Hybrid gas density monitor
With Modbus® or analogue 4 ... 20 mA output signal
Model GDM-100-T

Applications

- Medium and high-voltage equipment
- Gas density monitoring in closed SF$_6$ gas compartments
- Remote monitoring of the SF$_6$ condition
- Raising an alarm when defined limit values have been reached

Special features

- Ideally suited for smart grid or modernisation projects
- Modbus® delivers measured values for pressure, temperature and gas density as digital signal
- The 4 ... 20 mA version outputs the absolute pressure at 20 °C [68 °F] or the gas density in g/l as an analogue signal for SF$_6$ gas
- Compact design with only one process connection
- Suitable for alternative gases

Left: Hybrid gas density monitor with integrated transmitter, model GDM-100-T
Right: Hybrid gas density monitor with attached transmitter, model GDM-100-T

Description

Gas density is a crucial operating parameter for high-voltage plants. If the required gas density is not present, safe operation of the plant cannot be guaranteed.

The WIKA gas density measuring instruments provide reliable warnings against dangerously low gas levels, even under extreme ambient conditions. If the gas density drops as a result of a leakage, the switch contacts will switch. In addition to the traditional gas density monitor, with the model GDM-100-T high-precision sensors and evaluation electronics are incorporated.

Via the on-site display, the pressure based on 20 °C [68 °F] can be read directly on the instrument. With the integrated switch contacts, simple switching tasks can be realised quickly and without complication. The integrated 4 ... 20 mA or Modbus® sensors integrated or attached to the instrument enable remote monitoring of the plant.

The measured data for pressure, temperature and gas density are transmitted using the standardised Modbus® RTU protocol. The model GDM-100-T can also be configured for alternative gases consisting of N$_2$, CF$_4$, O$_2$, CO$_2$, 3M™, Novec™ 4710, He and Ar.

The analogue version of the GDM-100-T uses the proven technology of the 4 ... 20 mA analogue signal and outputs the absolute pressure at 20 °C [68 °F] or the gas density in g/l for SF$_6$ gas as an analogue signal.

The data storage enables trend analysis to be carried out, so that critical SF$_6$ gas conditions can be predicted and rectified in time. An optimisation of the maintenance strategy from time-based (TBM) to condition-based (CBM) is possible through the use of the gas density monitor.

TBM = Time Based Maintenance
CBM = Condition Based Maintenance

WIKA
Part of your business

Specifications of the gas density monitor

Nominal size
100

Calibration pressure P$_E$
To customer specification

Accuracy specifications
- ±1 % at an ambient temperature of 20 °C [68 °F]
- ±2.5 % at ambient temperature -20 … +60 °C [-4 ... +140 °F] and with calibration pressure in accordance with reference isochore (reference diagram KALI-Chemie AG, Hanover, prepared by Dr. Döring 1979)

Scale range
Vacuum and overpressure range with measuring span of 1.6 ... 16 bar [23 ... 232 psi]
(at an ambient temperature of 20 °C [68 °F] and gaseous phase)

Permissible ambient temperature
Operation: -20 ... +60 °C [-4 ... +140 °F]
Storage: -40 ... +60 °C [-40 ... +140 °F]

Process connection
G ½ B per EN 837, bottom stainless steel, spanner flats 22 mm
Other connections on request.

Pressure element
Stainless steel, welded
Gas-tight: Leakage rate ≤ 1 · 10^{-8} mbar · l / s
Test method: Helium mass spectrometry

Movement
Stainless steel
Bimetal link (temperature compensation)

Dial
Aluminium
The scale range is subdivided into red, yellow and green ranges

Pointer
Aluminium, black

Case
Stainless steel, with gas filling
Gas-tight: Leakage rate ≤ 1 · 10^{-5} mbar · l / s
Test method: Helium mass spectrometry

