

# Hybrid gas density monitor with analogue current loop output signal



## Product description

Swiss based Trafag offers precise, reliable and maintenance-free instruments, developed for density monitoring of SF<sub>6</sub> and alternative gases. Measurement is based on the gas density reference principle or the patented quartz tuning fork technology. Hybrid monitors combine both principles in one instrument. Thus offering the most reliable solution on the market by directly measuring the gas density.

## Applications

- High voltage technology
- Medium voltage technology
- SF<sub>6</sub> and variety of alternative mixed gases

## Features

- Exact switching output at all temperatures
- Fully temperature compensated by design
- No contact bouncing
- Continuous density measurement
- Long term drift free sensor output signal
- Maintenance free indoor and outdoor use



LVD: 2014/35/EU; EMC: 2014/30/EU



S.I. 2016 No. 1101; S.I. 2016 No. 1091



RoHS/Reach compliant

## Technical Data

|                          |                                                                                                                                                     |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Measuring principle      | <ul style="list-style-type: none"> <li>• Monitor: Absolute pressure reference gas measuring system</li> <li>• Sensor: Oscillating quartz</li> </ul> |
| Measuring range          | max. 0 ... 60 kg/m <sup>3</sup><br>max. 0 ... 1250 kPa abs. @ 20°C                                                                                  |
| Output signal            | <ul style="list-style-type: none"> <li>• Monitor: Floating change-over contact (SPDT)</li> <li>• Sensor: 4 ... 20mA, 6.5 ... 20mA</li> </ul>        |
| Quantity of switchpoints | 1 ... 3 microswitches                                                                                                                               |
| Ambient temperature      | -40°C ... +80°C                                                                                                                                     |

## Additional information

Data sheet [www.trafag.com/H72515](http://www.trafag.com/H72515)  
 Instructions [www.trafag.com/H73515](http://www.trafag.com/H73515)

## Ordering information/Type code

|                            | XXXX                                                                                                     | XX   | XXXX | XX | XX | XX |
|----------------------------|----------------------------------------------------------------------------------------------------------|------|------|----|----|----|
| <b>Custom build code</b>   | <b>Hybrid gas density monitor with microswitches and 2-wire current output</b>                           |      |      |    |    |    |
|                            | One microswitch                                                                                          | 8781 |      |    |    |    |
|                            | Two microswitches                                                                                        | 8782 |      |    |    |    |
|                            | Three microswitches                                                                                      | 8783 |      |    |    |    |
| <b>Output signal</b>       | See table below: Output signal                                                                           | XX   |      |    |    |    |
| <b>Pressure connection</b> | Threaded, axial and radial types                                                                         |      | 1XXX |    |    |    |
|                            | Flanged and cap nut, axial and radial types                                                              |      | 2XXX |    |    |    |
|                            | Compartment immersion types <sup>1)</sup>                                                                |      | 5XXX |    |    |    |
| <b>Code number</b>         | Determined by Trafag                                                                                     |      |      | XX |    |    |
| <b>Options</b>             | Basic density indicator dial with two colour sectors without markings                                    |      |      |    |    | 60 |
|                            | Density indicator dial with scale according to customer specification                                    |      |      |    |    | 61 |
|                            | Low pressure indicator <sup>4</sup>                                                                      |      |      |    |    | 66 |
|                            | Process gas wetted O-rings composed of IIR                                                               |      |      |    |    | C2 |
|                            | Microswitch or combined microswitch / sensor outlet                                                      |      |      |    |    |    |
|                            | EMC-cable gland M20x1.5, brass nickel-plated, for cable-ø 7 ... 12.5 [mm]                                |      |      |    |    | 10 |
|                            | EMC-cable gland M20x1.5, brass nickel-plated, for cable-ø 8 ... 11 [mm]                                  |      |      |    |    | 07 |
|                            | EMC-cable gland M20x1.5, brass nickel-plated, for cable-ø 11 ... 14 [mm]                                 |      |      |    |    | 08 |
|                            | EMC-cable gland M25x1.5, brass nickel-plated, for cable-ø 8 ... 16 [mm]                                  |      |      |    |    | 11 |
|                            | EMC-cable gland M25x1.5, brass nickel-plated, for cable-ø 12.5 ... 20.5 [mm]                             |      |      |    |    | 17 |
|                            | ITT Cannon connector                                                                                     |      |      |    |    | 12 |
|                            | Blank plug M20x1.5, brass nickel-plated <sup>2)</sup>                                                    |      |      |    |    | 13 |
|                            | Blank plug M25x1.5, brass nickel-plated <sup>3)</sup>                                                    |      |      |    |    | 04 |
|                            | Blank plug M25x1.5, PA <sup>2) 3)</sup>                                                                  |      |      |    |    | 05 |
|                            | Separate sensor outlet                                                                                   |      |      |    |    |    |
|                            | EMC-cable gland M20x1.5, brass nickel-plated, for cable-ø 4 ... 10 [mm]                                  |      |      |    |    | U8 |
|                            | EMC-cable gland M20x1.5, brass nickel-plated, for cable-ø 7 ... 12.5 [mm]                                |      |      |    |    | U1 |
|                            | EMC-cable gland M20x1.5, brass nickel-plated, for cable-ø 8 ... 11 [mm]                                  |      |      |    |    | U6 |
|                            | EMC-cable gland M20x1.5, brass nickel-plated, for cable-ø 11 ... 14 [mm]                                 |      |      |    |    | U3 |
|                            | Blank plug M20x1.5, brass nickel-plated <sup>3)</sup>                                                    |      |      |    |    | U2 |
|                            | Integrated valve for monitor test with DN8 coupling and M26x1.5 protective cap                           |      |      |    |    |    |
|                            | Standard test port orientation                                                                           |      |      |    |    | W3 |
|                            | Test port orientation 180°                                                                               |      |      |    |    | W0 |
|                            | Test port orientation 270°                                                                               |      |      |    |    | W1 |
|                            | Test port orientation 90°                                                                                |      |      |    |    | W2 |
|                            | Integrated valve for process gas quality test and refilling with DN8 coupling and M26x1.5 protective cap |      |      |    |    |    |
|                            | Standard filling port orientation                                                                        |      |      |    |    | F3 |
|                            | Filling port orientation 180°                                                                            |      |      |    |    | F0 |
|                            | Filling port orientation 270°                                                                            |      |      |    |    | F1 |
|                            | Filling port orientation 90°                                                                             |      |      |    |    | F2 |

|                                               | XXXX | XX | XXXX | XX | XX | XX |
|-----------------------------------------------|------|----|------|----|----|----|
| <b>Accessories</b>                            |      |    |      |    |    |    |
| Thermal insulation ring for probe housing     |      |    |      |    |    | 06 |
| Thermal foam cover with drain holes           |      |    |      |    |    | 37 |
| Weather protection cover                      |      |    |      |    |    | 46 |
| Pressure connection adapter 2300 - G1/2" male |      |    |      |    |    | N1 |

<sup>1)</sup> Requires single-cable connection by microswitch outlet

<sup>2)</sup> Select if EMC-cable gland is procured locally

<sup>3)</sup> Without IP compatibility, not for use in operation

<sup>4)</sup> Only for configurations with max. switchpoint range 0 ... 1100 kPa abs @ 20°C

## Output signal

| Analogue output signal | Output parameter                                         | Measuring range              | Code |
|------------------------|----------------------------------------------------------|------------------------------|------|
| 4 ... 20 mA            | Density [kg/m <sup>3</sup> ],<br>gas specific linearised | 0 ... 60 kg/m <sup>3</sup>   | A1   |
|                        |                                                          | 0 ... 30 kg/m <sup>3</sup>   | A2   |
|                        |                                                          | 0 ... 15 kg/m <sup>3</sup>   | A3   |
| 4 ... 20 mA            | Density [gas pressure@20 °C],<br>gas specific linearised | 0 ... 60 kg/m <sup>3</sup>   | B1   |
|                        |                                                          | 0 ... 30 kg/m <sup>3</sup>   | B2   |
|                        |                                                          | 0 ... 15 kg/m <sup>3</sup>   | B3   |
| 6.5 ... 20 mA          | Generic, non-linear (legacy) <sup>1)</sup>               | 0 ... 56.1 kg/m <sup>3</sup> | 20   |
|                        |                                                          | 0 ... 28 kg/m <sup>3</sup>   | M2   |

