

# Gas density sensor

## For gas density, temperature and pressure of insulating gases

### Model GD-20 with Modbus<sup>®</sup> or analogue 4 ... 20 mA signal

WIKA data sheet SP 60.77

#### Applications

- Permanent monitoring of the relevant gas condition parameters in closed tanks
- For internal and external SF<sub>6</sub>-insulated equipment
- Density measurement of alternative gases in electrical equipment or in the laboratory

#### Special features

- High-accuracy sensor technology
- Digital MODBUS<sup>®</sup> RTU or analogue 4 ... 20 mA output signal
- IP67 ingress protection, optionally with IP6k9k field case
- Very good long-term stability and EMC characteristics
- Compact design



**Fig. left: Model GD-20-D, plastic circular connector**

**Fig. centre: Model GD-20-D, metal circular connector**

**Fig. right: Model GD-20-A, metal circular connector**

#### Description

##### Permanent monitoring

In order to prevent system failures in switchgear and network outages, the permanent monitoring of the gas density is essential.

The model GD-20 calculates the current gas density from the pressure and temperature using a complex virial equation in the gas density sensor's powerful microprocessor. Pressure changes resulting from thermal effects will be compensated by this and will not affect the output value.

##### MODBUS<sup>®</sup> fieldbus

The RS-485 interface communicates using the MODBUS<sup>®</sup> RTU protocol. The instrument's output parameters and their units can be configured and read according to requirements. The GD-20 model can be freely configured at the factory for any defined gas mixture consisting of SF<sub>6</sub>, N<sub>2</sub>, CF<sub>4</sub>, O<sub>2</sub>, CO<sub>2</sub>, 3M<sup>™</sup> Novec<sup>™</sup> 4710, He and Ar.

The calculation is based on the partial pressure method of the individual gas components.

##### Signal stability

Due to its high long-term stability, the sensor is maintenance-free and requires no recalibration. Due to the hermetically sealed weld seam and a measuring cell design without sealing elements, the permanent sealing of the measuring cell is ensured.

The gas density sensor is also available with analogue output signal (4 ... 20 mA) for output of the compensated pressure (p at 20 °C [68 °F]).

# Specifications

## Digital sensor technology, model GD-20-D

Compensated pressure range in bar abs. at 20 °C [68 °F] (g/l SF <sub>6</sub> )	Pressure in bar abs.	Temperature	Output parameters	Output signal
0 ... 2 (12.28)	0 ... 2.4	-40 ... +80 °C [-40 ... +176 °F]	<ul style="list-style-type: none"> <li>■ Density</li> <li>■ Pressure at 20 °C [68 °F]</li> <li>■ Pressure</li> <li>■ Temperature</li> </ul>	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 <sup>1)</sup>

Compensated pressure range in bar abs. at 20 °C [68 °F] (g/l SF <sub>6</sub> ) 0 ... 2 (12.28) 0 ... 6 (38.87) 0 ... 3 (18.65)	For -40 ... -20 °C [-40 ... -4 °F]	<ul style="list-style-type: none"> <li>■ ±2 % (standard)</li> <li>■ ±1.25 % (option)</li> </ul>
	For -20 ... +80 °C [-4 ... +176 °F]	<ul style="list-style-type: none"> <li>■ ±1.5 % (standard)</li> <li>■ ±0.75 % (option)</li> </ul>
Compensated pressure range in bar abs. at 20 °C [68 °F] (g/l SF <sub>6</sub> ) 0 ... 8 (53.4) 0 ... 10 (68.96) 0 ... 12 (85.79) 0 ... 16 (124.64)	For -40 ... +80 °C [-40 ... +176 °F]	<ul style="list-style-type: none"> <li>■ ±1.25 % (standard)</li> <li>■ ±0.6 % (option)</li> </ul>
<b>Pressure accuracy</b>	<ul style="list-style-type: none"> <li>■ ±1 % at 20 °C [68 °F] (standard)</li> <li>■ ±0.2 % at 20 °C [68 °F] (option)</li> </ul>	
<b>Temperature accuracy</b>	±1.5 K	
<b>Reference conditions</b>	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<sub>6</sub> gas and a gas mixture consisting of 6 % Novec 4710, 5 % O<sub>2</sub> and 89 % CO<sub>2</sub>.

