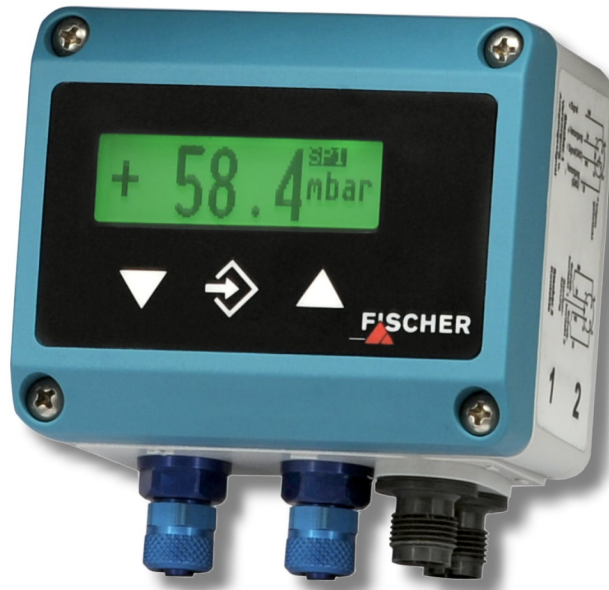




Ex II 3G Ex nA IIC T4
Ex II 3D Ex tc IIIB T125°C IP65



RoHS II
COMPLIANT



Operating manual

DE45 ... R/S

Digital differential pressure switch / transmitter
with colour-change LCD

for explosive areas
Dust explosion protection zone 22, dry dusts
Gas explosion protection zone 2, gases and vapors

09005703 BA_EN_DE45_ATEX_LCD Rev. ST4-E 10/16

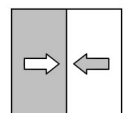


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Masthead

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1 Safety instructions

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.

WARNING

For explosion-proof models the specialized personnel must have received special training or instruction or be authorized to work with explosion-proof instruments in explosion hazard areas.

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.

The instrument must be decommissioned and secured against inadvertent re-operation if a situation arises in which it must be assumed that safe operation is no longer possible. Reasons for this assumption could be:

- evident damage to the instrument
- failure of the electrical circuits
- longer storage outside the approved temperature range.
- considerable strain due to transport

Repairs may be carried out by the manufacturer only.

A professional single conformity inspection as per DIN EN 61010, section 1, must be carried out before the instrument can be re-commissioned. This inspection must be performed at the manufacturer's location. Correct transport and storage of the instrument are required.

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	<p>Type and source of danger</p> <p>This indicates a direct dangerous situation that could lead to death or serious injury (highest danger level).</p> <p>a) Avoid danger by observing the valid safety regulations.</p>
 WARNING	<p>Type and source of danger</p> <p>This indicates a potentially dangerous situation that could lead to death or serious injury (medium danger level).</p> <p>a) Avoid danger by observing the valid safety regulations.</p>
 CAUTION	<p>Type and source of danger</p> <p>This indicates a potentially dangerous situation that could lead to slight or serious injury, damage or environmental pollution (low danger level).</p> <p>a) Avoid danger by observing the valid safety regulations.</p>
NOTICE	<p>Note / advice</p> <p>This indicates useful information of advice for efficient and smooth operation.</p>

2 Product and functional description

2.1 Use as intended

The DE45 is a multi-functional switching unit with an optional transmitter output. It is suitable for measuring overpressure, under-pressure and differential pressure in gaseous media.


The unit is suitable as an electrical device for operation in potentially explosive areas.

2.1.1 Explosion hazard area classification

Dust explosion protection

Devices with the order code DE45 ## 00 ### KWDL # S##### are suitable as 'Electrical equipment for use in areas with combustible dust', Zone 22 - dry dusts.

Designation as per Directive 94/9/EC

 II 3D Ex tc IIIB T125°C IP65
-10 °C ≤ T_{amb} ≤ 60 °C

WARNING


Static electricity

The case must be equipped with an earth connection on the side to reduce the surface resistance.

Gas explosion protection

Devices with the order code DE45 ## 00 ### KWDM # RS##### are suitable as 'Electrical equipment for use in potentially explosive areas, Zone 2 - Gases and vapours.

Designation as per Directive 94/9/EC

 II 3G Ex nA IIC T4
-10 °C ≤ T_{amb} ≤ 60 °C

2.2 Part designations

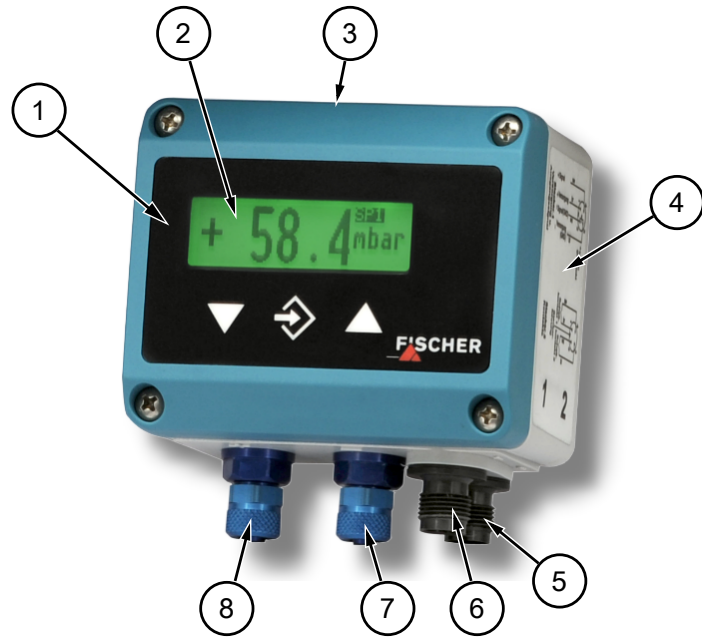


Illustration 1: Part designations

1	Membrane keyboard	5	M12 connector 2 (4-pin, male)
2	LC display	6	M12 connector 1 (5-pin, male)
3	Casing lid	7	Process connection (-)
4	Lower part of casing	8	Process connection (+)

