



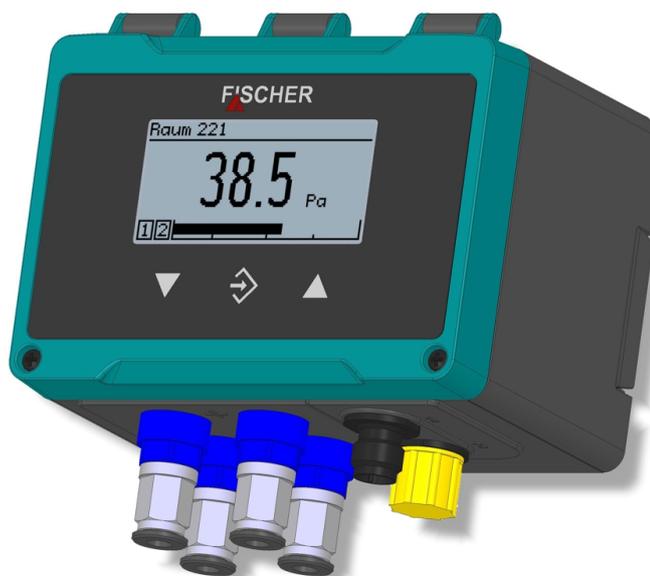
Ex II 3G Ex ec IIC T4 Gc
Ex II 3D Ex tc IIIB T125°C Dc



IO-Link



Modbus

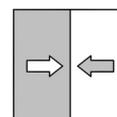


Data sheet

DE91

Differential pressure transmitter
PRO-LINE®

for low pressure measurements



1 Product and functional description

1.1 Performance characteristics

Typical applications

- Filter equipment
- Dynamic filter monitoring
- Precision air duct measurements
- Volume flow measurement
- Clean room pressure equalisation
- Burner underpressure measurement
- Furnace circulating control

Main features

- Long-term stable measurement of very low pressures
- Robust, overpressure-proof and maintenance-free
- Multi-line LC display
 - Full graphic
 - Colour backlit for visualisation of operating states
 - Multilingual plain text menu
- Characteristic curve conversion via table with max. 30 measuring points
- Turn down 4:1
- 4 switching outputs
- USB interface OTG
- Remote parameterisation via optional 'inTouch' PC software

Options

- Capacitive sensor element
 - Channel 1 (compatible with DE46)
 - Kanal 2
- Piezoresistive Sensorelement
 - Channel 2 only
- ATEX Zone 2 and 22
- Two factory-set analog outputs (subsequently switchable)
 - 0 ... 10 V
 - 0 ... 20 mA
 - 4 ... 20 mA
- Modbus interface with switching outputs
- Modbus interface without switching outputs
- IO-Link interface with switching outputs

1.2 Intended use

The DE91 is a configurable differential pressure transmitter with optional outputs and digital interfaces. It is suitable for measuring very low overpressure, underpressure and differential pressures in neutral gaseous media.

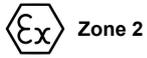
The device may only be used for the purpose stipulated by the manufacturer. The manufacturer will not be liable for damage arising from incorrect or improper use.

1.2.1 Explosion hazard area classification

Eurasian Economic Union (EAC):

The device does not have ATEX approval for this market. It may only be used there as an industrial device.

1.2.1.1 Gas explosion protection



Zone 2

Devices with the order code DE91 ### ## # # # # 000 R1 # # are suitable as “Electrical equipment for use in potentially explosive areas”, Zone 2 - Gases and vapours.

Designation as per Directive 2014/34/EU:

Ex II 3G Ex ec IIC T4 Gc

1.2.1.2 Dust explosion protection



Zone 22

Devices with the order code DE91 ### ## # # # # 000 R1 # # are suitable as “Electrical equipment for use in areas with combustible dust”, Zone 22 - dry dusts.

Designation as per Directive 2014/34/EU:

Ex II 3D Ex tc IIIB T125°C Dc

-20°C ≤ T_{amb} ≤ 60°C

1.3 Function diagram

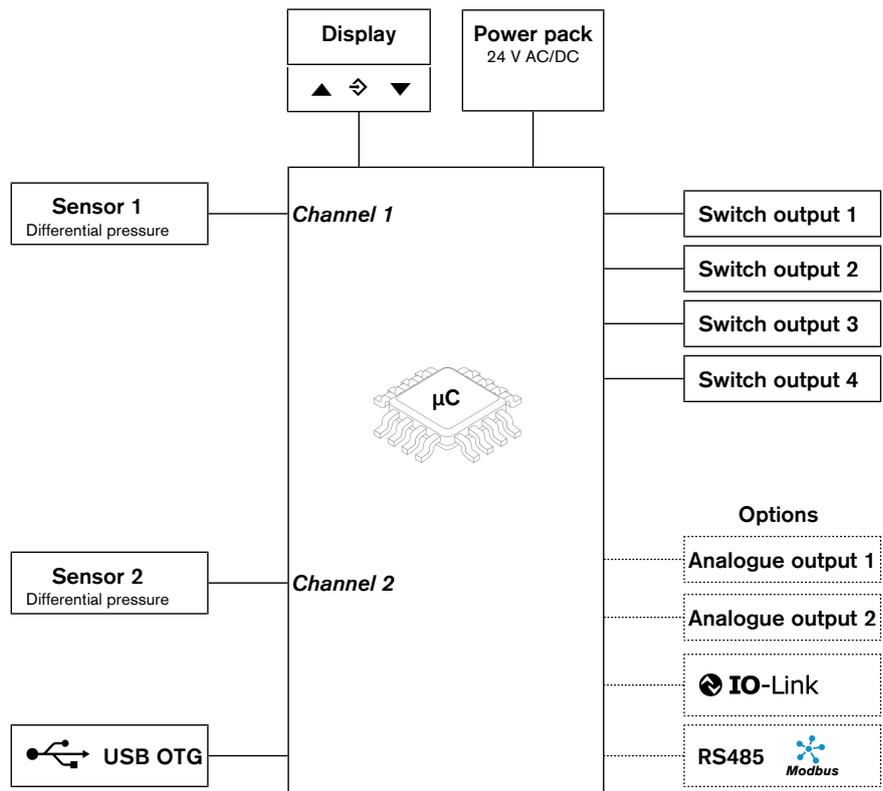


Fig. 1: Function diagram

1.4 Design and mode of operation

Depending on the measuring range and the channel used, two different sensor technologies are used. Both sensor types are equally suitable for overpressure, underpressure and differential pressure measurements.

Sensor type A is a capacitive sensor element. The pressures to be measured act directly on the sensor element with a micromechanically manufactured differential capacitor in silicon glass technology.

This type of sensor is used for channels 1 and 2.

Sensor type B is a piezoresistive sensor element. The pressures to be measured act directly on a silicon diaphragm fitted with a resistance measuring bridge.

This sensor type is only used for channel 2

Mode of action:

When the pressure is equal, the measuring diaphragm is at rest. If a pressure difference occurs, the diaphragm is deflected, resulting in a change in resistance or capacitance, depending on the sensor type. This change is analysed and displayed by the electronics integrated in the device and converted into up to four switching contacts.

Options:

The device can be equipped with up to two analogue outputs. The output signal can be attenuated, spread, inverted and also transformed non-linearly via a table function.

The device can either be equipped with a Modbus RTU interface or alternatively with an IO-Link interface.

1.4.1 Equipment

Overall, the device can be delivered with the following equipment.

Sensor type	Channel 1	Channel 2
capacitive	A	A
piezoresistiv		B

Output	1-channel	2-channel	Modbus RTU ¹⁾		IO-Link
			(Opt1)	(Opt2)	
Switch output 1	x	x	x		x
Switch output 2	x	x	x		x
Switch output 3		x	x		x
Switch output 4		x	x		x
Analogue output 1	x	x			
Analogue output 2		x			

Interfaces	1-channel	2-channel	Modbus RTU ¹⁾		IO-Link
			(Opt1)	(Opt2)	
USB interface	x	x	x	x	x
RS485 Modbus RTU			x	x	
IO-Link					x

¹⁾ Opt1: without switching outputs; Opt2: with switching outputs

1.4.2 Modbus RTU

For operating a device with a Modbus RTU interface, the corresponding Modbus manual is available for download from the FISCHER website.

1.4.3 IO-Link

For operating a device with an IO-Link interface, the IODD file and the corresponding interface description are available for download from the FISCHER website.

1.5 Equipment versions

Process connections

The connections presented here are used for all models.