## Analogue sensor technology, model GD-20-A

Compensated pressure range in bar abs. at 20 °C [68 °F] (g/l SF <sub>6</sub> )	Accuracy <sup>1)</sup>	Output parameters	Output signal
0 ... 2 (12.28)	<ul style="list-style-type: none"> <li>■ ±2 % (standard)</li> <li>■ ±1.5 % (option)</li> </ul>	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<sub>6</sub> gas. Accuracy is achieved after a maximum 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)	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

Case	
Case material	316L
Case options	<ul style="list-style-type: none"> <li>■ Field case</li> <li>■ Cable outlet</li> <li>■ Metal cable outlet, shield optionally connected (heavy-duty version)</li> </ul>

## Suitable for the following gases

- SF<sub>6</sub>
- N<sub>2</sub>
- CF<sub>4</sub>
- O<sub>2</sub>
- CO<sub>2</sub>
- Novec 4710
- He
- Ar

Gas mixtures and components can be individually configured and combined at the factory. 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
<b>Power consumption</b>	
Model GD-20-A	≤ 0.75 W
Model GD-20-D	≤ 0.45 W
<b>Maximum permissible load R<sub>A</sub> (model GD-20-A)</b>	$R_A \leq (U_B - 9.5 \text{ V}) / 0.023 \text{ A}$ with R <sub>A</sub> in Ohm and U <sub>B</sub> in V
<b>Time response</b>	
Settling time <sup>1)</sup>	< 10 ms
Switch-on time <sup>2)</sup>	≤ 500 ms

1) E.g. with any sudden pressure spikes

2) Time after switching on until the first measured value is output.


## Process connections

- G ½ B
- G ¼ B
- G ¾ B JIS
- ¼ NPT
- DN 6 via adapter
- DN 8 via adapter
- DN 20 via adapter
- Malmquist via adapter

## Electrical connections


### 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 <sub>+</sub> Supply voltage
	3	U <sub>-</sub> 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 <sub>+</sub> Supply voltage
	2	-
	3	U <sub>-</sub> 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<sup>2</sup>
- Gauge pressure based on 1,013 mbar at 20 °C [68 °F]: bar, MPa, kPa, psi, Pa, N/cm<sup>2</sup>
- Density: g/litre, kg/m<sup>3</sup>
- Temperature: °C, °F, K
- Absolute pressure: bar, MPa, kPa, psi, Pa, N/cm<sup>2</sup>
- Gauge pressure based on 1,013 mbar: bar, MPa, kPa, psi, Pa, N/cm<sup>2</sup>

### Output parameters analogue version (model GD-20-A)

Absolute pressure at 20 °C [68 °F] as 4 ... 20 mA current signal

## Operating conditions

Operating conditions		
<b>Vibration resistance</b>	<ul style="list-style-type: none"> <li>■ 5 g, 15 ... 2,000 Hz, for versions with field case</li> <li>■ 20 g, 30 ... 2,000 Hz, for versions without field case</li> </ul>	
<b>Shock resistance</b>		
Single shock loads	500 g (1.4 ms, 1 shock, 3 axes)	
Continuous shock	100 g (4 ms, 10,000 shocks, 3 axes)	
<b>Permissible temperature ranges</b>		
Ambient temperature	-40 ... +80 °C [-40 ... +176 °F]	
Storage temperature	-40 ... +70 °C [-40 ... +158 °F]	
<b>Permissible air humidity</b>	≤ 95 % r. h. (non-condensing)	
<b>Ingress protection <sup>1)</sup></b>		
M12 x 1 plastic	IP67, with mating connector	
M12 x 1 metal	IP67, with mating connector	
Cable outlet plastic	IP67, with cable	
Cable outlet metal	IP67, with cable	
Field case	IP6k9k, with cable/blind plug	
<b>Electrical safety</b>		
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

1) The respective IP protection rating applies to electrical outputs with plug-type design when plugged in or with cable/blind plug, respectively. The mating connector must be suitable for the required ingress protection.