2.3 Function diagram

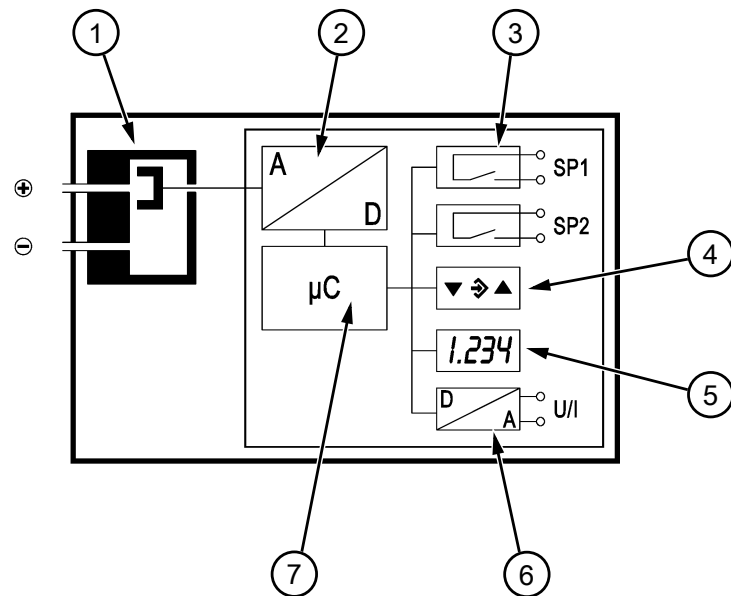


Illustration 2: Function diagram DE45_LCD

1	Sensor element	5	LC display
2	Signal processing	6	Analogue output
3	Switching outputs	7	Microcontroller
4	Membrane keyboard		

2.4 Design and mode of operation

The device is based on a piezo-resistive sensor element that is suitable for measuring overpressure, underpressure and differential pressure. The pressures to be compared directly act on a silicon diaphragm equipped with piezo-resistive resistors.

When the pressure is equal, the measuring diaphragm is in its idle state. In the event of differential pressure, the diaphragm is moved toward the lower pressure which changes the resistance of the attached resistors. This change is evaluated by the device's electronics and transformed into the display, switch contacts or an optional output signal.

The optional output signal can be dampened, spread, inverted and transformed via a table function even if it is non-linear.

3 Installation

3.1 General

The device is designed for installation onto flat assembly plates. For screw connection to the assembly plate, the device features four assembly bores on its back, which can be used for \varnothing 3.5 mm tapping screws.

Optionally, the device can be delivered with a wall-mounting plate.

At the factory, the device is calibrated for vertical installation, but the installation position is arbitrary. For any installation positions that are not vertical, the zero-point signal can be corrected via the installed offset correction.

The enclosure protection type IP 65 is only guaranteed, if a suitable power supply cable is used (see accessories).

If the device is intended for outdoor use, we recommend permanently protecting the membrane keypad against UV radiation and using a suitable enclosure or at least the erection of a sufficiently dimensioned canopy as a protection measure against constant rain or snow.

WARNING

Falling objects

The operator must ensure that any falling objects cannot collide with the installed unit. Steps must be taken to prevent

- ✓ sparks being generated on impact.
- ✓ the protection class of the casing is no longer guaranteed.
 - a) This can be avoided by attaching protective cover,
 - b) a protective casing or
 - c) a similar element.

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 the suitability of the instrument for the media that is to be measured.
- Maximum pressures must be observed (cf. Tech. data)

CAUTION

Do not blow into the pressure connections.

This can damage the pressure sensor.

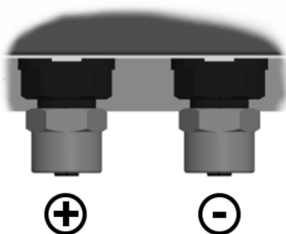


Illustration 3: Process connection

The pressure measuring lines must be installed on a gradient so that no water pockets for gas measurements can be created. If the required incline is not reached, water filters need to be installed at suitable points.

The pressure sensing lines need to be kept as short as possible and installed without sharp bends to avoid interfering delay times.

The pressure connections are marked with (+) and (-) symbols on the device. When the differential pressure is measured, the higher pressure is connected to the (+) side and the lower pressure to the (-) side.

If the pressure sensing lines are already pressurized at the time of commissioning, zero-point control and adjustment cannot be performed. In such cases, the device should be only connected to the mains without the pressure sensing lines.

3.3 Electrical connection

3.3.1 Electrical connections

⚠ WARNING

Operation in areas at risk of explosion

If operated in explosive areas, the electrical data of the unit and the valid local regulations and guidelines for the installation and operation of electrical systems in explosive areas must be observed (e.g. DIN EN 60079-14)

- 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.

If units are used in potentially explosive areas, the personnel must receive additional training or briefings or have a permit to work on explosion-protected units in potentially explosive systems.

