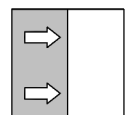


Operating manual

MS13

Digital pressure transmitter / switch
with colour change display



Masthead

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Version history

Rev. ST4-A 04/16	Version 1 (first edition)
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1 Safety guidelines

1.1 General



WARNING

This operating manual contains instructions fundamental to the installation, operation and maintenance of the device that must be observed unconditionally. It must be read by the assembler, operator and the specialized personnel in charge of the instrument before it is installed and put into operation.

This operating manual is an integral part of the product and therefore needs to be kept close to the instrument in a place that is accessible at all times to the responsible personnel.

The following sections, in particular instructions about the assembly, commissioning and maintenance, contain important information, non-observance of which could pose a threat to humans, animals, the environment and property.

The instrument described in these operating instructions is designed and manufactured in line with the state of the art and good engineering practice.

1.2 Personnel Qualification

The instrument may only be installed and commissioned by specialized personnel familiar with the installation, commissioning and operation of this product.

Specialized personnel are persons who can assess the work they have been assigned and recognize potential dangers by virtue of their specialized training, their skills and experience and their knowledge of the pertinent standards.

1.3 Risks due to Non-Observance of Safety Instructions

Non-observance of these safety instructions, the intended use of the device or the limit values given in the technical specifications can be hazardous or cause harm to persons, the environment or the plant itself.

The supplier of the equipment will not be liable for damage claims if this should happen.

1.4 Safety Instructions for the Operating Company and the Operator

The safety instructions governing correct operation of the instrument must be observed. The operating company must make them available to the installation, maintenance, inspection and operating personnel.

Dangers arising from electrical components, energy discharged by the medium, escaping medium and incorrect installation of the device must be eliminated. See the information in the applicable national and international regulations.

Please observe the information about certification and approvals in the Technical Data section.

1.5 Unauthorised Modification

Modifications of or other technical alterations to the instrument by the customer are not permitted. This also applies to replacement parts. Only the manufacturer is authorised to make any modifications or changes.

1.6 Inadmissible Modes of Operation

The operational safety of this instrument can only be guaranteed if it is used as intended. The instrument model must be suitable for the medium used in the system. The limit values given in the technical data may not be exceeded.

The manufacturer is not liable for damage resulting from improper or incorrect use.

1.7 Safe working practices for maintenance and installation work

The safety instructions given in this operating manual, any nationally applicable regulations on accident prevention and any of the operating company's internal work, operating and safety guidelines must be observed.

The operating company is responsible for ensuring that all required maintenance, inspection and installation work is carried out by qualified specialized personnel.

1.8 Pictogram explanation



DANGER

Type and source of danger

This indicates a **direct** dangerous situation that could lead to death or **serious injury** (highest danger level).

- a) Avoid danger by observing the valid safety regulations.



WARNING

Type and source of danger

This indicates a **potentially** dangerous situation that could lead to death or **serious injury** (medium danger level).

- a) Avoid danger by observing the valid safety regulations.



CAUTION

Type and source of danger

This indicates a **potentially** dangerous situation that could lead to slight or serious injury, damage or **environmental pollution** (low danger level).

- a) Avoid danger by observing the valid safety regulations.



NOTICE

Note / advice

This indicates useful information of advice for efficient and smooth operation.

2 Product and functional description

2.1 Delivery scope

- MS13 Digital pressure transmitter / switch
- Operating instructions

The unit is supplied ex-works with standard parameters.

For accessories, please see the list in section Order code [▶ 31].

2.2 Performance features

Important features

- LCD colour change display
- Switchable pressure units
- 2 independent switching points with lots of configuration options
- Analogue signal output with possibility of characteristic curve spread, characteristic curve reversal and offset setting
- Characteristic curve implementation via table with max. 30 measuring points
- Complete adjustment of all parameters and measuring point protocol possible through optional transmitter PC interface.

Typical applications

- Simple pump control systems
- Monitoring of pumps and compressors
- Filling level measuring

Application areas

- Technical facility equipment (TGA)
- Process engineering
- Process technology
- Environmental technology

2.3 Intended use

The MS13 is a pressure transmitter/ switch for measuring relative pressure. The unit is suitable for measuring pressure and under-pressure in non-aggressive gas-like and fluid media.

The MS13 complies with the state-of-the-art and is safe; it also takes into account the relevant regulations and EC directives. The manufacturer will not be liable for damage arising from incorrect or improper use.

The unit was designed bearing in mind all relevant factors that could impact on its safety. Also, the unit was produced, inspected and supplied with a user manual so that if it is used in unforeseeable reasonable conditions, its safety is guaranteed for its entire service life.



NOTICE

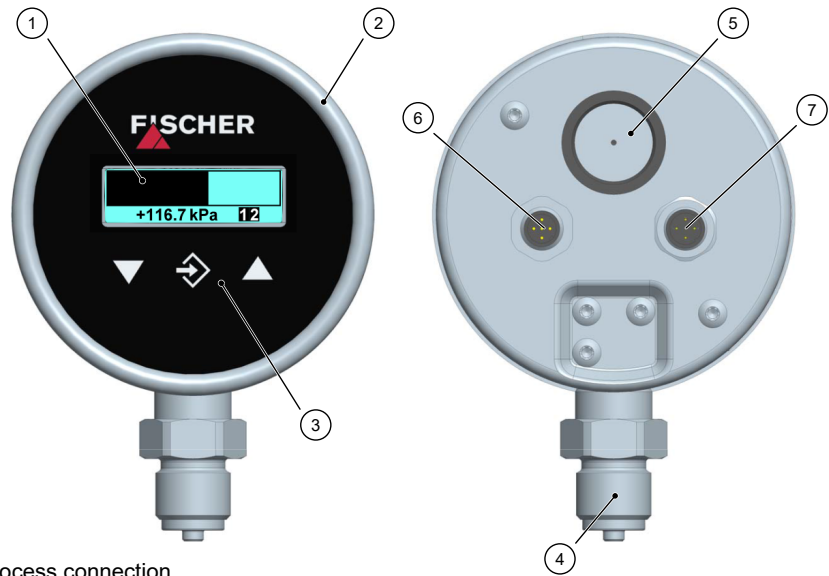
Soiled or aggressive media

Please contact the manufacturer before using this unit with dirty or aggressive media because the unit needs to be adapted for the specific customer in terms of the parts that come into contact with the media.

The device may only be used for the purpose stipulated by the manufacturer.

2.4 Product Overview

All units of the series MS13 are supplied in an NG100 bayonet ring housing made of stainless steel.



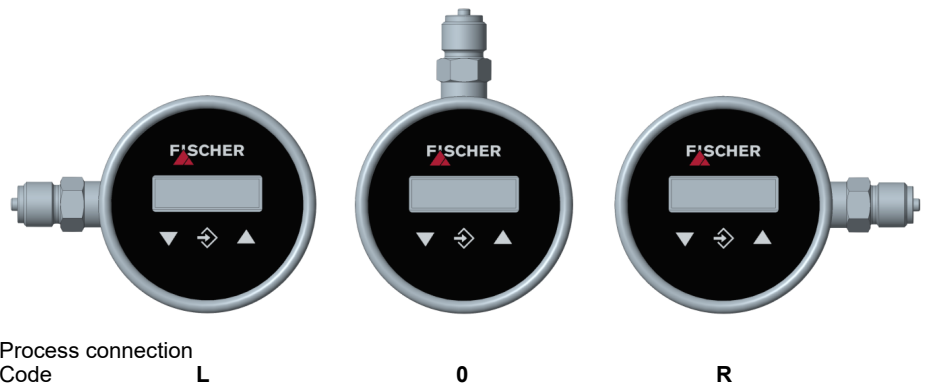
Process connection
Code **U**

Fig. 1: Product Overview

1	Colour change display	2	Bayonet ring housing
3	Keyboard	4	Process connection
5	Blowout plug	6	M12 plug 1
7	M12 plug 2		

Process connection

The following options are available for the process connection.

