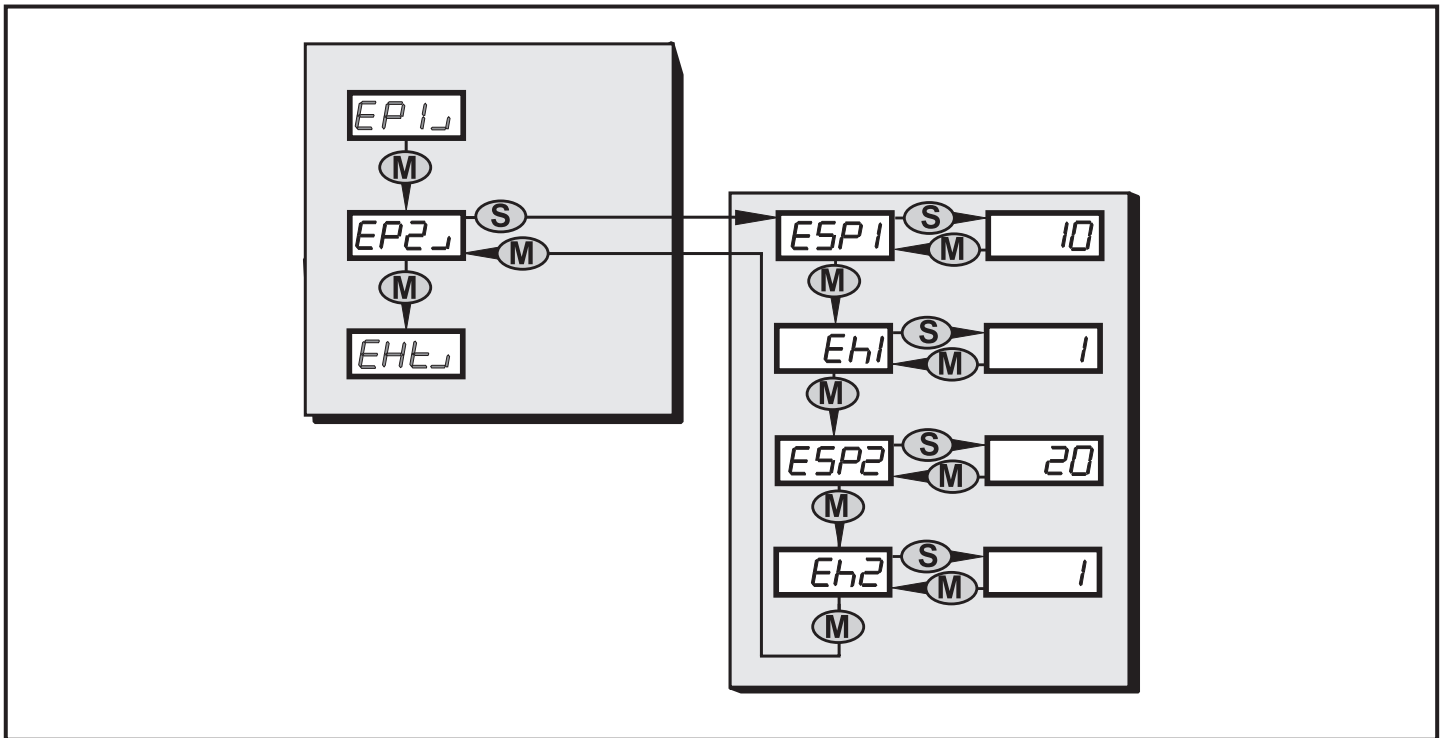
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## 9.2.5 EP1 menu