3-wire connection

The device is connected as follows in a 3-wire switch:

The connection "Signal ground" (-Sig) is connected internally to the supply ground. It only serves as the ground connection for the output signal. This means that the output signal is free of interference levels on the power supply lines.

The supply voltage (24 V DC) may not exceed 32 V DC. The supply circuit must be protected by a slow 200 mA fuse.

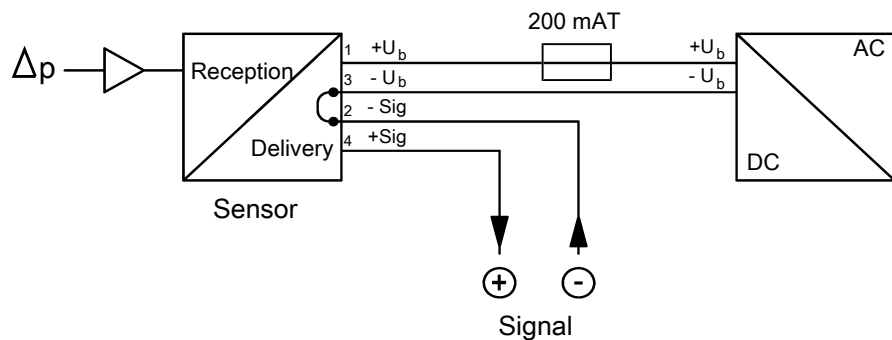


Illustration 4: 3L-switch with internal bridge

Connector 1: Supply and output signal

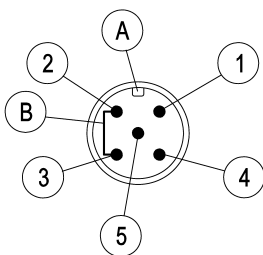


Illustration 5: M12 Plug 5-pin

Pos	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	n.c.	

Connector 2: Switching outputs

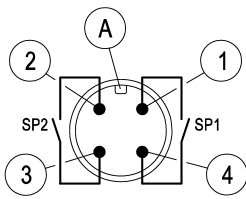


Illustration 6: M12 Plug 4-pin

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

3.3.2 Ground connection

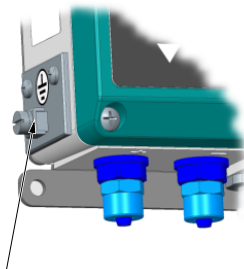
⚠ WARNING

Static electricity

The case must be equipped with an earth connection on the side to reduce the surface resistance.

Only devices for operation in potentially explosive areas with combustible, Zone 22 – Dry dusts have an earth connection on the left-hand side.

The housing is made of a non-conductive plastic. To reduce its surface resistance, a metal layer has been applied in an evaporation process. To discharge any static charging (e.g. caused by wiping), the housing must be earthed.



Ground connection

Illustration 7: Ground connection

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

LC display

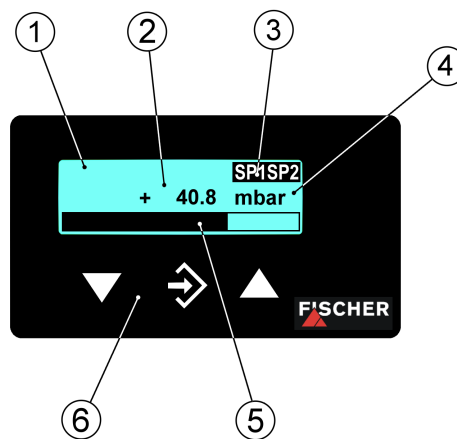


Illustration 8: DE45 LCD display

1	LCD with back lighting	4	Unit
2	Measurement display 4...6 digits	5	Bar chart display
3	Status display of the switch points	6	Keyboard

In normal mode, the current measured value is shown on a 4-digit LC display. To show very large values, it is possible to switch to a 5 or 6-digit presentation (see Parameter **MB decimal place**).

SP1SP2

Illustration 9: Display SP1 SP2

The unit is shown on the right of the display. If the device is equipped with contacts, a closed contact is always symbolised by an inverted text "SP1" or "SP2".

Various colours can be selected for the back lighting. Depending on the measured value, the colour of the back lighting can be automatically changed. This can be used e.g. to depict good/poor differences. The back lighting can also be deactivated.

The measured value can also be shown in a bar chart. The measured value is also shown in smaller pictures as a number.

During the programming, the menu items and the associated parameters are shown on the display. The device continues to function whilst the parameters are being set; apart from one exception, the changes come into effect instantly. The exception here is a change of switching times - here the previously valid time must have run down.

4.2.1 Keyboard

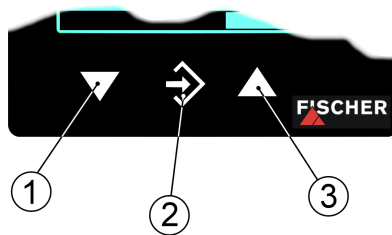


Illustration 10: Operating keys [LC display]

1	Page down menu	Reduce value
2	Call up menu	Save value
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 "**Menu level 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:

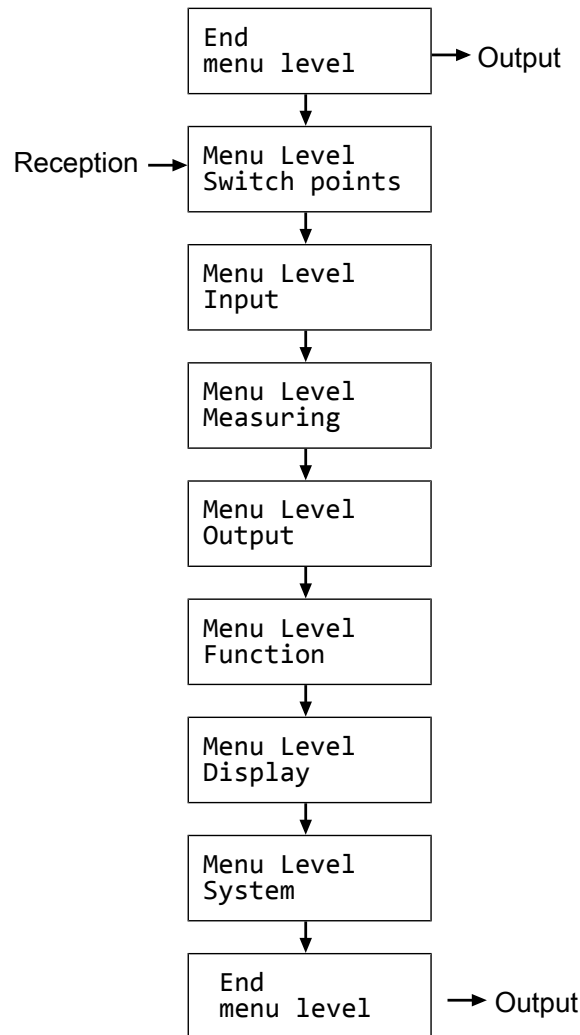


Illustration 11: Menu levels

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	MRS-50% ... MRE+50%
SP1 Off	Switching point 1 off	MRS-50% ... MRE+50%
SP1 Delay	Switching point 1 delay	0...1800 s
SP1 Function	Switching point 1 function	NO, NC
SP2 On	Switch point 2 On	MRS-50% ... MRE+50%
SP2 Off	Switching point 2 off	MRS-50% ... MRE+50%
SP2 Delay	Switching point 2 delay	0...1800 s
SP2 Function	Switching point 2 function	NO, NC

The two switch 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 switch 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 MRS – 50% to MRE + 50%. MRS stands for measuring range start and MRE for measuring range end.

Example:

Measurement range = 0 ... 100 Pa

The value range for this measuring range is -50 Pa ... +150 Pa.

Together, the two parameters **SP1 On** and **SP1 Off** determine the switch function of switch 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 switch 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.

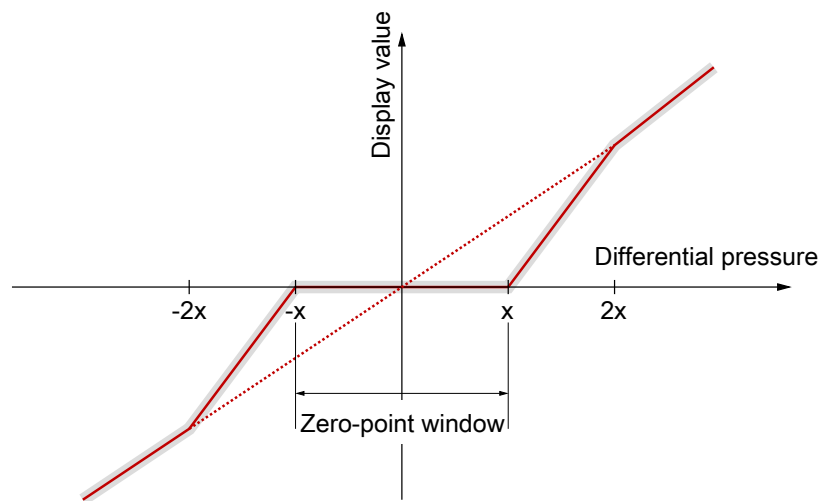


Illustration 12: Zero-point window

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	MB-start ... MB-end
Value pair2	Value pair 2	
Value pair3	Value pair 3	
	...	
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.

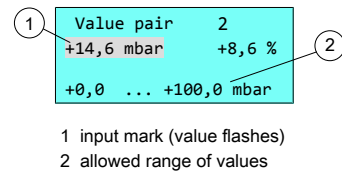
The **MB unit** gives the user the option of defining a completely independent unit. Letters, numbers or special characters can be used. The unit can be max. 4 characters long.

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.



- 1 input mark (value flashes)
- 2 allowed range of values

Illustration 13: Value pair

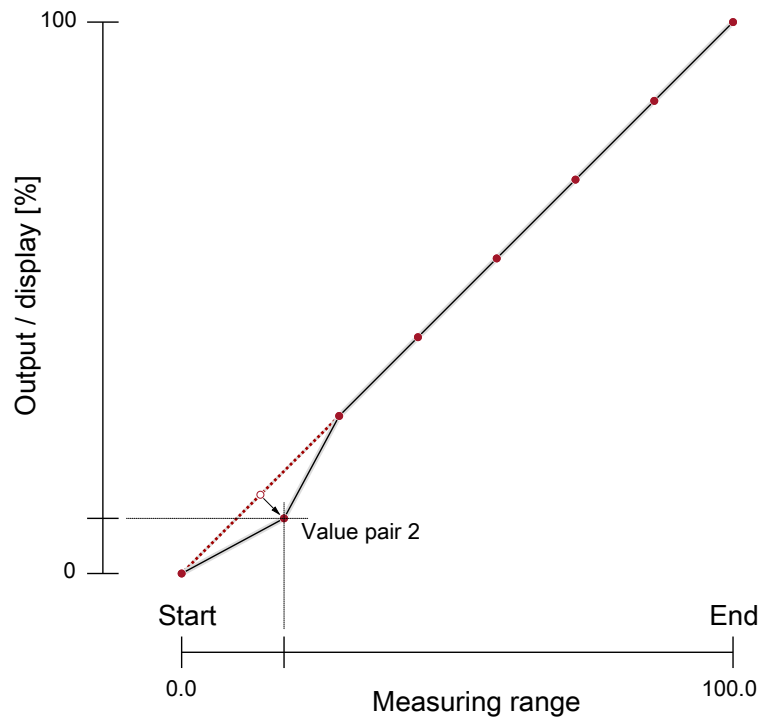


Illustration 14: Table function (example)

