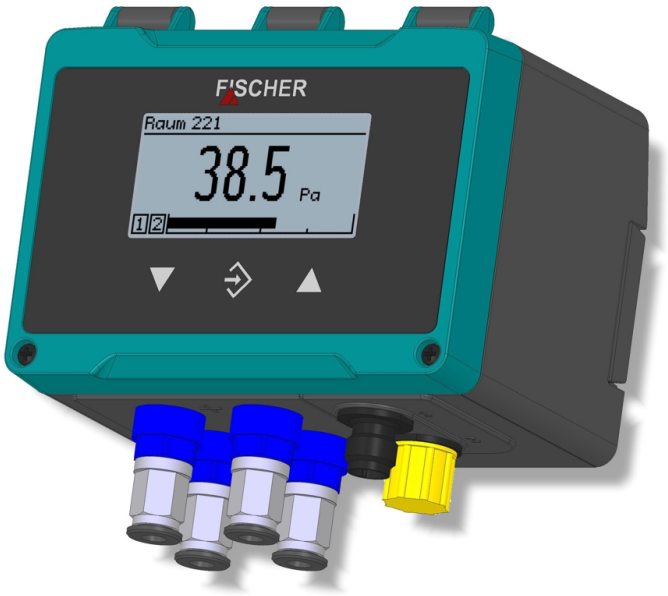
developing solutions

FISCHER
MESS- UND REGELTECHNIK

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

IO-Link Modbus



Data sheet

DE91

Differential pressure transmitter
PRO-LINE ®

for low pressure measurements

09015442 • DB_EN_DE91 • Rev. ST4-B • 07/24

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:

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:

II 3D Ex tc IIIB T125°C Dc

-20°C ≤ T_{amb} ≤ 60°C

1.3 Function diagram

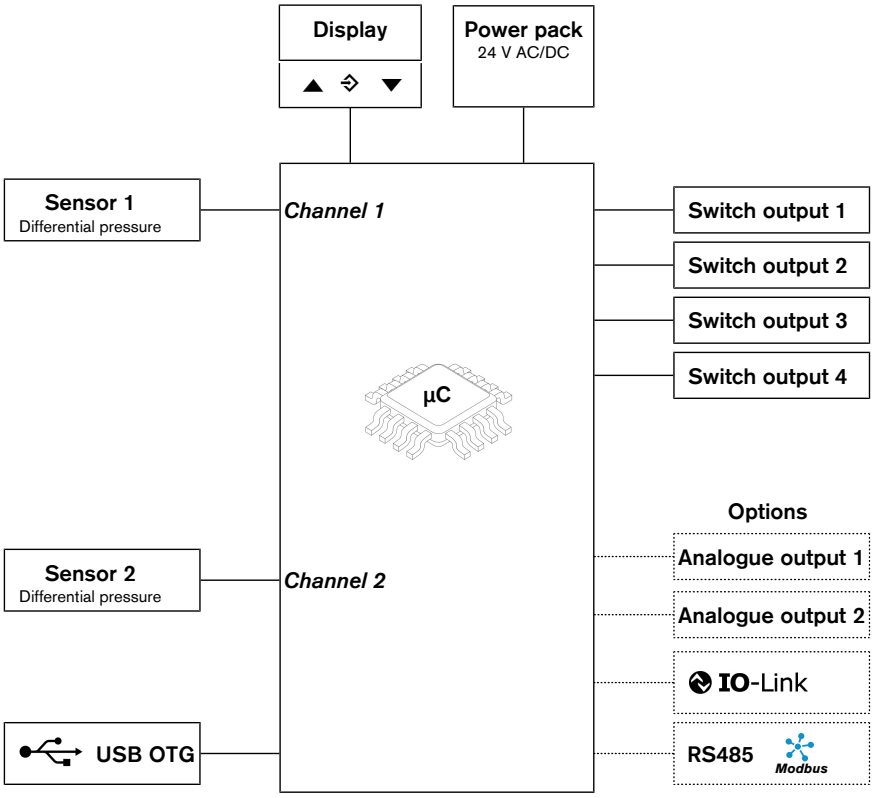


Fig. 1: Function diagram

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*)		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*)		IO-Link
			(Opt1)	(Opt2)	
USB interface	x	x	x	x	x
RS485 Modbus RTU			x	x	
IO-Link					x

*) 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.