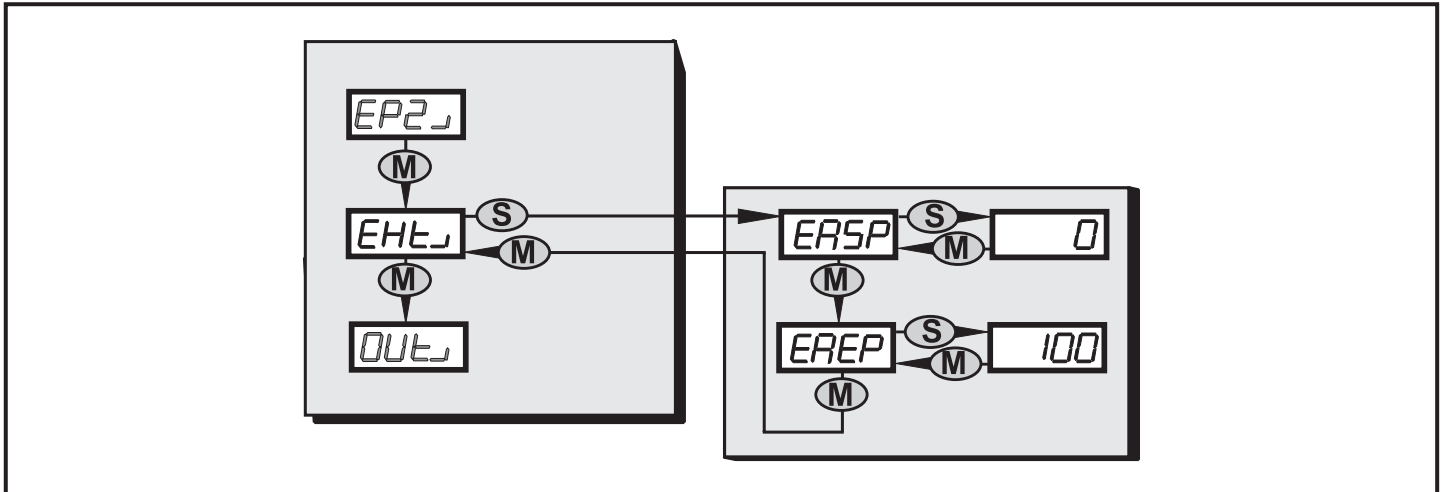


## 9.2.6 EP2 menu

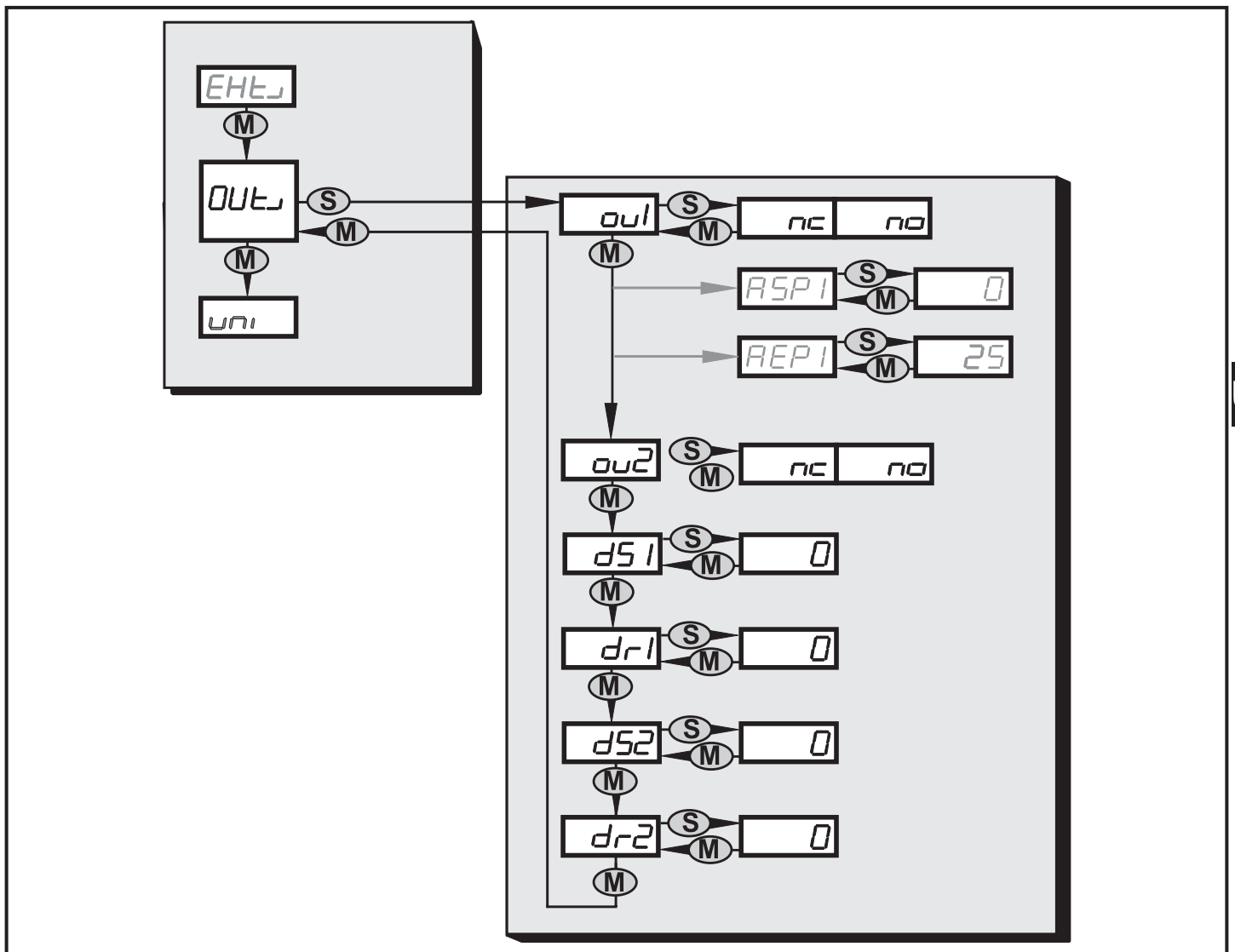
The menu for the external process value 2 is only available if it was configured in the PC software.