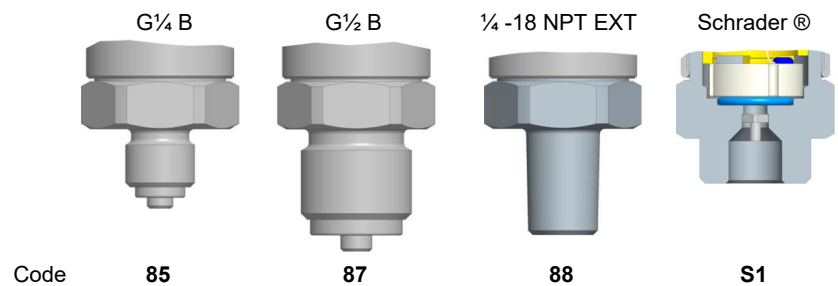


Process connection
Code **L**

0

R

Fig. 2: Process connection direction



Code **85**

87

88

S1

Fig. 3: Process connections

Code	Process connection
85	Connection shanks with external thread G¼ B
87	Connection shanks with external thread G½ B
88	Connecting port with outer thread ¼ -18 NPT EXT
S1	Schrader® screw connection inner thread 7/16 UNF

Electrical connections

The power is connected using two M12 connectors.

M12 flanged connector DIN EN 61076-2-101 coding A	
Connector 1	5-pin Ms-nickel-plated
Connector 2	4-pin Ms-nickel-plated

Nameplate

This type plate serves as an example of the information that is stated. The data shown is purely fictive, but does correspond to the actual conditions. For more information, please see the order code at the end of these instructions.

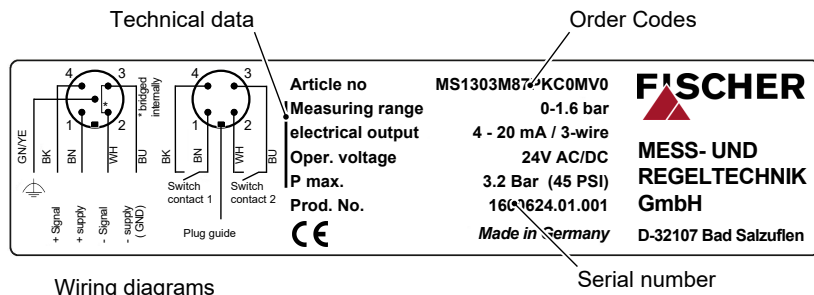


Fig. 4: Nameplate

2.5 Function diagram

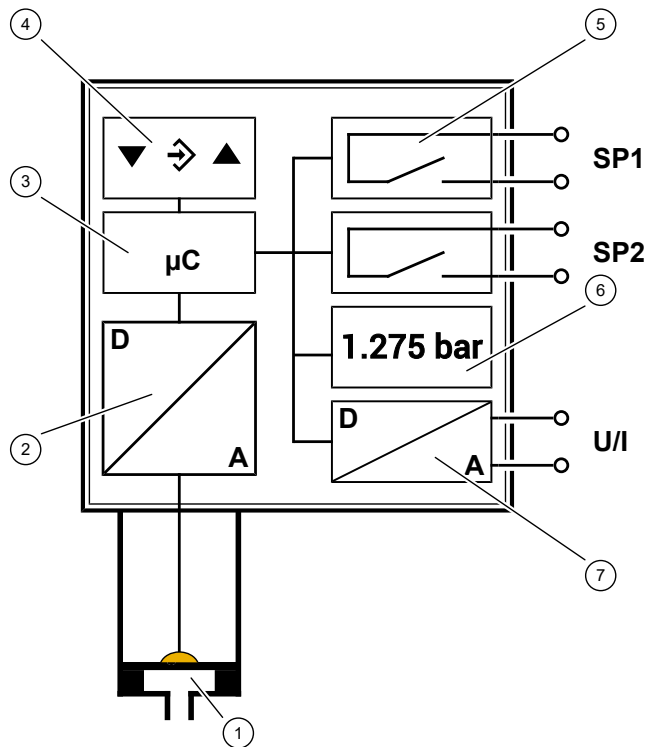


Fig. 5: Function diagram

1 Measuring cell	2 A/D converter
3 Micro-controller	4 Keyboard
5 Switching outputs	6 LCD colour change display
7 D/A converter	

2.6 Design and mode of operation

The device is based on a ceramic sensor element that is suitable for measuring over-pressure and under-pressure. The pressure deforms the measuring membrane causing a change in resistance on the attached measuring bridge. This change is evaluated by the device's electronics and transformed into the display, switch contacts or an standardised analogue output signal.

The optional output signal can be dampened, spread, inverted and transformed via a table function even if it is non-linear. Overstepped limits can be visualised with the LCD colour change display.

The unit is configured with a keyboard or by means of remote configuration from a PC.

3 Installation and assembly

3.1 Generalities

The instrument may only be installed and commissioned by specialized personnel familiar with the installation, commissioning and operation of this product.

Specialized personnel are persons who can assess the work they have been assigned and recognize potential dangers by virtue of their specialized training, their skills and experience and their knowledge of the pertinent standards.



⚠ WARNING

Mounting pressure transmitters

During assembly, observe the respective national and international guidelines and safety regulations.

Only mount the pressure transmitter to systems that are depressurized. Only ever operate the unit within the permitted measuring range or below the maximum overload.

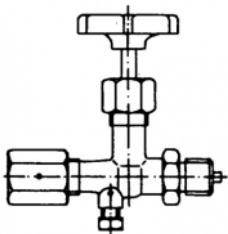


Fig. 6: Shutoff valve.

The device is set ex-works for vertical installation, however any installation position is possible.

To guarantee safe working conditions during installation and maintenance, suitable stop valves must be fitted in the system (see accessories). By means of the manometer shutoff, the unit

- Can be depressurized or taken out of operation.
- Be disconnected from the power supply within the applicable system for repairs or inspections.

3.2 Process connection

- By authorized and qualified specialized personnel only.
- The pipes need to be depressurized when the instrument is being connected.
- Appropriate steps must be taken to protect the device from pressure surges.
- Check that the device is suitable for the medium being measured.
- Maximum pressures must be observed (cf. Tech. data)



⚠ WARNING

Earth connection via the system earth

During assembly, ensure that the earth connection between the pressure transmitter and the system earth is ensured. The connection to the system earth is realised via the process connection. Therefore, never use an insulated Teflon tape or similar. Design the process connection acc. to EN 837 and use a suitable flat seal.

3.2.1 Measuring lines that need to be connected

The following points need to be observed when connecting the pressure line:

- To ensure there is no influence on the measured values, severe bends and coils in the wire should be avoided.
- To prevent deposits, there should be a continuous incline or drop of at least 8%.
- When measuring steam pressure, a water bag-forming loop must be provided due to the temperature (see accessories).

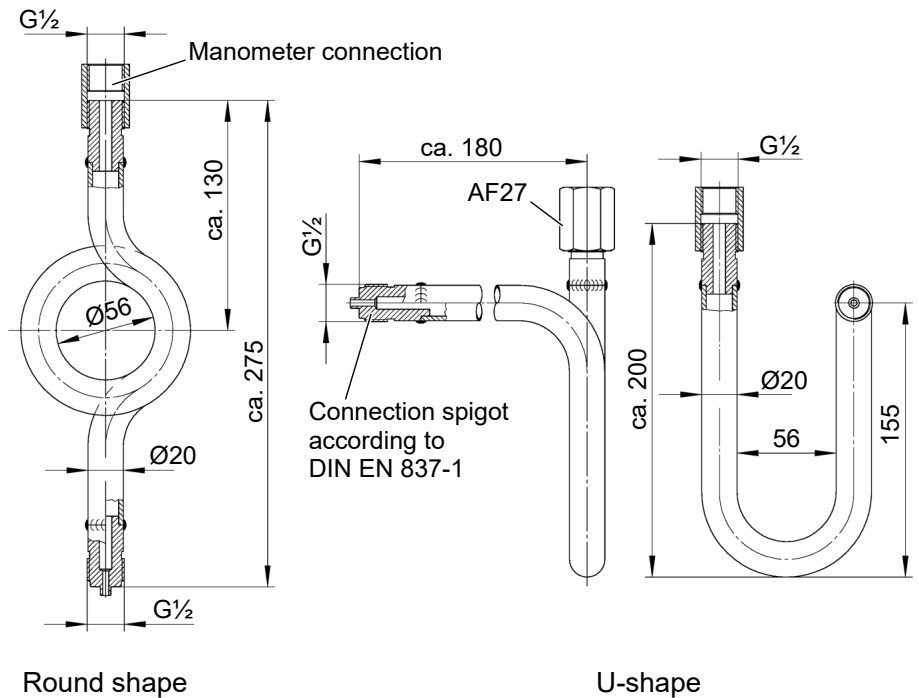


Fig. 7: Siphon MZ1###

- The transmitter must be positioned below the measuring point for liquid measurements. Vent the pressure line before commissioning.
- The transmitter must be positioned above the measuring point for gas measurements.