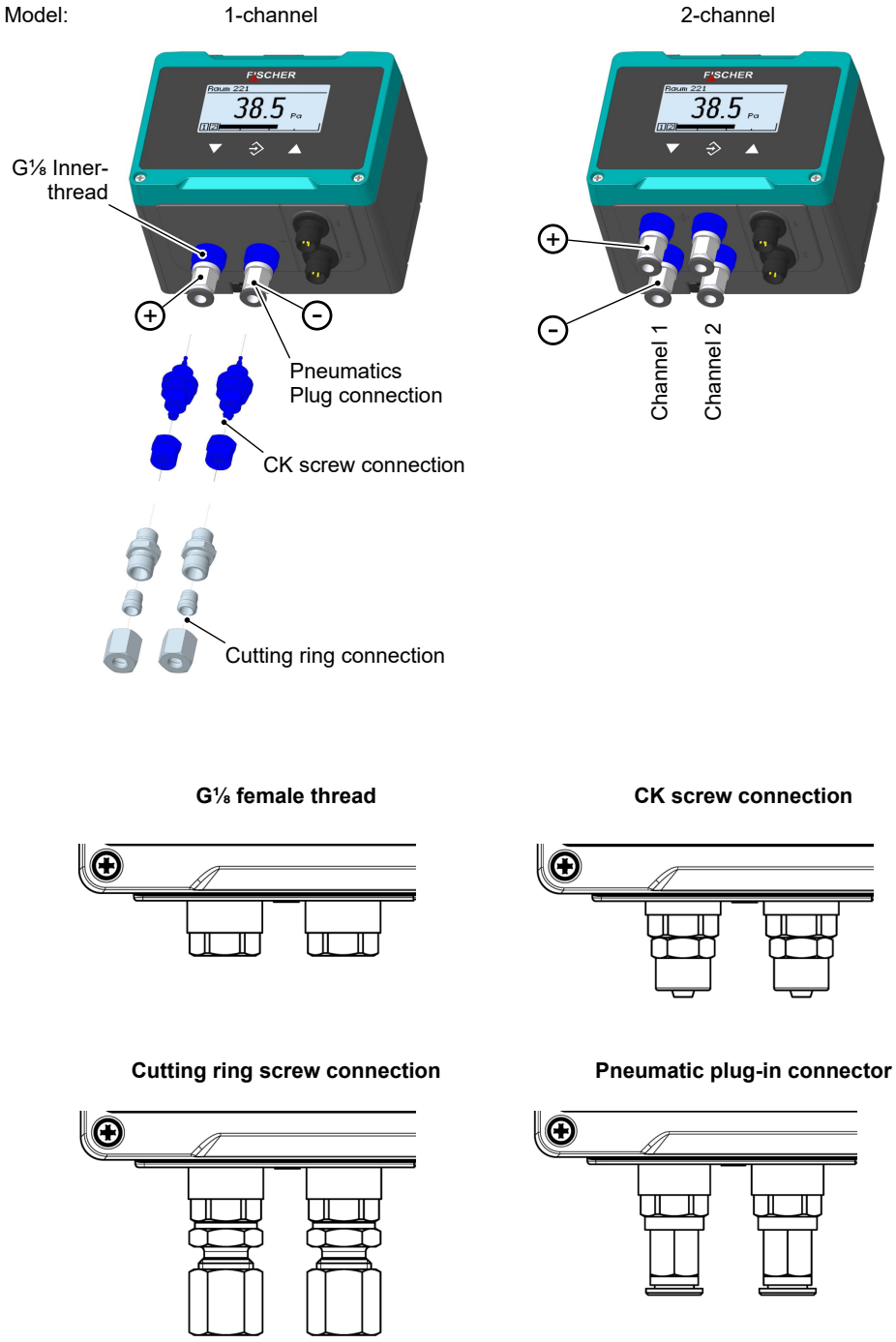


Fig. 2: Process connections

Electric connections

Two M12 flange connectors is installed for the electrical connection.