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

Parameter name	Description	Value range
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

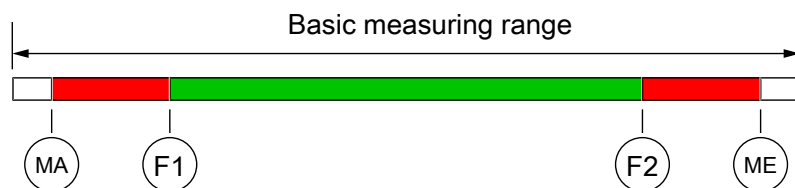


Illustration 15: Function Auto1

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, 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

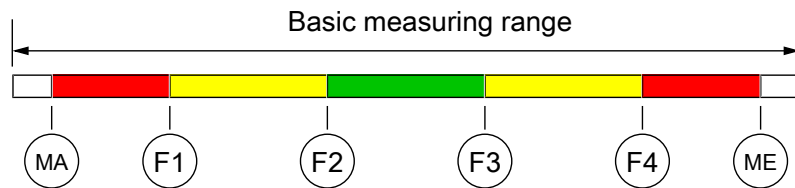


Illustration 16: Function Auto2

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.

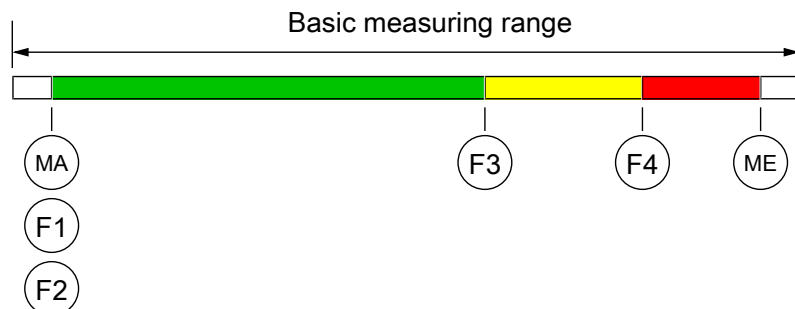


Illustration 17: Example Auto2

4.3.7 Menu Level System

Parameter name	Description	Value range
Language	Language switchover	DE, EN, FR, ES, IT,PT,HU
Software Info	Information about the Software	Device type, controller ID, firmware version
Config Info	Information about the configuration	Basic measuring range, output signal, contacts
Statistics	Statistics	Operation 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 Maintenance

5.1 Wartung (maintenance)

To ensure reliable operation and a long service life, we recommend carrying out the following test on a regular basis:

- Check the reading.
- Checking the switch function in connection with the downstream components.
- Checking the differential pressure lines for leaks.
- Checking the electrical connections (terminal connection of the cable).

The precise test cycles and operating and ambient conditions need to be adjusted. If several components of the unit interact, all operating instructions of the other units also need to be observed.

WARNING

Dust deposits

The device must be cleaned with a damp cloth a regular intervals to prevent heat build-up. Cleaning intervals depend on the amount of local dust.

5.2 Transport

The measuring device must be protected against impacts. It should be transported in the original packaging or a suitable transport container.

5.3 Service

All defective or faulty devices should be sent directly to our repair department. Please coordinate all shipments with our sales department.

WARNING

Process media residues

Process media residues in and on dismantled devices can be a hazard to people, animals and the environment. Take adequate preventive measures. If required, the devices must be cleaned thoroughly.

Return the device in the original packaging or a suitable transport container.

5.4 Disposal

WARNING

Incorrect disposal may pose a risk to the environment.

Please help to protect the environment by always disposing of the work pieces and packaging materials in compliance with the valid national waste and recycling guidelines or reuse them.

6 Technical data

Please also observe the order code here.

6.1 Input variables

Measuring variable

Differential pressure for gas-like media

Measuring Range

Measuring Range			Stat. operating pressure max.	Bursting pressure
mbar	Pa	kPa	mbar	mbar
0...4	0...400	0...0.4	50	150
0...6	0...600	0...0.6	50	150
0...10	0...1000	0...1.0	100	300
0...16	0...1600	0...1.6	100	300
0...25	---	0...2.5	250	750
0...40	---	0...4.0	250	750
0...60	---	0...6.0	500	1500
0...100	---	0...10.0	500	1500
0...160	---	0...16.0	1500	3000
0...250	---	0...25.0	1500	3000
±2.5	±250	±0.25	50	150
±4	±400	±0.4	50	150
±6	±600	±0.6	50	150
±10	±1000	±1.0	100	300
±16	±1600	±1.6	100	300
±25	---	±2.5	250	750
±40	---	±4.0	250	750
±60	---	±6.0	500	1500
±100	---	±10.0	500	1500

