

ifm electronic



Operating instructions  
Combined pressure sensor

**efector500<sup>®</sup>**

**PY9970**

**UK**

704237 / 01 05 / 2010

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# Preliminary note

- In these instructions the operating elements are represented as follows:  
[Mode/Enter] = “Mode/Enter” button
- The indications are represented as follows:  
[OU1] = parameter “OU1”, [Hno] = parameter value “Hno”
- An instruction on how to act is indicated by “▶”.  
Example: ▶ Check the reliable functioning of the unit.
- A reaction to the action is indicated by “>”.  
Example: > LEDs 7 + 8 are lit.

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## 1 Safety instructions

- **Please read the product description prior to installing the unit.**
- **Ensure that the product is suitable for your application without any restrictions.**
- **If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.**
- **Please check for all applications that the product materials (see Technical data) are compatible with the media to be measured.**
- **For gaseous media the application is limited to max. 25 bar.**

## 2 Function and features

The pressure sensor detects the system pressure.

- It shows the current system pressure on its display.
- It generates 2 output signals according to the set output configuration.

	Output 1	Output 2
Analogue output (only output 2)		I: 4 ... 20 mA
		U: 0 ... 10 V
Switching function (output 1 and output 2; function can be selected for each output separately)	hysteresis function / N.O. (Hno)	
	hysteresis function / N.C. (Hnc)	
	window function / N.O. (Fno)	
	window function / N.C. (Fnc)	
Output polarity (applies to both switching outputs)	p-switching (PnP)	
	n-switching (nPn)	

### Applications

Type of pressure: relative pressure

Order no.	Measuring range		Permissible overload pressure		Bursting pressure	
	bar	PSI	bar	PSI	bar	PSI
PY9970	0...400	0...5800	600	8700	800	11600

$$\text{MPa} = \text{bar} \div 10 / \text{kPa} = \text{bar} \times 100$$



Static and dynamic overpressures exceeding the indicated overload pressure are to be avoided by taking appropriate measures.

The indicated bursting pressure must not be exceeded. Even if the bursting pressure is exceeded only for a short time, the unit can be destroyed.

NOTE: Risk of injury!

For gaseous media the application is limited to max. 25 bar.

# 3 Function

## 3.1 Switching function

OUTx changes its switching state when the set switching limits have not been reached or have been exceeded (SPx, rPx). The following switching functions can be selected:

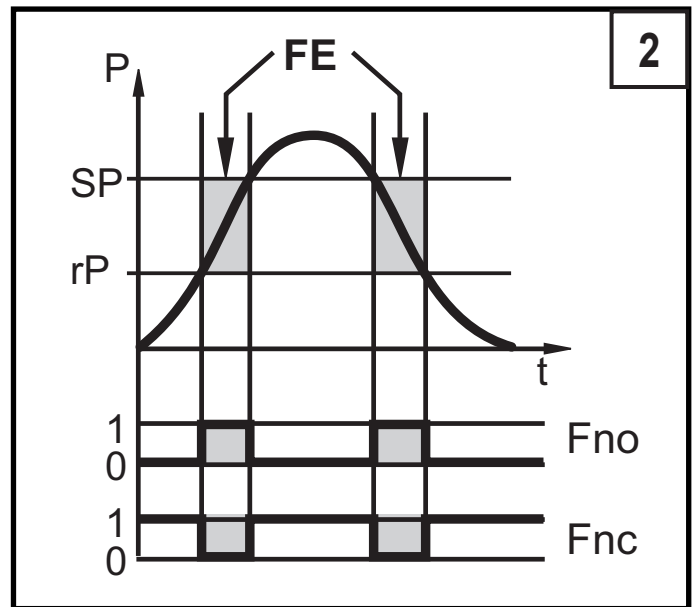
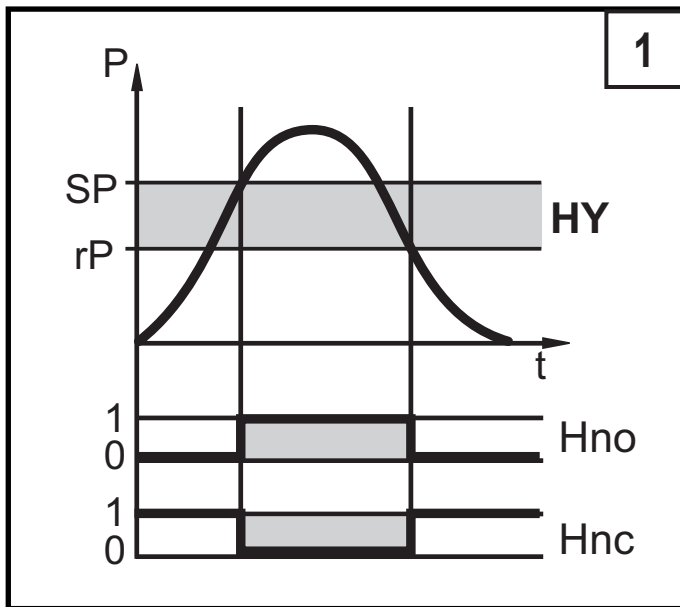
- hysteresis function / normally open: [OUx] = [Hno] (→ fig. 1).
- hysteresis function / normally closed: [OUx] = [Hnc] (→ fig. 1).

First the set point (SPx) is set, then the reset point (rPx) with the requested difference.

- window function / normally open: [OUx] = [Fno] (→ fig. 2).
- window function / normally closed: [OUx] = [Fnc] (→ fig. 2).

The width of the window can be set by means of the difference between SP2 and rP2. SP2 = upper value, rP2 = lower value.