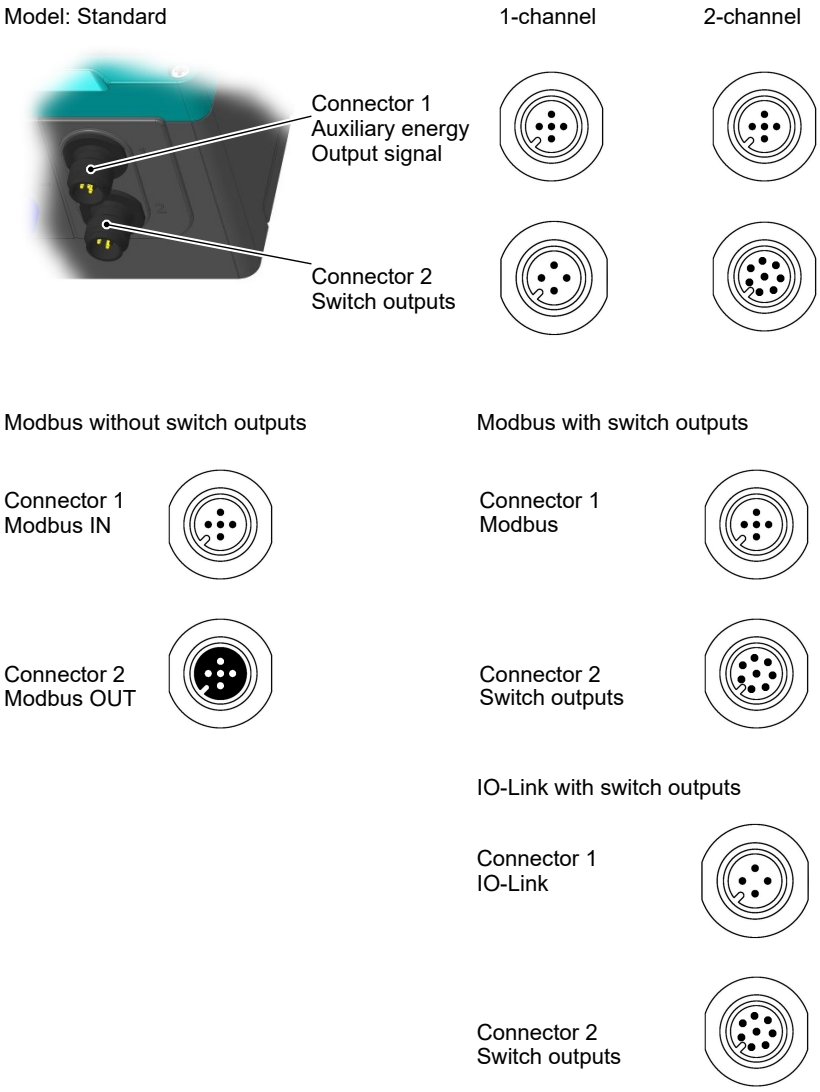


Fig. 3: Electric connections

ATEX model

Fig. 4: ATEX model

1.5.1 Type plate

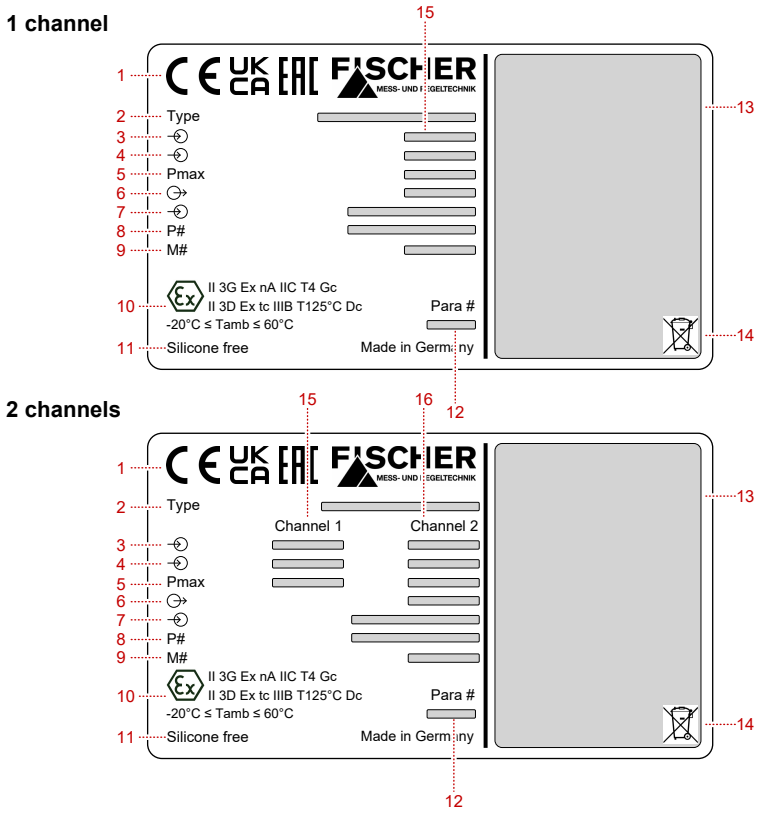


Fig. 5: Type plate

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 sizes

Analogausgänge

Die Anzahl der Analogausgänge ist von der Geräteausführung abhängig.

Geräteausführung	**1-Kanal**	**2-Kanal**
Anzahl der Analogausgänge	1	2

Das Ausgangssignal ist durch Parametrierung einstellbar. Bei Auslieferung werden beide Analogausgänge auf das gleiche Signal eingestellt (s. Typenschild).

Ausgangssignal	**0 … 20 mA** **4 … 20 mA**	**0 … 10 V** **2 … 10 V** **1 … 5 V**
Signalbereich	0,0 … 21,5 mA	0,0 … 10,5 V
Bürde R_L	≤ 600 Ω	≥ 2 kΩ
Turn down	4:1	4:1

Schaltausgänge

Die Anzahl der Schaltausgänge ist von der Geräteausführung abhängig. Die Zuordnung der Schaltausgänge zu den Kanälen ist frei parametrierbar.

Standardausführung	**1-Kanal**	**2-Kanal**
Anzahl der Schaltausgänge	2	4
Zuordnung bei Auslieferung	SP1-> Kanal 1 SP2-> Kanal 1	SP1-> Kanal 1 SP2-> Kanal 1 SP3-> Kanal 2 SP4-> Kanal 2

Modbus (Opt1)	**1-Kanal**	**2-Kanal**

Anzahl der Schaltausgänge	0	0
Zuordnung bei Auslieferung	---	--

Modbus (Opt2)	**1-Kanal**	**2-Kanal**