## EMC tests

EMC tests	
<b>Immunity against EM fields</b>	30 V/m (at 80 MHz to 6 GHz)
<b>Immunity against surge voltages (surge) per IEC 61000-4-5</b>	1 kV, unbalanced, lines to earth, RS485A to RS485B, $U_+$ vs. $U_-$
<b>ESD per IEC 61000-4-2</b>	8 kV contact discharge, 15 kV indirect discharge, 8 kV indirect discharge
<b>Immunity against conducted HF signals in accordance with IEC 61000-4-6</b>	10 V at 150 kHz to 80 MHz
<b>Immunity against fast transients (burst) per IEC 61000-4-4</b>	4 kV

## Approvals

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

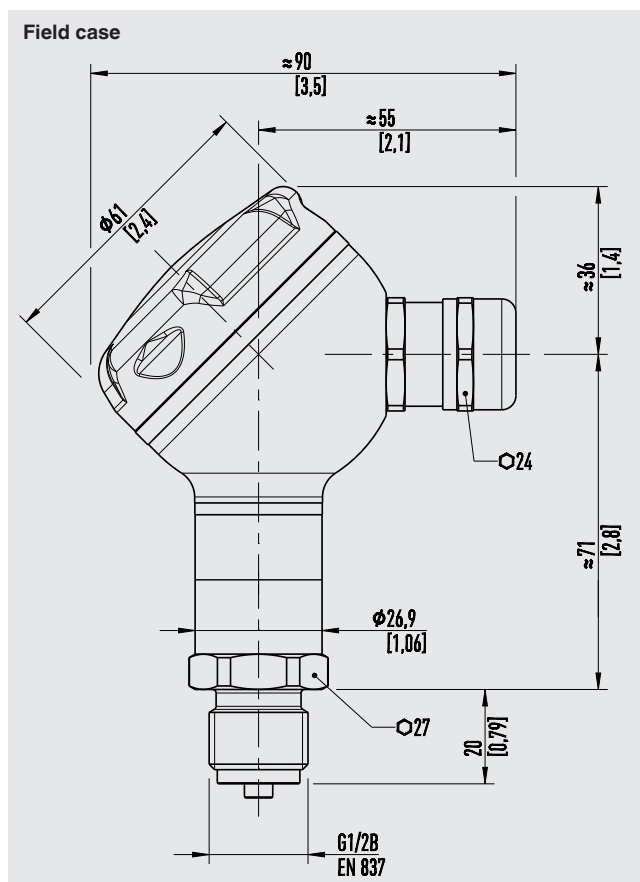
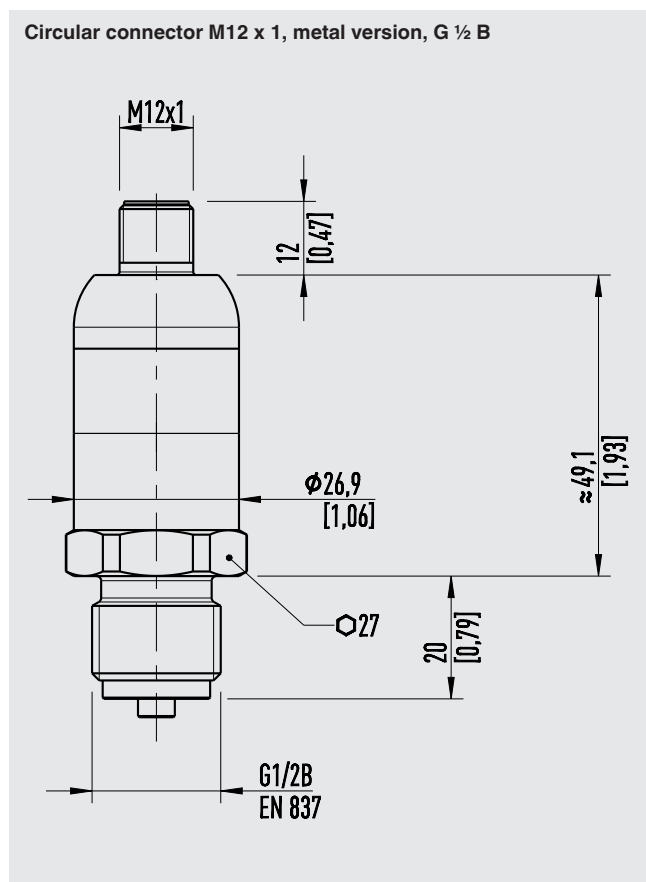
## Manufacturer's information and certificates

