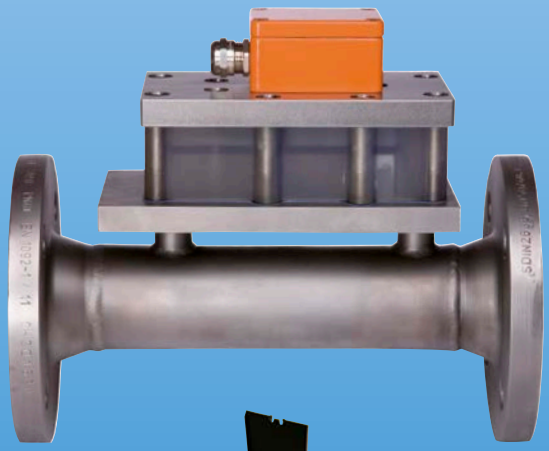
Oscillation Flowmeter

for gases

DOG-4



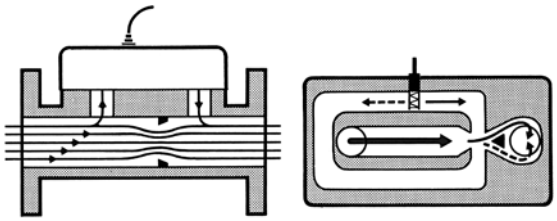
- Measuring ranges: 0.12 - 12 ... 60 - 6000 m^3/h air
- p_{max}: PN 40; t_{max}: 120 °C
- Connection: flange DN 25 ... DN 200
- Material: stainless steel
- Accuracy: ±1.5 % of reading
- No moving parts
- Long-term stability
- Options: flow computer, analogue and pulse outputs

S5

Order from: C A Briggs Company
622 Mary Street; Suite 101; Warminster, PA 18974
Phone: 267-673-8117 - Fax: 267-673-8118
Sales@cabriggs.com - www.cabriggs.com

Description

The KOBOLD flowmeter DOG-4 is used for flow measurement of gases.
The medium flows through an orifice in a tube. Bypass bores are located at the sides. The dynamic pressure at the orifice causes part of the gas volumetric flow to flow into the bypass. The division ratio remains constant over the whole measuring range.



The bypass channel contains the Oscillator – the Measuring cell itself. When the gas flows through the measuring cell, a gas column oscillates in a U-shaped channel mounted to the left and right. This oscillation frequency is proportional to the flow velocity and thus to the total volume flow. The oscillation frequency is sensed with a platinum sensor. An electrical alternating signal is generated that is displayed in the series connected electronics.

Application

The inner, connected flow channels are generously dimensioned. The constant changes of direction of the flow in the channels have a self-cleaning effect. The devices are therefore extremely dirt resistant and have no consumables. The mounting position can be chosen at will. When condensate forms in the gas, the horizontal mounting position with the sensing element pointing upwards is recommended. The gas flow velocity anywhere in the pipework upstream of the flowmeter should not exceed the sound velocity. Pressure drops above critical and pulsating streams must be avoided. The recommended inlet pipe section is 10 x DN and the outlet pipe section 5 x DN.
The version available with the bypass ball valves installed between the measuring head and the housing enables easy sensor replacement and/ or measuring head cleaning without flow interruption in main line/ flowmeter. The bypass valves also serve for sensor protection against mechanical damage during start-up.

Areas of Application

- Compressed air
- Natural gas, biogas, fermentation gas
- Propane
- Hydrogen gas
- Nitrogen
- Argon

Technical Details

Measuring accuracy:	±1.5% of reading (at $Q_t \leq$ MV ≤ 100%*) ±5% of reading (at 1% ≤ MV ≤ Q_t*) **The lower limit Q_t depends on the density* Q_t= 8% at density 1 kg/m³ Q_t= 4% at density 2 kg/m³ Q_t= 2% at density 4 kg/m³ Q_t= 1% at density ≥ 8 kg/m³
Repeatability:	0.1% of reading
Media temperature:	-20 ... +120 °C (non ATEX version) -20 ... +60 °C (ATEX version)
Ambient temperature:	-25 ... +80 °C (non ATEX version) -25 ... +60 °C (ATEX version)
Operating pressure:	see flange pressure rating
Span:	1:100
Sensor:	platinum sensor
Protection:	IP 65