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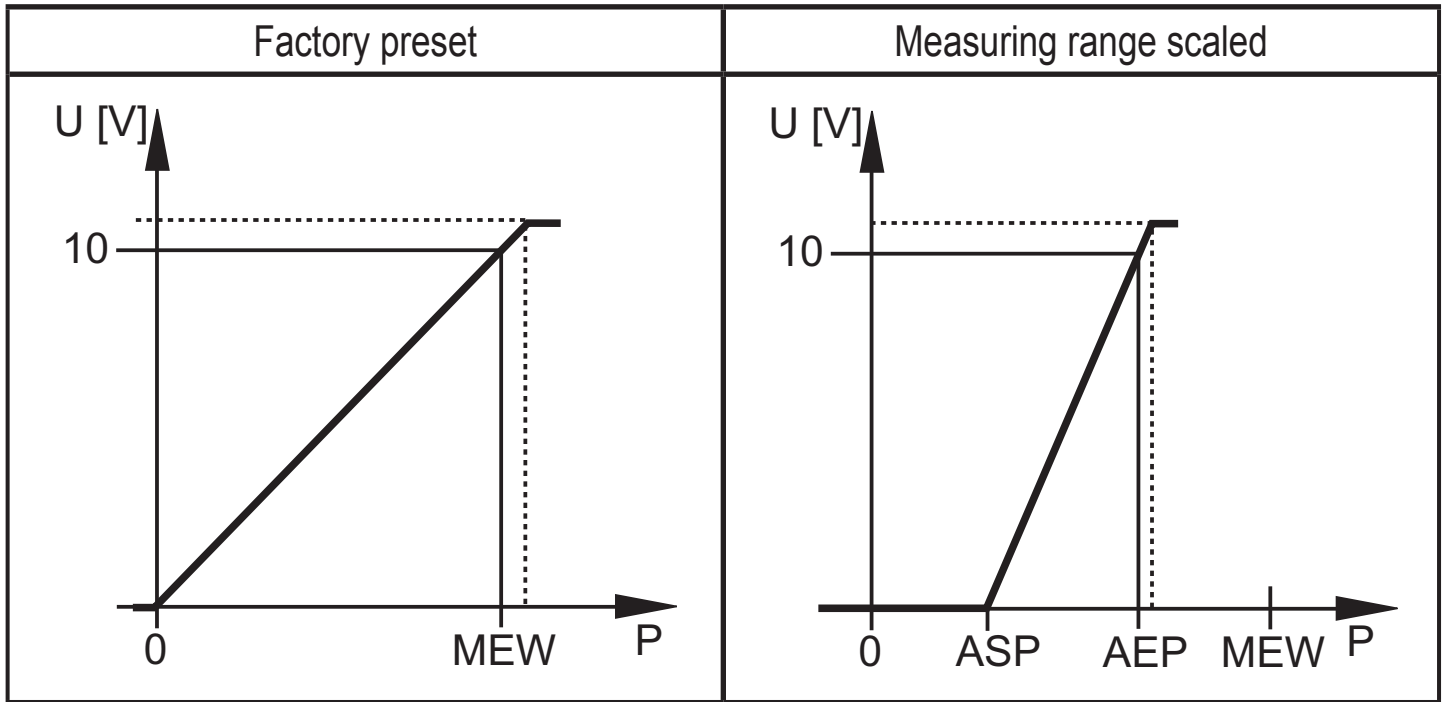
P = system pressure; HY = hysteresis; FE = window (acceptable range)

## 3.2 Analogue function

- [OU2] defines whether the set measuring range is provided as a 4...20 mA signal ([OU2] = [I]) or a 0...10 V signal ([OU2] = [U]).
- [ASP] defines the measured value at which the output signal is 4 mA or 0 V.
- [AEP] defines the measured value at which the output signal is 20 mA or 10 V.

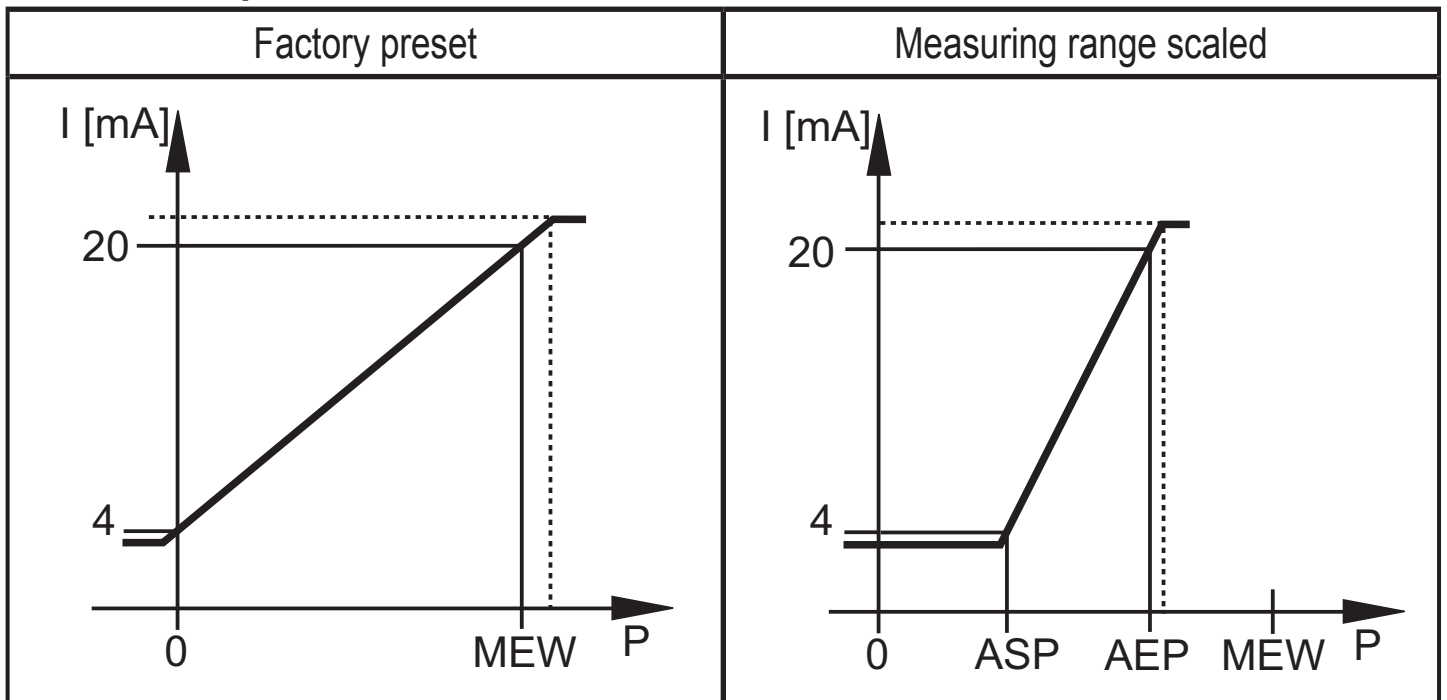
Minimum distance between [ASP] and [AEP] = 25 % of the span.