Logo	Description
-	China RoHS directive

Approvals and certificates, see website

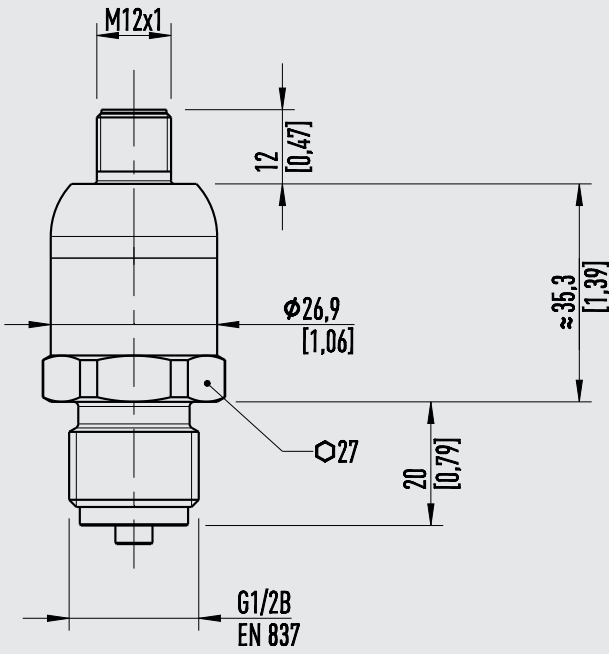
## Dimensions in mm [in]