3.2.2 Pressure surge absorption

Pulsating pressure on the system side can lead to functional problems. We recommend installing a damping element in the pressure connection lines as a protective measure.

a) Capillary throttle

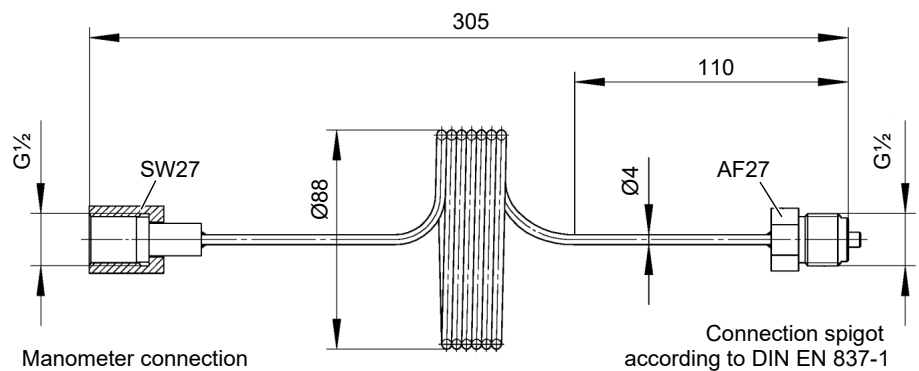


Fig. 8: Capillary throttle MZ400#

b) Settable damping reactor

In operating mode, the damping throttle must be set so that the output signal follows the pressure changes with a delay.

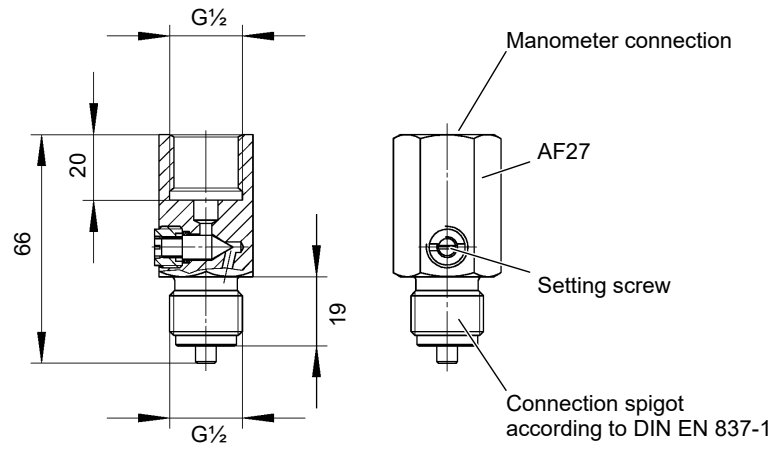
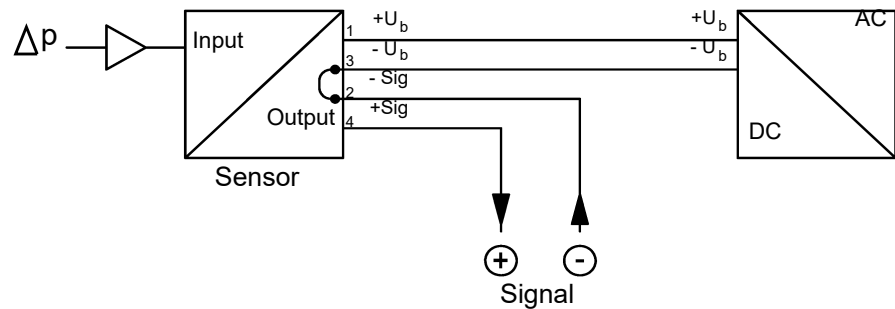


Fig. 9: Damping reactor MZ410#

3.3 Electrical connections

- By authorized and qualified specialized personnel only.
- When connecting the unit, the national and international electro-technical regulations must be observed.
- Disconnect the system from the mains, before electrically connecting the device.
- Install the consumer-adapted fuses.
- Do not connect the connector if strained.

3-Leiterschaltung



Connector 1: Supply and output signal

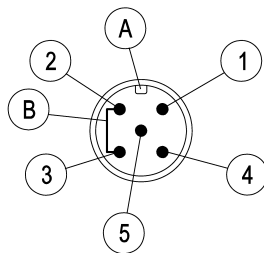


Fig. 10: M12 connector 5-pin

Item	Description	Cable colour
A	Coding A	
B	Internal bridge	
1	+U _b Supply	brown
2	-Sig Signal	white
3	-U _b Supply	blue
4	+Sig Signal	black
5	FE Functional earth	Green/yellow

Connector 2: Switching outputs

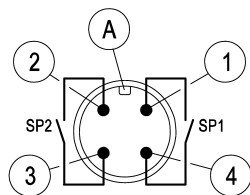


Fig. 11: M12 Plug 4-pin

Pos	Description	Cable colour
A	Coding A	
1	SP1 Switch point 1 (no)	brown
2	SP2 Switch point 2 (no)	white
3	SP2 Switch point 2 (com)	blue
4	SP1 Switch point 1 (com)	black

4 Commissioning

4.1 General

All electrical supply, operating and measuring lines, and the pressure connections must have been correctly installed before commissioning. All supply lines are arranged so that there are no mechanical forces acting on the device.

Check that the pressure connections do not leak before commissioning.

4.2 Control elements

4.2.1 LC display

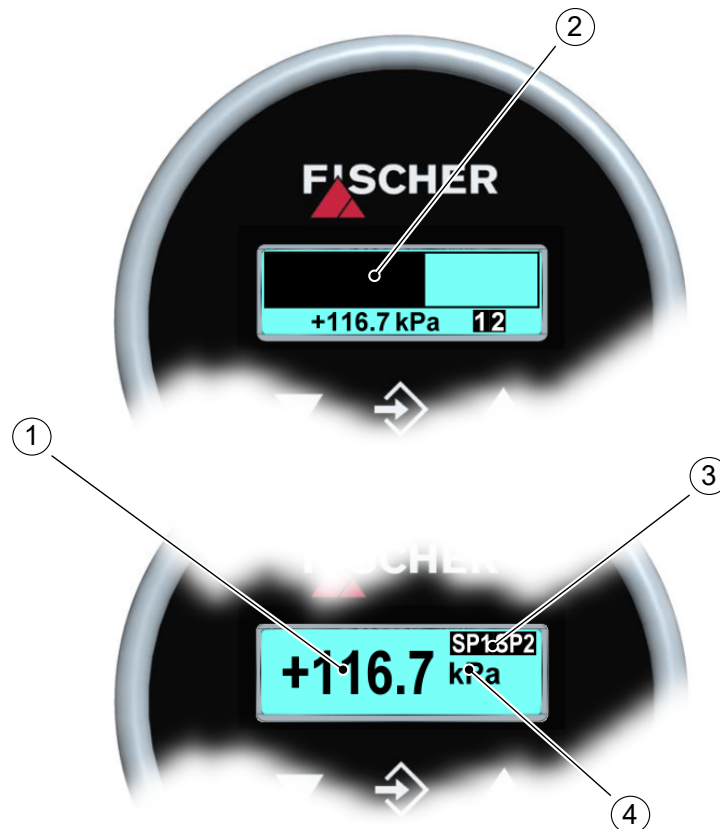


Fig. 12: LC display

1	Measurement display 4...6 digits	2	Bar chart display
3	Status display of the switch points	4	Unit

SP1SP2

Fig. 13: LC display 2SP

The unit is shown to the right of the measured value. If the device is equipped with contacts, a closed contact is always symbolised by an inverted text "SP1" or "SP2". One exception is the 1-channel bar chart diagram. Here, the switching points are symbolised with simple numbers "12".

4.2.2 Keyboard

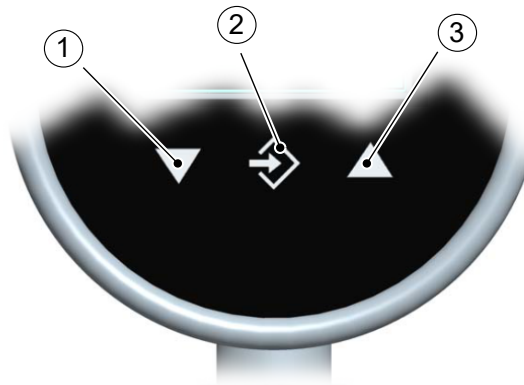


Fig. 14: Keyboard

1	Page down menu	Decrease value	
2	Call up menu	Save value	OK
3	Page up menu	Increase value	

The individual menu items and parameters can be displayed using the buttons ▲ and ▼. The respective menu item is selected or the parameters for making changes are called up via the button ⇨.