## Voltage output 0...10 V



P = system pressure, MEW = final value of the measuring range  
 The output signal is between 0 and 10 V in the set measuring range.  
 It is also indicated:  
 System pressure above the measuring range: output signal > 10 V.

## Current output 4...20 mA



P = system pressure, MEW = final value of the measuring range

The output signal is between 4 and 20 mA in the set measuring range.

It is also indicated:

- System pressure above the measuring range: output signal > 20 mA.
- System pressure below the measuring range: output signal drops to max. 3.2 mA (depending on the scaling).

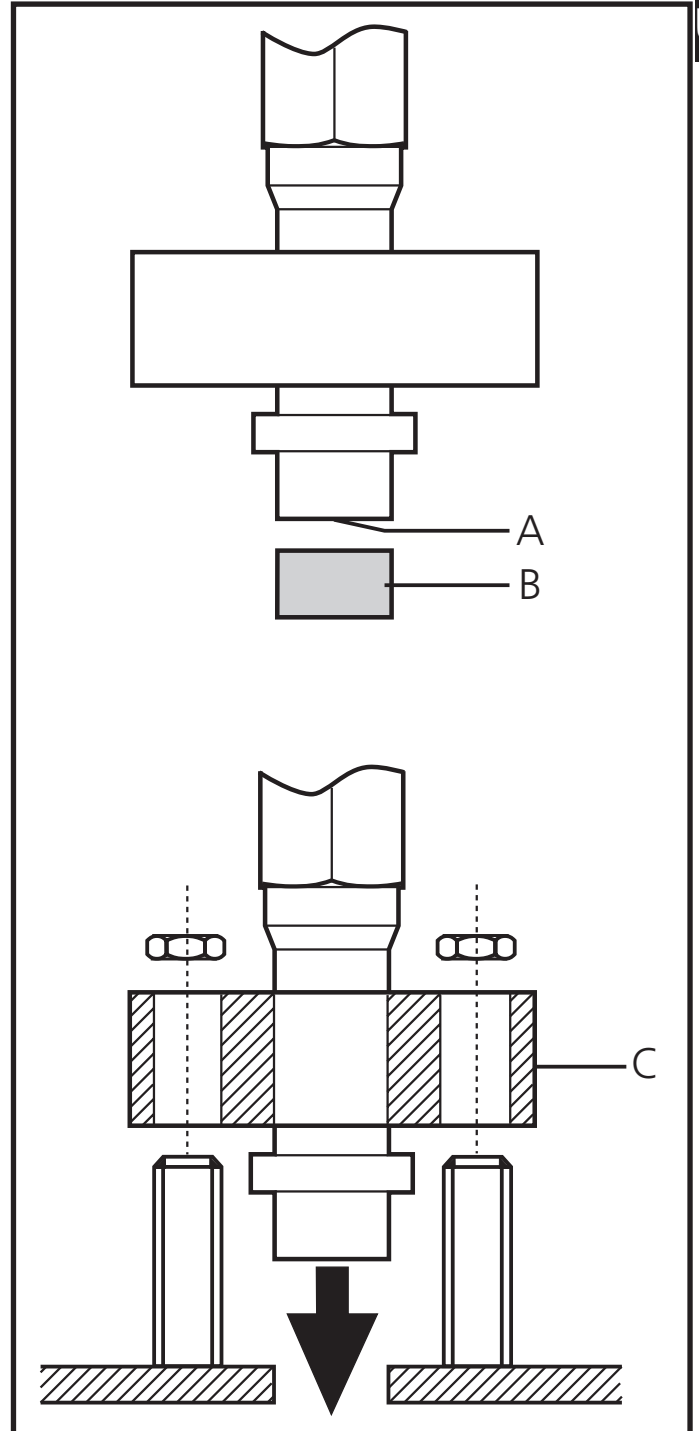
## 4 Installation



Before mounting and removing the sensor, make sure that no pressure is applied to the system.

1. Remove the protective cap (B).  
NOTE: the metal membrane (A) must not be touched.
2. Insert the sensor tip carefully into the bore. The metal membrane (A) must not get into contact with the edge of the bore. Use the washer indicated by the manufacturer of your plant.
3. Push the fixing bores of the clamping flange (C) over the threaded bolts of the homogeniser.
4. Put the nuts onto the bolts and tighten them alternately (the sensor tip must not be jammed).  
Tightening torque: 180 Nm.

Otherwise follow the instructions of the manufacturer of your plant.