6.2 Output parameters

Output signal

0...20 mA
4...20 mA,
0...10 V

Signal range

0.0...21.0 mA
0.0...11.0 V

Apparent ohmic resistance

0/4...20mA:
 $U_b \leq 26 \text{ V} : R_L \leq (U_b - 4 \text{ V})/0,02 \text{ A}$
 $U_b > 26 \text{ V} : R_L \leq 1100 \Omega$
0...10V:
 $R_L \geq 2 \text{ k}\Omega$

Switching outputs

2 potential-free semiconductor switches (MOSFET)

	MOSFET
Progr. switching function	One-pin activator (NO) One-pin deactivator (NC)
Max. switching voltage	3...32 V AC/DC
Max. switching current	0.25A
max. switching output	8 W / 8 VA $R_{ON} \leq 4 \Omega$

6.3 Auxiliary energy**Rated Voltage**

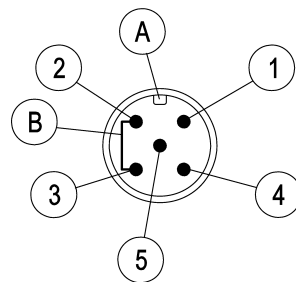
24 V AC/DC

Admissible operating voltage $U_b = 12...32 \text{ V AC/DC}$ **⚠ WARNING****Supply circuit**

A CE-conform mains adapter with a slow 200 mA fuse only may be used in the power supply circuit.

Electrical connection

2 x round plug connector M12



A Coding

B Bridge

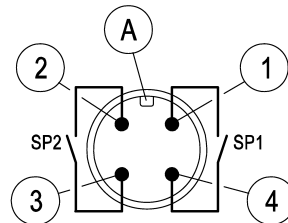
1 Power supply (+Ub)

2 Output (- Sig)

3 Power supply (-Ub)

4 Output (+ Sig)

5 not connected



A Coding

1 Switch output 1

2 Switch output 2

3 Switch output 2

4 Switch output 1

*Illustration 18: Electrical connection DE45_LCD***6.4 Measuring accuracy****Characteristic curve deviation**

(Non-linearity and hysteresis)

Maximum: 1.0 % FS

Typical: 0.5 % FS

The information refers to a linear, non-spread characteristic curve at 25 °C and applies to all measuring ranges. FS (Full Scale) refers to the basic measuring range.

Temperature coefficient (TK)

Measurement range	TK zero-point [% FS/10K]		TK span [% FS/10K]	
	typ.	max.	typ.	max.
mbar				
0...4	0.2	1.0	0.3	1.0
0...6	0.2	1.0	0.3	1.0
0...10	0.2	0.4	0.3	0.3
0...16	0.2	0.4	0.3	0.3
0...25	0.2	0.4	0.3	0.3
0...40	0.2	0.4	0.3	0.3
0...60	0.2	0.4	0.3	0.3
0...100	0.2	0.4	0.3	0.3
0...160	0.2	0.4	0.3	0.3
0...250	0.2	0.4	0.3	0.3
±2.5	0.2	1.0	0.3	1.0
±4	0.2	0.5	0.3	0.5
±6	0.2	0.4	0.3	0.3
±10	0.2	0.4	0.3	0.3
±16	0.2	0.4	0.3	0.3
±25	0.2	0.4	0.3	0.3
±40	0.2	0.4	0.3	0.3
±60	0.2	0.4	0.3	0.3
±100	0.2	0.4	0.3	0.3

With reference to the basic measuring range (FS), Compensation range 0..60°C.

6.5 Application conditions**Ambient conditions**

Ambient temperature	-10 ... +60 °C	
Media temperature	-10 ... +60 °C	
Storage temperature	-20 ... +70 °C	
Enclosure protection class	IP65 as per EN 60529	
EMC	EN 61326-1:2013	
ATEX	EN 61326-2-3:2013	
	EN 60079-0:2012 + A11:2013	Dust
	EN 60079-31:2014	Gases and vapours
RoHS	EN 60079-15:2010	

6.6 Construction design**Process connection**

2x aluminium hose screw connection for 6/4 mm or 8/6 mm hose.
2x pneumatic plug connector for 6/4 mm or 8/6 mm hose.

Materials

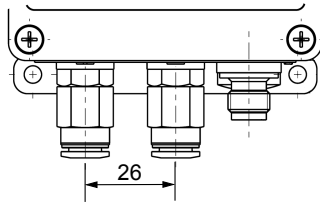
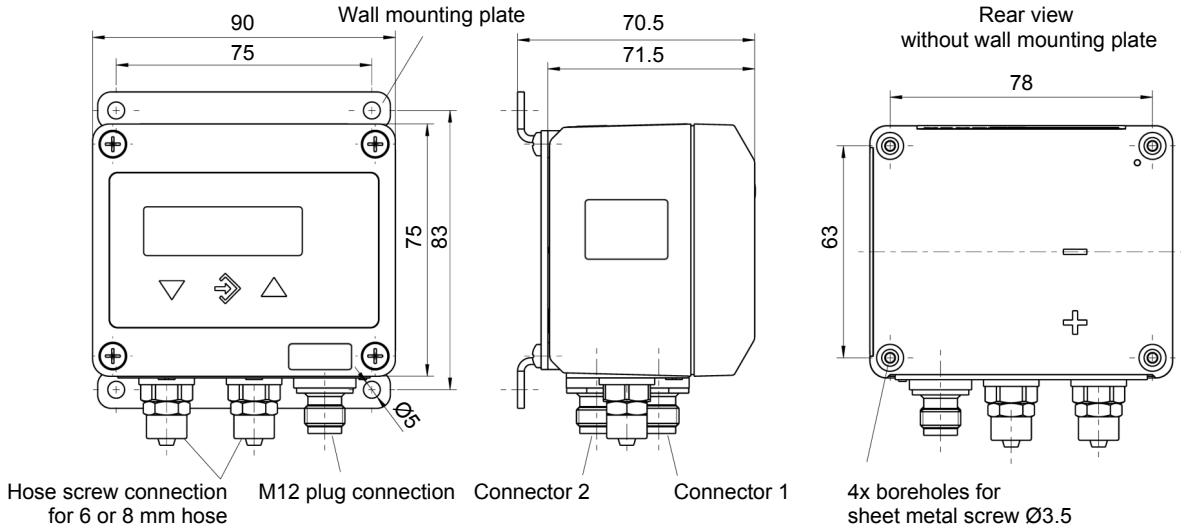
Housing	Polyamide (PA) 6.6
	If used in Zone 22, a 2µ aluminium layer is applied to the outer surface of the lower part of the housing in an evaporation process.
Media-contacting material	Silicon, PVC, aluminium, brass