If a parameter can be changed, the display flashes. The change is made via the buttons ▲ and ▼. The value is saved with the button ⇨.

To leave a menu level or the entire menu, select the parameter "Quit" and press ⇨.

Example:

Switch-on point set switchpoint 1

In normal mode, press the button ⇨ to enter the menu. The **Menu level Switch points** appears. Press the enter key ⇨ again to call up the display parameter.

The first parameter **SP 1 on** is displayed. To change this parameter, press the button ⇨ again.

The device jumps to the input:

- The parameter is stated in the 1st line.
- The value that is to be changed is shown in the 2nd line, the display flashes.
- The input limits are displayed in the 3rd line (if there is one).

The required value is set with the buttons ▲ and ▼ and then confirmed with ⇨.

4.3 Menu levels

The menu levels are structured as follows:

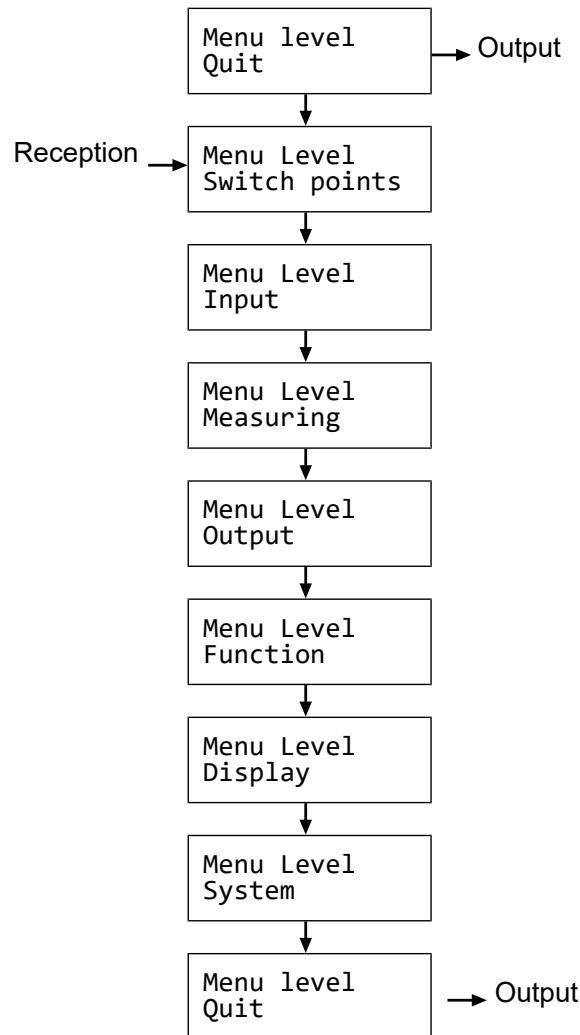


Fig. 15: Menu levels

The following tables provide an overview of the parameters of the individual menu levels. In the Menu Level System you can change to the respective national language using the language parameter. You can see which languages are supported there.

4.3.1 Menu Level Switch points

Parameter name	Description	Value range
SP1 On	Switch point 1 On	MBA-50% ... MBE+50%
SP1 Off	Switching point 1 off	MBA-50% ... MBE+50%
SP1 delay	Switching point 1 delay	0...1800 s
SP1 Function	Switching point 1 function	NO, NC
SP2 On	Switch point 2 On	MBA-50% ... MBE+50%
SP2 Off	Switching point 2 off	MBA-50% ... MBE+50%
SP2 delay	Switching point 2 delay	0...1800 s
SP2 Function	Switching point 2 function	NO, NC

The two switching outputs are configured by four parameters respectively. For the switch point 1 these are

- **SP1 On**
- **SP1 Off**
- **SP1 delay**
- **SP1 Function**

Accordingly for switch point 2:

- **SP2 On**
- **SP2 Off**
- **SP2 delay**
- **SP2 Function**

The function of the individual parameters is explained for both switch points using Switch point 1 as an example.

SP1 On defines the activation point, **SP1 Off** the deactivation point of switching output 1. The values are shown in the valid unit and set accordingly. The values are shown in the valid unit and set accordingly. Both parameters can be set independently over the entire value range.

The value range ranges from $MBA - 50\%$ to $MBE + 50\%$. MBA stands for start of measuring range and MBE for the end of the measuring range.

Example:

Measuring range = 0 ... 160 kPa

The value range for this measuring range is -80 kPa ... +240 kPa.

Together, the two parameters **SP1 On** and **SP1 Off** determine the switch function of switching output 1:

- If **SP1 On** > **SP1 Off**, the output switches on, if the measured value exceeds SP1 On. It is only switched off again if the measured value SP1 Off is undercut (hysteresis function).
- If **SP1 On** = **SP1 Off**, the output switches on if the measured value exceeds SP1 On and off if the measured value undercuts the same value (SP1 Off).
- If **SP1 On** < **SP1 Off**, the output switches on, if the measured value lies within these switch points: i.e:
SP1 On < Measured value < **SP1 Off** (window function).

SP1 Delay allows the reaction of the switch output to be delayed by between 0 and 1800 s. This parameter applies equally for switching on and off.

SP1 Function changes the function of the switching output 1. It is possible here to define whether the contact should work as a open contact (NO) or a break contact (NC).

4.3.2 Menu Level Input

Parameter name	Description	Value range
Absorption	Attenuation, damping	0...100 s
Offset corr.	Offset correction	1/3 basic measuring range
Zero-pt. wind.	Zero-point window	1/3 basic measuring range

If there are unsteady pressure readings during operation, you can use the parameters **Absorption** and **Zero-pt. wind.** to stabilise the reading and the output signal.

The parameter **Absorption** functions like a capillary throttle. However, it only acts on the display, output signal and switch points (if these exist) but not on the measuring cell itself.

You can set the response time to pressure jumps in the range 0.0 to 100 s.



NOTICE

Response time

At maximum damping it can take over 2 minutes until the pressure jump from the nominal pressure 100% to 0% is also shown as zero in the display.

In many cases, unsteady readings are not a problem during normal operating mode, but this is not true for the idle state, i.e. if a measured value of zero is expected. The parameter **Zero-pt. wind.** is designed to solve this. Its value defines a range around zero at which the measured value is set to zero (see fig.).

The display only stops showing zero when the pressure leaves the set window. When twice the window value is reached, the measuring pressure and the display correspond again. This avoids jumps in the display.

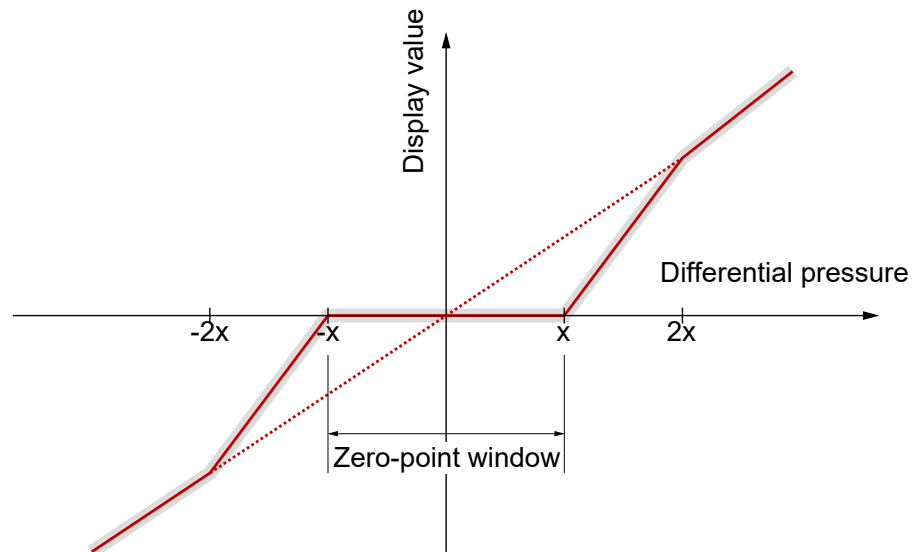


Fig. 16: Zero-point window

It makes sense to set the Offset (zero-point displacement) if, without differential pressure (remove measuring line), the display shows a value that is not zero. Before the offset correction, the zero-point window must be set to zero.