# 5 Electrical connection

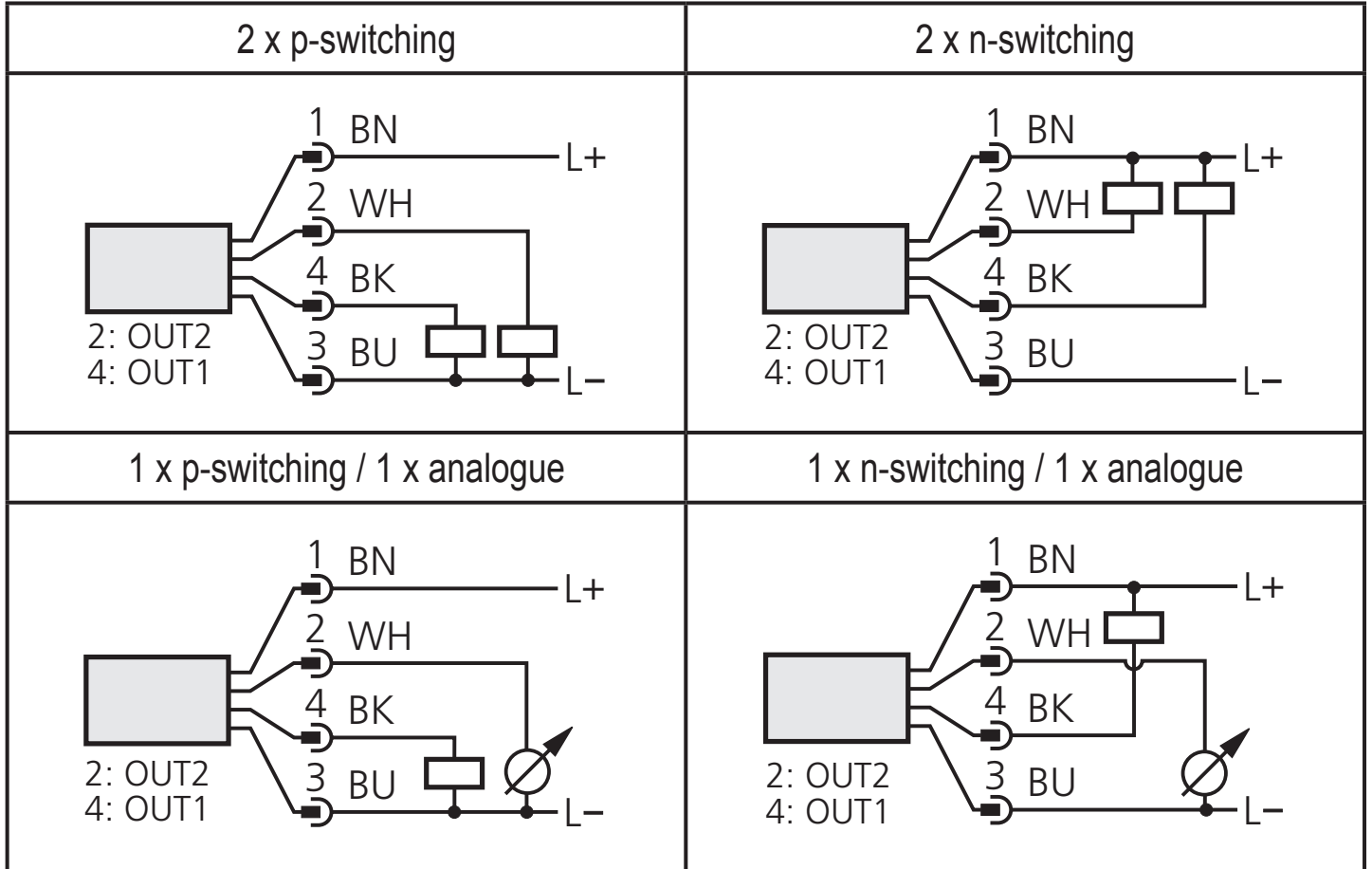


The unit must be connected by a qualified electrician.

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

Voltage supply to EN50178, SELV, PELV.

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

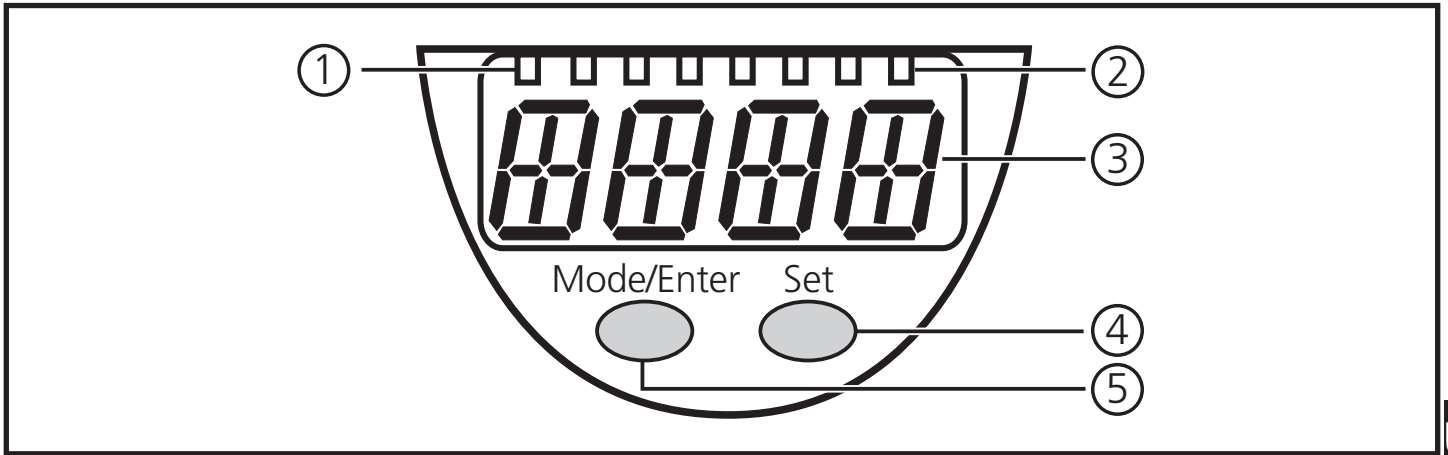


Core colours of ifm sockets:

1 = BN (brown), 2 = WH (white), 3 = BU (blue), 4 = BK (black).



# 6 Operating and display elements



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## 1: Indicating LEDs

- 3 x LED green = indicating the display unit for the system pressure; lighting LED = set display unit.

## 2: Indicating LEDs

- 2 x LED yellow = indicating of the switching status of the outputs; lighting LED = the respective output has switched.

## 3: 4-digit display

- Display of the system pressure, display of parameters and parameter values.