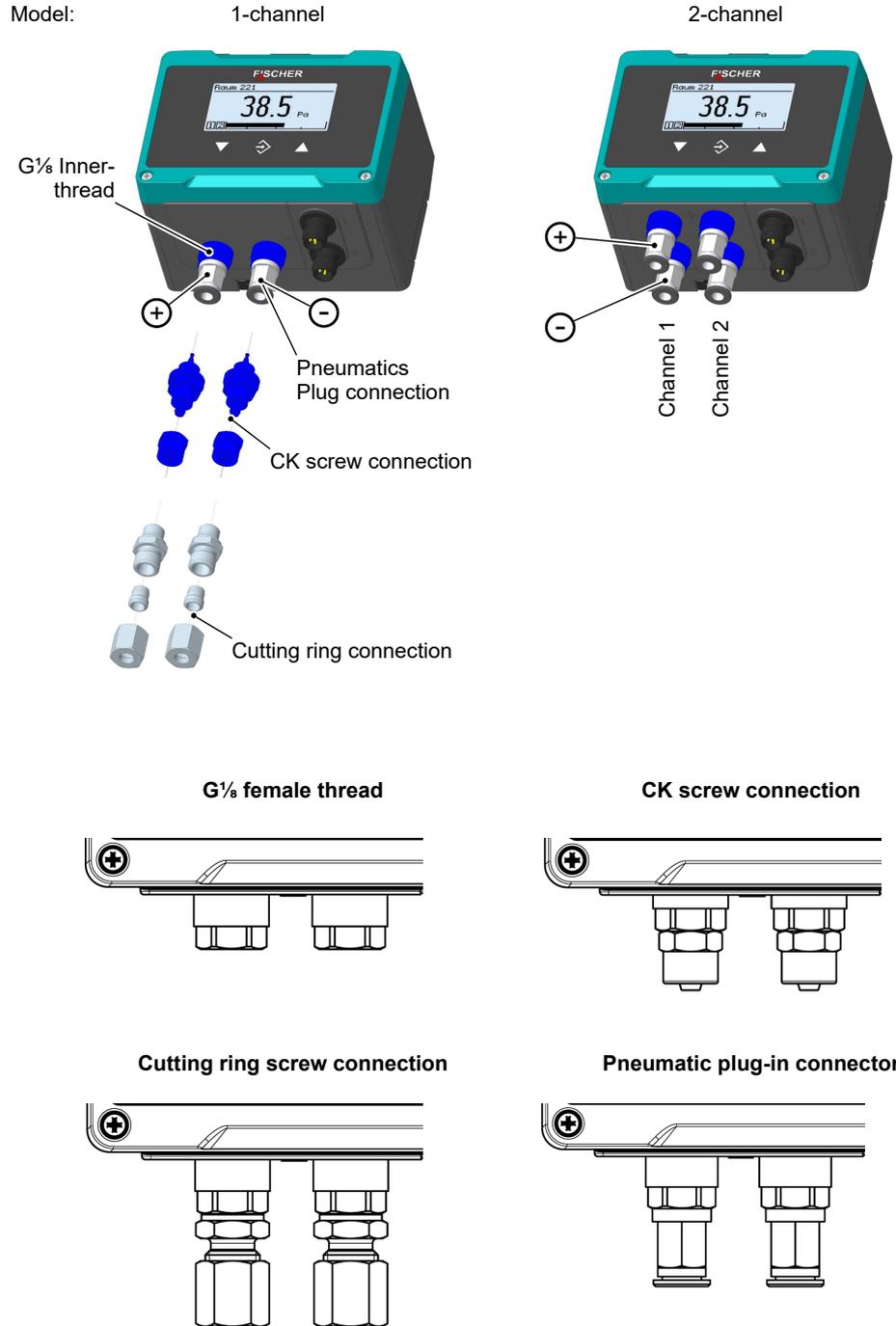


Fig. 2: Process connections

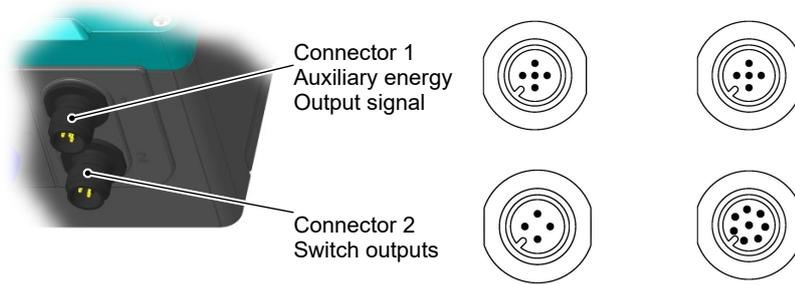
Electric connections

Two M12 flange connectors is installed for the electrical connection.

Model: Standard

1-channel

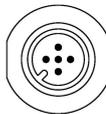
2-channel



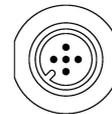
Modbus without switch outputs

Modbus with switch outputs

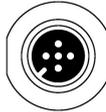
Connector 1
Modbus IN



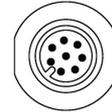
Connector 1
Modbus



Connector 2
Modbus OUT

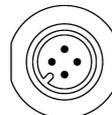


Connector 2
Switch outputs



IO-Link with switch outputs

Connector 1
IO-Link



Connector 2
Switch outputs

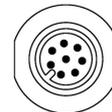


Fig. 3: Electric connections

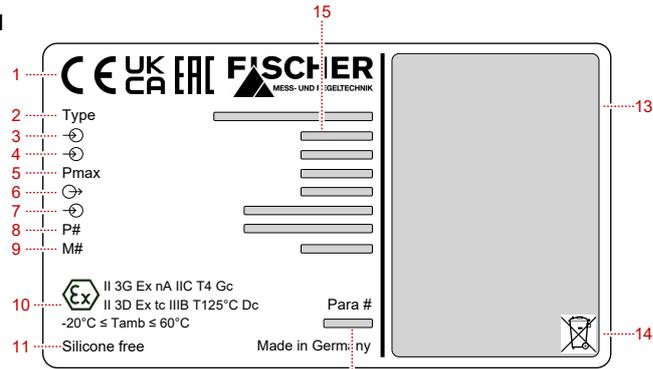
ATEX model



Fig. 4: ATEX model

1.5.1 Type plate

1 channel



2 channels

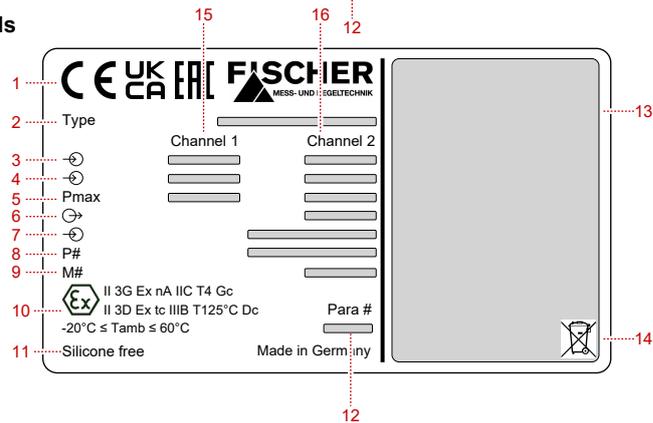


Fig. 5: Type plate

1	Conformity	2	Device type (order code)
3	Basic measuring range	4	Set measuring range
5	Overload capacity	6	Output signal
7	Auxiliary energy	8	Production number
9	Customer item number	10	ATEX marking
11	Special properties	12	Parameter number
13	Circuit diagram	14	WEEE marking
15	Data for channel 1	16	Data for channel 2

Explanations of the symbols

-  Input
-  Output
- CAL** Factory Setting
- Pmax** Proof Pressure
- P#** Production No.
- M#** Customers Art.no.
- Para. #** Parameter No.