Anzahl der Schaltausgänge	4	4
Zuordnung bei Auslieferung	SP1-> Kanal 1 SP2-> Kanal 1 SP3-> Kanal 1 SP4-> Kanal 1	SP1-> Kanal 1 SP2-> Kanal 1 SP3-> Kanal 2 SP4-> Kanal 2

IO-Link	**1-Kanal**	**2-Kanal**
Anzahl der Schaltausgänge	4	4
Zuordnung bei Auslieferung	SP1-> Kanal 1 SP2-> Kanal 1 SP3-> Kanal 1 SP4-> Kanal 1	SP1-> Kanal 1 SP2-> Kanal 1 SP3-> Kanal 2 SP4-> Kanal 2

Typ	**Potentialfreier Halbleiterschalter (MOS-FET)**
progr. Schaltfunktion	Einpoliger Schließer (NO) Einpoliger Öffner (NC)
max. Schaltspannung	3…32 V AC/DC
max. Schaltstrom	0,25 A
max. Schaltleistung	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						
-20 … +80 Pa						

Measuring range	Measurement deviation [%]	Zero point [%/10K]	Span [%/10K]
-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**
Umgebungstemperaturbereich	-20 … +70 °C	-20 … +60 °C
Mediumtemperaturbereich	-20 … +70 °C	-20 … +60 °C
Lagerungstemperaturbereich	-20 … +70 °C	-20 … +70 °C
Schutzart	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 the parts in contact with the 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 the parts in contact with the environment
Polyester, PET, polyamide 6.6, aluminium, nickel-plated brass, stainless steel