<sup>1)</sup> Do not use for new designs

## Further customised parameterisation to be indicated

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Process gas              | SF <sub>6</sub> , SF <sub>6</sub> - based mixed gas, customer specific alternative gas<br>(gas mixtures to be indicated in mol-%)                                                                                                                                                                                                                                                                                                                                              |
| Units for indicator dial | kPa, MPa, bar, psi, kg/m <sup>2</sup> , kg/cm <sup>2</sup> ,<br>absolute (standard) or relative (optional) units <sup>1)</sup> ,<br>optionally available dial indication dual units                                                                                                                                                                                                                                                                                            |
| Switchpoint @ 20°C       | For each microswitch, indicate switching point p@20°C.<br><br>Standard factory setting is for decreasing pressure.<br>Optionally, factory setting for increasing pressure is available.<br><br>Especially for outdoor installations in areas with high daily temperature fluctuations it is recommended to maintain a minimum switching point distance of 40-60 kPa from filling pressure to next higher and lower switching point(s). Please contact us for more information. |
| Gas pressure @ 20°C      | Requirement for specific process gas if other than 100 % SF <sub>6</sub>                                                                                                                                                                                                                                                                                                                                                                                                       |

<sup>1)</sup> The monitoring principle is based on a density reference chamber system and is accordingly calibrated. When not using dials scaled to density expressed as "absolute pressure at 20°C of the respective gas mixture", additional environmental factors are required for correct interpretation of the dial reading. E.g. in case of using relative pressure units, local ambient pressure (e.g. altitude or weather derivations) as well as thermal effects have to be considered when comparing with a locally installed relative pressure gauge. The difference between relative and absolute pressure is calibrated to 1 bar

## Mechanical density monitoring

|                            |                                                     |                                                                                                                                                                                                 |
|----------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Monitoring</b>          | Principle                                           | Absolute pressure measuring system with sealed reference gas chamber, fully temperature compensated by design <sup>1)</sup>                                                                     |
|                            | Range                                               | 0 ... 1100 kPa abs. @ 20°C<br>with low pressure indicator option<br>0 ... 1250 kPa abs. @ 20°C<br>without low pressure indicator option                                                         |
|                            | Output                                              | Floating change-over contact (SPDT)                                                                                                                                                             |
|                            | Accuracy                                            | Refer to density indicator and microswitch sections                                                                                                                                             |
| <b>Microswitch</b>         | Output signal                                       | Floating change-over contact (SPDT)                                                                                                                                                             |
|                            | Resistive load (Inductive load)                     | AC - 250 V/10 (1.5) A<br>DC - 250 V/0.1 (0.05) A, 220 V/0.25 (0.2) A,<br>110 V/0.5 (0.3) A, 24 V/2 (1) A                                                                                        |
|                            | Resistance of insulation                            | > 100 MΩ, 500 VDC, ex factory                                                                                                                                                                   |
|                            | Dielectric strength                                 | 2 kVAC, 50Hz, terminal to ground (earth)                                                                                                                                                        |
|                            | Switching cycle capacity                            | Up to 1M mechanical, more than 10'000<br>with maximum load                                                                                                                                      |
|                            | Effect of vibration                                 | 4 g, 20 ... 100 Hz effects no contact bounce at<br>5 kPa minimum distance from set switchpoint                                                                                                  |
|                            |                                                     |                                                                                                                                                                                                 |
| <b>Switchpoint setting</b> | Factory adjustment                                  | According to customer specification, <sup>2)</sup><br>standard setting is for decreasing pressure                                                                                               |
|                            | Lowest switchpoint setting                          | 120 kPa abs. @ 20°C                                                                                                                                                                             |
|                            | Highest switchpoint setting                         | 0 ... 1100 kPa abs. @ 20°C<br>with low pressure indicator option<br>0 ... 1250 kPa abs. @ 20°C<br>without low pressure indicator option                                                         |
|                            | Distance from the lowest to the highest switchpoint | Up to 180 kPa @ 20°C <sup>3)</sup>                                                                                                                                                              |
|                            | Switching differential                              | 3 ... 7 kPa typ. (15 kPa max.) if lowest to highest switchpoint<br>distance is up to 130 kPa<br>5 ... 10 kPa typ. (20 kPa max.) if lowest to highest switchpoint<br>distance is 130 ... 180 kPa |

<sup>1)</sup> Depending on process gas requirements, the fully sealed reference gas chamber contains up to 0.001 kg of SF<sub>6</sub>. The relevant national regulations governing the disposal of hazardous waste apply and must be followed. Decommissioned or defective monitors can be returned to the manufacturer for disposal in a safe and environmentally appropriate manner

<sup>2)</sup> Especially in areas with high daily temperature fluctuations it is recommended to maintain a minimum switchpoint distance of 40-60 kPa from filling pressure to surrounding switchpoint(s). Please contact us for more information

<sup>3)</sup> Distance from lock-out to high-alarm pressure, or from lock-out to filling pressure (no high-alarm)

### Switchpoint accuracy over temperature based on reference chamber pressure

|                                                                               |            | +20°C | -30°C ... +50°C | -40°C ... +60°C |
|-------------------------------------------------------------------------------|------------|-------|-----------------|-----------------|
| <b>First alarm switchpoint setting<br/>pressure abs. @ 20°C <sup>1)</sup></b> |            |       |                 |                 |
| ≤ 650 kPa                                                                     | [kPa max.] | ± 8   | ± 10            | ± 12            |
| > 650 kPa ... 1000 kPa                                                        | [kPa max.] | ± 8   | ± 12            | ± 14            |
| > 1000 kPa                                                                    | [kPa max.] | ± 10  | ± 15            | ± 16            |
| <b>High pressure alarm <sup>1) 2)</sup></b>                                   |            |       |                 |                 |
| ≤ 1000 kPa                                                                    | [kPa max.] | ± 10  | ± 16            | ± 20            |
| > 1000 kPa                                                                    | [kPa max.] | ± 10  | ± 17            | ± 21            |

<sup>1)</sup> While no liquefaction occurs and the insulation gas is completely gaseous

<sup>2)</sup> Only applicable if factory adjustment includes high-alarm switchpoint above filling pressure

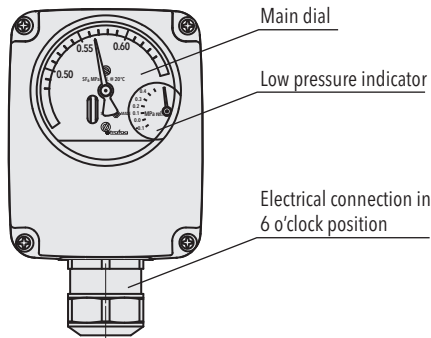
### Density indicator

|                                       | Main dial                                                                                           | Low pressure indication option                                                        |
|---------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Indicator principle</b>            | Absolute pressure, fully temperature compensated by means of sealed reference gas chamber           | Indication of relative pressure, for safety reasons it is not temperature compensated |
| <b>Scale</b>                          | Colour sectors (standard red/yellow/green or red/green), switchpoint markings, single or dual units | Single unit, graduated range                                                          |
| <b>Unit</b>                           | See table „Further customised parameterisation to be indicated“                                     | According to main dial unit (rel., g.)                                                |
| <b>Numbered range</b>                 | Up to 180 kPa @ 20°C between lowest and highest indicated value <sup>1)</sup>                       | Vacuum up to lowest switchpoint, 500 kPa rel. max.                                    |
| <b>Accuracy within numbered range</b> | ± 10 kPa @ 20°C                                                                                     | Up to 200 kPa rel.: ± 20 kPa<br>Up to 500 kPa rel.: ± 10% MV                          |

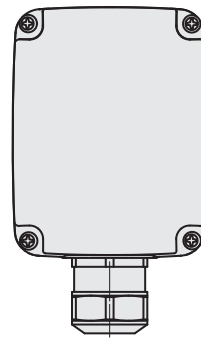
<sup>1)</sup> Typically ranges are from lock-out switchpoint to filling pressure (no high-alarm), or from lock-out switchpoint to high-alarm switchpoint

## Density indicator

### Main dial and low pressure indicator

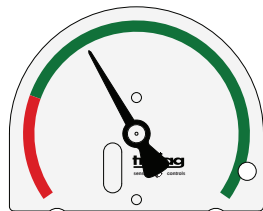


### Hybrid monitor without indication dial

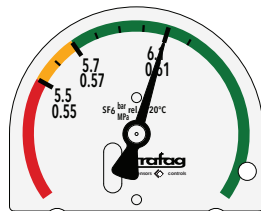


### Density indicator dial according to customer specification

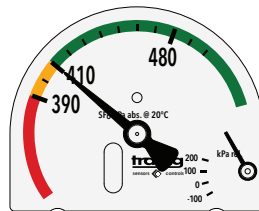
Availability of a full variety of units including dual range indication, this also includes dial rotated by 90°/180°/270°.



