

Gas density sensor

For gas density, temperature and pressure of insulating gases Model GD-20 with Modbus[®] or analogue 4 ... 20 mA signal

Applications

- Permanent monitoring of the relevant gas condition parameters in closed tanks
- For internal and external SF₆-insulated equipment
- Density measurement of alternative gases in electrical equipment or in the laboratory

Special features

- High-accuracy sensor technology
- Digital MODBUS[®] 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[®] fieldbus

The RS-485 interface communicates using the MODBUS[®] 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 SF₆, N₂, CF₄, O₂, CO₂, 3M[™] Novec[™] 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 ₆) | 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"> ■ 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 range 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] | <ul style="list-style-type: none"> ■ ±2 % (standard) ■ ±1.25 % (option) |
| | For -20 ... +80 °C [-4 ... +176 °F] | <ul style="list-style-type: none"> ■ ±1.5 % (standard) ■ ±0.75 % (option) |
| Compensated pressure range 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] | <ul style="list-style-type: none"> ■ ±1.25 % (standard) ■ ±0.6 % (option) |
| Pressure accuracy | <ul style="list-style-type: none"> ■ ±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 SF₆ gas and a gas mixture consisting of 6 % Novec 4710, 5 % O₂ and 89 % CO₂.

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) | <ul style="list-style-type: none"> ■ ±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 SF₆ 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"> ■ Field case ■ Cable outlet ■ Metal cable outlet, shield optionally connected (heavy-duty version) |

Suitable for the following gases

- SF₆
- N₂
- CF₄
- O₂
- CO₂
- 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 |
| 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) | $R_A \leq (U_B - 9.5 \text{ V}) / 0.023 \text{ A}$ 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.


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 ₊ | 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/cm²
- Gauge pressure based on 1,013 mbar at 20 °C [68 °F]: bar, MPa, kPa, psi, Pa, N/cm²
- Density: g/litre, kg/m³
- Temperature: °C, °F, K
- Absolute pressure: bar, MPa, kPa, psi, Pa, N/cm²
- Gauge pressure based on 1,013 mbar: bar, MPa, kPa, psi, Pa, N/cm²

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 | | |
|---|--|---------|
| Vibration resistance | <ul style="list-style-type: none"> ■ 5 g, 15 ... 2,000 Hz, for versions with field case ■ 20 g, 30 ... 2,000 Hz, for versions without field case | |
| Shock resistance | | |
| Single shock loads | 500 g (1.4 ms, 1 shock, 3 axes) | |
| Continuous shock | 100 g (4 ms, 10,000 shocks, 3 axes) | |
| Permissible temperature ranges | | |
| Ambient temperature | -40 ... +80 °C [-40 ... +176 °F] | |
| Storage temperature | -40 ... +70 °C [-40 ... +158 °F] | |
| Permissible air humidity | ≤ 95 % r. h. (non-condensing) | |
| Ingress protection ¹⁾ | | |
| 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 | |
| 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 |

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 | |
|---|---|
| Immunity against EM fields | 30 V/m (at 80 MHz to 6 GHz) |
| Immunity against surge voltages (surge) per IEC 61000-4-5 | 1 kV, unbalanced, lines to earth, 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