## 4: Set button "Set"

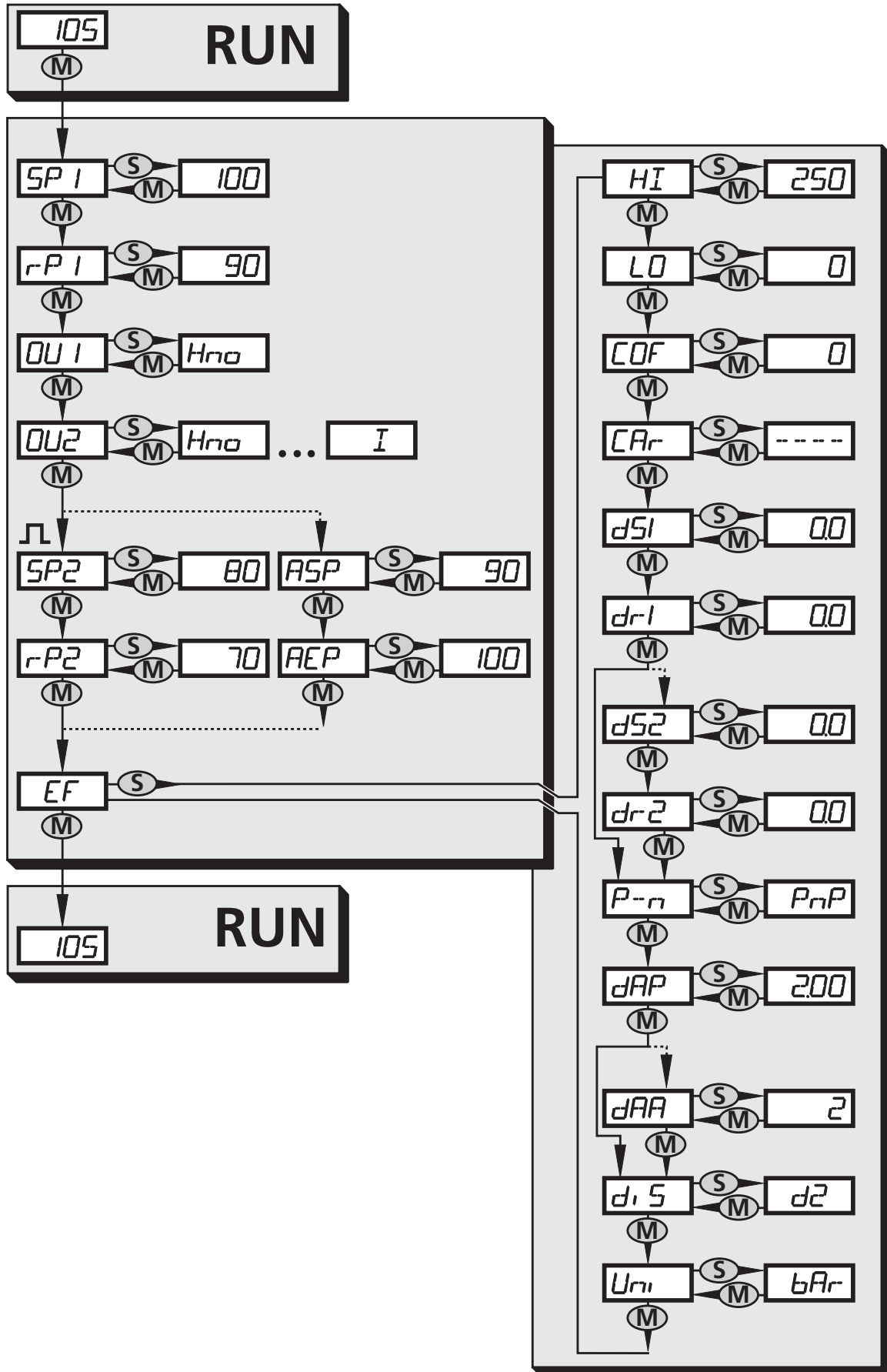
- Setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly).

## 5: Set button "Mode / Enter"

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

# 7 Menu

## 7.1 Menu structure



## 7.2 Menu explanation

SP1/rP1	Upper / lower limit value for the system pressure at which output 1 changes its switching status.
SP2/rP2	Upper / lower limit value for the system pressure at which output 2 changes its switching status.
OU1	Output function for OUT1: <ul style="list-style-type: none"> <li>Switching signal for the limit values: hysteresis function [H ..] or window function [F ..], normally open [. no] or normally closed [. nc] each.</li> </ul>
OU2	Output function for OUT2: <ul style="list-style-type: none"> <li>Switching signal for the limit values: hysteresis function [H ..] or window function [F ..], normally open [. no] or normally closed [. nc] each.</li> <li>Analogue signal for the current system pressure: 4...20 mA [I] or 0...10 V [U].</li> </ul>
ASP	Analogue start point for the system pressure: measured value at which 4 mA / or 0 V are output.
AEP	Analogue end point for the system pressure: measured value at which 20 mA / or 10 V are output.
EF	Extended functions / Opening menu level 2.
HI	Maximum value memory for the system pressure.
LO	Minimum value memory for the system pressure.
COF	Zero point calibration.
CAr	Calibration reset.
dS1/dS2	Switch-on delay for für OUT1 / OUT2.
dr1/dr2	Reset delay für OUT1 / OUT2.
P-n	Output polarity: pnp / npn
dAP	Damping for the switching outputs
dAA	Damping for the analogue output
diS	Update rate and orientation of the display.
Uni	Standard unit of measurement for the system pressure.


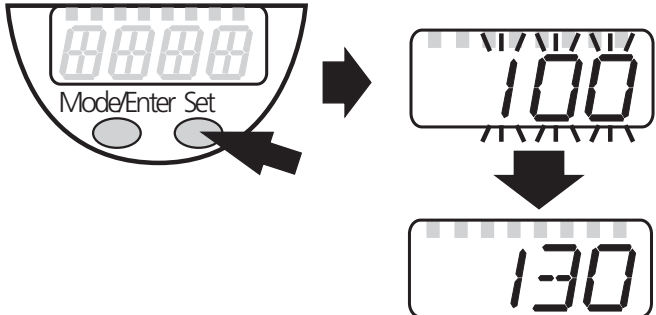
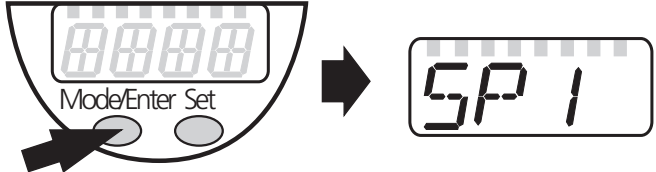
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# 8 Parameter setting

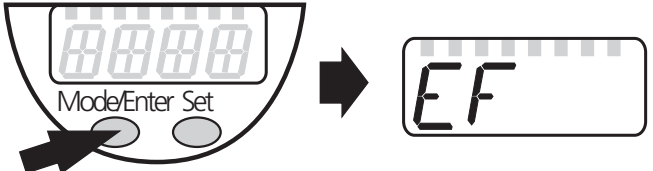
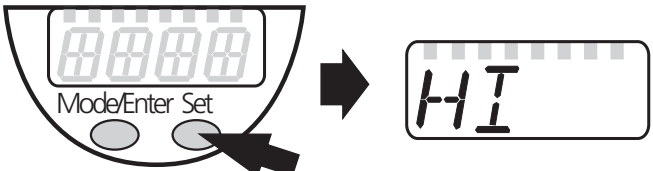
During the parameter setting process the unit remains in the operating mode. It continues its monitoring function with the existing parameters until parameter setting has been terminated.