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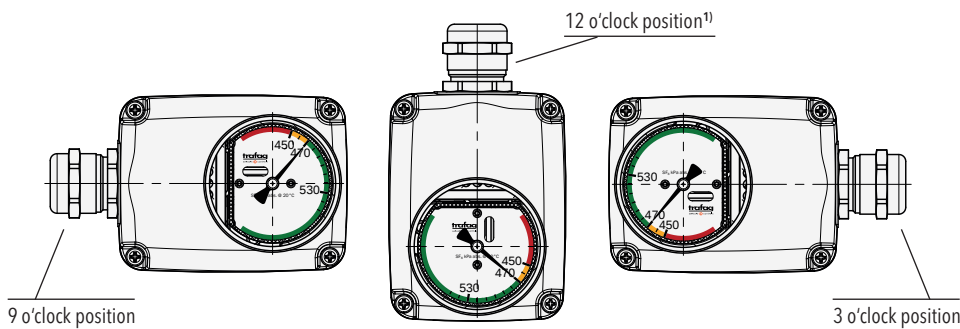


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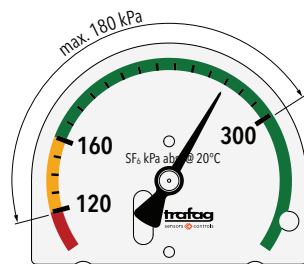
878x.XX.XXXX.XX.60.61.66

### Customized dial orientation based on electrical connection position

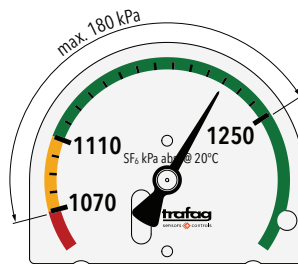


<sup>1)</sup> Should only be used for indoor applications while using neither a weather protection cover nor a thermal foam cover

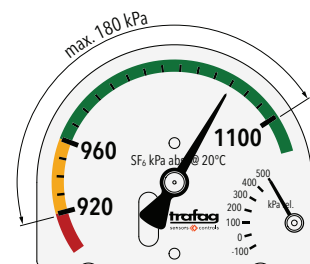
### Maximum switchpoint range



Lowest switchpoint setting: 120 kPa abs. @ 20°C, distance from lowest to highest switchpoint: up to 180 kPa @ 20°C



Highest switchpoint setting: 1250 kPa abs. @ 20°C, distance from lowest to highest switchpoint: up to 180 kPa @ 20°C



Highest switchpoint setting with low pressure indicator: 1100 kPa abs. @ 20°C, distance from lowest to highest switchpoint: up to 180 kPa @ 20°C

## Electronical density measuring

|                        |                                                                                     |                                                                                                                                                               |
|------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Sensor</b>          | Principle                                                                           | Oscillating quartz sensor                                                                                                                                     |
|                        | Range <sup>1)</sup>                                                                 | max. 0 ... 60 kg/m <sup>3</sup><br>max. 0 ... 1250 kPa abs. @ 20°C                                                                                            |
|                        | Output                                                                              | 4 ... 20 mA, 6.5 ... 20 mA                                                                                                                                    |
| <b>Electrical data</b> | Supply voltage                                                                      | 10 ... 30 VDC                                                                                                                                                 |
|                        | Earthing                                                                            | Via process connection or wire terminal                                                                                                                       |
|                        | Resistance of insulation                                                            | >100 MΩ, 500 VDC, ex factory                                                                                                                                  |
|                        | Dielectric strength                                                                 | 500 VAC, 50 Hz, terminal to ground (earth)                                                                                                                    |
| <b>EMC protection</b>  | ESD                                                                                 | 15 kV air, 8 kV contact, EN/IEC 61000-4-2                                                                                                                     |
|                        | Radiated immunity                                                                   | 10 V/m, 80 ... 6000 MHz, EN/IEC 61000-4-3                                                                                                                     |
|                        | Burst                                                                               | 2 kV, EN/IEC 61000-4-4                                                                                                                                        |
|                        | Surge                                                                               | Up to 2 kV, EN/IEC 61000-4-5                                                                                                                                  |
|                        | Conducted immunity                                                                  | 10 Vrms, EN/IEC 61000-4-6                                                                                                                                     |
| <b>Accuracy</b>        | Density measurement                                                                 | See table: Accuracy                                                                                                                                           |
|                        | Repeatability density measurement                                                   | See table: Accuracy                                                                                                                                           |
|                        | Transient response time required for signal output to reach accuracy tolerance band | Less than 1 h after connecting monitor to pressurised compartment<br>Less than 1 min. when monitor is vacuumised together with compartment before gas filling |

<sup>1)</sup> Maximum value is either kg/m<sup>3</sup> or kPa abs. @ 20°C, whichever is reached first

## Accuracy

The indicated accuracy is validated for SF<sub>6</sub> and common SF<sub>6</sub> mixtures, common C4-FN (CAS No. 42532-60-5) mixtures and synthetic air. Please contact us for further information.

| Density measuring range                        | 0 ... 15 kg/m <sup>3</sup>         | 0 ... 30 kg/m <sup>3</sup>         | 0 ... 60 kg/m <sup>3</sup><br>0 ... 56.1 kg/m <sup>3</sup> |
|------------------------------------------------|------------------------------------|------------------------------------|------------------------------------------------------------|
| Total error band -40°C ... +80°C <sup>1)</sup> | ± 1.8 % FS typ.<br>± 2.3 % FS max. | ± 1.4 % FS typ.<br>± 2.0 % FS max. | ± 1.0 % FS typ.<br>± 1.8 % FS max.                         |
| Repeatability                                  | ± 0.3 % FS typ.                    | ± 0.3 % FS typ.                    | ± 0.2 % FS typ.                                            |

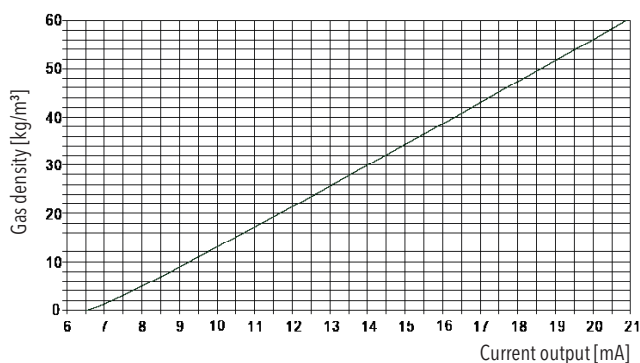
<sup>1)</sup> Total error band (TEB) for defined ambient temperature range while the insulation gas is completely gaseous