2.9.2 Dimensional drawings

All dimensions in mm unless otherwise stated

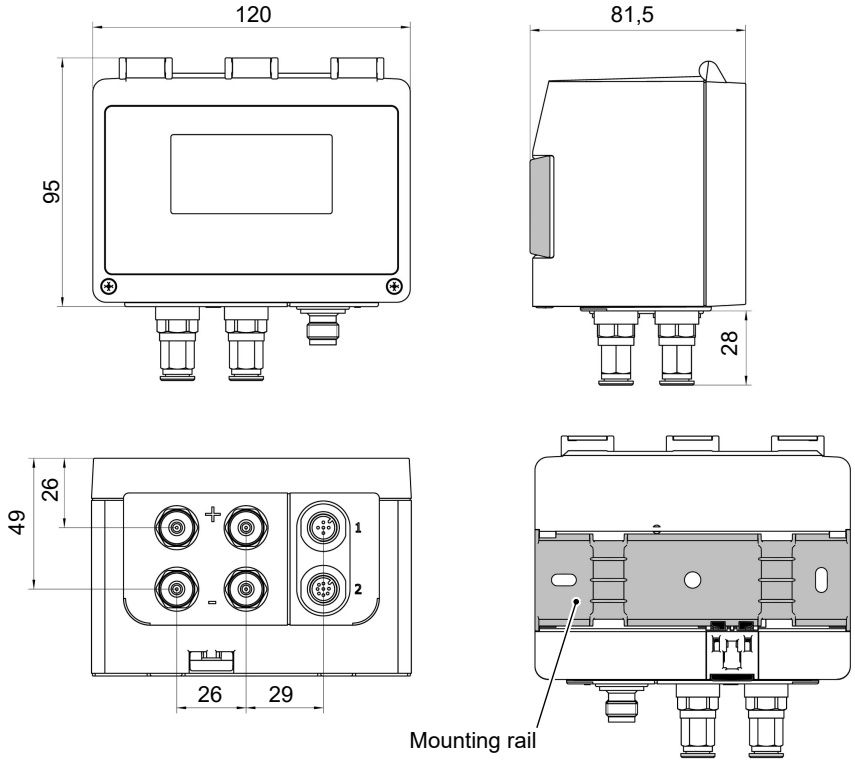


Fig. 6: Dimension drawing

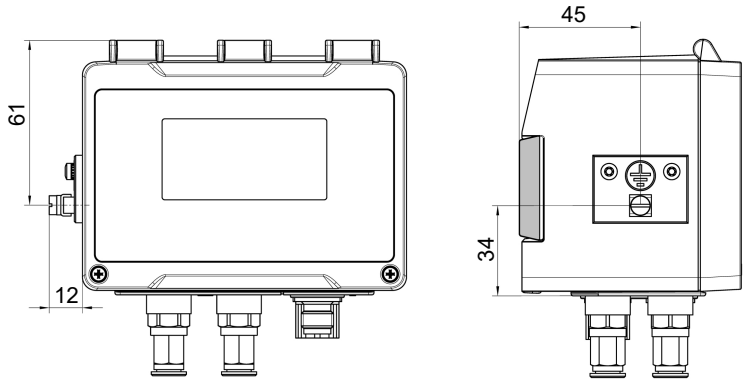


Fig. 7: Dimension drawing ATEX

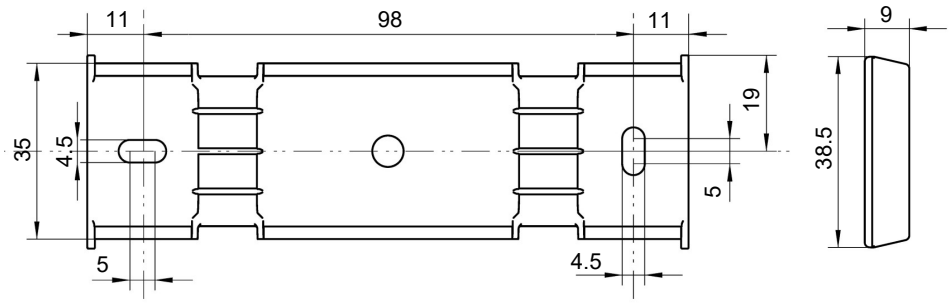


Fig. 8: Mounting rail

Process connections

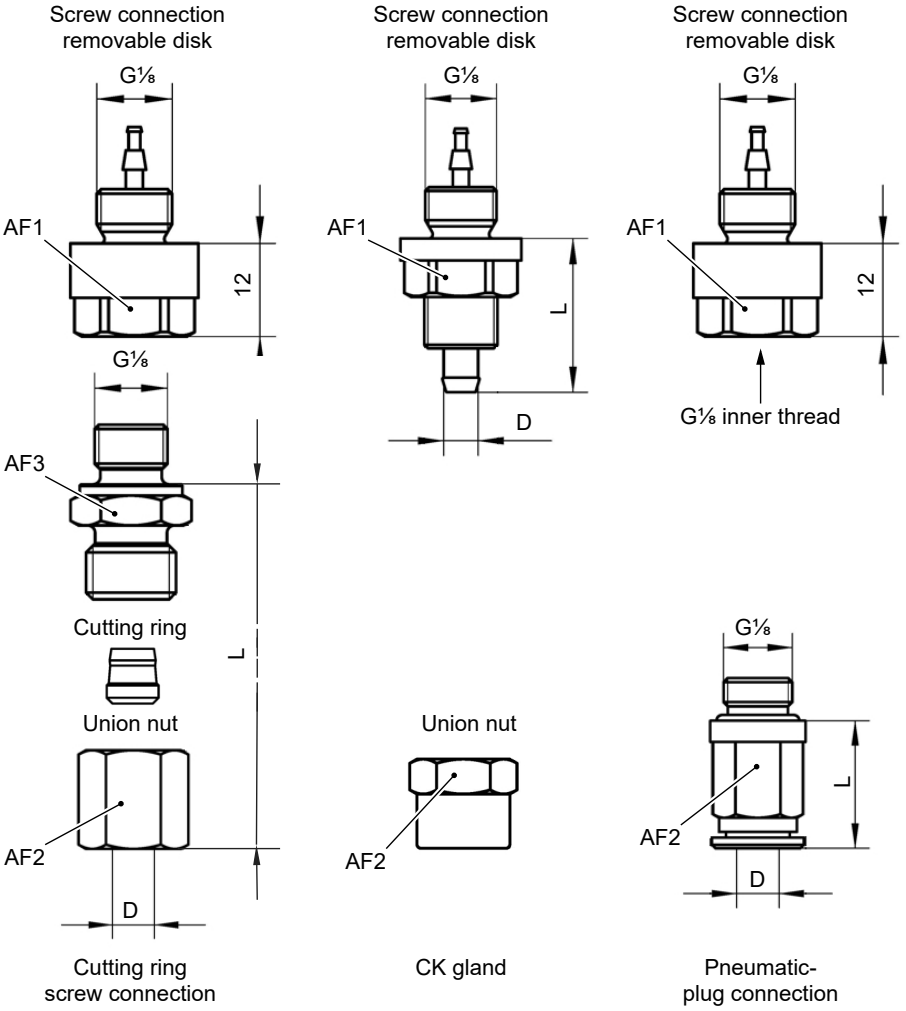
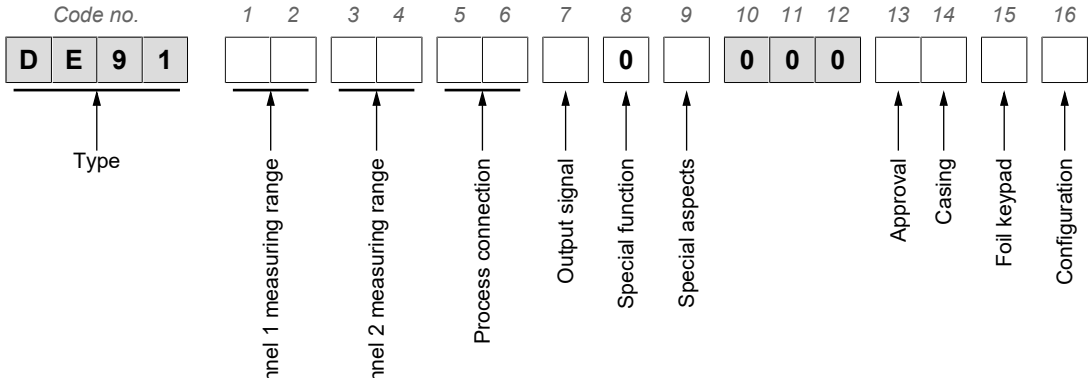


Fig. 9: Process connection Options

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	ohne		
	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

[3,4]	Measuring ranges channel 2		
L6	-250	…	+250 Pa
L8	-1	…	+1 kPa
	Sensor type B (piezoresistive)		
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	G⅛ 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	ohne
Switchable, factory preset:	
C	0 … 10 V
A	0 … 20 mA
P	4 … 20 mA
Digital interface:	
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	ohne
E	Measuring accuracy ±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	

Software

The configuration software inTouch is available at fischermesstechnik.de as a download.

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

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