| 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 | |

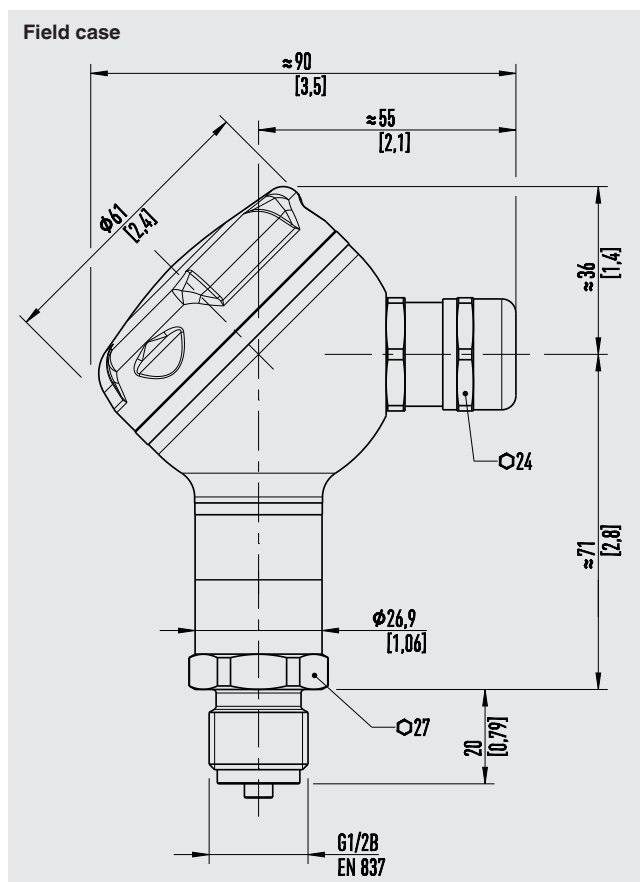
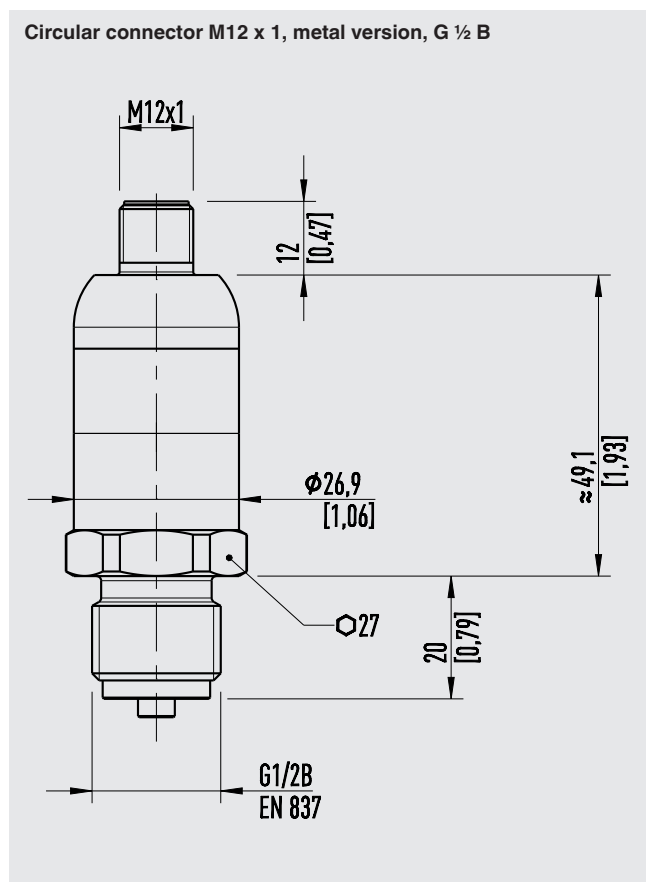
Manufacturer's information and certificates

| Logo | Description |
|------|----------------------|
| - | China RoHS directive |

Approvals and certificates, see website

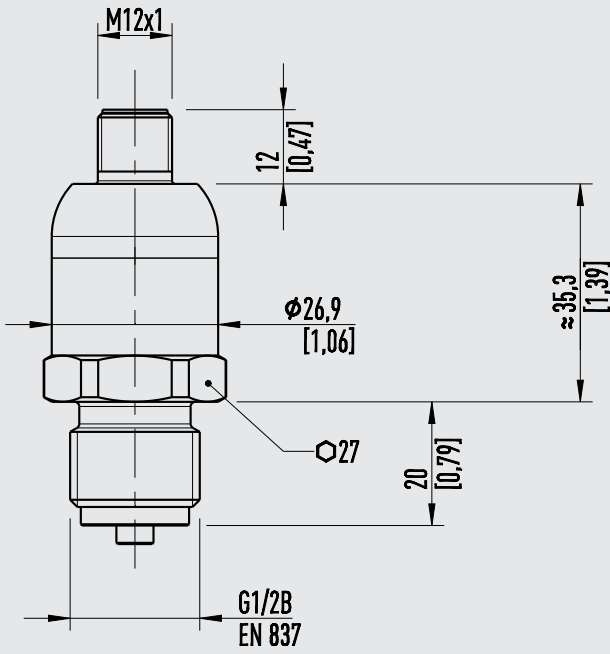
Dimensions in mm [in]