2 Technical data

2.1 General

Type designation	DE91	
Pressure type	Differential pressure	
Measuring principle	Sensor type A	Capacitive
	Sensor type B	Piezoresistiv
Reference conditions (acc. to IEC 61298-1)		
Temperature	+15 to +25 °C	
Relative humidity	45 ... 75 %	
Air pressure	86 to 106 kPa	860 to 1060 mbar
Installation position	vertical	

2.2 Input variables

Measuring variable	Differential pressure for gas-like media
Conversion	1 Pa = 10^{-5} bar
	1 kPa = 10^{-2} bar

2.2.1 Sensor type A (capacitive)

This type can be fitted for channel 1 and channel 2.

Measuring range	Max. stat. Operating pressure	Overload	Bursting pressure
0 ... 25 Pa	100 kPa	100 kPa	170 kPa
0 ... 50 Pa			
0 ... 100 Pa			
0 ... 160 Pa			
0 ... 250 Pa			
0 ... 400 Pa			
0 ... 500 Pa			
0 ... 600 Pa			
0 ... 1000 Pa			
-12,5 ... +12,5 Pa			
-25 ... +25 Pa			
-50 ... +50 Pa			
-20 ... +80 Pa			
-100 ... +100 Pa			
-250 ... +250 Pa			
-1 ... +1 kPa			

2.2.2 Sensor type B (piezoresistive)

This type can only be fitted for channel 2.

Measuring range	Max. stat. Operating pressure	Overload	Bursting pressure
0 ... 1600 Pa	31 kPa	31 kPa	41 kPa
0 ... 2500 Pa	31 kPa	31 kPa	41 kPa
0 ... 4000 Pa	31 kPa	31 kPa	41 kPa
0 ... 6000 Pa	80 kPa	80 kPa	100 kPa
0 ... 1,6 kPa	31 kPa	31 kPa	41 kPa
0 ... 2,5 kPa	31 kPa	31 kPa	41 kPa
0 ... 4 kPa	31 kPa	31 kPa	41 kPa
0 ... 6 kPa	80 kPa	80 kPa	100 kPa
0 ... 10 kPa	80 kPa	80 kPa	100 kPa
0 ... 16 kPa	140 kPa	140 kPa	250 kPa
0 ... 25 kPa	140 kPa	140 kPa	250 kPa
-1,6 ... +1,6 kPa	31 kPa	31 kPa	41 kPa
-2,5 ... +2,5 kPa	31 kPa	31 kPa	41 kPa
-4 ... +4 kPa	31 kPa	31 kPa	41 kPa
-6 ... +6 kPa	80 kPa	80 kPa	100 kPa
-10 ... +10 kPa	80 kPa	80 kPa	100 kPa
-16 ... +16 kPa	140 kPa	140 kPa	250 kPa
-25 ... +25 kPa	140 kPa	140 kPa	250 kPa

2.3 Output variables

Analogue outputs

The number of analogue outputs depends on the device version.

Device version	1-channel	2-channel
Number of analogue outputs	1	2

The output signal can be set in the configuration. Upon delivery, both analogue outputs are set to the same signal (see the type plate).

Output signal	0 to 20 mA 4 to 20 mA	0 ... 10 V 2 ... 10 V 1 ... 5 V
Signal range	0.0 to 21.5 mA	0.0 to 10.5 V
Load impedance R_L	$\leq 600 \Omega$	$\geq 2 \text{ k}\Omega$
Turn down	4:1	4:1

Switch outputs

The number of switch outputs depends on the device model. The assignment of the switch outputs to the channels can be configured freely.

Standard version	1-channel	2-channel
Number of switch outputs	2	4
Assignment on delivery	SP1-> channel 1 SP2-> channel 1	SP1-> channel 1 SP2-> channel 1 SP3-> channel 2 SP4-> channel 2

Modbus (Opt1)	1-channel	2-channel
Number of switch outputs	0	0
Assignment on delivery	---	--

Modbus (Opt2)	1-channel	2-channel
Number of switch outputs	4	4
Assignment on delivery	SP1-> channel 1 SP2-> channel 1 SP3-> channel 1 SP4-> channel 1	SP1-> channel 1 SP2-> channel 1 SP3-> channel 2 SP4-> channel 2

IO-Link	1-channel	2-channel
Number of switch outputs	4	4
Assignment on delivery	SP1-> channel 1 SP2-> channel 1 SP3-> channel 1 SP4-> channel 1	SP1-> channel 1 SP2-> channel 1 SP3-> channel 2 SP4-> channel 2

Type	Potential-free semiconductor switch (MOSFET)
Progr. switching function	1-pole normally open (NO) 1-pole normally closed (NC)
Max. switching voltage	3 to 32 V AC/DC
Max. switching current	0.25 A
Max. switching output	8 W / 8 VA $R_{ON} \leq 4 \Omega$

2.4 Measuring accuracy

- The specifications for the measurement error incl. linearity and hysteresis.
- All specifications relate to the basic measuring range (see the type plate) and a compensation range of -20 ... +70°C.