## 9.2.7 Ext menu



## 9.2.8 Out menu



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## 9.3 Explanation of the menu

Menu level 1	
V1 )	Sub-menu for the characteristic vibration value 1
V2 )	Sub-menu for the characteristic vibration value 2
EV1)	Sub-menu for the external characteristic vibration value 1 with respective configuration
EV2)	Sub-menu for the external characteristic vibration value 2 with respective configuration
EP1)	Sub-menu for the external process value 1
EP2)	Sub-menu for the external process value 2 with respective configuration
EXT)	Sub-menu for the external input in the configuration as analogue input
OUT)	Sub-menu for the outputs
Uni	Unit of the vibration velocity - mm/s or in/s
Test	Self-test - (PASS or FAIL) is automatically made when the sensor is switched on
Sub-menu characteristic vibration values V1) and V2)	
The values indicated for the switch points SP1 and SP2 of characteristic values of the vibration velocity change when another unit is selected.	
SP1	Switch point pre-alarm If the switch point is exceeded, - OU1 switches, if it is digital - the yellow LED "OU1" lights - the measured value display changes to yellow
SP2	Switch point main alarm If the switch point is exceeded, - OU2 switches - the red LED "OU2" lights - the measured value display changes to red
AUER	Averaging → chapter 6.5

Sub-menu external characteristic vibration values EV1) and EV2) with respective configuration	
ESP1	Switch point pre-alarm If the switch point is exceeded, - OU1 switches, if it is digital - the yellow LED "OU1" lights - the measured value display changes to yellow
ESP2	Switch point main alarm If the switch point is exceeded, - OU2 switches - the red LED "OU2" lights - the measured value display changes to red
AUER	Averaging → chapter 6.5
Sub-menu external characteristic vibration values EP1) and EP2) with respective configuration	
ESP1	Switch point pre-alarm If the switch point is exceeded, - OU1 switches, if it is digital - the yellow LED "OU1" lights - the measured value display changes to yellow
Eh1	Hysteresis pre-alarm Absolute distance between set and reset point
ESP2	Switch point main alarm If the switch point is exceeded, - OU2 switches - the red LED "OU2" lights - the measured value display changes to red
Eh2	Hysteresis main alarm Absolute distance between set and reset point
Sub-menu external input as analogue current input	
EASP	Scaling of external sensor for the process value, initial value of the measuring range at 4 mA
EAEP	Scaling of external sensor for the process value, final value of the measuring range at 20 mA
Sub-menu outputs	
ou1	Switching logic OU1 (OU1 = digital) NC, NO (normally closed, normally open)

ASP1	Scaling current output with respective configuration (OU1 = analogue), value at 4 mA
AEP1	Scaling current output with respective configuration (OU1 = analogue), value at 20 mA
ou2	Switching logic OU2 NO, NC (normally open, normally closed)
dS1	Switch-on delay for OU1 (0...60 s)
dr1	Switch-off delay for OU1 (0...60 s)
dS2	Switch-on delay for OU2 (0...60 s)
dr2	Switch-off delay for OU2 (0...60 s)
Error message	
Err1	The value to be displayed is less than -999 or greater than 9999. ▶ Check the scaling of the current output (ASP1, AEP1) and set again.

## 10 Parameter setting via the pushbuttons on the unit

 During the parameter setting process the monitoring function of the unit is maintained. It continues to monitor with the existing parameters until the parameter setting has been completed.

### 10.1 Parameter setting in general

3 steps must be taken for each parameter setting:

<b>1</b>	<b>Select parameter</b> ▶ Press [Mode/Enter] until the requested parameter is displayed.	
----------	---	--

<p><b>2 Set parameter value</b></p> <ul style="list-style-type: none"> <li>▶ Press [Set].</li> <li>&gt; The current setting value of the parameter is displayed.</li> <li>▶ Press [Set] for 3 s.</li> <li>▶ Setting of the decimal point (cc. cc) and the sign by pressing [Set] several times.</li> <li>▶ Press [Mode/Enter] to confirm.</li> <li>▶ Set an individual digit with [Set] and confirm with [Mode/Enter].</li> <li>▶ Repeat with all digits.</li> </ul>	
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<p><b>3 Acknowledge parameter value</b></p> <ul style="list-style-type: none"> <li>▶ Press [Mode/Enter].</li> <li>&gt; The parameter is displayed again. The new setting value is saved.</li> </ul>	
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**Set other parameters**

- ▶ Start again with step 1.