Select the **Offset corr.** parameter and correct the reading using the buttons ▲ or ▼ until zero is shown in the display.

When setting the offset, the current measured value is displayed. The zero-point window is not active during the offset setting.

4.3.3 Menu Level Measuring

Parameter name	Description	Value range
MB start	Measuring range start	Basic measuring range
MB end	Measuring range end	Basic measuring range
Unit	Measuring range unit	bar, mbar, Pa, kPa, MPa, psi, InWc, mmWs, mmHg
Limit	Measuring range limit	yes, no

The transmitter output signal primarily depends on the sensed pressure. However, you have the option of adjusting the output signal to a large extent to suit your requirements.



NOTICE

Adjustment of the output signal

The basic measuring range (indicated on the type label) and the type of output signal (voltage / current) are not variable.

The parameters **MB start** and **MB end** initially define the two pressures between which the output signal will change at all. Both values are adjustable across the entire basic measuring range. The set values also refer to the pressure in the respective unit. However, the signal values (current / voltage) for 'Start of measuring range' and 'End of measuring range' are fixed.

If **MB start** is smaller than **MB end**, this is called an increasing characteristic curve; the output signal increases as the pressure increases.

If **MB end** is smaller than **MB start**, this is a decreasing characteristic curve and the output signal decreases as the pressure increases.

The difference between the values **MB start** and **MB end** must be at least 25 % of the basic measuring range.

You can select a unit other than the unit of the basic measuring range with the parameter **Unit**. The user should remember however that not every unit is suitable. The conversion is automatic.

The parameter **Limit** allows the display, output and switching points to be limited to the range between Start of measuring range and End of measuring range. This makes sense when content is measured to avoid "negative contents". If Limit is set to "no", those measured values that are greater or smaller than the end values are shown.

4.3.4 Menu Level Output

Parameter name	Description	Value range
min. output	min. output	
max. output	max. output	0.0 ... 21.0 mA or 0.0 ... 11.0 V
Error signal	Measuring range unit	

The parameters **min. output**, **max. output** and **error signal** define the limits of the output signal that may not be undercut or exceeded regardless of the pressure. The limit values take priority over the range defined by the **MB start** and **MB end** parameters! These parameters primarily serve to prevent error messages in downstream systems caused by brief overstepping of measuring ranges.

The parameter **min. output** is usually only used for devices with an output signal 4...20 mA because frequently values of below 3.8 mA are evaluated as error signals.

The **max. output** value can be used for the voltage and current to limit the maximum value.

The value defined via the parameter **Error signal** is issued if the device detects an internal error and can no longer work correctly. It should be noted here that not all potential errors and faults can be detected by the device itself.

4.3.5 Menu Level Function

The Function menu level is a variable menu whose appearance depends on the value of the Function parameter. There are linear, square rooted and table functions

Linear function

The input signal is linear before being sent to the display and the output. The range defined in the menu "Measuring" serves as the measuring range. If the function LINEAR is active, the other menu items are cancelled.

Parameter name	Description	Value range
Function	Function	Value = linear

Square rooted function

Here, the input signal is square rooted before being sent to the display and the output. This is necessary e.g. for flow measurements with differential pressure. A free unit can be defined for the display. To do this, the start and end of the display range and the number of decimal points are defined. It is also possible to define the unit with 4 characters.

Parameter name	Description	Value range
Function	Function	Value = square rooted
MB decimal pl.	Measuring range decimal places	1234, 123.4, 12.34, 1,234, 12345, 123456
MB start	Measuring range start	-9999 ... +9999
MB end	Measuring range end	-9999 ... +9999
MB unit	Measuring range unit	4 characters

The following section contains descriptions of the parameters **MB decimal pl.**, **MB start**, **MB end** and **MB unit** to describe the table function.

Tables function

This function allows free adjustment of the input variable to the display and output via a table with up to 30 support points. A value pair comprising a measured value and display value is issued for every support point.



NOTICE

Change of parameter

When switching from TABLE to another function, the table is initialised again and the existing values are lost.

Parameter name	Description	Value range
Function	Function	Value = Table
MB decimal pl.	Measuring range decimal places	1234, 123.4, 12.34, 1,234, 12345, 123456
MB start	Measuring range start	-9999 ... +9999
MB end	Measuring range end	-9999 ... +9999
MB unit	Measuring range unit	4 characters
No. of pairs	Number of pairs	n = 3...30
Value pair1	Value pair 1	
Value pair2	Value pair 2	MB-start ... MB-end
Value pair3	Value pair 3	

Parameter name	Description	Value range
	...	
Value pair30	Value pair 30	

The display range is defined with the parameters **MB decimal pl.**, **MB start** and **MB end**. The user can select the configuration freely.

Using the parameter **MB decimal pl.**, it is possible to select between a 5 or 6-digit presentation. The resolution is not increased. Only an extra zero or two zeros are added. This serves the correct display of larger values. The measuring range must be positive for the 6 digit presentation.

The **MB unit** gives the user the option of defining a completely independent unit. Letters, numbers or special characters can be used. The unit can be max. 4 characters long.

If the function TABLE is selected, then it is also necessary to state the **No. of pairs**. It is defined here how many pairs of values (support points) are used in the table. A table is made up of at least 3, max. 30 support points.



NOTICE

Number of value pairs

If the number of value pairs is changed, the table is initialised again and the existing values are deleted.

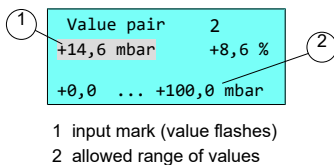


Fig. 17: Value pair

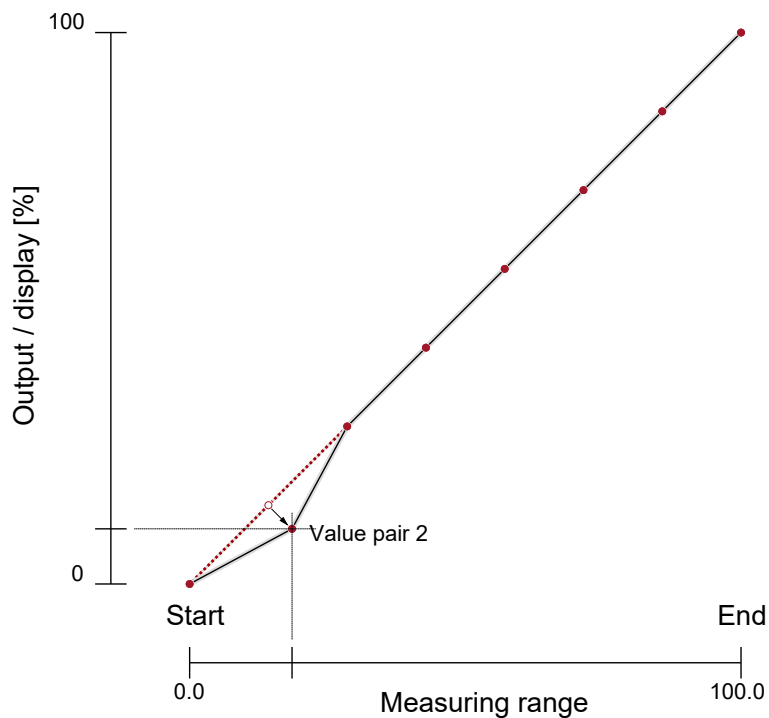


Fig. 18: Table function (example)

The individual value pairs can be seen and changed with the **Value pair1** to **Value pair30** parameters. A value pair comprises a measured value (left side) and a display value (right side). The measured value must lie within the measuring range and the display value must lie within the defined "free unit". The respective limits are shown during input. The table must contain either increasing or decreasing values. the table must contain either continuously increasing or continuously failing values. A change from an increasing to a decreasing characteristic curve within a support point table is not allowed.

4.3.6 Menu Level Display

The Display menu level is a variable menu whose appearance depends on the value of the colour parameter. In addition to the various colours for the background lighting, there are also two auto-functions with colour switching available.

Parameter name	Description	Value range
Colour	Colour	Off, red, green, yellow, blue, pink, turquoise, white, Auto1: Red-green Auto2: Red-yellow-green
Lighting	Lighting time	0 s, 10 ... 600 s
Contrast	Contrast	15 ... 45
Bar chart	Barchart display	yes, no

The most important parameter is **Colour**. A fixed colour can be defined for the background colour here. There are also two auto-functions with colour switching available. Alternatively, the background illumination can be permanently deactivated.