Materials (Transmitter)

Housing:	stainless steel 1.4404 / 316L
Orifice:	stainless steel 1.4404 / 316L
Measuring head:	polyphenylene sulfide (PPS)
Sensor:	platinum
Gaskets:	Klinger SIL® C-4265, NBR
Ball valves:	stainless steel

Note:

Sponsored by the Federal Ministry of Economics and Technology on the basis of a resolution of the German Bundestag.

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Electronic Options

Electronics DOG-...A/B/C/D/E/F/R (Transducer with/without ATEX/IECEx certification)

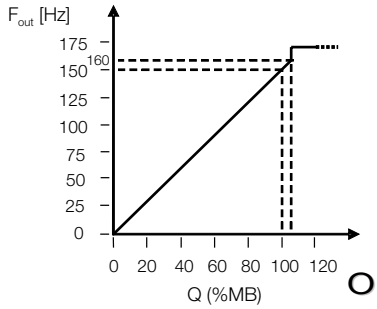
Power supply:

A:	230 V_{AC} ±10 %, 50 … 60 Hz (with ATEX/IECEx)
B:	230 V_{AC} ±10 %, 50 … 60 Hz (without ATEX/IECEx)
C:	110 V_{AC} ±10 %, 50 … 60 Hz (without ATEX/IECEx)
D:	110 V_{AC} ±10 %, 50 … 60 Hz (with ATEX/IECEx)
E:	24 V_{AC} ±10 %, 50 … 60 Hz (without ATEX/IECEx)
F:	24 V_{AC} ±10 %, 50 … 60 Hz (with ATEX/IECEx)
R:	24 V_{DC} ±20 %, (without ATEX/IECEx)
Input:	platinum sensor (Allowed distance: max. 50 m to transmitter)
Output:	opto coupler, frequency linear to flow (see graph below) V_{CE}: 12 - 24 V (recommended), max. 30 V I_C: max. 50 mA P_{tot}: 100 mW at 25 °C derating: 0.91 mW/°C
Ambient temperature:	-25 … +60 °C
Protection:	IP 20

Ex version (A/D/F):

ATEX	
Transducer:	⟨Ex⟩ II (1)G [Ex ia Ga] IIC
Sensor:	⟨Ex⟩ II 1 G Ex ia IIC T4 Ga
IECEx	
Transducer:	[Ex ia Ga] IIC
Sensor:	Ex ia IIC T4 Ga
Transducer Mounting:	DIN Rail
Dimensions:	
Width:	45 mm
Height:	105.6 mm
Depth:	113.6 mm
Weight:	approx. 200 g

Frequency/Flow Linearity



Electronics DOG-...G/H/I/K/L (Transducer without/with ATEX/IECEx certification and Flow rate/Unit counter, with current/pulse output)

Display:	alphanumeric LCD, UV-resistant with displayed functions: **Flow rate** (7 digits, 17 mm high) **Total** (7 digits, 17 mm high) **resettable** **Accumulated total** (11 digits, 8 mm high) **not resettable**
Units:	**Flow**: m^3, cf, scf, Nm^3 time units: /sec, /min, /hr, /day **Total**: m^3 **Accumulated total**: m^3
Decimal places:	**Flow**: 0, 1, 2 or 3 **Total**: 0, 1, 2 or 3 **Accumulated total**: according to selection for total
Backlighting:	yes
Signal input:	**Flow:** DOG-4 sensor
Power supply:	
G:	230 V_{AC} ± 10 %, 50 … 60 Hz (without ATEX/IECEx)
H:	230 V_{AC} ± 10 %, 50 … 60 Hz (with ATEX/IECEx)
I:	110 V_{AC} ± 10 %, 50 … 60 Hz (without ATEX/IECEx)
K:	110 V_{AC} ± 10 %, 50 … 60 Hz (with ATEX/IECEx)
L:	24 V_{DC} ± 20 %, (without ATEX/IECEx)
Electrical connection:	4 x M16x1.5 cable gland
Housing material:	ABS with PC cover
Weight:	approx. 1800 g
Analogue output:	4 … 20 mA (active), 10-Bit resolution, 3-wire
Pulse output:	PNP, 24 V_{DC} active max. 50 mA, scaled according to linearised accumulated total (e. g. pulse every 12 litres) pulse duration: user defined 0.008 s … 2 s max. frequency 64 Hz
Protection:	IP 65
Mounting:	wall mounting
Data protection:	EEPROM backup, backup of running totals every minute, data retention at least 10 years