**Change the operating mode**

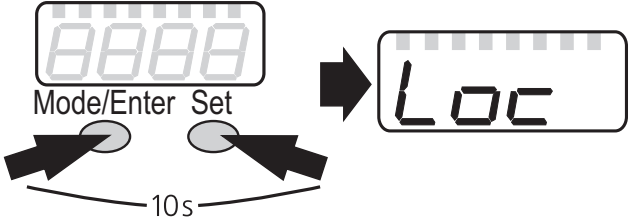
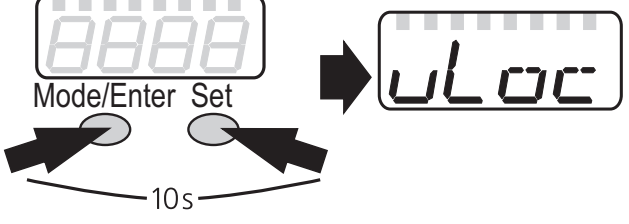
- ▶ Press [Mode/Enter] several times until the current measured value is displayed.
  - > The unit returns to the operating mode.
- If no button is pressed within 30 s, the unit automatically returns to the operating mode.

**10.1.1 Change from menu level 1 to the sub-menu**

<ul style="list-style-type: none"> <li>▶ Press [Mode/Enter] until [EF┘] is displayed.</li> </ul>	
<ul style="list-style-type: none"> <li>▶ Briefly press [Set].</li> <li>&gt; The first parameter of the submenu is displayed (here: [LFCO]).</li> </ul>	

## 10.1.2 Locking / unlocking

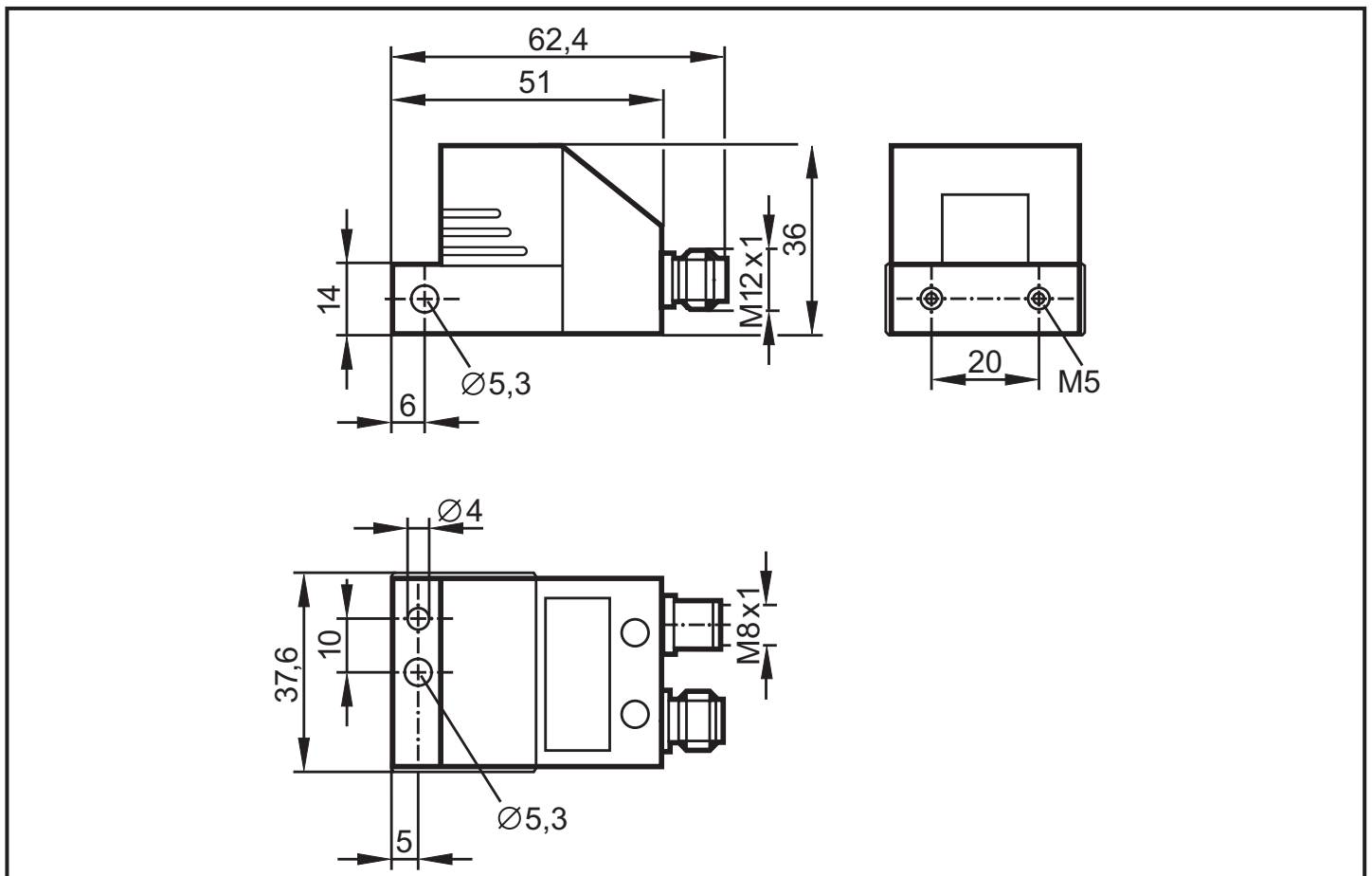
The unit can be locked electronically to prevent unintentional settings.