Window

Selectable versions	
Option 1	Laminated safety glass
Option 2	Acrylic glass

Ring
Bayonet ring, stainless steel, secured by means of 3 welding spots

Permissible air humidity
≤ 90 % r. h. (non-condensing)

Ingress protection
IP65 per IEC/EN 60529

Weight
approx. 1.4 kg [3.09 lb]

High-voltage test 100 %
2 kV, 50 Hz, 1 s

Switch contacts

Number of switch contacts

Selectable versions	
Option 1	1 magnetic snap-action contact
Option 2	2 magnetic snap-action contacts
Option 3	3 magnetic snap-action contacts

Switching directions

Selectable versions	
Option 1	Falling pressure
Option 2	Rising pressure

Switching functions

Selectable versions	
Option 1	Normally closed
Option 2	Normally open

Circuits

Selectable versions	
Option 1	Galvanically connected
Option 2	Galvanically isolated

Switching accuracy in the temperature range [-4 ... +140 °F]
Switch point = calibration pressure PE: Such as measuring span
Switch point ≠ calibration pressure P$_E$: Shifted parallel to calibration pressure

Switch points
Not adjustable and secured against adjustment.

Max. switching voltage
AC 250 V

Switching power
30 W / 50 SS, max. 1 A

Material of switch contacts
80 % Ag / 20 % Ni, gold-plated

For further information on magnetic snap-action contacts, see data sheet AC 08.01

Optional calibration valve

All weld seams are qualified in accordance with DIN EN ISO 15613 in combination with DIN EN ISO 15614-1 and DIN EN ISO 15614-12 by the notified body TÜV Süd.

Tightening torque, test connection: 40 Nm ±10 %
Gas-tight: Leakage rate ≤ 1 · 10^{-8} mbar · l/s

Sensor technology

Digital sensor technology, model GD-20-D

Compensated pressure in bar abs. at 20 °C [68 °F] (g/l SF_6)	Pressure in bar abs.	Temperature	Output parameters	Output signal
0 … 2 (12.28)	0 … 2.4	-40 … +80 °C [-40 ... +176 °F]	■ Density ■ Pressure at 20 °C [68 °F] ■ Pressure ■ Temperature	Modbus® RTU
0 … 3 (18.65)	0 … 3.7			
0 ... 6 (38.87)	0 ...7.5			
0 … 8 (53.4)	0 … 10.1			
0 … 10 (68.96)	0 … 12.9			
0 … 12 (85.79)	0 … 15.7			
0 … 16 (124.64)	0 … 21.3			

Accuracy specifications		
Accuracy [1]		
Compensated pressure ranges in bar abs. at 20 °C [68 °F] (g/l SF_6) 0 … 2 (12.28) 0 … 6 (38.87) 0 … 3 (18.65)	For -40 ... -20 °C [-40 ... -4 °F]	■ ±2 % (standard) ■ ±1.5 % (option)
	For -20 ... +80 °C [-4 ... +176 °F]	■ ±1.25 % (standard) ■ ±0.75 % (option)
Compensated pressure ranges in bar abs. at 20 °C [68 °F] (g/l SF_6) 0 … 8 (53.4) 0 … 10 (68.96) 0 … 12 (85.79) 0 … 16 (124.64)	For -40 ... +80 °C [-40 ... +176 °F]	■ ±1.25 % (standard) ■ ±0.6 % (option)
Pressure accuracy	■ ±1 % at 20 °C [68 °F] (standard) ■ ±0.2 % at 20 °C [68 °F] (option)	
Temperature accuracy	±1.5 K	
Reference conditions	Per IEC 61298-1	

[1] Specifications apply to measurement of the compensated pressure over the entire temperature range from -40 ... +80 °C [-40 ... +176 °F], valid only for pure SF_6 gas and a gas mixture consisting of 6 % 3M™ Novec™ 4710, 5 % O_2 and 89 % CO_2.