Examples of analogue versions, model GD-20-A

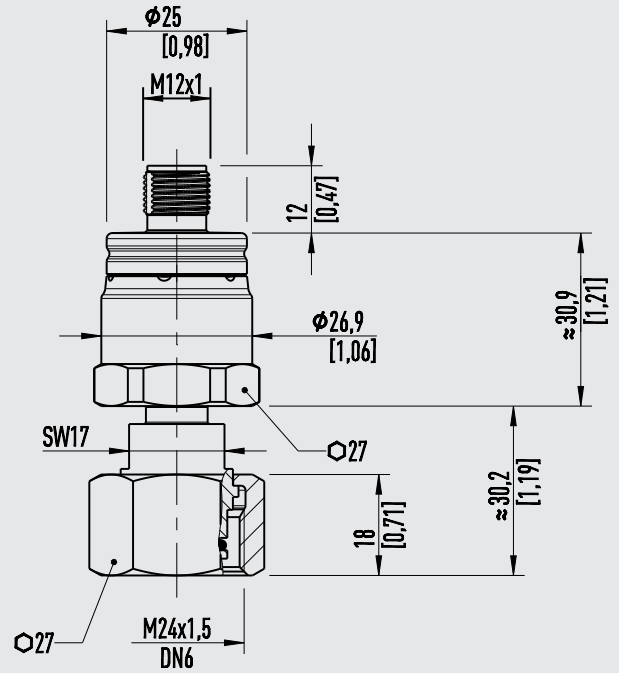


Examples of digital versions, model GD-20-D

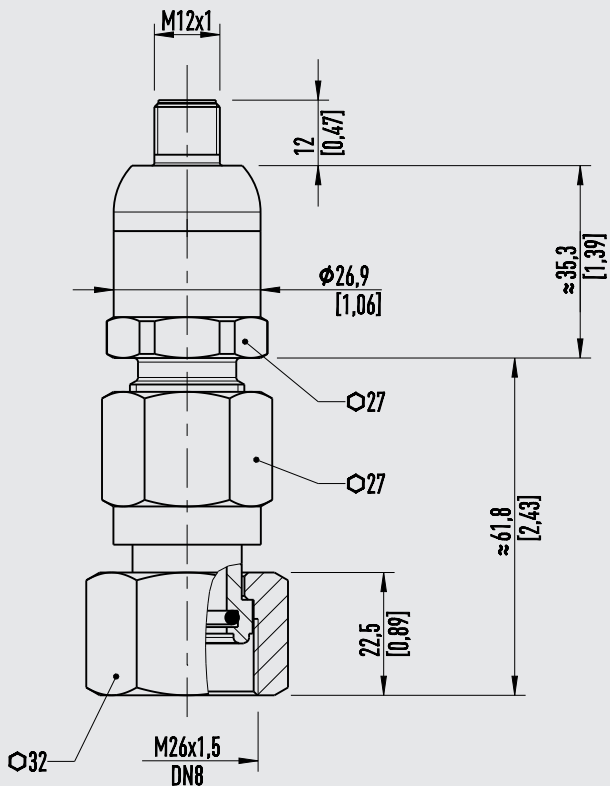
Circular connector M12 x 1, metal version, G 1/2 B



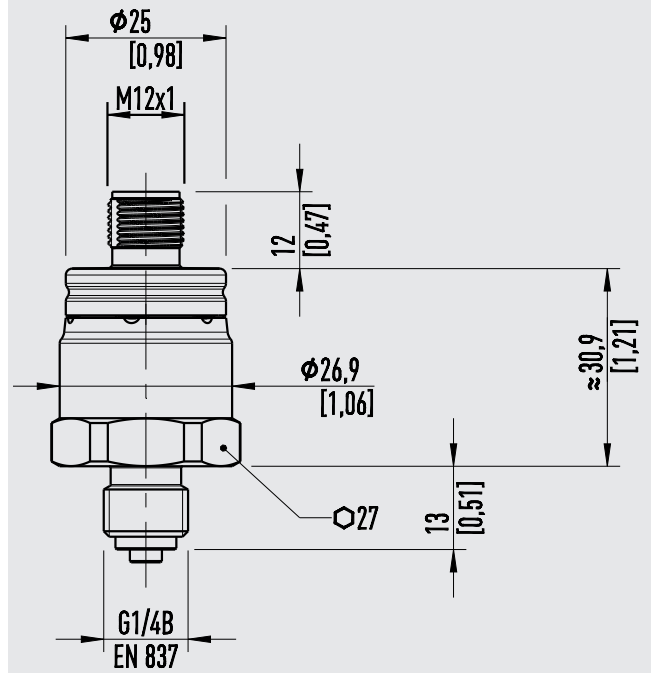
Circular connector M12 x 1, plastic version, adapter DN 6



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 ₊ | 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 | | |
| Field case | IP6k9k | | - | - | 1 | 2 |