Elektronic Options (continuation)

Communication:	Modbus RTU RS485 2-wire (optional, other Modbus versions on request)

Ex version (K):

ATEX	
Transducer:	Ⓔx II (1)G [Ex ia Ga] IIC
Sensor:	Ⓔx II 1 G Ex ia IIC T4 Ga
IECEx	
Transducer:	[Ex ia Ga] IIC
Sensor:	Ex ia IIC T4 Ga

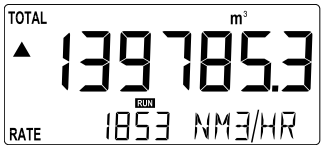
Electronics DOG-...M/N/O/P (Transducer without/with ATEX/IECEx certification and Flow computer)

Display:	alphanumeric LCD, UV-resistant with displayed functions: **Compensated flow rate** (7 digits, 17 mm high) **Compensated total** (7 digits, 17 mm high) resettable **Accumulated total** (11 digits, 8 mm high) not resettable **Actual line temperature** (6 digits) **Actual line pressure** (6 digits)
Units:	**Flow**: m^3, cf, scf, Nm^3 time units: /sec, /min, /hr, /day **Total**: m^3 **Accumulated total**: m^3 **Temperature**: °C, °F or K **Pressure**: mbar, bar, PSI
Decimal places:	**Flow**: 0, 1, 2 or 3 **Total**: 0, 1, 2 or 3 **Accumulated total**: according to selection for total **Temperature/Pressure**: 1
Backlighting:	yes
Signal input:	**Flow**: DOG-4 Sensor **Temperature**: PT100, 2- or 3-wire **Pressure**: 0(4) … 20 mA (passive), 14-Bit resolution, 2- or 3-wire
Power supply:	
M:	230 V_{AC} ± 10 %, 50 … 60 Hz (without ATEX/IECEx)
N:	230 V_{AC} ± 10 %, 50 … 60 Hz (with ATEX/IECEx)
O:	110 V_{AC} ± 10 %, 50 … 60 Hz (without ATEX/IECEx)
P:	110 V_{AC} ± 10 %, 50 … 60 Hz (with ATEX/IECEx)
Electrical Connection:	5 x M16x1.5 cable gland
Housing material:	ABS with PC cover
Weight:	approx. 1800 g
Analogue output:	4 … 20 mA (active), 10-Bit resolution, 3-wire
Pulse output:	PNP, 24 V_{DC} active max. 50 mA, scaled according to linearised accumulated total (e. g. pulse every 12 litres) pulse duration: user defined 0.001 s … 10 s max. frequency 500 Hz
Protection:	IP 65
Mounting:	wall mounting
Data protection:	EEPROM backup, backup of running totals every minute, data retention at least 10 years
Communication:	Modbus RTU RS485 2-wire (optional, other Modbus versions on request)

Ex version (P):

ATEX	
Transducer:	Ⓔx II (1)G [Ex ia Ga] IIC
Sensor:	Ⓔx II 1 G Ex ia IIC T4 Ga
IECEx	
Transducer:	[Ex ia Ga] IIC
Sensor:	Ex ia IIC T4 Ga

Display



Note: *Temperature and pressure sensors are not included in scope of delivery.*

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Order Details for DOG-4 (Example: **DOG-42S0S50 0 A0 0**)