## 8.1 Parameter setting general

Each parameter setting requires 3 steps:

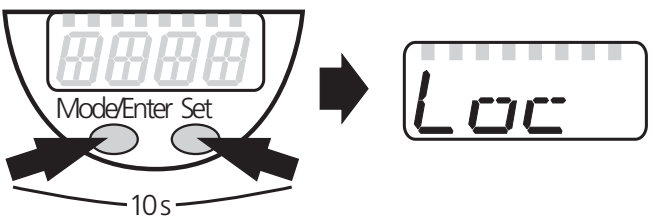
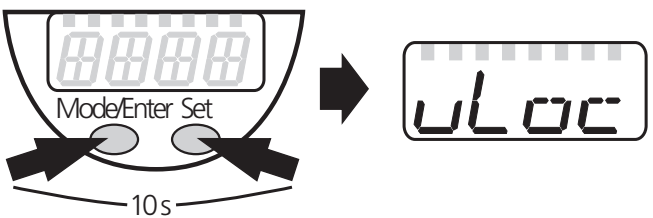
<p><b>1</b></p>	<p><b>Selecting parameter</b></p> <ul style="list-style-type: none"> <li>▶ Press [Mode/Enter] until the requested parameter is displayed</li> </ul>	
<p><b>2</b></p>	<p><b>Setting the parameter value</b></p> <ul style="list-style-type: none"> <li>▶ Press [Set] and keep the button pressed.</li> <li>&gt; Current setting value of the parameter bit flashes for 5 s.</li> <li>&gt; After 5 s: Setting value is changed: incremental by pressing briefly or scrolling by holding pressed.</li> </ul>	
<p>The numerical values are incremented continuously. If the value is to be reduced: Let the display move to the maximum setting value. Then the cycle starts again at the minimum setting value.</p>		
<p><b>3</b></p>	<p><b>Acknowledge parameter value</b></p> <ul style="list-style-type: none"> <li>▶ Press [Mode/Enter] briefly.</li> <li>&gt; The parameter is displayed again. The new setting value is stored.</li> </ul>	
<p><b>Set more parameters:</b></p> <ul style="list-style-type: none"> <li>▶ Start again with step 1.</li> </ul>		
<p><b>Finishing parameter setting:</b></p> <ul style="list-style-type: none"> <li>▶ Press [Mode/Enter] several times until the current measured value is displayed or wait for 15 s. The unit returns to the operating mode if no button is pressed for over 15 s after acknowledgement of the new parameter value.</li> </ul>		

- Changing from menu level 1 to menu level 2:

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

- Locking / unlocking

The unit can be locked electronically to prevent unintentional wrong settings.

<ul style="list-style-type: none"> <li>▶ Ensure 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: &gt; [Loc] is displayed briefly when 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>	

On delivery: Unlocked.

- Timeout:

If no button is pressed for 15 s while the parameters are being set, the unit returns to the operating mode with unchanged values.



## 8.2 Setting the output signal

<b>8.2.1 Setting the output function</b>	
<ul style="list-style-type: none"> <li>▶ Select [OU1] and set the switching function: [Hno] = hysteresis function / normally open, [Hnc] = hysteresis function / normally closed, [Fno] = window function / normally open, [Fnc] = window function / normally closed.</li> </ul>	<i>OU 1</i>
<ul style="list-style-type: none"> <li>▶ Select [OU2] and set the switching function: [Hno] = hysteresis function / normally open, [Hnc] = hysteresis function / normally closed, [Fno] = window function / normally open, [Fnc] = window function / normally closed, [I] = current signal proportional to the pressure 4...20 mA, [U] = voltage signal proportional to the pressure 0...10 V.</li> </ul>	<i>OU2</i>
<b>8.2.2 Setting the switching limits</b>	
<ul style="list-style-type: none"> <li>▶ Select [SP1] / [SP2] and set the value at which the output switches.</li> </ul>	<i>SP 1</i> <i>SP 2</i>
<ul style="list-style-type: none"> <li>▶ Select [rP1] / [rP2] and set the value at which the output switches back. rPx is always lower than SPx. The unit only accepts values which are lower than SPx.</li> </ul>	<i>r-P 1</i> <i>r-P 2</i>
<b>8.2.3 Scaling the analogue value</b>	
<ul style="list-style-type: none"> <li>▶ Select [ASP] and set value at which 4 mA / 0 V are output.</li> </ul>	<i>ASP</i>
<ul style="list-style-type: none"> <li>▶ Select [AEP] and set value at which 20 mA / 10 V are output. Minimum distance between ASP and AEP = 25 % of the span (scaling factor 1:4).</li> </ul>	<i>AEP</i>