Analogue sensor technology, model GD-20-A

Compensated pressure range in bar abs. at 20 °C [68 °F] (g/l SF_6)	Accuracy [1]	Output parameters	Output signal
0 … 2 (12.28)	■ ±2 % (standard) ■ ±1.5 % (option)	Absolute pressure at 20 °C [68 °F]	4 ... 20 mA
0 … 3 (18.65)			
0 ... 6 (38.87)			
0 … 8 (53.4)			
0 … 10 (68.96)			
0 … 12 (85.79)			
0 … 16 (124.64)			

[1] Specifications apply to measurement of the compensated pressure over the entire temperature range from -40 ... +80 °C [-40 ... +176 °F], valid only for pure SF_6 gas. Accuracy is achieved after a maximum of 60 minutes operating time.

Density range in g/l SF$_6$ (compensated pressure in bar abs. at 20 °C [68 °F])	Accuracy [1]	Output parameters	Output signal
0 … 10 (1.64)	■ ±2 % (standard) ■ ±1.5 % (option)	SF$_6$ gas density in g/l	4 ... 20 mA
0 … 16 (2.59)			
0 ... 25 (3.97)			
0 … 40 (6.16)			
0 … 60 (8.87)			
0 … 80 (11.33)			

[1] Specifications apply to measurement of the compensated pressure over the entire temperature range from -40 ... +80 °C [-40 ... +176 °F], valid only for pure SF$_6$ gas. Accuracy is achieved after a max. of 60 minutes operating time.

Pressure reference
Absolute

Long-term stability at reference conditions
±0.1 % per year for the density signal

Overload safety and burst pressure

Compensated pressure range in bar abs. at 20 °C [68 °F] (g/l SF$_6$)	Overload safety in bar abs.	Burst pressure in bar abs.
0 ... 2 (12.28)	6.2	10
0 ... 3 (18.65)	14.5	24
0 ... 6 (38.87)	14.5	24
0 ... 8 (53.4)	31	52
0 ... 10 (68.96)	31	52
0 ... 12 (85.79)	31	52
0 ... 16 (124.64)	62	103

Case (attached transmitter)

Case	
Case material	316L
Case options	■ Cable outlet ■ Metal cable outlet, shield optionally connected (heavy-duty version)

Suitable for the following gases

■ SF$_6$
■ N$_2$
■ CF$_4$
■ O$_2$
■ CO$_2$
■ 3M™ Novec™ 4710
■ He
■ Ar

Gas mixtures and components can be individually configured and combined ex-works. The calculation is based on the physical principle of the partial pressure method. The gas mixture cannot be changed subsequently.

Output signal

Output signal	
Voltage supply	DC 10 … 30 V
Power consumption	
Model GD-20-A	≤ 0.75 W
Model GD-20-D	≤ 0.45 W
Maximum permissible load R_A (model GD-20-A)	$R_A \leq (U_B - 9.5\,V) / 0.023\,A$ with R_A in ohm and U_B in V
Time response	
Settling time [1]	< 10 ms
Switch-on time [2]	≤ 500 ms

1) e.g. with any sudden pressure spikes
2) Time after switching on until the first measured value is output.

Electrical connections with integrated transmitter

Electrical connection, digital versions (model GD-20-D)
Modbus®-RTU via RS-485 interface in rear cable socket

Rear cable socket		
1	-	-
2	U_+	DC 10 ... 30 V
3	U_-	Mass
4	A	RS-485 signal
5	B	RS-485 signal
6	-	-

Electrical connection, analogue version (model GD-20-A)
4 … 20 mA current signal in rear cable socket

Rear cable socket		
1	U_+	DC 10 ... 30 V
2	-	-
3	U_-	Mass
4	-	-
5	-	-
6	-	-

Electrical connections with attached transmitter

Electrical connection, digital versions (model GD-20-D)
- Modbus®-RTU via RS-485 interface
- Circular connector M12 x 1 metal (5-pin)
- Circular connector M12 x 1 plastic (5-pin)