Measuring range air [m³/h]	Model Material stainless steel	Pressure rating [PN]	Connection flange [size/type]	Ball valve	Electronics	Options
0.12 ... 12	**DOG-42S0S25..**	10 ... 40 bar	DN 25	**0** = without ball valve **1** = with ball valve	**B0** = frequency output, 230 V_{AC} **A0** = as 'B0', with ATEX/IECEx **C0** = frequency output, 110 V_{AC} **D0** = as 'C0', with ATEX/IECEx **E0** = frequency output, 24 V_{AC} **F0** = as 'E0', with ATEX/IECEx **R0** = frequency output, 24 V_{DC} **G0** = unit counter, pulse output, analogue output, 230 V_{AC} **H0** = as 'G0', with ATEX/IECEx **I0** = unit counter, pulse output, analogue output, 110 V_{AC} **K0** = as 'I0', with ATEX/IECEx **L0** = unit counter, pulse output, analogue output, 24 V_{DC} **M0** = flow computer, pulse output, analogue output, 230 V_{AC} **N0** = as 'M0', with ATEX/IECEx **O0** = flow computer, pulse output, analogue output, 110 V_{AC} **P0** = as 'O0', with ATEX/IECEx **Y0** = special (specify in clear text)	**0** = without **Y** = special option (specify in clear text)
0.2 ... 20	**DOG-4200S25..**					
0.35 ... 35	**DOG-4250S25..**					
0.7 ... 70	**DOG-42A0S25..**					
0.12 ... 12	**DOG-42S0A25..**	Class 150	ANSI 1"			
0.2 ... 20	**DOG-4200A25..**					
0.35 ... 35	**DOG-4250A25..**					
0.7 ... 70	**DOG-42A0A25..**					
0.12 ... 12	**DOG-42S0B25..**	Class 300				
0.2 ... 20	**DOG-4000B25..**					
0.35 ... 35	**DOG-4250B25..**					
0.7 ... 70	**DOG-42A0B25..**					
0.12 ... 12	**DOG-42S0S40..**	10 ... 40 bar	DN 40			
0.2 ... 20	**DOG-4200S40..**					
0.9 ... 90	**DOG-42A5S40..**					
2 ... 200	**DOG-42C0S40..**					
0.12 ... 12	**DOG-42S0A40..**	Class 150	ANSI 1 ½"			
0.2 ... 20	**DOG-4200A40..**					
0.9 ... 90	**DOG-42A5A40..**					
2 ... 200	**DOG-42C0A40..**					
0.12 ... 12	**DOG-42S0B40..**	Class 300				
0.2 ... 20	**DOG-4200B40..**					
0.9 ... 90	**DOG-42A5B40..**					
2 ... 200	**DOG-42C0B40..**					
0.12 ... 12	**DOG-42S0S50..**	10 ... 40 bar	DN 50			
0.2 ... 20	**DOG-4200S50..**					
1.1 ... 110	**DOG-42B0S50..**					
2.5 ... 250	**DOG-42C5S50..**					
0.12 ... 12	**DOG-42S0A50..**	Class 150	ANSI 2"			
0.2 ... 20	**DOG-4200A50..**					
1.1 ... 110	**DOG-42B0A50..**					
2.5 ... 250	**DOG-42C5A50..**					
0.12 ... 12	**DOG-42S0B50..**	Class 300				
0.2 ... 20	**DOG-4200B50..**					
1.1 ... 110	**DOG-42B0B50..**					
2.5 ... 250	**DOG-42C5B50..**					
1.4 ... 140	**DOG-42B5F80..**	16 bar	DN 80			
4.5 ... 450	**DOG-42D5F80..**					
8.0 ... 800	**DOG-42F0F80..**					

Order Details for DOG-4 (Example: **DOG-42S0S50 0 A0 0**) (continued)