## 8.3 User settings (optional)

<b>8.3.1 Setting the unit of measurement for the system pressure</b>	
▶ Select [Uni] and set the unit of measurement: [bAr], [MPa] or [PSI].	Uni
<b>8.3.2 Configuring the display</b>	
▶ Select [diS] and set update rate and orientation of the display: [d1]: Update of the measured value every 50 ms. [d2]: Update of the measured value every 200 ms. [d3]: Update of the measured value every 600 ms. [Ph]: Display of the measured peak value remains for a short time (peak hold). [rd1], [rd2], [rd3], [Ph]: Display like d1, d2, d3, Ph; rotated by 180°. [OFF]: The display is deactivated in the operating mode.	di S
<b>8.3.3 Zero-point calibration</b>	
▶ Select [COF] and set a value between -5% and 5% of the final value of the measuring range. The internal measured value "0" is shifted by this amount.	COF
Resets the calibration set by COF to the value set at the factory. ▶ Press [Mode/Enter] until [CAr] is displayed. ▶ Press [Set] and keep it pressed until [----] is displayed. ▶ Press [Mode/Enter] briefly.	CAr
<b>8.3.4 Setting the delay time for the switching outputs</b>	
[dS1] / [dS2] = switch-on delay for OUT1 / OUT2. [dr1] / [dr2] = switch-off delay for OUT1 / OUT2. ▶ Select [dS1], [dS2], [dr1] or [dr2], set value between 0.1 und 50 s (at 0.0 the delay time is not active).	dS 1 dS 2 dr 1 dr 2
<b>8.3.5 Setting the output polarity</b>	
▶ Select [P-n], set [PnP] or [nPn].	P--n

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<b>8.3.6 Setting the damping for the switching outputs</b>	
<p>▶ Select [dAP], set value between 0.01 ... 4.00 s; (at 0.00 [dAP] time is not active).</p> <p>dAP-value = response time between pressure change and change of the switching status in seconds (s).</p> <p>Correlation between switching frequency and [dAP]: <math>f_{\max} = 1 \div 2dAP</math>.</p> <p>Setting at the factory: dAP = 2.00 s.</p>	
<b>8.3.7 Setting the damping for the analogue output</b>	
<p>▶ Select [dAA], set value between 0.01 ... 4.00 s; (at 0.00 [dAA] time is not active).</p> <p>dAA-value = response time between pressure change and change of the switching status in seconds (s).</p> <p>Setting at the factory: dAA = 2 s.</p>	

## 8.4 Service functions

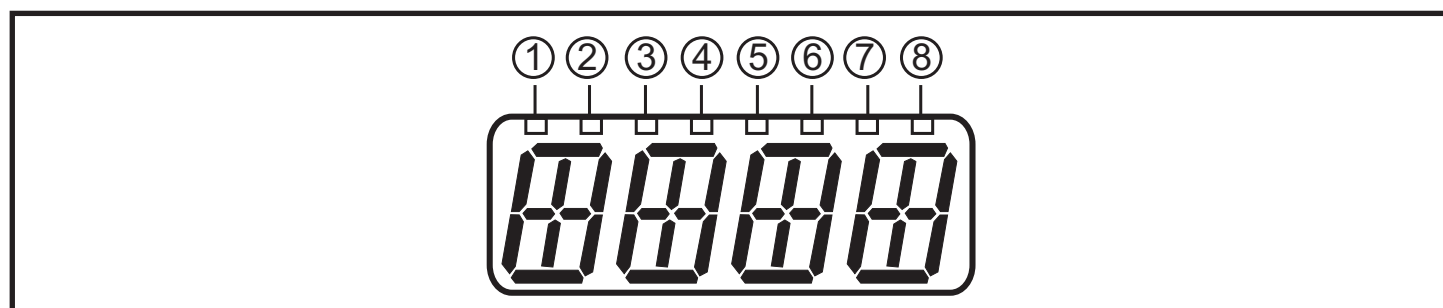
<b>8.4.1 Reading the min./max. values for the system pressure</b>	
<p>▶ Select [HI] or [LO], press [Set] briefly. [HI] = maximum value, [LO] = minimum value.</p> <p>Delete memory:</p> <p>▶ Select [HI] or [LO].</p> <p>▶ Press [Set] until [----] is displayed.</p> <p>▶ Press [Mode/Enter] briefly.</p>	



## 9 Operation

After power on of the supply voltage the unit is in the Run mode (= normal operation). It carries out its measurement and evaluation functions and generates output signals according to the set parameters.

### 9.1 Operation indication



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numerical value + LED 1	current system pressure in bar
numerical value + LED 2	current system pressure in MPa
numerical value + LED 3	current system pressure in PSI
LED 7	switching status of OUT2
LED 8	switching status of OUT1

LEDs 4, 5, 6: not used

### 9.2 Read the set parameter values

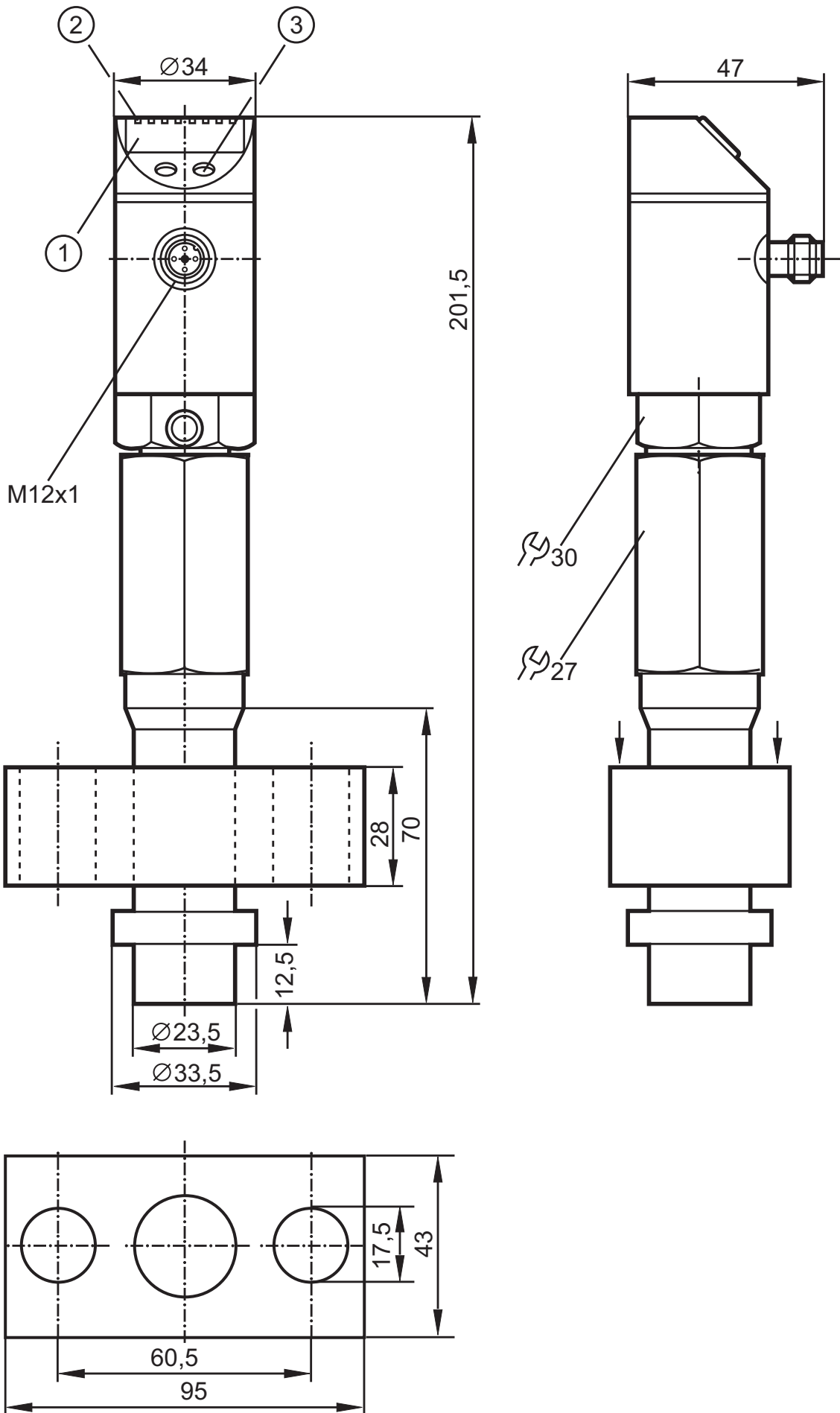
- ▶ Press [Mode/Enter] briefly to scroll the parameters.
- ▶ Press [Set] briefly to indicate the corresponding parameter value for 15 s. After another 15 s the unit returns to the Run mode.