## Surge level details

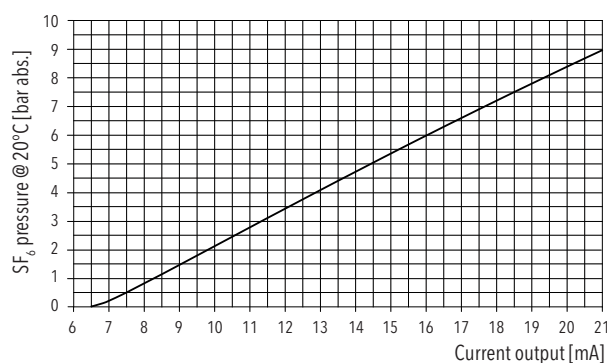
| Maximum surge load level [kV] | Coupling category | Coupling settings | Signal coupling                      | Severity level |
|-------------------------------|-------------------|-------------------|--------------------------------------|----------------|
| 1                             | Line to Line      | L-N               | U <sub>s</sub> + to U <sub>s</sub> - | 3              |
| 1                             | Line to Earth     | L-PE              | U <sub>s</sub> + to Earth            | 2              |
| 1                             | Line to Earth     | N-PE              | U <sub>s</sub> - to Earth            | 2              |
| 2                             | Line to Earth     | L-N               | Shield to Earth                      | 3              |

## Conversion of output signal 6.5 ... 20 mA

### Relation of current output to gas density



### Relation of current output to SF<sub>6</sub> pressure @ 20°C



$$\text{Gas density [kg/m}^3\text{]} = 4.651 * I[\text{mA}] - 1.898 * \sqrt{I[\text{mA}] - 6.475} - 29.921$$

$$\begin{aligned} \text{SF}_6 \text{ pressure @ T [K] [bar abs.]} = & \\ & \{ 0.000569502 * T[\text{K}] * \text{Density [kg/m}^3\text{]} + \\ & (0.00250695 * 0.000569502 * T[\text{K}] - \\ & 0.00073822) * \text{Density [kg/m}^3\text{]}^2 - \\ & (0.00000212238 * 0.000569502 * T[\text{K}] - \\ & 0.000000513) * \text{Density [kg/m}^3\text{]}^3 \} \end{aligned}$$

$$\text{SF}_6 \text{ pressure @ 20°C [bar abs.]} \approx 0.6303 * I[\text{mA}] - 4.1419$$

(add. non-linearity  $\pm 0.3\%$  FS between 9.5 and 19.25 mA)

The relation of current output to SF<sub>6</sub> pressure @ 20°C above applies only if 100 % SF<sub>6</sub> gas is used. Density and current to pressure @ 20°C correlations are defined by specific isochores. Please contact us for process gases other than 100 % SF<sub>6</sub>.

## Conversion of output signal 4 ... 20 mA

In contrast to the 6.5 ... 20 mA signal, the 4 ... 20 mA signal is linearised for the specific gas, either to density [kg/m<sup>3</sup>] or to normalised pressure [kPa @ 20°C]. Thus, no additional conversion is required.

## General specifications

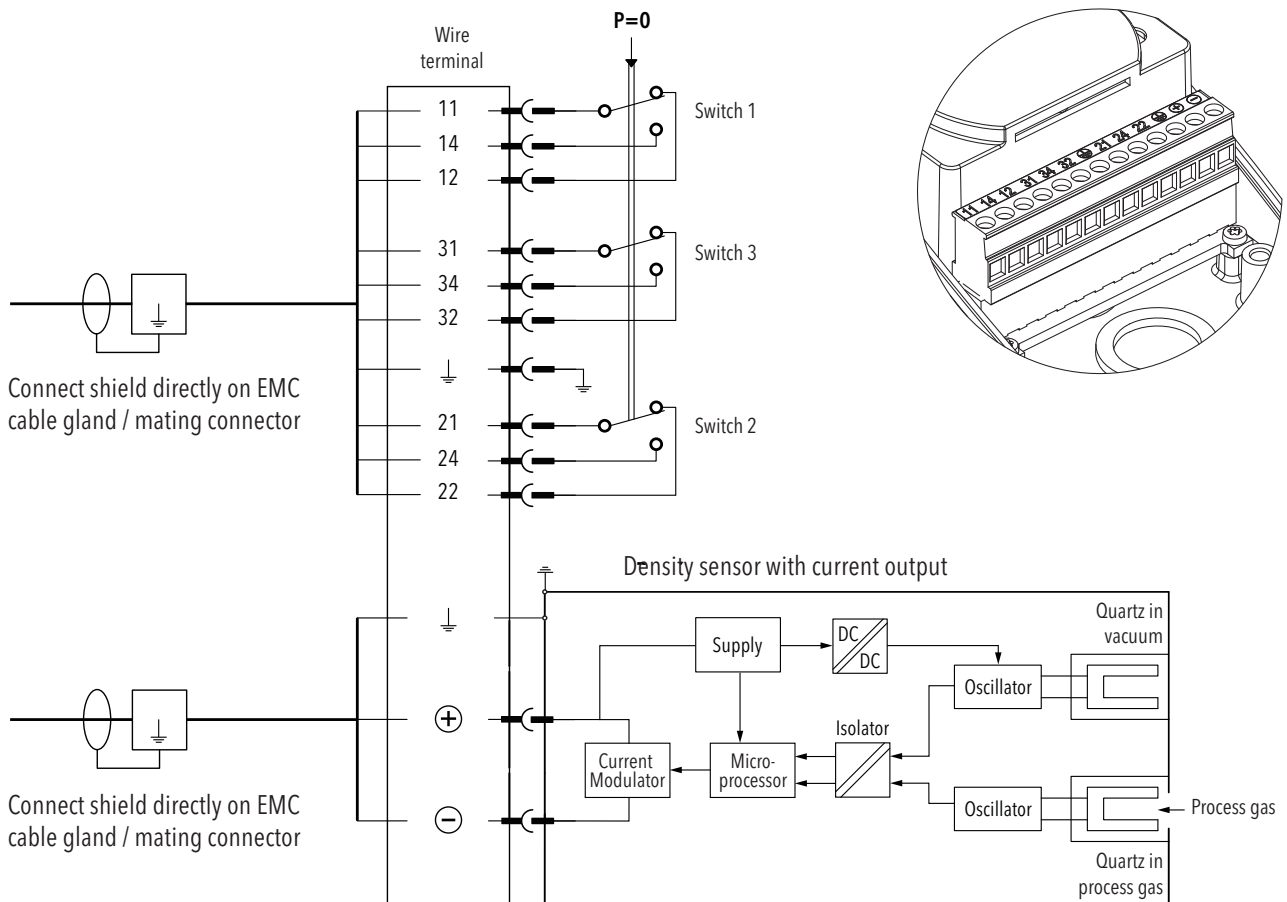
|                                 |                                                       |                                                                                                                                                                                                        |
|---------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental conditions</b> | Ambient temperature <sup>1)</sup>                     | -40°C ... +80°C                                                                                                                                                                                        |
|                                 | Protection <sup>2)</sup>                              | IP65 and IP67                                                                                                                                                                                          |
|                                 | Humidity                                              | IEC 60068-2-30 (damp heat, cyclic, 100 % RH @ +55°C), membrane provides condensation compensation                                                                                                      |
|                                 | Overpressure                                          | 1300 kPa abs. with low pressure indicator option, without low pressure indicator option and lowest switchpoint setting<br>≤ 650 kPa abs. @ 20°C: 1300 kPa abs.<br>> 650 kPa abs. @ 20°C: 1600 kPa abs. |
|                                 | Shock                                                 | 70 g, 3 ms, 10'000 times at all axes excited on process connection without damage to instrument                                                                                                        |
|                                 | Routine inspection of reference chamber gas tightness | Integral pressure testing with helium, leakage detection rate < 7·10 <sup>-8</sup> mbar · l/s                                                                                                          |
| <b>Mechanical data</b>          | Process gas wetted material                           | Process connection and measuring system:<br>1.4404, 1.4435, 1.4571 (AISI316L, AISI316Ti)<br>Test and re-filling valve:<br>1.4404 (AISI316L), CuZn39Pb3 (C38500)<br>Sealing: IIR                        |
|                                 | Housing                                               | AlSi10Mg, powder coated                                                                                                                                                                                |
|                                 | Screwed cable gland                                   | Brass nickel plated, PA as option                                                                                                                                                                      |
|                                 | Dial                                                  | Dial face and pointer: Aluminium sheet<br>Window: PMMA                                                                                                                                                 |