2.4.1 Sensor type A (capacitive)

This type can be fitted for channel 1 and channel 2.

Measuring range	Measurement deviation [%]		Zero point [%/10K]		Span [%/10K]	
	Typ.	Max.	Typ.	Max.	Typ.	Max.
0 ... 25 Pa	0,5	1,0	0,3	0,6	0,3	0,6
0 ... 50 Pa						
0 ... 100 Pa						
0 ... 160 Pa						
0 ... 250 Pa						
0 ... 400 Pa						
0 ... 500 Pa						
0 ... 600 Pa						
0 ... 1000 Pa						
-12,5 ... +12,5 Pa						
-25 ... +25 Pa						
-50 ... +50 Pa						

Measuring range	Measurement deviation [%]	Zero point [%/10K]	Span [%/10K]
-20 ... +80 Pa			
-100 ... +100 Pa			
-250 ... +250 Pa			
-1 ... +1 kPa			

2.4.2 Sensor type B (piezoresistive)

This type can only be fitted for channel 2.

Measuring range	Measurement deviation [%]		Zero point [%/10K]		Span [%/10K]	
	Typ.	Max.	Typ.	Max.	Typ.	Max.
0 ... 1600 Pa	0,25	0,5	0,15	0,3	0,05	0,1
0 ... 2500 Pa			0,15	0,25		
0 ... 4000 Pa			0,1	0,2		
0 ... 6000 Pa			0,1	0,2		
0 ... 1,6 kPa			0,15	0,3		
0 ... 2,5 kPa			0,15	0,25		
0 ... 4 kPa			0,1	0,2		
0 ... 6 kPa			0,1	0,2		
0 ... 10 kPa			0,1	0,15		
0 ... 16 kPa			0,05	0,1		
0 ... 25 kPa			0,05	0,1		
-1,6 ... +1,6 kPa			0,1	0,2		
-2,5 ... +2,5 kPa			0,1	0,15		
-4 ... +4 kPa			0,05	0,1		
-6 ... +6 kPa			0,05	0,1		
-10 ... +10 kPa			0,05	0,1		
-16 ... +16 kPa			0,05	0,1		
-25 ... +25 kPa			0,05	0,1		

2.5 Digital interfaces

USB interface

USB On The Go	2.0
Data rate	12 Mbit/s (Full Speed)
Connection	Micro USB Type B
Communication	Host/device mode

Modbus RTU interface

Interface	RS 485
Protocol	Modbus RTU
Modbus specification	Application Protocol Specification V1.1b3 (April 26, 2012)
Address	1 ... 247
Baudrate	2400 ... 115200 Baud
Parity	Even, Odd, None
Stop bits	1...2

IO-Link interface

Connection	M12-4 Class A
IO-Link specification	V1.1
Pin assignment	acc. IEC 60974-5-2
Power supply device	max. 200 mA
Data transfer rates	COM 2 = 38,4 kBaud

2.6 Auxiliary energy

NOTICE! Only a CE-compliant mains adapter with a slow 200 mA fuse may be used in the power supply circuit for ATEX devices.

Rated voltage	24 V AC/DC	
Admissible operating voltage U_b	19.2 to 28.8 V AC/DC	Default Modbus RTU
	18 to 30 V DC	IO-Link
Power consumption	Typ. 2W (VA) Max. 3W (VA)	

2.7 Operating conditions

	Standard	ATEX
Ambient temperature range	-20 ... +70 °C	-20 ... +60 °C
Media temperature range	-20 ... +70 °C	-20 ... +60 °C
Storage temperature range	-20 ... +70 °C	-20 ... +70 °C
Protection class	IP65	IP65
EMC	EN 61326-1:2013 EN 61326-2-3:2013	
ATEX	EN IEC 60079-0:2018 EN IEC 60079-7:2015/A1:2018 EN 60079-31:2014	
RoHS	EN IEC 63000:2018	

2.8 Display

Display	Full graphic LC display
Resolution	128 x 64 Pixel
Backlight	RGB
Measured value display	6 digits

2.9 Construction design**Process connection**

		Outer Ø	Inner Ø
CK screw connections made of aluminium	Hose	6 mm	4 mm
	Hose	8 mm	6 mm
Pneumatic plug-in connector in nickel-plated brass	Hose	6 mm	4 mm
	Hose	8 mm	6 mm
Cutting ring connection in stainless steel	Pipe	6 mm	
	Pipe	8 mm	

Electrical connection

Standard version	1-channel	2-channel
Connector 1: Auxiliary energy, output	5-pin male	5-pin male
Connector 2: Switch outputs	4-pin male	8-pin male

Modbus without switch outputs	1-channel	2-channel
Connector 1: Modbus IN	5-pin male	5-pin male
Connector 2: Modbus OUT	5-pin female	5-pin female

Modbus with switch outputs	1-channel	2-channel
Connector 1: Modbus	5-pin male	5-pin male
Connector 2: Switch outputs	8-pin male	8-pin male