Assembly

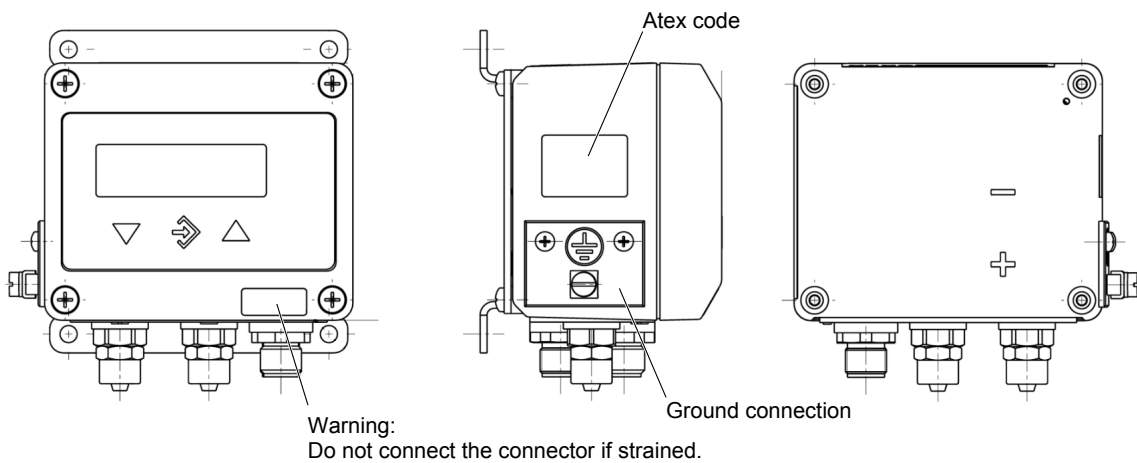
Attachment boreholes on the rear for attaching the mounting plates.
 Wall mounring using the wall mounting plate.
 Panel installation using the panel installation set.
 Assembly of the mounting rails using an adapter.

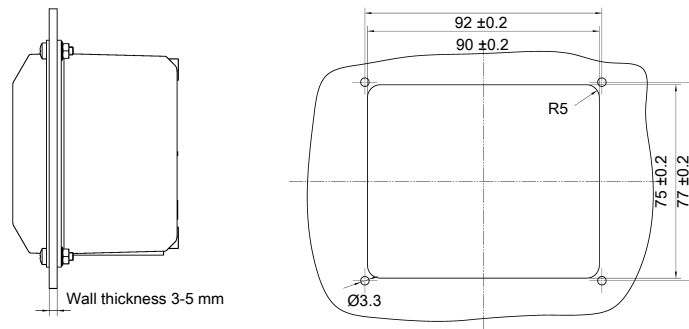
Wall mounting

Model for zone 2



Model for zone 22



Front panel assembly**6.7 Display and operating interface****Display**

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

Programming

Attenuation	0.0 ... 100.0 s (jump response time 10 / 90 %) for signal output; separately also for display
Switch output	Switch-off point, switch-on point, response time (0...100s), function (NC / NO contact)
Measuring range unit	mbar / Pa / "free unit", 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	$\pm\frac{1}{3}$ 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.

6.8 Certificates and approvals

EC Declaration of conformity (see Attachment)