<sup>1)</sup> Approved for extended temperature range -55°C ... +80°C for max. 200h per year

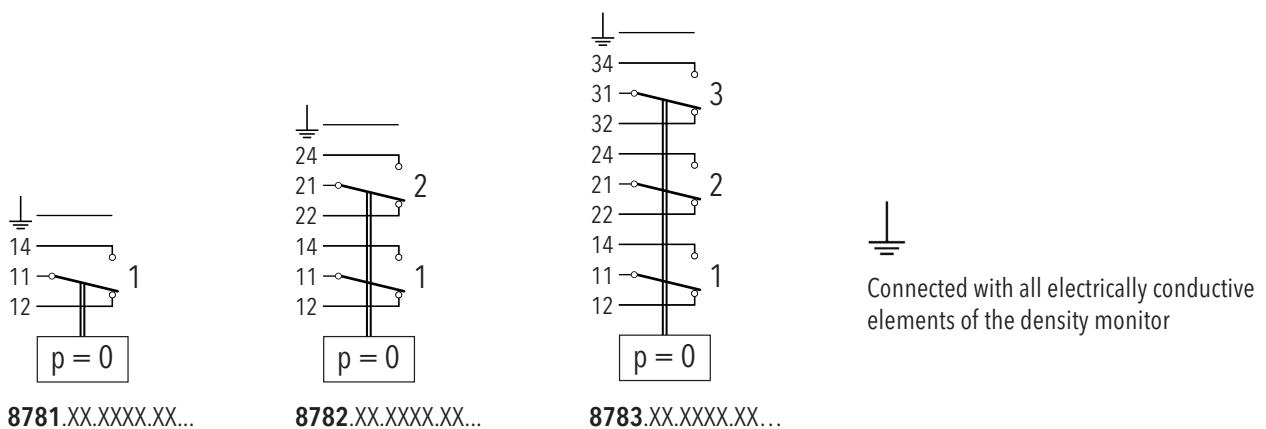
<sup>2)</sup> While using appropriate cable gland and/or mating connector mounted according to instruction

## Electrical connections

Independent cabling for sensor is optional and can also be implemented with a combined microswitch / sensor outlet.

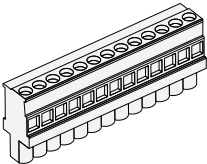
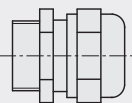


## Microswitch in non-pressurised condition ( $p_{rel} = 0$ )

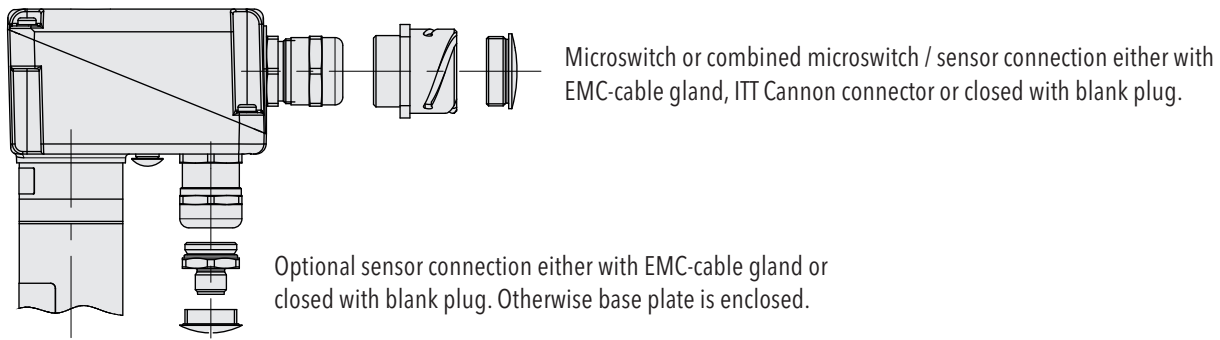


### Connection via wire terminal in density monitor

The wires of the cable are connected to the wire terminal inside the density monitor housing.  
 The cable is fixed with the cable gland.

|                                                                                                                                 | Microswitch connection                                                                                    | Density sensor connection                                                               |
|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Wire terminal<br>                              | Plugable, 0.2 ... 2.5 mm <sup>2</sup> , 13-pins<br>Contact assignment see section: Electrical Connections |                                                                                         |
| EMC-cable gland<br>(Details see type code)<br> | M20x1.5 or M25x1.5<br>Material: Brass nickel-plated<br>cable-ø min. 7 mm,<br>max. 20.5 mm IP65, IP67      | M20x1.5<br>Material: Brass nickel-plated<br>cable-ø min. 4 mm,<br>max. 14 mm IP65, IP67 |
| Blank plug<br>(Details see type code)<br>      | M20x1.5 or M25x1.5<br>Material: Brass nickel-plated<br>IP65, IP67                                         | M20x1.5<br>Material: Brass nickel-plated<br>IP65, IP67                                  |
| Blank plug<br>(Details see type code)<br>    | M25x1.5<br>Material: Polyamide PA<br>IP40                                                                 |                                                                                         |

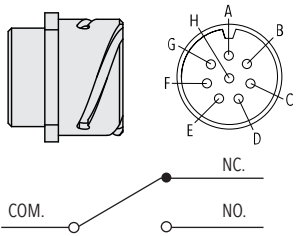
IP protection only when cable / connector and plug are correctly mounted



### Connection via connector on density monitor housing

The cables are connected to the connector outside the housing.

The wiring inside the density monitor from the wire terminal to the connector is already provided for the options below.

|                                                                                                                                                                                      | Microswitch connection                                                                                                                                                                              | Density sensor connection |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| ITT Cannon <sup>1)</sup><br> <p>COM.      NC.      NO.</p> <p>e.g. switch 1: COM_1, NC_1, NO_1</p> | Material: Shell aluminum alloy,<br>insert neoprene, contacts copper alloy<br>Pin assignment:<br><br>PIN B: COM_1      PIN E: COM_2<br>PIN C: COM_3      PIN F: NC_2<br>PIN D: NC_3      PIN H: NC_1 | PIN A: (+)<br>PIN G: (-)  |

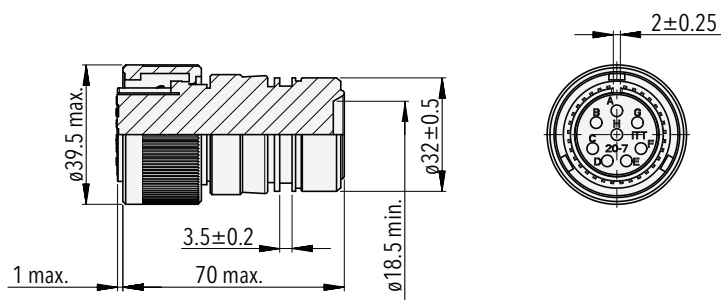
<sup>1)</sup> Sheltering options are limited to weather protection cover (46) and/or thermal insulation ring (06) for probe housing

### Accessories

#### Female electrical plug ITT Cannon

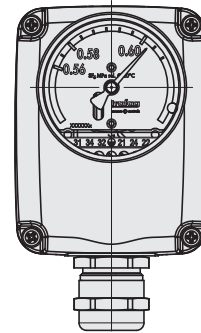
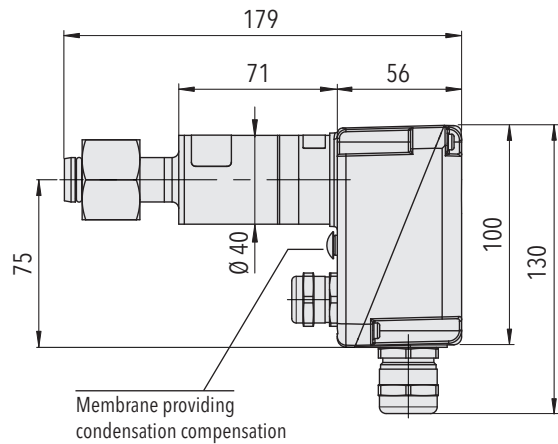
- Shell: Aluminum alloy with tin zinc plating
- Insulator: CR-elastomere
- Contact: copper alloy
- Contact plating: hard silver