Circular connector M12 x 1 (5-pin)			
	1	-	-
	2	U_+	Supply voltage
	3	U_-	Mass
	4	A	Signal RS-485
	5	B	Signal RS-485

Electrical connection, analogue version (model GD-20-A)
- Circular connector M12 x 1 metal (5-pin)
- Circular connector M12 x 1 plastic (5-pin)

Circular connector M12 x 1 (5-pin)			
	1	U_+	Supply voltage
	2	-	-
	3	U_-	Mass
	4	-	-
	5	-	-

Output parameters

Output parameters, digital versions (model GD-20-D)
- Absolute pressure at 20 °C [68 °F]: bar, MPa, kPa, psi, Pa, N/cm^2
- Gauge pressure based on 1,013 mbar at 20 °C [68 °F]: bar, MPa, kPa, psi, Pa, N/cm^2
- Density: g/litre, kg/m^3
- Temperature: °C, °F, K
- Absolute pressure: bar, MPa, kPa, psi, Pa, N/cm^2
- Gauge pressure based on 1,013 mbar: bar, MPa, kPa, psi, Pa, N/cm^2

Output parameters, analogue version (model GD-20-A)
Absolute pressure at 20 °C [68 °F] or gas density in g/l for SF_6 gas as 4 ... 20 mA-current signal

Operating conditions

Operating conditions		
Electrical safety		
Model GD-20-D	Reverse polarity voltage U_+ vs. U_-	DC 30 V
Model GD-20-A	Reverse polarity voltage U_+ vs. U_-	DC 40 V

EMC tests

EMC tests	
Immunity to EMF	30 V/m (at 80 MHz to 6 GHz)
Immunity against surge voltages (surge) per IEC 61000-4-5	1 kV, non-symmetrical, cables to ground, RS485A to RS485B, U_+ vs. U_-
ESD per IEC 61000-4-2	8 kV contact discharge, 15 kV indirect discharge, 8 kV indirect discharge
Immunity against conducted HF signals in accordance with IEC 61000-4-6	10 V at 150 kHz to 80 MHz
Immunity against fast transients (burst) per IEC 61000-4-4	4 kV

Approvals

Approvals included in the scope of delivery

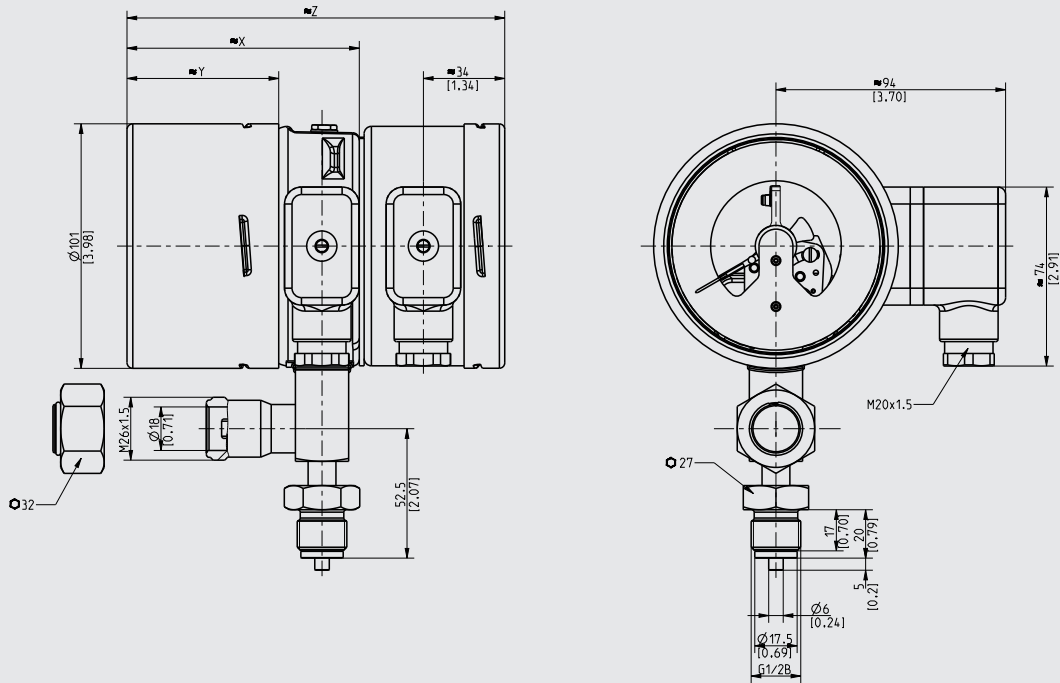| Logo	Description	Country
CE	**EU declaration of conformity**	European Union
	EMC directive EN 61326 emission (group 1, class B) and immunity (industrial application)	
	RoHS directive	