<ul style="list-style-type: none"><li>▶ Make sure that the unit is in the normal operating mode.</li><li>▶ Press [Mode/Enter] + [Set] for 10 s.</li><li>&gt; [Loc] is displayed.</li></ul>	
<p>During operation: [Loc] is briefly displayed if you try to change parameter values.</p>	
<p>For unlocking:</p> <ul style="list-style-type: none"><li>▶ Press [Mode/Enter] + [Set] for 10 s.</li><li>&gt; [uLoc] is displayed.</li></ul>	
<p>On delivery: not locked.</p>	

## 11 Maintenance, repair and disposal

- ▶ Dispose of the device in accordance with the national environmental regulations.

## 12 Scale drawing

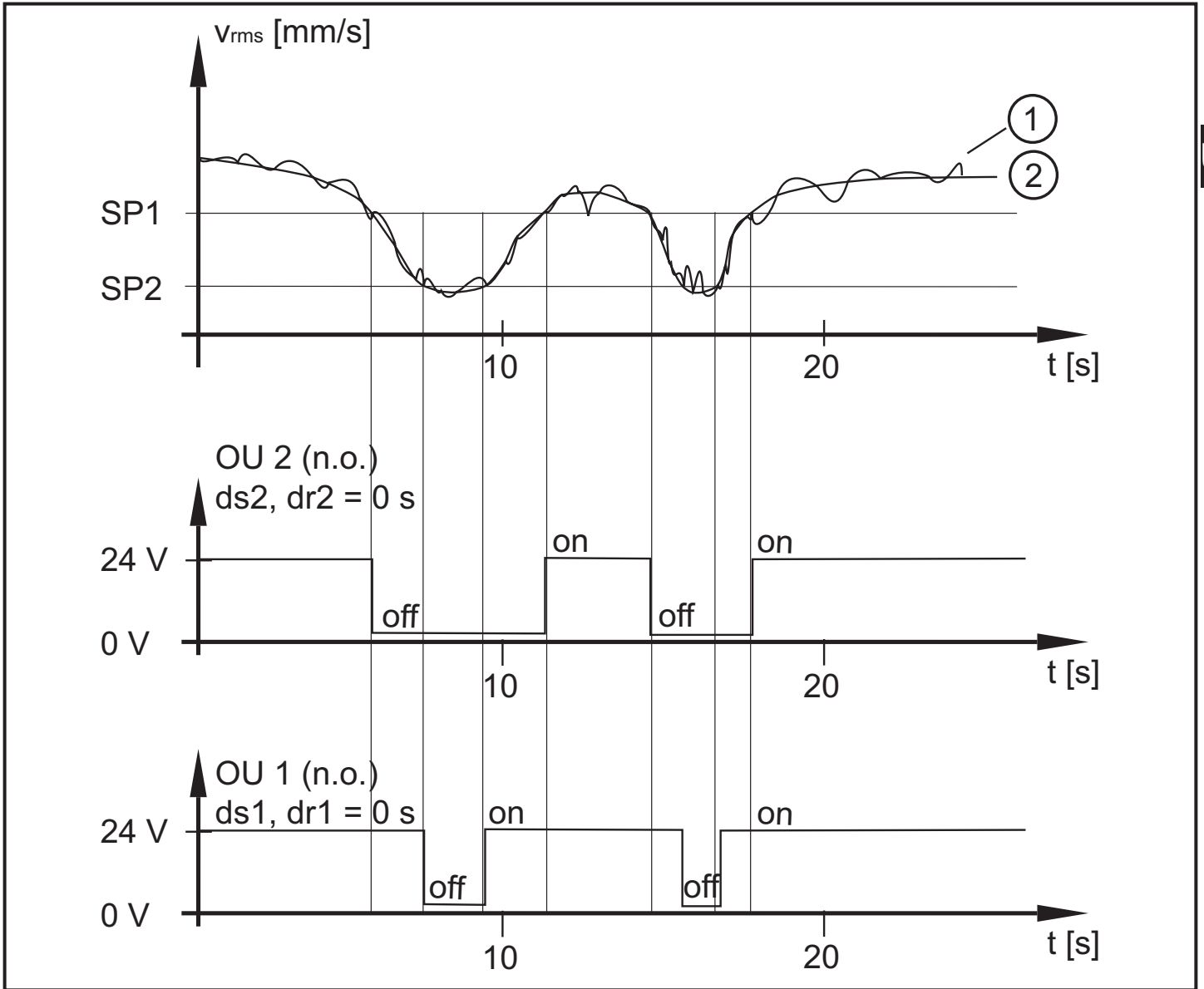




# 13 Time diagrams

## 13.1 Averaging for a characteristic vibration value

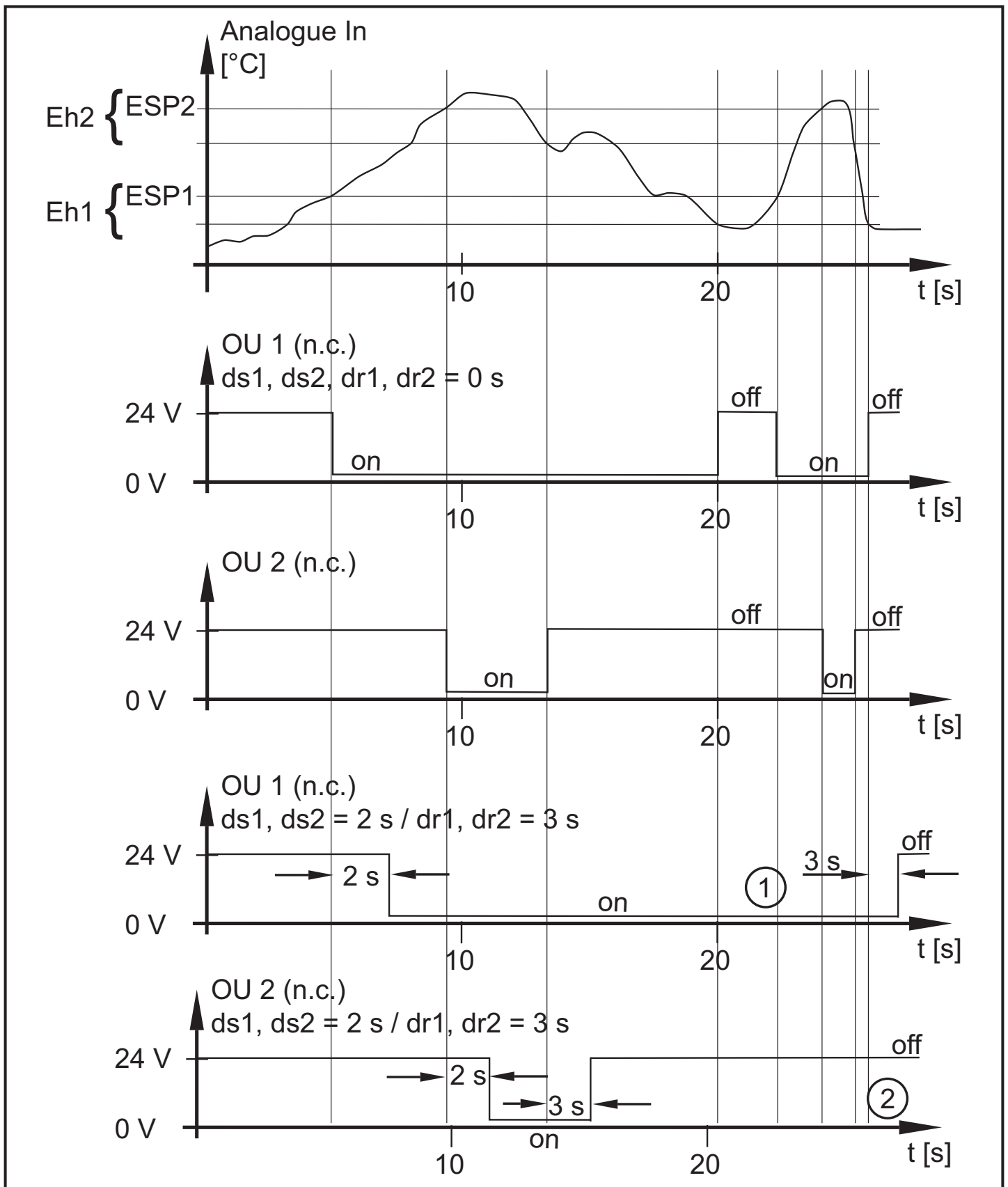
The time diagram shows the effect of averaging for a characteristic vibration value. The outputs are configured as normally open (OU1 and OU2 → NO), averaging (AUER) = 0.25.