### 9.3 Fault indication

[OL]	overload pressure (measuring range exceeded)
[UL]	underpressure range (measuring range below the minimum value)
[SC1]	short circuit in OUT1*
[SC2]	short circuit in OUT2*
[SC]	short circuit in both switching outputs*

\*The output concerned is switched off as long as the short circuit exists. This faults are indicated even if the display is deactivated.

# 10 Scale drawing



1: display; 2: LED's; 3: programming button

# 11 Technical data

Operating voltage [V].....	20 ... 30 DC <sup>1)</sup>
Current consumption [mA].....	< 65
Current rating each switching output [mA].....	250
Short-circuit prot., reverse polarity prot. / overload prot., watchdog	
Voltage drop [V] .....	< 2
Power-on delay time [s] .....	0.2
Min. response time switching outputs [ms] .....	3
Switching frequency [Hz] .....	170 ... 0.125
Analogue output .....	4 ... 20 mA / 0 ... 10 V
Max. load current output [ $\Omega$ ] .....	(UB - 10) x 50; 700 at UB = 24V
Min. load with voltage output [ $\Omega$ ] .....	2000
Min. response time analogue output [ms] .....	3
Accuracy / deviations (in% of the span) <sup>2)</sup>	
- Accuracy of switch point .....	< $\pm$ 1.0
- Characteristics deviation (linearity, incl. hysteresis and repeatability) <sup>3)</sup> .....	< $\pm$ 1.0
- Repeatability (with temperature fluctuations < 10K) .....	< $\pm$ 0.25
- Temperature coefficients (TEMPCO) in the compensated temperature range 0 ... +80°C (in% of the span per 10 K)	
- greatest TEMPCO of the zero point / of the span .....	< $\pm$ 0.3 / < $\pm$ 0.3
Materials (wetted parts) .....	high-grade stainless steel
Housing material .....	stainless steel (304S15); stainless steel (316S12); PC(Macrolon); Pocan; PEI; FPM (Viton)
Protection, Protection class .....	IP 67 III
Insulation resistance [ $M\Omega$ ].....	> 100 (500 V DC)
Shock resistance [g] .....	50 (DIN / IEC 68-2-27, 11ms)
Vibration resistance [g] .....	20 (DIN / IEC 68-2-6, 10 - 2000 Hz)
Switching cycles min. ....	1 million
Operating temperature [°C] .....	-25 ... +80
Storage temperature [°C] .....	-40 ... +100
Medium temperature [°C] .....	-10 ... +140
EMC EN 61000-4-2 ESD: .....	4 / 8 KV
EN 61000-4-3 HF radiated: .....	10 V/m
EN 61000-4-4 Burst: .....	2 KV
EN 61000-4-5 Surge: .....	0.5 / 1 KV
EN 61000-4-6 HF conducted: .....	10 V

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1) to EN50178, SELV, PELV

2) all indications are referred to a turn down of 1:1

3) limit value setting to DIN 16086

## 11.1 Setting ranges

Uni = bAr								
SP1 / SP2		rP1 / rP2		ASP		AEP		$\Delta P$
min	max	min	max	min	max	min	max	
4	400	2	398	0	160	100	400	1

$\Delta P$  = increments

Uni = MPa								
SP1 / SP2		rP1 / rP2		ASP		AEP		$\Delta P$
min	max	min	max	min	max	min	max	
0,4	40,0	0,2	39,8	0,0	16,0	10,0	40,0	0,1

$\Delta P$  = increments

Uni = PSI								
SP1 / SP2		rP1 / rP2		ASP		AEP		$\Delta P$
min	max	min	max	min	max	min	max	
60	5800	30	5770	0	2320	1450	5800	10

$\Delta P$  = increments

## 12 Factory setting

	Factory setting	User setting
SP1	100	
rP1	92	
OU1	Hno	
OU2	I	
SP2	300	
rP2	292	
ASP	0	
AEP	400	
COF	0.0	
dS1	0.0	
dr1	0.0	
dS2	0.0	
dr2	0.0	
P-n	PnP	
dAP	2.00	
dAA	2.00	
diS	d2	
Uni	bAr	

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Further information at [www.ifm.com](http://www.ifm.com)