→ For approvals and certificates, see website

Dimensions in mm
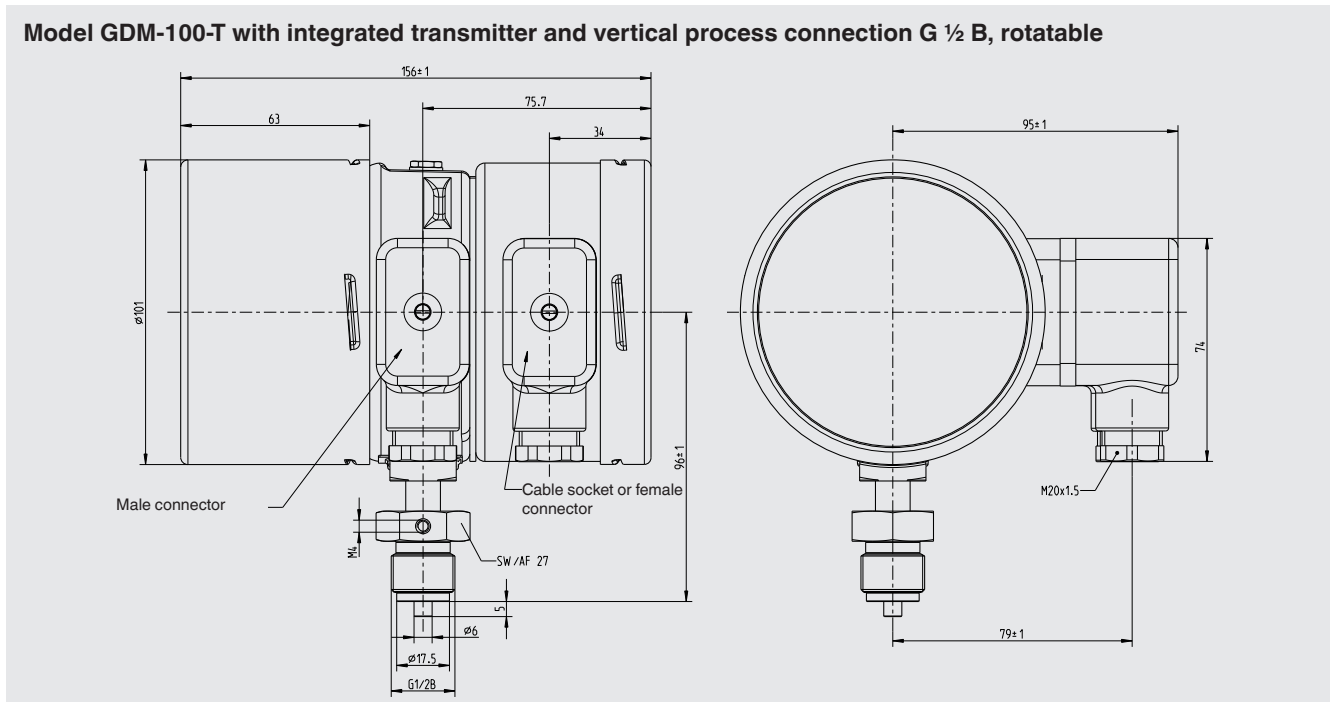
**Model GDM-100-T with integrated transmitter and vertical process connection G ½ B, rotatable**
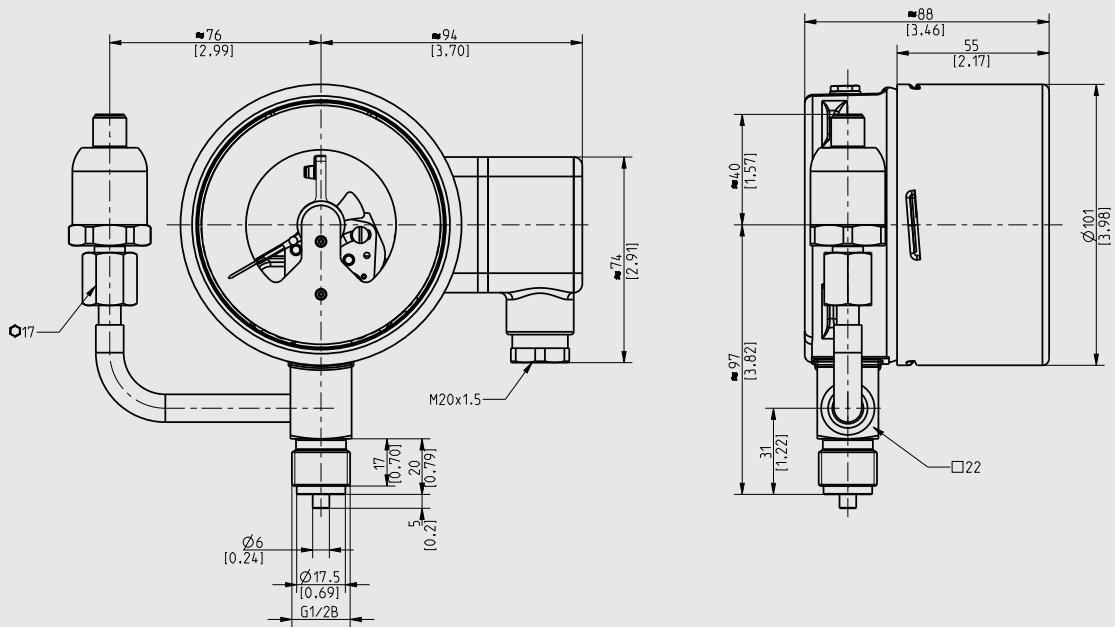
Model GDM-100-T with attached digital transmitter and vertical process connection G ½ B