IO-Link with switch outputs	1-channel	2-channel
Connector 1: IO-Link	4-pin male	4-pin male
Connector 2: Switch outputs	8-pin male	8-pin male

General activities

Installation position	User-defined
Dimensions (without connections)	120 x 81.5 x 95 mm
Weight	Max. 380 g

2.9.1 Materials

Materials of parts in contact with medium	
Sensor type A	PBT plastic, rubber, glass, gold, Tygon®, aluminium, titanium and brass
Sensor type B	Silicon, PVC, FKM, aluminium, brass, stainless steel, PP/EPDM

Materials of parts in contact with surroundings
Polyester, PET, polyamide 6.6, aluminium, nickel-plated brass, stainless steel

2.9.2 Dimensional drawings

All dimensions in mm unless otherwise stated

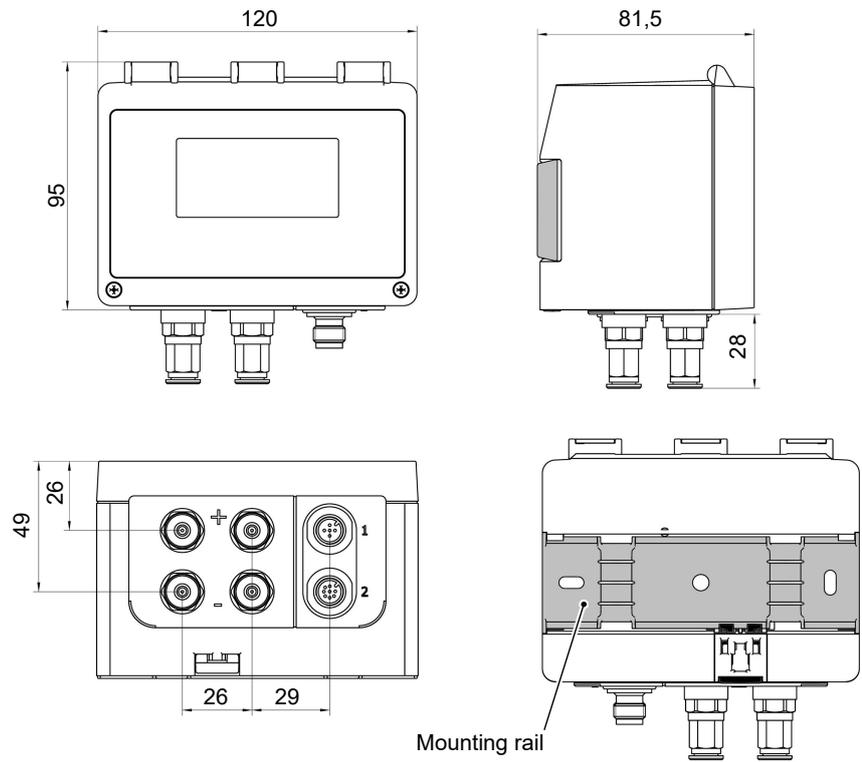


Fig. 6: Dimension drawing

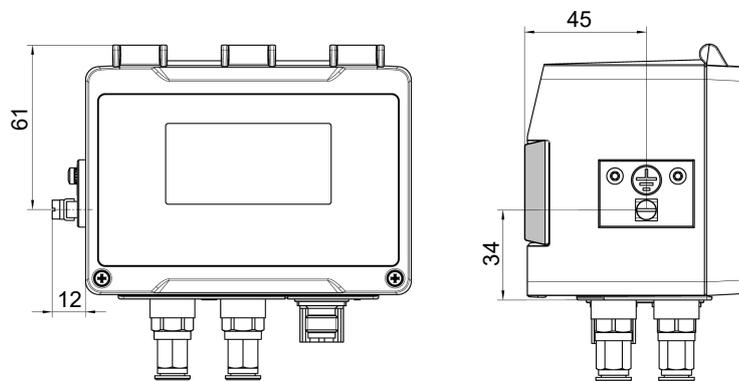


Fig. 7: Dimension drawing ATEX