Measuring range air [m³/h]	Model Material stainless steel	Pressure rating [PN]	Connection flange [size/type]	Ball valve	Electronics	Options
1.4 ... 140	**DOG-42B5S80..**	40 bar	DN 80	**0** = wihout ball valve **1** = with ball valve	**B0** = frequency output, 230 V_{AC} **A0** = as 'B0', with ATEX/IECEx **C0** = frequency output, 110 V_{AC} **D0** = as 'C0', with ATEX/IECEx **E0** = frequency output, 24 V_{AC} **F0** = as 'E0', with ATEX/IECEx **R0** = frequency output, 24 V_{DC} **G0** = unit counter, pulse output, analogue output, 230 V_{AC} **H0** = as 'G0', with ATEX/IECEx **I0** = unit counter, pulse output, analogue output, 110 V_{AC} **K0** = as 'I0', with ATEX/IECEx **L0** = unit counter, pulse output, analogue output, 24 V_{DC} **M0** = flow computer, pulse output, analogue output, 230 V_{AC} **N0** = as 'M0', with ATEX/IECEx **O0** = flow computer, pulse output, analogue output, 110 V_{AC} **P0** = as 'O0', with ATEX/IECEx **Y0** = special (specify in clear text)	**0** = without **Y** = special option (specify in clear text)
4.5 ... 450	**DOG-42D5S80..**					
8.0 ... 800	**DOG-42F0S80..**					
1.4 ... 140	**DOG-42B5A80..**	Class 150	ANSI 3"			
4.5 ... 450	**DOG-42D5A80..**					
8.0 ... 800	**DOG-42F0A80..**					
1.4 ... 140	**DOG-42B5B80..**	Class 300				
4.5 ... 450	**DOG-42D5B80..**					
8.0 ... 800	**DOG-42F0B80..**					
2.7 ... 270	**DOG-42D0F1H..**	16 bar	DN 100			
6.5 ... 650	**DOG-42E5F1H..**					
10 ... 1000	**DOG-42F5F1H..**					
2.7 ... 270	**DOG-42D0S1H..**	40 bar				
6.5 ... 650	**DOG-42E5S1H..**					
10 ... 1000	**DOG-42F5S1H..**					
2.7 ... 270	**DOG-42D0A1H..**	Class 150	ANSI 4"			
6.5 ... 650	**DOG-42E5A1H..**					
10 ... 1000	**DOG-42F5A1H..**					
2.7 ... 270	**DOG-42D0B1H..**	Class 300				
6.5 ... 650	**DOG-42E5B1H..**					
10 ... 1000	**DOG-42F5B1H..**					
6.0 ... 600	**DOG-42E0F1F..**	16 bar	DN 150			
12 ... 1200	**DOG-42G0F1F..**					
30 ... 3000	**DOG-42H0F1F..**					
6.0 ... 600	**DOG-42E0S1F..**	40 bar				
12 ... 1200	**DOG-42G0S1F..**					
30 ... 3000	**DOG-42H0S1F..**					
6.0 ... 600	**DOG-42E0A1F..**	Class 150	ANSI 6"			
12 ... 1200	**DOG-42G0A1F..**					
30 ... 3000	**DOG-42H0A1F..**					
6.0 ... 600	**DOG-42E0B1F..**	Class 300				
12 ... 1200	**DOG-42G0B1F..**					
30 ... 3000	**DOG-42H0B1F..**					

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Order Details for DOG-4 (Example: **DOG-42F0F80 0 A0 0**) (continued)