≈76
[2.99]

≈94
[3.70]

≈88
[3.46]

55
[2.17]

74
[2.91]

⌀101
[3.98]

40
[1.57]

≈97
[3.82]

31
[1.22]

○17

M20x1.5

□22

17
[0.70]

20
[0.79]

5
[0.2]

⌀6
[0.24]

⌀17.5
[0.69]

G1/2B

Model GDM-100-T with integrated transmitter and vertical process connection G ½ B with calibration valve

≈Z

≈X

≈Y

≈34
[1.34]

≈94
[3.70]

⌀101
[3.98]

74
[2.91]

M26x1.5

⌀18
[0.71]

52.5
[2.07]

○32

M20x1.5

○27

17
[0.70]

20
[0.79]

5
[0.2]

⌀6
[0.24]

⌀17.5
[0.69]

G1/2B

Model GDM-100-T with attached digital transmitter and vertical process connection G ½ B with calibration valve
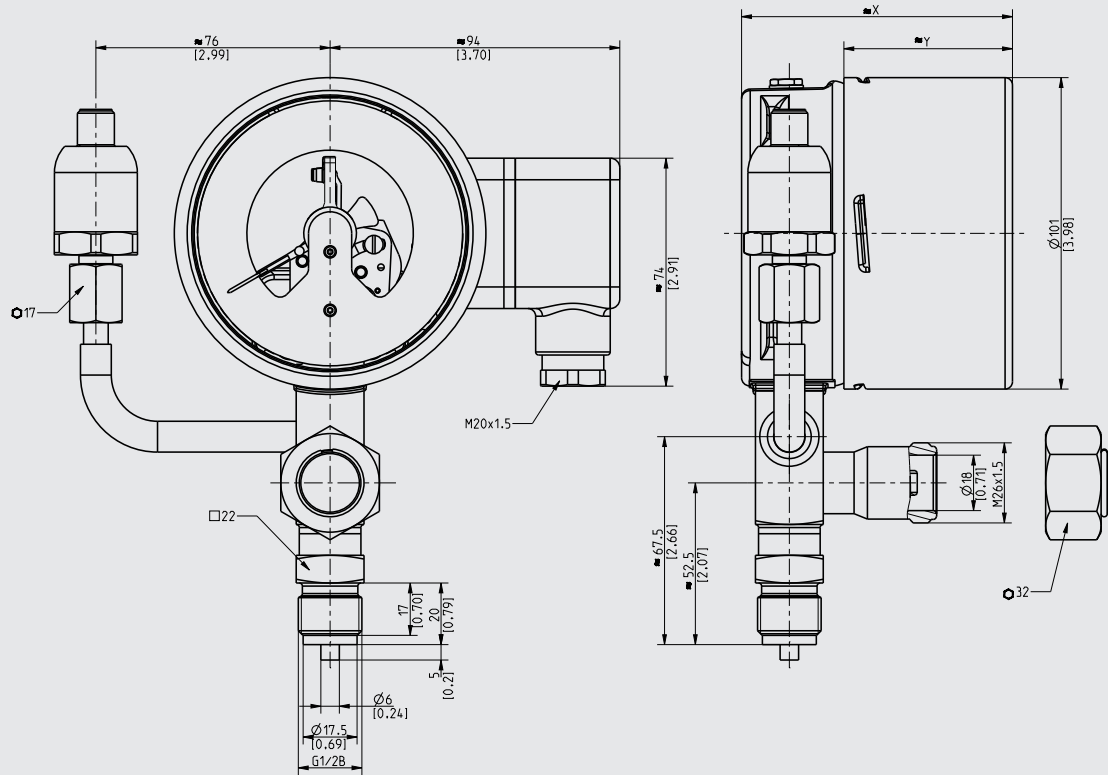
Model GDM-100-T with rear attached digital transmitter and vertical process connection G ½ B
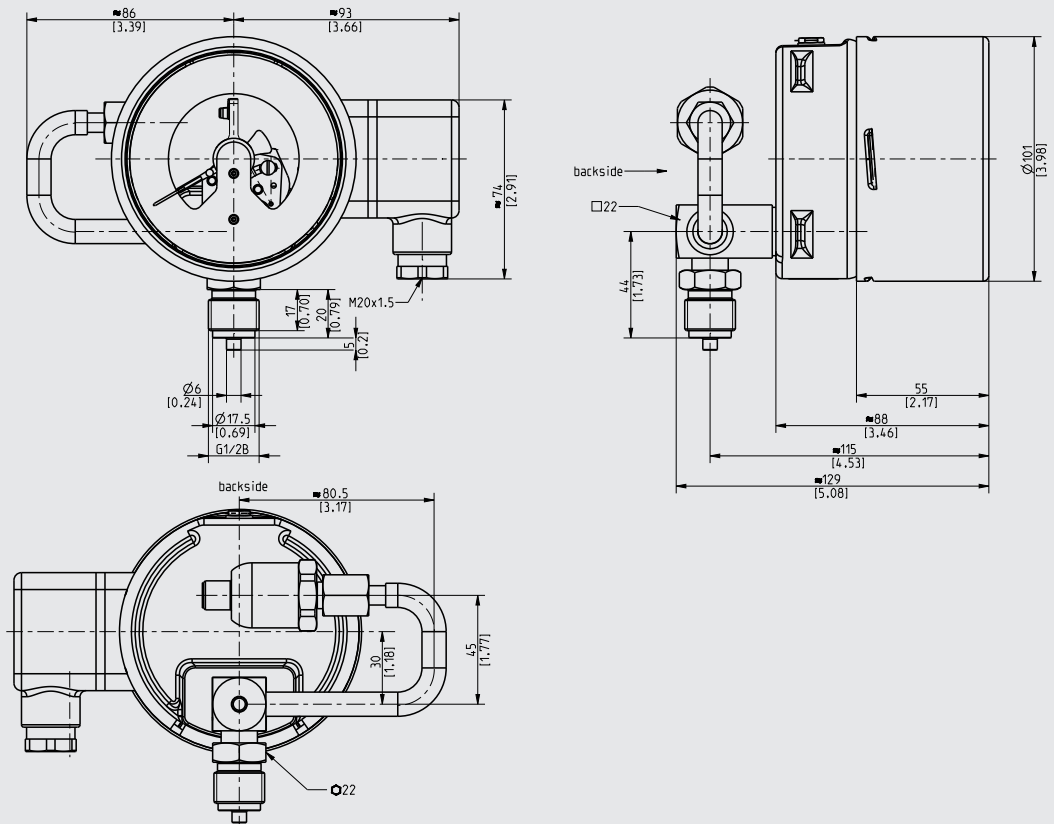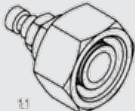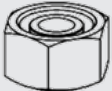
Optional versions, model GDM-100-T with attached analogue GD-20-A transmitter