If permanent lighting is not required, the parameter **Lighting time** can be used to define when the lighting should be switched off after the last time a button is pressed. In addition to permanent lighting (0 s), automatic shut-down after 10... 600 s is also possible. The set time is only valid if the parameter **Colour** is not set to "off".

Amongst other things, the legibility of the display depends on the temperature and the reading angle. To ensure optimised legibility, the display can be adjusted using the parameter **Contrast**. When the contrast is changed, it is possible that the display appears empty or almost completely black. In this case, the contrast must be turned up or down.

Via the parameter **Bar chart**, the display can be switched between a display where the measured value is either shown in large digits or the display shows small digits and an additional barchart.

Auto1: Colour-change red to green

In the mode with the automatic colour switchover, it is possible to enter the required switch thresholds "red-green switchover", "green-red switchover".

The switching thresholds can be moved within the measuring range. The series of switch points cannot be altered.

Parameter name	Description	Value range
Red-Gr. switch.	Red-green switching	MRS - 50% ...
Gr-Red switch.	Green-red switching	MRE + 50%
Hysteresis	Hysteresis	0.1 ... 10.0 %
Delay	Delay	0 ... 1800 s
Colour	Colour	Off, red, green, yellow, blue, pink, turquoise, white, Auto1: Red-green Auto2: Red-yellow-green
Lighting	Lighting time	0 s, 10 ... 600 s
Contrast	Contrast	15 ... 45
Bar chart	Barchart display	yes, no

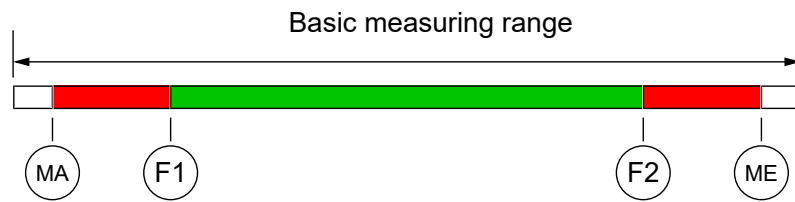


Fig. 19: Function Auto1

MA	MB-start	Measuring range start
F1	Red-Gr. switch.	Red-green switching
F2	Gr-Red switch.	Green-red switching
ME	MB-end	Measuring range end

The parameter **Hysteresis** can be used to prevent fast and unwanted colour changes. The hysteresis is set in the range 0.1... 10%.



NOTICE

Overlapping colour areas

Note: In the case of large hysteresis values, steps must be taken to ensure that the ranges of the individual colours do not overlap. Otherwise it is possible that the colour change may not function in the desired way.

The parameter **Delay** offers a further option to prevent unwanted colour changes. The colour change here can be delayed between 0...1800 s.

The parameter **Lighting** can be used to define when the lighting should be switched off after the last time a button is pressed. In addition to permanent lighting, automatic shut-down after 10...600 s is also possible. The set time is only valid if the parameter **Colour** is not set to "off". The lighting can be switched on permanently with the value 0s.

The legibility of the display can be adjusted using the parameter **Contrast**. When the contrast is changed, it is possible that the display appears empty or almost completely black. In this case, the contrast must be turned up or down again.

Via the parameter **Bar chart**, the display can be switched between a display where the measured value is either shown in large digits or the display shows small digits and an additional barchart.

Auto2: Colour-change red-yellow-green

In the Auto 2 mode with the automatic colour switchover, it is possible to enter the required switch thresholds "red-yellow switchover", "yellow-green switchover", "green-yellow switchover", "yellow-red switchover".

The switching thresholds can be moved within the measuring range. The series of switch points cannot be altered.

Parameter name	Description	Value range
Red-Yell.switch.	Red-yellow switchover	
Yell.-Gr.switch.	Yellow-green switchover	MRS - 50% ...
Gr.-Yell. switch	Green-yellow switchover	MRE + 50%
Yell.-Red switch	Yellow-red switchover	
Hysteresis	Hysteresis	0.1 ... 10.0 %
Delay	Delay	0 ... 1800 s
Colour	Colour	Off, red, green, yellow, blue, pink, turquoise, white,

Parameter name	Description	Value range
		Auto1: Red-green Auto2: Red-yellow-green
Lighting	Lighting time	0 s, 10 ... 600 s
Contrast	Contrast	15 ... 45
Bar chart	Barchart display	yes, no

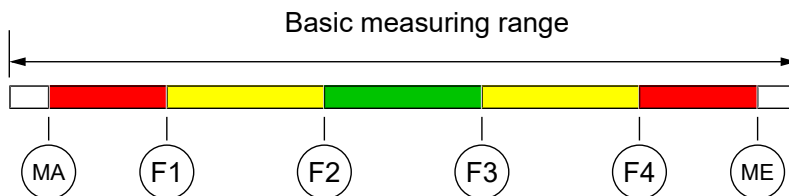


Fig. 20: Function Auto2

MA	MB-start	Measuring range start
F1	Red-Yell.switch.	Colour-change red to yellow
F2	Yell.-Gr.switch.	Colour-change yellow to green
F3	Gr.-Yell. switch	Colour-change green to yellow
F4	Yell.-Red switch	Colour-change yellow to red
ME	MB-end	Measuring range end

In this menu the same parameters are used as those described in the previous sections.



NOTICE

Unused range

If a range is not to be used, the associated switch thresholds (F1...F4) can be set to the same value.

Example

The parameter Colour is set to Auto2. Only the green, yellow and red ranges are required here. To fade out the lower ranges red and yellow, the switch thresholds "red-yellow switching" and "yellow-green switching" are set to the start of the measuring range.

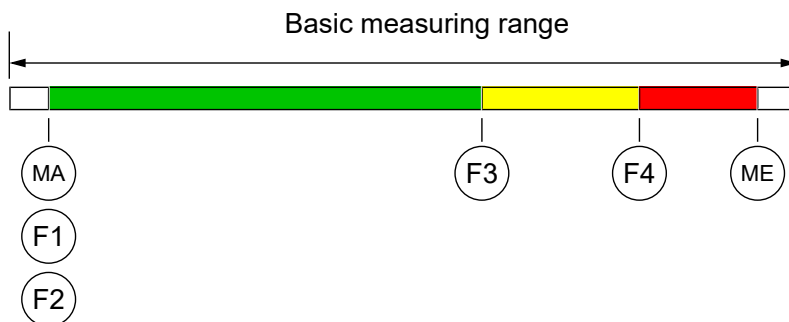


Fig. 21: Example Auto2

4.3.7 Menu Level System

Parameter name	Description	Value range
Language	Language change	DE, EN, FR, ES, IT,PT,HU

Parameter name	Description	Value range
Software Info	Information about the software	Device type, serial number, firmware version
Config Info	Information about the configuration	Basic measuring range, output signal, contacts
Key numbers	Key numbers	Operating time, switch cycles of the contacts
Password	Password	0/1...999
Load config.	Load configuration	
Save config	Save configuration	

The user menu can be switched to German, English, French, Spanish, Italian, Portuguese or Hungarian using the parameter **Language**.

The menu items **Software - Info** and **Config - Info** provide information about the device. This information helps to answer questions about the device quickly.

- The device type, controller ID and the firmware version is shown in **the software info**.
- The basic measuring range, the defined output signal and existing contacts are stated in the **Config Info**.

The **Statistics** provide information about the operating time and the relay switching cycles from the time of delivery. The operating time is shown in days (d) and hours (h)

A **Password** can be used to protect the menu against unauthorised access. The password is a figure from 1 to 999. The input 0 means that no password is active.

The password needs to be set if the user presses the button in normal mode to enter the menu. If a wrong password is entered, the system automatically jumps back to normal mode again. If no password is active, the display immediately jumps to the menu.



NOTICE

Forgotten password

The user cannot restore a forgotten password. Please contact the manufacturer in this case.

The user can load a saved configuration via the menu item **Load config**. This means that a functional set of parameters can be loaded after trying out various settings.

The menu item **Save config** serves to save the existing parameters in a protected memory area. This is helpful if the settings of a functional device needs to be optimised. **Save config** and **Load config** can be used to quickly restore the initial status again.



NOTICE

Delivery condition

If the user has not yet saved a configuration, the default values (status on delivery) are loaded. In this case, any measuring range spreads or switch points are reset and the device needs to be newly configured.