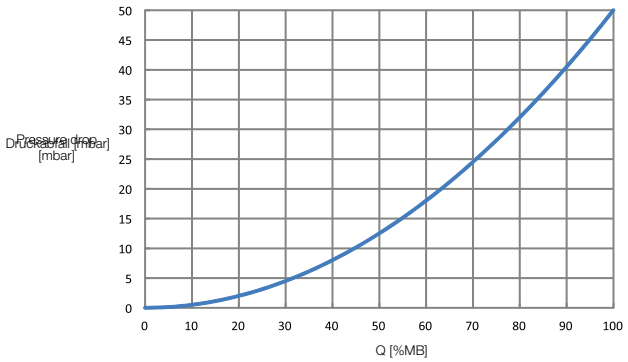
Measuring range air [m³/h]	Model Material stainless steel	Pressure rating [PN]	Connection flange [size/type]	Ball valve	Electronics	Options
12 ... 1200	**DOG-42G0E2H..**	10 bar	DN 200	**0** = without ball valve **1** = with ball valve	**B0** = frequency output, 230 V_{AC} **A0** = as 'B0', with ATEX/IECEx **C0** = frequency output, 110 V_{AC} **D0** = as 'C0', with ATEX/IECEx **E0** = frequency output, 24 V_{AC} **F0** = as 'E0', with ATEX/IECEx **R0** = frequency output, 24 V_{DC} **G0** = unit counter, pulse output, analogue output, 230 V_{AC} **H0** = as 'G0', with ATEX/IECEx **I0** = unit counter, pulse output, analogue output, 110 V_{AC} **K0** = as 'I0', with ATEX/IECEx **L0** = unit counter, pulse output, analogue output, 24 V_{DC} **M0** = flow computer, pulse output, analogue output, 230 V_{AC} **N0** = as 'M0', with ATEX/IECEx **O0** = flow computer, pulse output, analogue output, 110 V_{AC} **P0** = as 'O0', with ATEX/IECEx **Y0** = special (specify in clear text)	**0** = without **Y** = special option (specify in clear text)
25 ... 2500	**DOG-42G5E2H..**					
60 ... 6000 [1]	**DOG-42H5E2H..**					
12 ... 1200	**DOG-42G0F2H..**	16 bar				
25 ... 2500	**DOG-42G5F2H..**					
60 ... 6000 [1]	**DOG-42H5F2H..**					
12 ... 1200	**DOG-42G0S2H..**	40 bar				
25 ... 2500	**DOG-42G5S2H..**					
60 ... 6000 [1]	**DOG-42H5S2H..**					
12 ... 1200	**DOG-42G0A2H..**	Class 150	ANSI 8"			
25 ... 2500	**DOG-42G5A2H..**					
60 ... 6000 [1]	**DOG-42H5A2H..**					
12 ... 1200	**DOG-42G0B2H..**	Class 300				
25 ... 2500	**DOG-42G5B2H..**					
60 ... 6000 [1]	**DOG-42H5B2H..**					
Special	**DOG-42YYYYY..**	**Special**	**Special**			

[1] Calibrated up to 4000 m³/h. Higher flow rate calibration on request.

Order Details Accessories for DOG-4

DOG-4SEN01	DOG spare sensor with transport sleeve
DOG-4KAL01	DOG calibration software with connecting adapter

Pressure Loss/Flow



The diagram applies for gases with a density of air at NPT (0°C and 1013.25 mbar). The pressure loss is always proportional to the density of the gas. For example, the pressure loss doubles at 100% higher operating pressure.

Calculating the Actual Density

The actual density can be calculated with the following formula:

$$D = \frac{D_0 * P * T_0}{T}$$

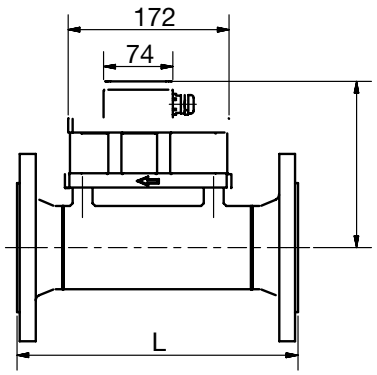
D_0 = density at 1 bar abs. and 0 °C (= 273 K)
T = temperature in K
(= °C + 273 for example 20 °C = 273 + 20 = 293 K)
T_0 = 273 K
P = operating pressure in bar (absolute pressure)

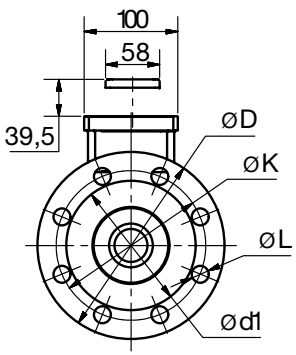
Calculating the Norm Flow

$$Q_N = Q \cdot \frac{P \cdot 273}{1.013 \cdot T}$$

Q_N = norm flow at 1.013 bar abs. and 0 °C
Q = operating flow
P = operating pressure in bar (absolute pressure)
T = operating temperature in K