Designation	Case ingress protection	Temperature range in °C	Shield provided by customer	Shield connected on the instrument side	Assignment U+	U-
Cable outlet 2 m, plastic	IP67	-40 ... +80 °C [-40 ... +176 °F]	Yes	-	Brown	Blue
Cable outlet 5 m, plastic			Yes	-		
Cable outlet 10 m, plastic			Yes	-		
Cable outlet 2 m, SS			Yes	-		
Cable outlet 5 m, SS			Yes	-		
Cable outlet 10 m, SS			Yes	-		
Cable outlet 2 m, shield connected, SS			Yes	Yes		
Cable outlet 5 m, shield connected, SS			Yes	Yes		
Cable outlet 10 m, shield connected, SS			Yes	Yes		

Accessories

Model	Description	Order number
Modbus® start-up kit	■ Power supply unit for sensor ■ Connection cable ■ Interface converter (RS-485 to USB) ■ USB cable type A to type B ■ Modbus® tool software on USB stick	14075896
WIKAsoft-GD for configuration and testing of the digital sensor	Free download from: www.wika.com/download	-
Optional accessories		
Recalibration valve	Model GLTC-CV ■ Enables easy recalibration of the gas density monitor without dismounting ■ Welded permanently to the instrument or available as loose valve for retrofitting	-
Connection cable for Switching outputs	■ Terminal without wiring ■ Connector mounted on the instrument side, cable with loose ends	-

Accessories for version with calibration valve

	Description	Order number
	Adapter from test connection (M26 x 1.5) to quick coupling	14146937
	Protective cap for test connection (M26 x 1.5)	14193772
	Calibration system for SF_6 gas density measuring instruments, model BCS-10	See WIKA data sheet SP 60.08
	Calibration system for SF_6 gas density measuring instruments, model ACS-10	See WIKA data sheet SP 60.15

Ordering information for mechanical instrument

Model (with attached or integrated transmitter) / Process connection and connection location / Pressure unit at 20 °C [68 °F] / Filling pressure / Number of switch points / Switch configuration at 20 °C [68 °F] / Gas mixture / Dial layout / Optional accessories

Sensor ordering information

Model (analogue or digital) / Compensated pressure range / Accuracy / Gas mixture

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