7 Order Codes

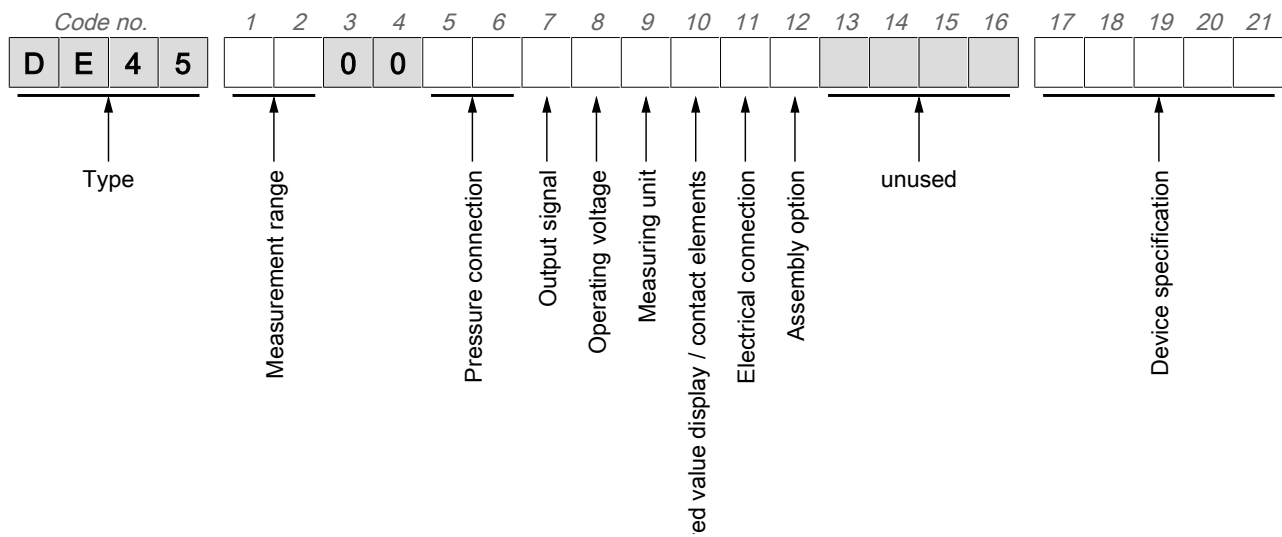


Illustration 19: Order code DE45_LCD

Measuring range:

[1.2]	(Code no.)
52	0 ... 4 mbar
53	0 ... 6 mbar
54	0 ... 10 mbar
55	0 ... 16 mbar
56	0 ... 25 mbar
57	0 ... 40 mbar
58	0 ... 60 mbar
59	0 ... 100 mbar
60	0 ... 160 mbar
82	0 ... 250 mbar
A6	-2.5 ... +2.5 mbar
A7	-4 ... +4 mbar
A8	-6 ... +6 mbar
A9	-10 ... +10 mbar
B1	-16 ... +16 mbar
B2	-25 ... +25 mbar
C5	-40 ... +40 mbar
B3	-60 ... +60 mbar
B4	-100 ... +100 mbar
D7	0 ... 400 Pa
J7	0 ... 500 Pa
D8	0 ... 600 Pa
D9	0 ... 1000 Pa
E1	0 ... 1600 Pa
L6	-250 ... +250 Pa

[1.2] (Code no.)	
N1	0 ... 1 kPa
N2	0 ... 1.6 kPa
N3	0 ... 2.5 kPa
N4	0 ... 4 kPa
N5	0 ... 6 kPa
E5	0 ... 10 kPa
L8	-1 ... +1 kPa
L9	-1.6 ... +1.6 kPa
M6	-2.5 ... +2.5 kPa
M7	-4 ... +4 kPa
M8	-6 ... +6 kPa

Pressure connection:

[5.6] (Code no.)	
40	Aluminium screw connection for 6 / 4 mm hose
41	Aluminium screw connection for 8 / 6 mm hose
P6	Pneumatic plug connector for 6/4 mm hose
P8	Pneumatic plug connector for 8/6 mm hose

Output signal:

[7] (Code no.)	
0	without output signal
A	0... 20 mA (3-wire)
P	4... 20 mA (3-wire)
C	0 ... 10 V (3-wire)

Operating voltage

[8] (Code no.)	
K	24 V AC/DC

Measuring unit:

[9] (Code no.)	
W	Selectable pressure units

Measured value display / contact elements:

[10] (Code no.)	
D	4-digit colour change LCD / 2 semiconductor switches

Electrical connection

[11] (Code no.)	
M	M12 plug connector, plastic (for ATEX devices Zone 2)
L	M12 connector socket, MS nickel-plated (for ATEX devices Zone 22)

Assembly option:

[12]	(Code no.)
0	Standard (attachment boreholes on rear side)
T	Panel mounting set
W	Wall mounting

7.1 Device specification

[17]	(Code no.)
R	Use in Zone 2 - Risk from gases and vapours Ex II 3G Ex nA IIC T4
S	Use in Zone 22 - Risk from dust Ex II 3D Ex tc IIIB T125°C IP65 $-10\text{ °C} \leq T_{\text{amb}} \leq 60\text{ °C}$

The codes with the numbers [18] to [22] specify the device as requested by the customer and agreed with our sales department.

7.2 Accessories

Order no.	Designation	No. of Poles	Length
06401993	Connection cable for switch outputs with M12 connector	4-pin	2 m
06401994	Connection cable for switch 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
EU03.F300	Transmitter PC Interface incl. PC software		

8 Attachments

8.1 EC Declaration of conformity



EU Declaration of Conformity

(Translation)

For the product described as follows

Product designation	Digital Differential Pressure Switch / Transmitter with colour changing LCD	
Type designation	DE45 ## 00 ### KWDM # R####	Zone 2
	DE45 ## 00 ### KWDL # S####	Zone 22

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

2014/30/EU	EMC Directive
2014/34/EU	ATEX 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
	Explosive atmospheres (ATEX)
EN 60079-0:2012 + A11:2013	Explosive atmospheres - Part 0: Equipment - General requirements
EN 60079-15:2010	Explosive atmospheres - Part 15: Equipment protection by type of protection "n"
EN 60079-31:2014	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
	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 II 3G Ex nA IIC T4 CE II 3D Ex tc IIIB T125°C IP65	Zone 2 Zone 22

Bad Salzufflen,
2016-09-29

S. Richter
General Manager R & D