Ordering code as separate item, individually packed: F90156



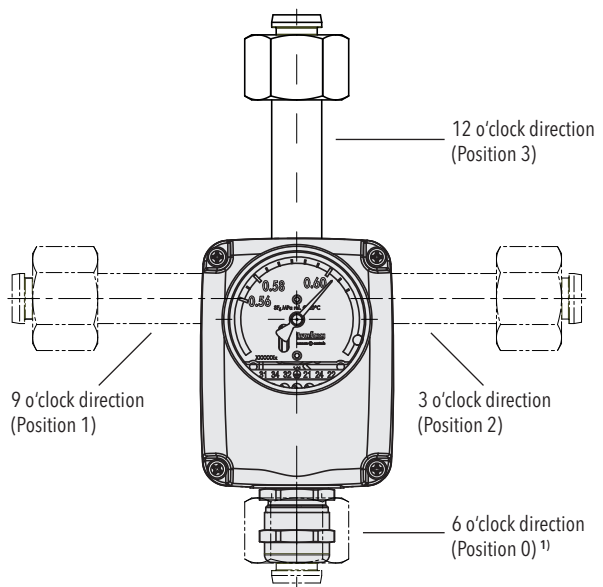
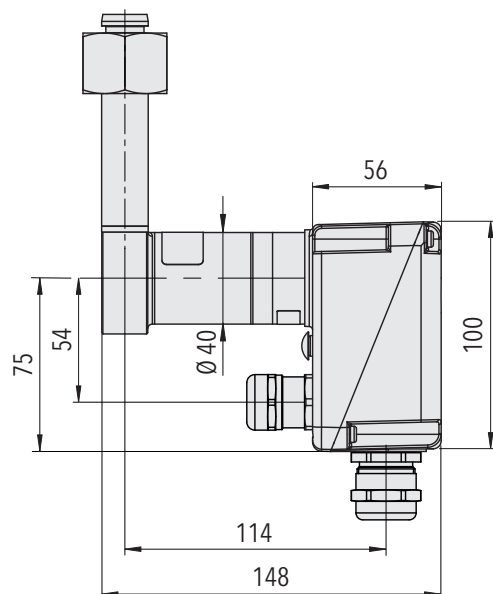
## Typical dimensions of hybrid density monitor

### Example model with axial process connection and cap nut



878x.20.2XXX.XX.XX.XX.XX

### Example model with radial process connection



878x.20.2XXX.XX.XX.XX.XX

Radial process connection is configurable for 12/3/6/9 o'clock direction

Position 0: 878x.XX.XXX0.XX.XX.XX.XX

Position 1: 878x.XX.XXX1.XX.XX.XX.XX

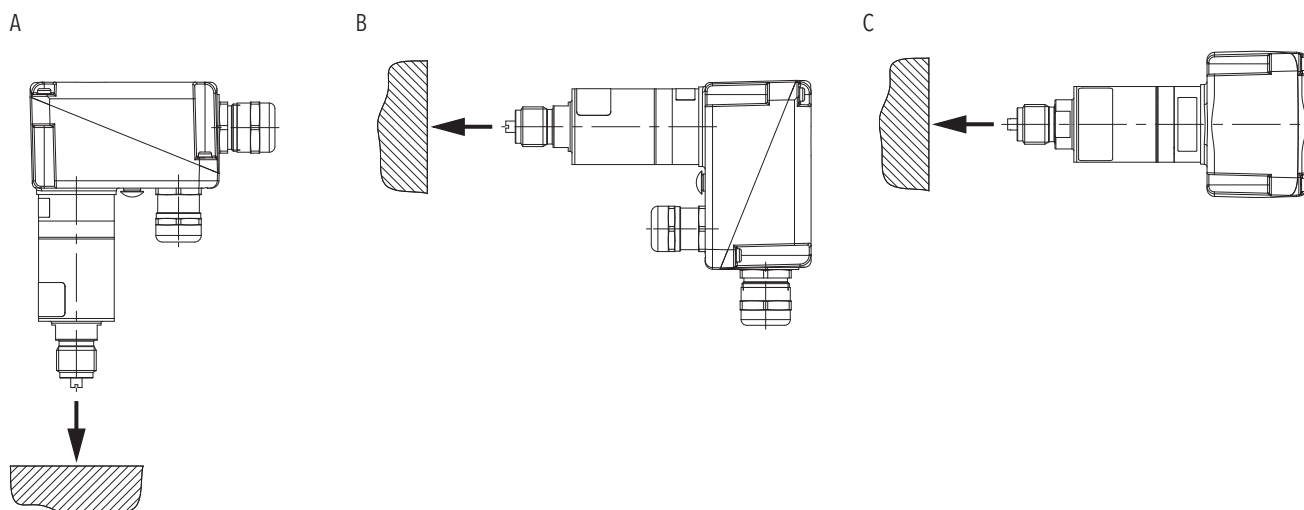
Position 2: 878x.XX.XXX2.XX.XX.XX.XX

Position 3: 878x.XX.XXX3.XX.XX.XX.XX

<sup>1)</sup> Limited while using density sensor connection.  
Please contact us for more details.

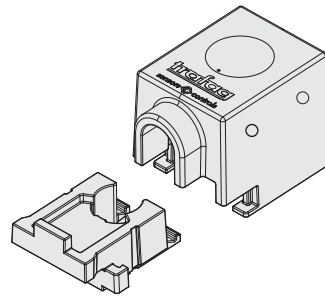
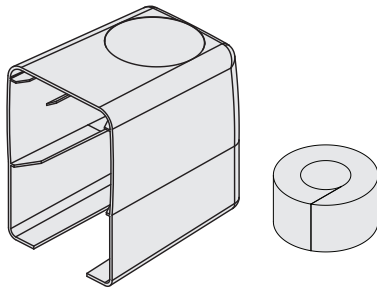
## Installation

|                                 | Indoor application                       | Outdoor application                                                                                                                    | Outdoor application with rapidly changing or extreme weather conditions                                                                     |
|---------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Installation orientation</b> | No limitations, any orientation possible | A, B, C <sup>1)</sup>                                                                                                                  | A, B, C <sup>1)</sup>                                                                                                                       |
| <b>Recommended option</b>       | None                                     | <ul style="list-style-type: none"> <li>• Weather protection cover (46)</li> <li>• Thermal insulation for probe housing (06)</li> </ul> | <ul style="list-style-type: none"> <li>• Thermal foam cover (37)</li> <li>• Compartment immersion type process connection (5XXX)</li> </ul> |