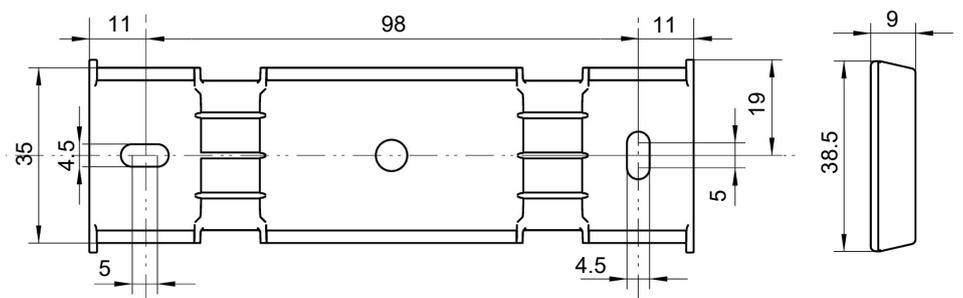


Fig. 8: Mounting rail

Process connections

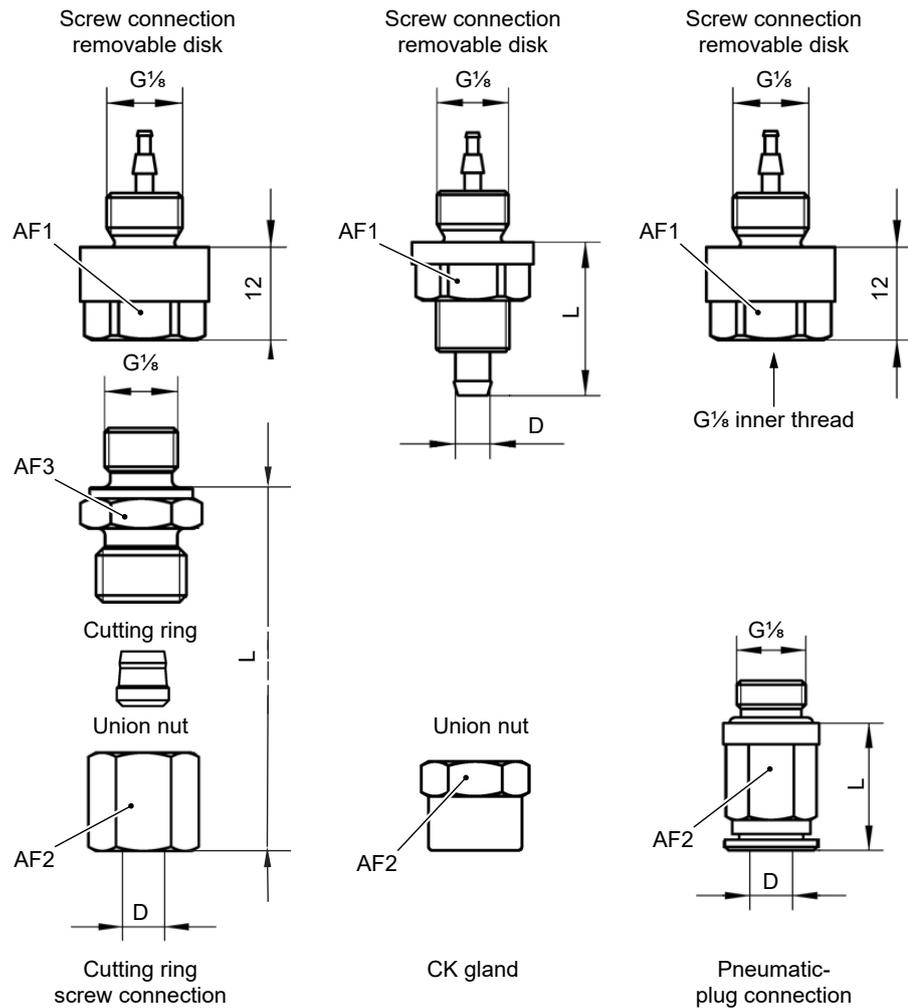
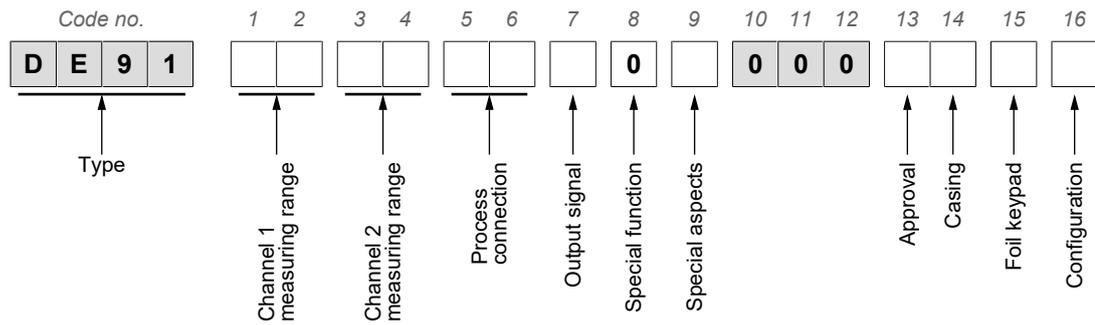


Fig. 9: Process connection Options

Prozessanschluss		D	d	L	AF1	AF2	AF3
Cutting ring screw connection	Pipe	6	---	23.5	14	14	14
		8	---	24.5	14	17	14
CK gland	Hose	6	4	21	14	12	---
		8	6	21	14	14	---
Pneumatic plug connection	Pneumatic hose	6	4	18	14	11	---
		8	6	20.5	14	13	---

D: outside diameter; d: inside diameter

3 Order codes



[1,2] Measuring ranges channel 1

Sensor type A (capacitive)		
D1	0 ...	25 Pa
J6	0 ...	50 Pa
D4	0 ...	100 Pa
D5	0 ...	160 Pa
D6	0 ...	250 Pa
D7	0 ...	400 Pa
J7	0 ...	500 Pa
D8	0 ...	600 Pa
D9	0 ...	1000 Pa
L4	-12.5 ...	+12.5 Pa
L5	-25 ...	+25 Pa
L2	-50 ...	+50 Pa
L0	-20 ...	+80 Pa
L7	-100 ..	+100 Pa
L6	-250 ...	+250 Pa
L8	-1 ...	+1 kPa