5 Technical Data

5.1 General Information

Reference conditions (acc. to IEC 61298-1)		
Temperature error	+15 ... +25 °C	
Relative humidity	45 ... 75 %	
Air pressure	86 ... 106 kPa	860 ... 1060 mbar
Installation position	User-defined	

5.2 Input variables

Relative pressure

Measuring range	Pressure safety		Characteristic curve deviation	
	Overpressure	Bursting pressure	Option	Default
0...+1.6 bar	4 bar (56 PSI)	7 bar	0.5%FS	1.0 % FS
0...+2.5 bar	10 bar	15 bar	0.5%FS	1.0 % FS
0...+4 bar	10 bar	15 bar	0.5%FS	1.0 % FS
0...+6 bar	20 bar	35 bar	0.5%FS	1.0 % FS
0...+10 bar	40 bar	70 bar	0.5%FS	1.0 % FS
0...+16 bar	40 bar	70 bar	0.5%FS	1.0 % FS
0...+25 bar	100 bar	150 bar	---	1.0 % FS
0...+40 bar	100 bar	150 bar	---	1.0 % FS
0...+60 bar	200 bar	250 bar	---	1.0 % FS

Vacuum and ± measuring ranges

Measuring range	Pressure safety		Characteristic curve deviation	
	Overpressure	Bursting pressure	Option	Default
0...-1 bar	4 bar (56 PSI)	7 bar	---	1.0 % FS
-1...0 bar	4 bar (56 PSI)	7 bar	---	1.0 % FS
-1...+0.6 bar	4 bar (56 PSI)	7 bar	---	1.0 % FS
-1...+1.5 bar	4 bar (56 PSI)	7 bar	---	1.0 % FS
-1...+3 bar	10 bar	15 bar	---	1.0 % FS
-1...+5 bar	20 bar	35 bar	---	1.0 % FS
-1...+9 bar	40 bar	70 bar	---	1.0 % FS
-1...+15 bar	40 bar	70 bar	---	1.0 % FS
-1...+24 bar	100 bar	150 bar	---	1.0 % FS

5.3 Output parameters

Analogue output

Output signal	Signal range	Apparent ohmic resistance
0...20 mA	0.0...21.0 mA	$R_L \leq 600 \Omega$
4...20 mA		
0...10 V	0.0...11.0 V	$R_L \geq 2 \text{ k}\Omega$

Switching outputs

2 potential-free relay contacts or
2 potential-free semiconductor switches (MOSFET)

	Relay	MOSFET
Progr. switching function	Open contact (NO) Break contact (NC)	One-pin activator (NO) One-pin deactivator (NC)
Max. switching voltage	32 V AC/DC	3...32 V AC/DC
Max. switching current	2 A	0.25 A
Max. switching output	60 W (VA)	8 W / 8 VA $R_{ON} \leq 1 \Omega$

5.4 Measurement accuracy

Non-linearity	Default	< 1.0 % FS
	Option ¹⁾	< 0.5 % FS
Hysteresis		< 0.5 % FS
Characteristic curve deviation ²⁾	Default	1.0 %
	Option ¹⁾	0.5 %
Temperature drift	Zero point	0.07 % FS/K
	Measuring range	0.05 % FS/K

¹⁾ only possible for certain measuring ranges

²⁾ incl. non-linearity and hysteresis

5.5 Auxiliary energy

Rated Voltage	24 V AC/DC
Admissible operating voltage	$U_b = 12...32$ V DC $U_b = 16.5...32$ V AC
Electrical connection	5-pin M12 circular plug connector
Power consumption	Typ. 2 W (2 VA) / Max. 3 W (3 VA)

5.6 Application conditions**Ambient conditions**

Increase ambient temperature	-10 ... +70 °C
Media temperature	-10 ... +70 °C
Storage temperature	-20 ... +70 °C
Enclosure protection class	IP 65 acc. to EN 60529
EMC	EN 61326-1:2013 EN 61326-2-3:2013
RoHS	EN 50581:2012

Materials of the parts that come into contact with the surroundings

Housing	Stainless steel 1.4301	
Bayonet ring	Stainless steel 1.4301	
Front plate	Aluminium	
Front film	PET	Polyethylene terephthalate
Bayonet ring seal	NBR	Nitrile rubber
Blowout plug	FKM	Fluorocarbon rubber

Materials of the parts that come into contact with the measuring medium

Process connection	Stainless steel 1.4404	
Measuring diaphragm	ceramic	
Seal	FKM	Fluorocarbon rubber

5.7 Display and operating interface

Advertisement

4...6-digit LCD, full graphic, colour backlighting

Programming

Attenuation	0.0...100.0s (jump response 10/90%)
Switch output	Switch-off point, switch-on point, delay (0...1800s), function (NC / NO contact)
Measuring range unit	bar, PSI, kPa, "free unit" ¹ , starting value, end value and decimal point for "free unit"
Output signal	User-definable within the basic measuring range ⁽¹⁾
Zero-point stabilising	0... $\frac{1}{3}$ of the basic measuring range ⁽²⁾
Zero point correction (off-set)	$\pm\frac{1}{3}$ of the basic measuring range ⁽³⁾
Implementation of characteristic curve	linear, square rooted, table with 3...30 support points
Password	001 ... 999 (000 = no password protection)

- (1) Max. effective spread 4:1
- (2) measured values around zero are set to zero.
- (3) To compensate different installation positions.