- 1: Raw signal
- 2: Averaged signal

## 13.2 Switching delay for the upper limit monitor

The time diagram shows the effect of the switching delay on the analogue input for an upper limit monitor ( $ESP1 < ESP2$ ). The outputs are set as normally closed ( $OU1$  and  $OU2 \rightarrow NC$ ).



1: Not switched off because the selected switching delay is too short ( $< 3$  s).

2: Not switched on because the selected switching delay is too short ( $< 2$  s).

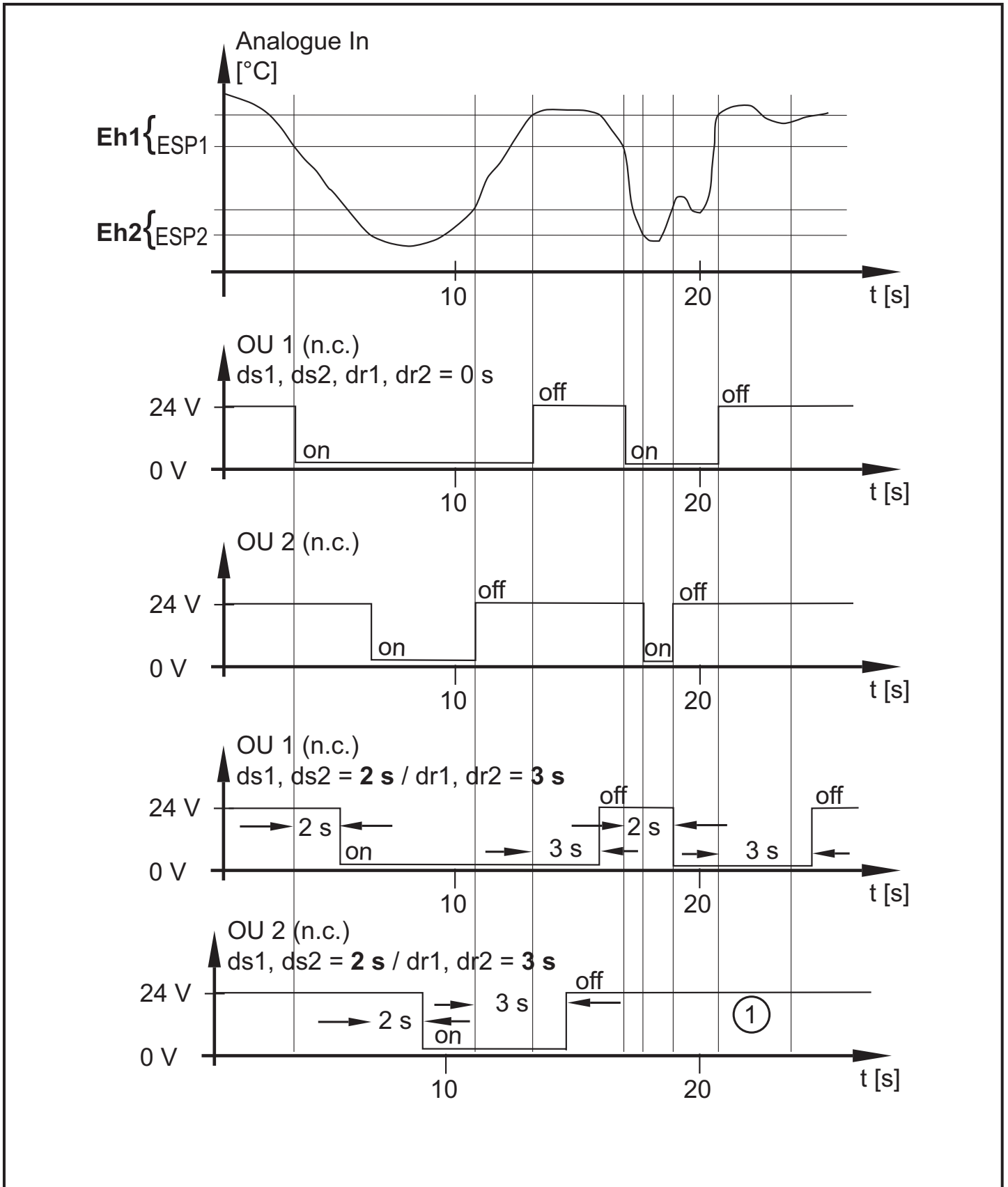


If the switching delays of pre-alarm and main alarm are set differently:

- main alarm already switched on, pre-alarm not yet switched on
- pre-alarm already switched off, main alarm not yet switched off

### 13.3 Switching delay for the lower limit monitor

The time diagram shows the effect of the switching delay on the analogue input for a lower limit monitor ( $ESP1 > ESP2$ ). The outputs are set as normally closed (OU1 and OU2  $\rightarrow$  NC).



1: Not switched on because the selected switching delay is too short.

# 14 Factory setting

	Factory setting	User setting
<b>Global settings</b>		
Input filter	10 Hz high pass	
<b>Characteristic vibration value 1</b>		
Filter	1000 Hz low pass	
Evaluation method	RMS	
Degree of integration	Vibration velocity	
Measurement time	0.25 s	
History interval	300 s	
History values	Maximum value + average value	
<b>Characteristic vibration value 2</b>		
Filter	6000 Hz low pass	
Evaluation method	Peak	
Degree of integration	Acceleration	
Measurement time	0.25 s	
History interval	300 s	
History values	Maximum value + average value	
<b>External input</b>		
Usage	Analogue signal	
Scaling VNA (if used = VNA)	Not used	
Input filter (if used = VNA)	Not used	
<b>External process value 1</b>		
Measurement time	0.5 s	

UK

	<b>Factory setting</b>	<b>User setting</b>
History interval	300 s	
History values	Maximum value + average value	
<b>External process value 2</b>	Not used	
Measurement time		
History interval		
History values		
<b>External characteristic vibration value 1</b>	Not used	
Filter		
Evaluation method		
Degree of integration		
Measurement time		
History interval		
History values		
<b>External characteristic vibration value 2</b>	Not used	
Filter		
Evaluation method		
Degree of integration		
Measurement time		
History interval		
History values		
<b>Outputs</b>		

	<b>Factory setting</b>	<b>User setting</b>
Switching logic pre-alarm	Characteristic vibration value 1 or characteristic vibration value 2 or external process value	
Switching logic main alarm	Characteristic vibration value 1 or characteristic vibration value 2 or external process value	

UK

The following list indicates the factory settings of the parameters that can be set via the pushbuttons on the unit:

	<b>Factory setting</b>	<b>User setting</b>
<b>Characteristic vibration value 1</b>		
SP1 (pre-alarm)	2.8 [mm/s] <sub>rms</sub>	
SP2 (main alarm)	4.5 [mm/s] <sub>rms</sub>	
AUER (averaging)	0.125	
<b>Characteristic vibration value 2</b>		
SP1 (pre-alarm)	5 [g] <sub>peak</sub>	
SP2 (main alarm)	7.5 [g] <sub>peak</sub>	
AUER (averaging)	1	
<b>External characteristic vibration value 1</b>	Not used	
ESP1 (pre-alarm)		
ESP2 (main alarm)		
AUER (averaging)		
<b>External characteristic vibration value 2</b>	Not used	

	<b>Factory setting</b>	<b>User setting</b>
ESP1 (pre-alarm)		
ESP2 (main alarm)		
AUER (averaging)		
<b>External process value 1</b>		
ESP1 (pre-alarm)	10	
ESP2 (main alarm)	20	
Eh1 (hysteresis pre-alarm)	1	
Eh2 (Hysteresis main alarm)	1	
<b>External process value 2</b>	Not used	
ESP1 (pre-alarm)		
ESP2 (main alarm)		
Eh1 (hysteresis pre-alarm)		
Eh2 (Hysteresis main alarm)		
<b>External input</b>		
EASP (4 mA)	0	
EAEP (20 mA)	100	
<b>Outputs</b>		
ou1 (output 1)	NC (normally closed)	
ASP1 (4 mA, if ou1 = I)	Not used	
AEP1 (20 mA, if ou1 = I)	Not used	
ou2 (output 2)	NC (normally closed)	
dS1 switch-on delay pre-alarm	0 [s]	
dr1 switch-off delay pre-alarm	0 [s]	



	<b>Factory setting</b>	<b>User setting</b>
dS2 switch-on delay main alarm	0 [s]	
dr2 switch-off delay main alarm	0 [s]	
<b>Display</b>		
uni	Metric	