Examples of analogue versions, model GD-20-A

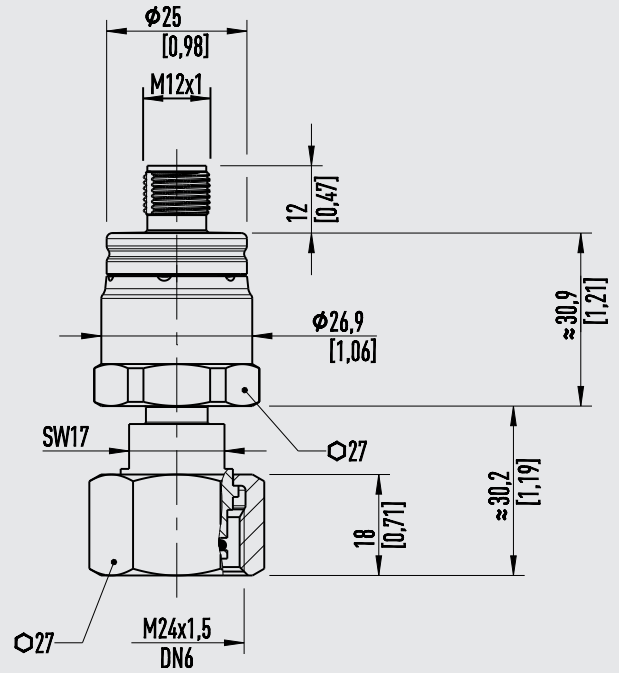


Examples of digital versions, model GD-20-D

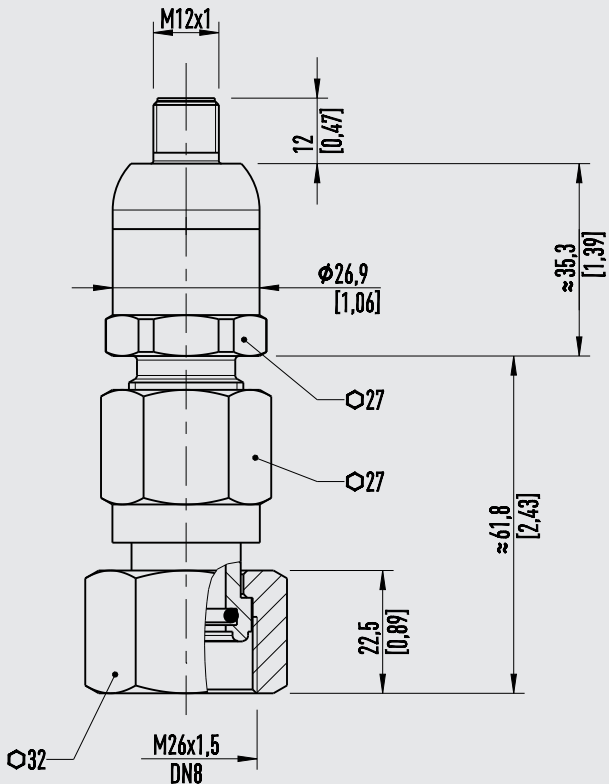
Circular connector M12 x 1, metal version, G 1/2 B



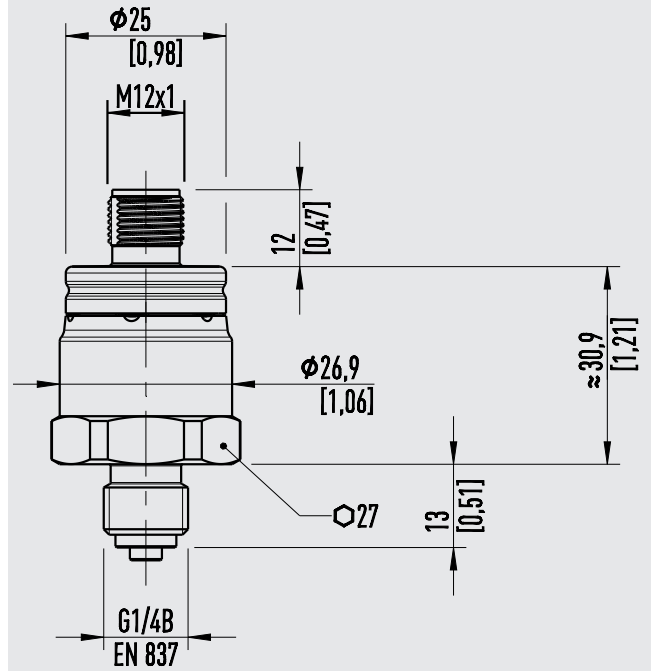
Circular connector M12 x 1, plastic version, adapter DN 6



Circular connector M12 x 1, metal version, adapter DN 8



Circular connector M12 x 1, plastic version, G 1/4 B



## Optional versions, model GD-20-A

Designation	Case ingress protection	Temperature range in °C	Shield provided by customer	Shield connected on the instrument side	Assignment	
					U <sub>+</sub>	U <sub>-</sub>
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		
Field case	IP6k9k		-	-	1	2

### Ordering information

Compensated pressure range / Accuracy / Gas mixture / Process connection / Electrical output / Optional version

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