[3,4] Measuring ranges channel 2

00	without	
Sensor type A (capacitive)		
D1	0 ...	25 Pa
J6	0 ...	50 Pa
D4	0 ...	100 Pa
D5	0 ...	160 Pa
D6	0 ...	250 Pa
D7	0 ...	400 Pa
J7	0 ...	500 Pa
D8	0 ...	600 Pa
D9	0 ...	1000 Pa
L4	-12.5 ...	+12.5 Pa
L5	-25 ...	+25 Pa
L2	-50 ...	+50 Pa
L0	-20 ...	+80 Pa
L7	-100 ..	+100 Pa
L6	-250 ...	+250 Pa
L8	-1 ...	+1 kPa

[3,4] Measuring ranges channel 2			
<i>Sensor type B (piezoresistive)</i>			
E1	0 ...	1600 Pa	
E2	0 ...	2500 Pa	
E3	0 ...	4000 Pa	
E4	0 ...	6000 Pa	
N2	0 ...	1.6 kPa	
N3	0 ...	2.5 kPa	
N4	0 ...	4 kPa	
N5	0 ...	6 kPa	
E5	0 ...	10 kPa	
E6	0 ...	16 kPa	
E7	0 ...	25 kPa	
L9	-1.6 ...	+1.6 kPa	
M6	-2.5 ...	+2.5 kPa	
M7	-4 ...	+4 kPa	
M8	-6 ...	+6 kPa	
R8	-10 ...	+10 kPa	
R9	-16 ...	+16 kPa	
T1	-25 ...	+25 kPa	
[5,6] Process connection			
00	G $\frac{1}{2}$ Internal thread (aluminium)		
40	CK screw connection made of aluminium for 6/4 mm hose		
41	CK screw connection made of aluminium for 8/6 mm hose		
P6	Pneumatic push-in connector MS nickel-plated for 6/4 mm hose		
P8	Pneumatic push-in connector MS nickel-plated for 8/6 mm hose		
24	Stainless steel cutting ring fitting for 6 mm pipe		
25	Stainless steel cutting ring fitting for 8 mm pipe		
[7] Output signal			
0	without		
<i>Switchable, factory preset:</i>			
C	0 ... 10 V		
A	0 ... 20 mA		
P	4 ... 20 mA		
<i>Digital interface:</i>			
M	RS485 Modbus RTU (without switching outputs)		
N	RS485 Modbus RTU (with 4 switching outputs)		
I	IO-Link (with 4 switching outputs)		
[8] Special function			
0	without		
[9] Special features			
0	without		
E	Measuring accuracy $\pm 0.5\%$		
[13,14] Authorisation		Housing	Lid colour
00	without	Anthrazite	Green
R1	ATEX Zone 2 and 22	Black (conductive)	Black (conductive)

[15]	Membrane keypad
0	Fischer
1	neutral
[16]	Parameterisation
0	Standard
1	Linear characteristic curve
2	Flow rate
3	Table
4	Volume flow with K-factor
5	Formula
6	Dynamic filter monitoring
7	Difference
Z	customised

3.1 Accessories

M12 connection cables

Designation	No. of pins	Length	Order No.
PUR connection cable with M12 connector	4 pins	2 m	06401993
		5 m	06401994
		10 m	06401572
	5-pin	2 m	06401995
		5 m	06401996
		10 m	06401573
	8-pin	2 m	09001844
		5 m	09011146
		10 m	09011016

USB interface

Designation		Order No.
Connection cable, USB-A on USB micro-B connector	2 m	09007340
Stick USB 2.0, USB-A/micro-B connector	16 GB	09007316

Modbus

Designation		Order No.
Modbus terminating resistor	120 ohm socket	06411280
	120 ohm connector	06411279

Connection set

To connect the differential pressure transmitter to the ventilation channels comprising

- 2 x PVC hose
- 2 x ABS weld socket incl. attachment screws.

Designation	Hose	Length	Order No.
Plastic connection set	2 x 6/4 mm	1 m	04005129
		2.5 m	04005148
		5 m	04005163
		10 m	04005216
	2 x 8/6 mm	1 m	04005217
		5 m	04005218

Comments:

For 2-channel devices, two connection sets may be required in some circumstances.

Complete connection set

To connect the differential pressure transmitter to the ventilation channels comprising

- 2 x PVC hose
- 2 x ABS weld socket incl. attachment screws
- 2 x field-wireable M12 connector
 - Channel 1: 4-pin/5-pin socket
 - Channel 2: 8-pin/5-pin socket

Designation	Hose	Length	Order No.	
Complete connection set	1-channel	4/6 mm	1 m	06411560
		6/8 mm	1 m	06411561
	2 channels	4/6 mm	1 m	06411562
		6/8 mm	1 m	06411563

Recalibration connection set

To ensure correct measurements at all times, it is necessary to calibrate the pressure transducer regularly and bring it back in line with national or international standards.

Designation	Order No.
Recalibration connection set	06411887
2x Push-in T-fitting, male thread G1/8 Female thread G1/8 - for hose, outer Ø 6 mm	
2x Plug-in sleeve Ø 6 mm	
2x Ball valve QH-QS-6-1/8	

Accessories for outdoor use

Designation	Material	Order No.
Canopy	Stainless steel	02006130

Software

The inTouch configuration software is available for download on our website (fischermesstechnik.de).

3.2 Information about the document

This document contains all technical data about the device. Great care was taken when compiling the texts and illustrations. nevertheless, errors cannot be ruled out.

Subject to technical amendments.

Notes

Notes



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