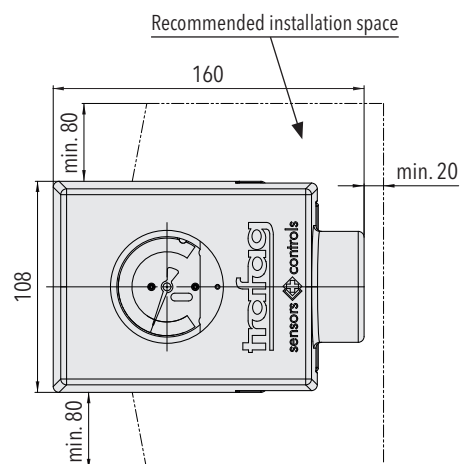
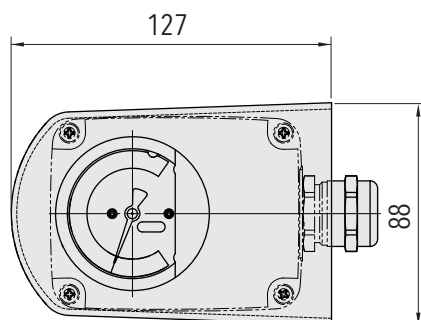
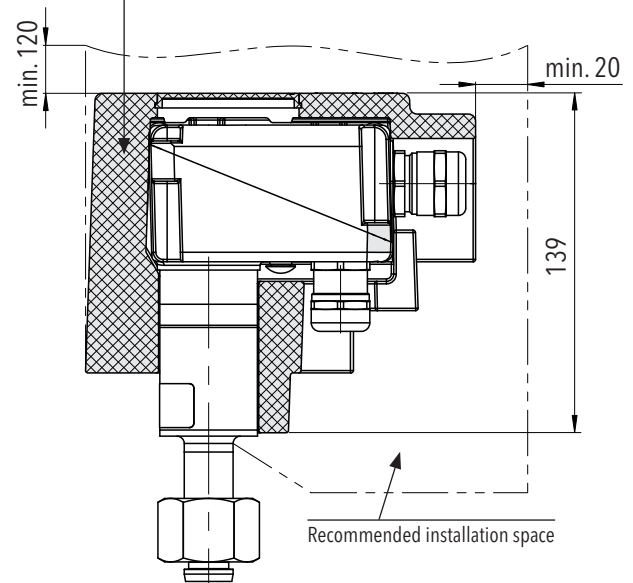
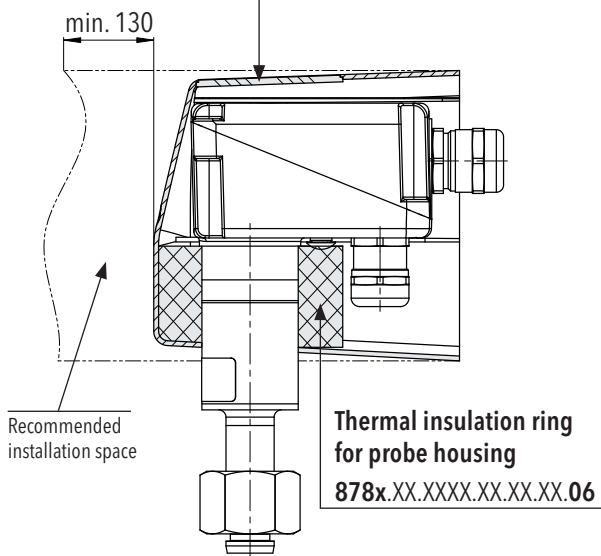
<sup>1)</sup> Or any orientation in between. A vertical upside down installation shall be avoided

## Sheltering options



**Weather protection cover**  
**878x.XX.XXXX.XX.XX.XX.46**

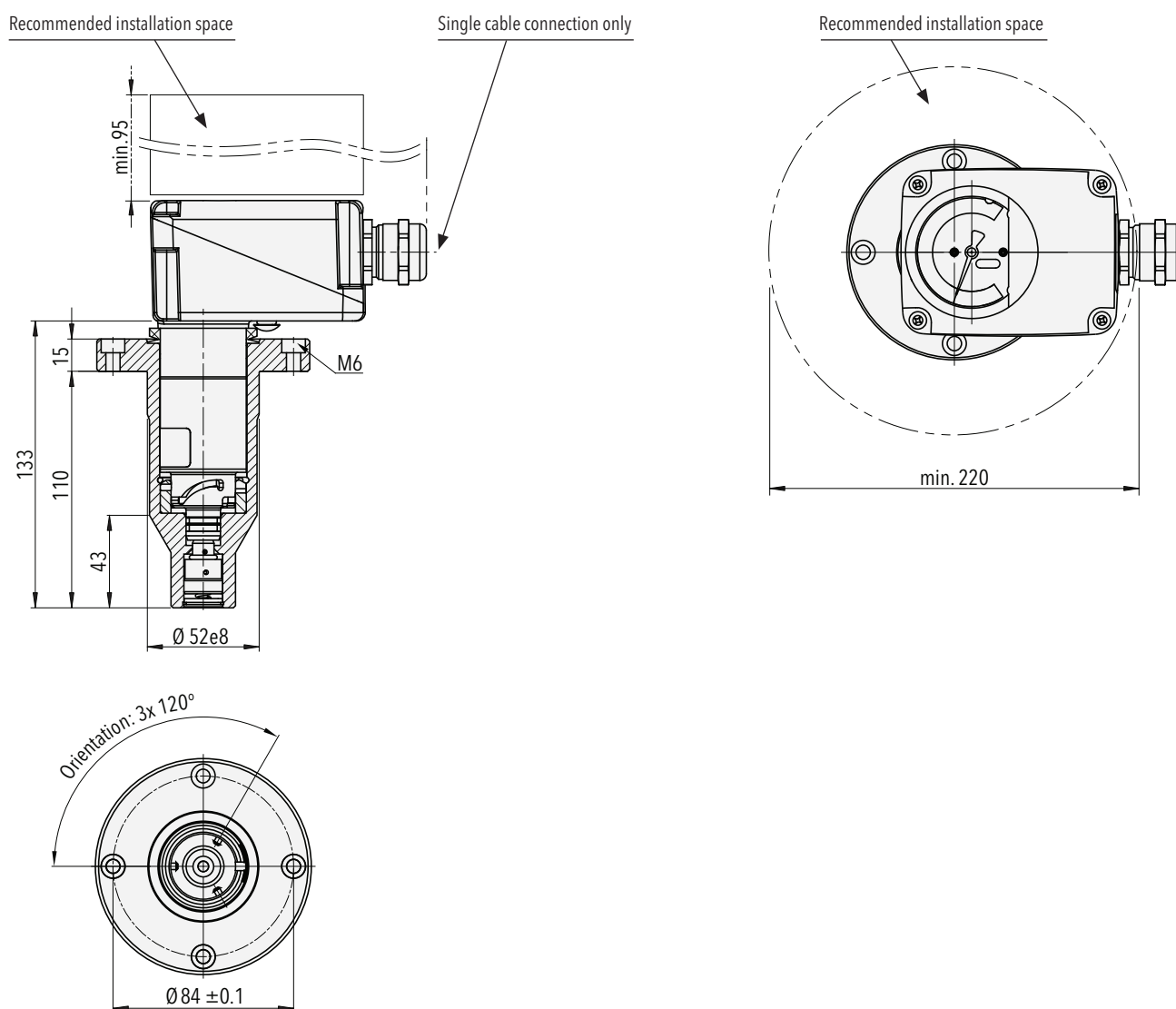
**Thermal foam cover**  
**878x.XX.XXXX.XX.XX.XX.37**



Weather protection cover (46) is aimed for long-term element protection. Insulation ring (06) for probe housing increases thermal inertia in moderate climates. Probe housing refers to the lower part of the monitor where reference chamber and oscillating quartz sensor are located.

Foam cover (37) increases thermal inertia of the hybrid density monitor. It is recommended in locations with high solar radiation or daily temperature fluctuations (high altitude, arctic, desert).

## Compartment immersion process connection

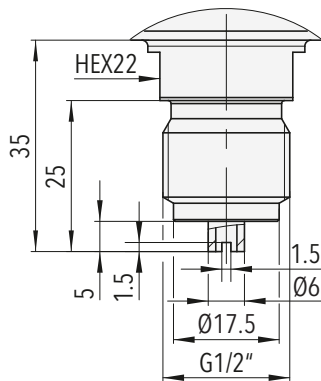


**878x.XX.5XXX.XX.XX.XX.XX**

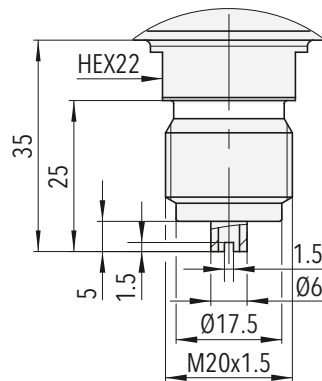
The in-compartment installation (5xxx) is aimed to match process gas and monitor probe temperature. Bayonet fitting allows installation while process is pressurised.