Dimensions and Weights DOG-4 (without ball valve)





Dimensional details without ball valve									
DN [mm]	L (Length) [mm]	H (Height) [mm]	ØD (outer Ø) [mm]	ØK (pitch circle) [mm]	ØL (hole Ø) [mm]	Ød1 (sealing surface) [mm]	No. of screws	Screw size	Weight [kg]
25	300	150	115	85	14	68	4	M12	8.1
40	300	158	150	110	18	88	4	M16	10
50	300	164	165	125	18	102	4	M16	11.6
80	300	178	200	160	18	138	8	M16	14.4
100	320	191	220	180	18	58	8	M16	16.6
150	320	218	285	240	22	212	8	M20	24.8
200	320	243	340	295	22	268	8	M20	35.8

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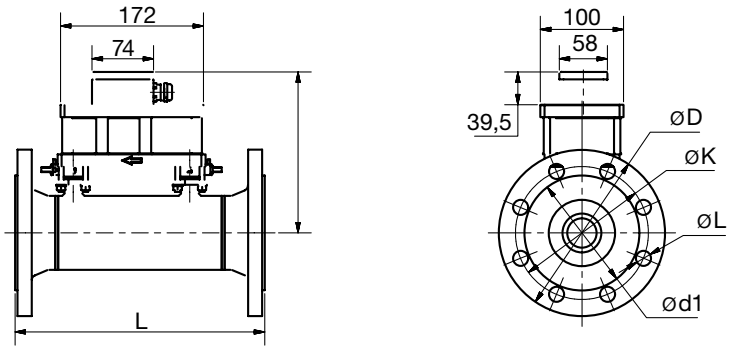
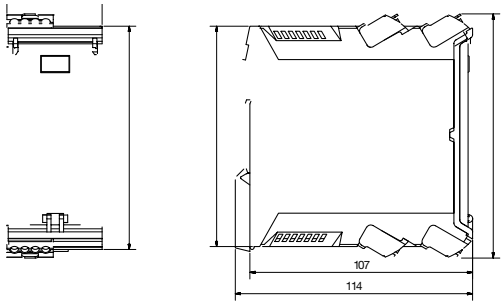
Dimensions and Weights DOG-4 (with ball valve)

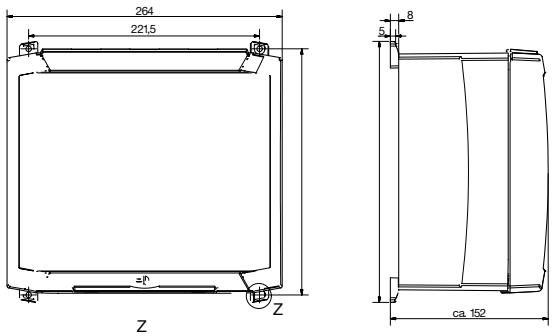


Dimensional details with ball valve									
DN [mm]	L (Length) [mm]	H (Height) [mm]	ØD (outer Ø) [mm]	ØK (pitch circle) [mm]	ØL (hole Ø) [mm]	Ød1 (sealing surface) [mm]	No. of screws	Screw size	Weight [kg]
25	300	166	115	85	14	68	4	M12	8.5
40	300	174	150	110	18	88	4	M16	10.4
50	300	180	165	125	18	102	4	M16	12
80	300	194	200	160	18	138	8	M16	14.8
100	320	207	220	180	18	58	8	M16	16.9
150	320	234	285	240	22	212	8	M20	25.3
200	320	259	340	295	22	268	8	M20	36.3

Dimensions Electronics DOG-...A/B/C/E/R



Dimensions Electronics DOG-...G/H/I/L/M/N/O



Accessories (optional)

- Replacement sensor
- Sealing for oscillator
- Recalibration tool for transmitter