5.8 Construction design

5.8.1 Dimensional picture

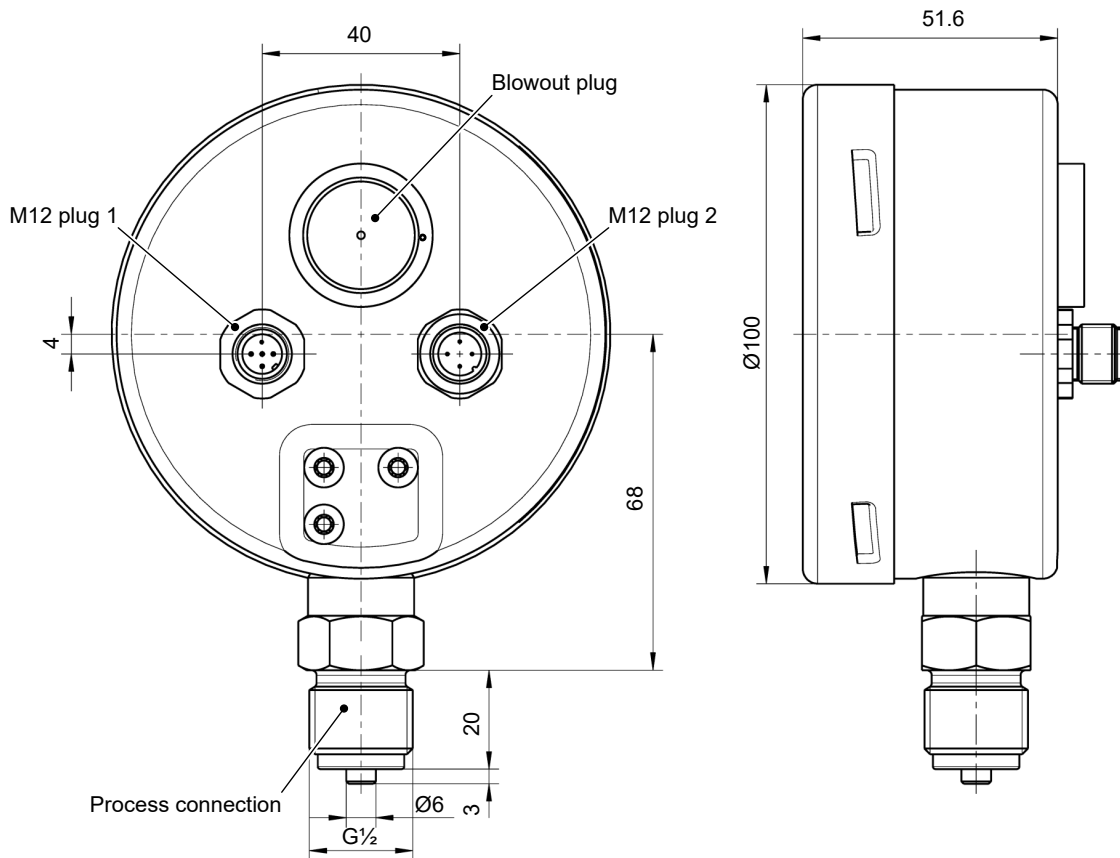


Fig. 22: Dimensional drawing

5.8.2 Process connection

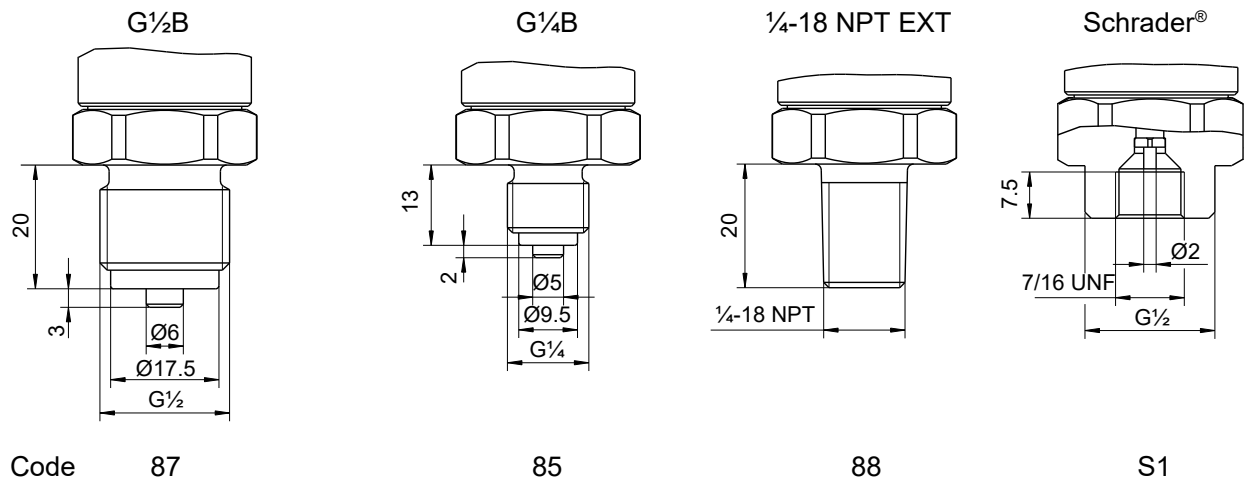
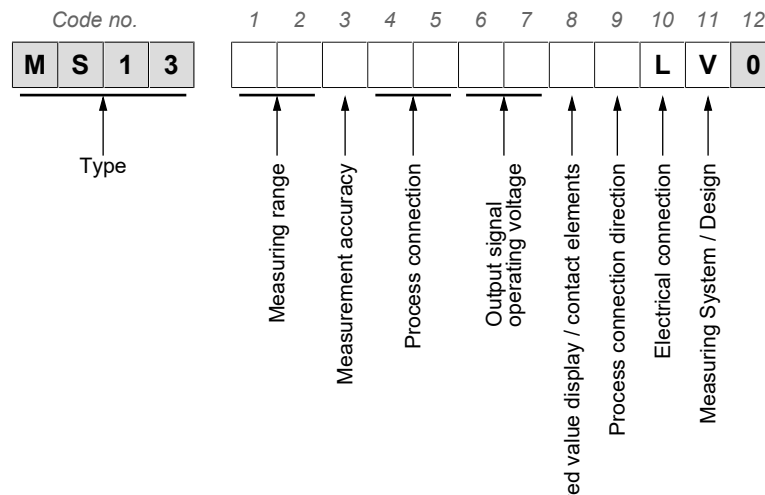


Fig. 23: Process connection

Port		Material
G $\frac{1}{2}$ B	Connection shanks with external thread	1.4404
G $\frac{1}{4}$ B	Connection shanks with external thread	1.4404
1/4-18 NPT EXT	Connection shanks with external thread	1.4404
7/16 UNF	Connection with inner thread for the Schrader®- screw connection >	1.4404

6 Order Codes



[1.2]	Measuring range	converted ranges	
	[bar]	[kPa]	[PSI]
03	0...1.6 bar	0 ... 160 kPa	0 ... 23.21 PSI
04	0...2.5 bar	0 ... 250 kPa	0 ... 36.26 PSI
05	0...4 bar	0 ... 400 kPa	0 ... 58.01 PSI
06	0...6 bar	0 ... 600 kPa	0 ... 87.02 PSI
07	0...10 bar	0 ... 1000 kPa	0 ... 145.0 PSI
08	0...16 bar	0 ... 1600 kPa	0 ... 232.1 PSI
09	0...25 bar	0 ... 2500 kPa	0 ... 362.6 PSI
10	0...40 bar	0 ... 4000 kPa	0 ... 580.1 PSI
11	0...60 bar	0 ... 6000 kPa	0 ... 870.2 PSI
31	-1...0 bar	-100 ... 0 kPa	-14.50 ... 0 PSI
32	-1...0.6 bar	-100 ... 60 kPa	-14.50 ... 8.702 PSI
33	-1...1.5 bar	-100 ... 150 kPa	-14.50 ... 21.75 PSI
34	-1...3 bar	-100 ... 300 kPa	-14.50 ... 43.51 PSI
35	-1...5 bar	-100 ... 500 kPa	-14.50 ... 72.52 PSI
36	-1...9 bar	-100 ... 900 kPa	-14.50 ... 130.5 PSI
37	-1...15 bar	-100 ... 15000 kPa	-14.50 ... 217.5 PSI
38	-1...24 bar	-100 ... 2400 kPa	-14.50 ... 348.1 PSI
39	0...-1 bar	0 ... -100 kPa	0 ... -14.50 PSI

[3]	Measurement accuracy
M	1.0 % characteristic curve deviation
0	0.5 % characteristic curve deviation

[4.5]	Process connection	Material
85	Connection shanks with external thread G $\frac{1}{4}$ B	
87	Connection shanks with external thread G $\frac{1}{2}$ B	1.4404
88	Connecting port with outer thread $\frac{1}{4}$ -18 NPT EXT	
S1	Schrader® screw connection inner thread 7/16 UNF	

[6.7] Output signal	Operating voltage	
EL 0 ... 20 mA	24 V AC/DC	3-wire version
PL 4 ... 20 mA	24 V AC/DC	3-wire version
CL 0 ... 10 V	24 V AC/DC	3-wire version

[8] Measuring value display/switching elements
C 4...6-digit colour change LCD 2 relay contacts
D 4...6-digit colour change LCD 2 semiconductor switches

[9] Process connection direction
L Port left
R Port right
0 Port on top
U Port below

[10] Electrical connection
L M12 connector socket Ms-nickel-plated

[11] Measuring System / Design
V FKM Fluororubber, Viton®

6.1 Accessories

Order no.	Designation	No. of Poles	Length
06401993	Connection cable for switching outputs with M12 connector	4-pin	2 m
06401994	Connection cable for switching outputs with M12 connector	4-pin	5m
06401995	Connection cable for supply/signal with M12 connector	5-pin	2 m
06401996	Connection cable for supply/signal with M12 connector	5-pin	5 m

Accessories acc. to data sheet MZ^{*)}

MZ310#	Wall mount acc. to DIN 16281
MZ1###	Siphons
MZ400#	Capillary throttle coil
MZ5###	Manometer shutoff valve acc. to DIN 16270/16271
MZ6###	Manometer shutoff valve acc. to DIN 16272

Parameter setting adapter^{*)}

EU05	Transmitter PC Interface incl. PC software
------	--

^{*)}A data sheet is available on our website or on request..

7 Attachments



EU Declaration of Conformity

(Translation)

For the product described as follows

Product designation **Digital Differential Pressure Transmitter / Switch with colour changing LCD**

Type designation **MS13**

it is hereby declared that it corresponds with the basic requirements specified in the following designated directives:

2014/30/EU EMC Directive
2011/65/EU RoHS Directive

The products were tested in compliance with the following standards.

Electromagnetic compatibility (EMC)
EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
EN 61326-2-3:2013 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 2-3: Particular requirements - Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning

RoHS
EN 50581:2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Also they were subjected to the conformity assessment procedure „**Internal production control**“.

The object of the declaration described above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Sole responsibility for the issue of this declaration of conformity in relation to fulfilment of the fundamental requirements and the production of the technical documents is with the manufacturer.

Manufacturer **FISCHER Mess- und Regeltechnik GmbH**
Bielefelder Str. 37a
32107 Bad Salzufflen, Germany
Tel. +49 5222 974 0

Documentation representative Mr. Stefan Richter
Dipl. Ing.
General Manager R & D

The devices bear the following marking: **CE**

**Bad Salzufflen,
2016-10-13**

S. Richter
General Manager R & D

09010207 CE EN MS13 Rev.B 10/16



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Fig. 24: CE_DE_MS13