## Process connections

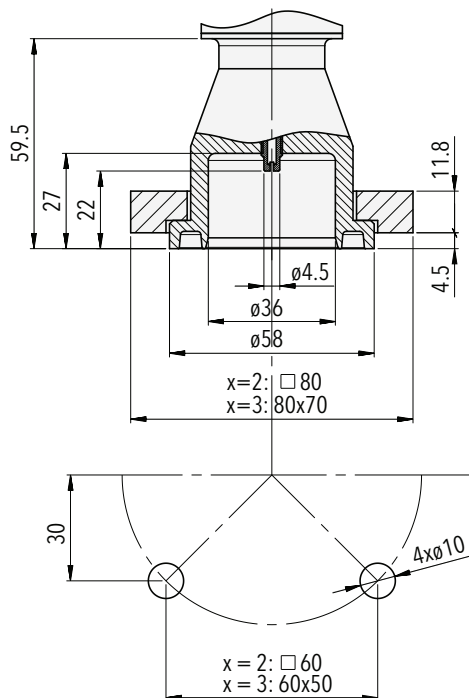
### Axial process connections



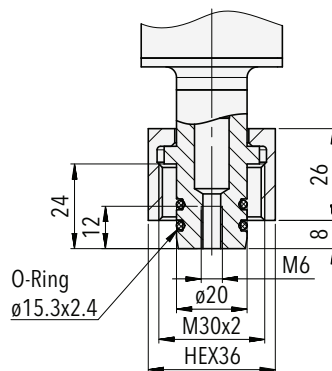
**878x.XX.1000.XX.XX.XX.XX**  
Axial threaded connection G1/2"



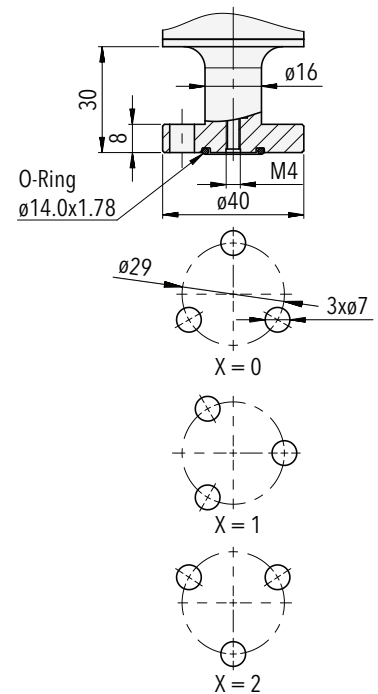
**878x.XX.1120.XX.XX.XX.XX**  
Axial threaded connection M20x1.5



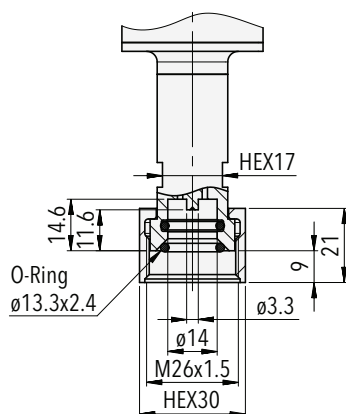
**878x.XX.2002.XX.XX.XX.XX**  
Axial flanged connection



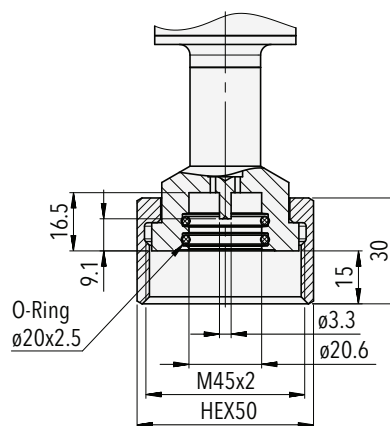
**878x.XX.2300.XX.XX.XX.XX**  
Axial cap nut connection



**878x.XX.220x.XX.XX.XX.XX**  
Axial flanged connection



**878x.XX.2551.XX.XX.XX.XX**  
Axial connection DN8



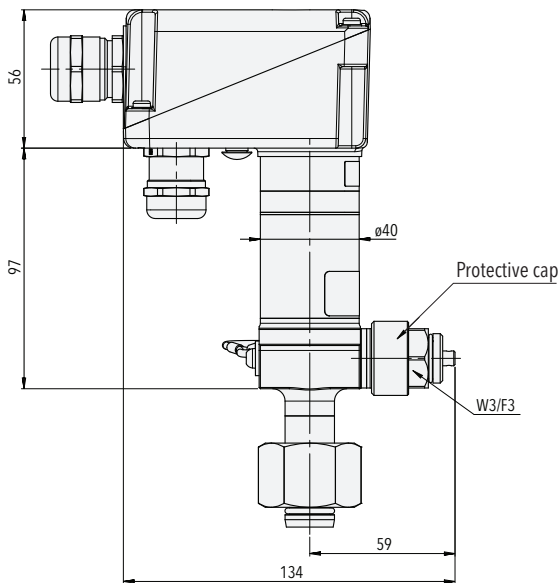
**878x.XX.2571.XX.XX.XX.XX**  
Axial connection DN20



## Integrated test valve DN8

## Integrated maintenance and re-filling valve DN8

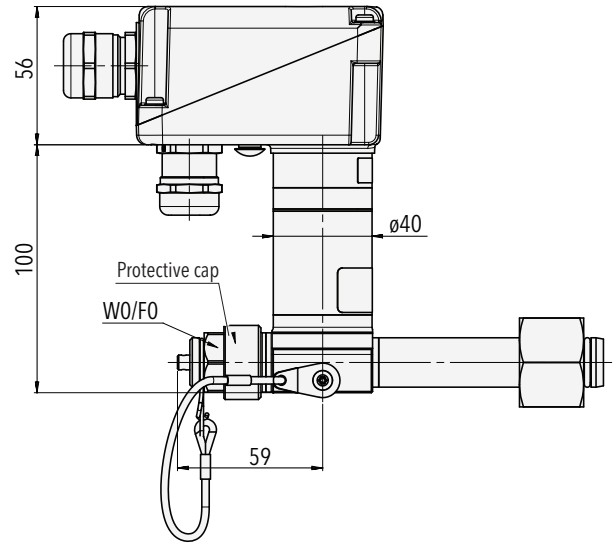
### Example model with axial process connection



#### 878x.XX.XXXX.XX.W0/W1/W2/W3.XX.XX

Test valve allows in-situ monitor and sensor verification without dismounting from pressure compartment. Test equipment is connected via DN8 port. Connection is configurable for direction W0/W1/W2/W3.

### Example model with radial process connection

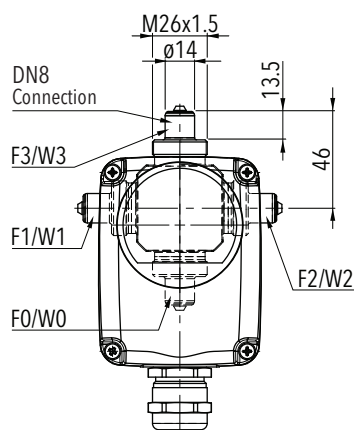


#### 878x.XX.XXXX.XX.F0/F1/F2/F3.XX.XX

Valve allows in-situ analyzing of gas quality and direct insulating gas replenishment of pressure compartment via DN8 port on re-filling valve. Connection is configurable for direction F0/F1/F2/F3.

### Orientation of valve connection <sup>1)</sup>

please specify when ordering

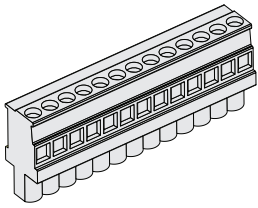


- F3/W3 (12 o'clock, Standard orientation)
- F0/W0 (6 o'clock, 180° orientation)
- F1/W1 (9 o'clock, 270° orientation)
- F2/W2 (3 o'clock, 90° orientation)

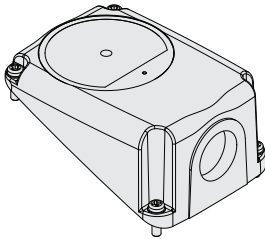
<sup>1)</sup> While using weather protection cover or thermal foam cover, the indicated installation spaces should be followed.  
See section installation and sheltering options

### Operating specification for test and re-filling valve:

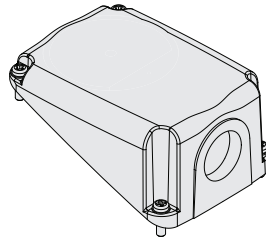
Opening and closing shall be limited to temperature range of -25°C ... +50°C.  
Mechanical lifetime min. 250 actuation cycles.



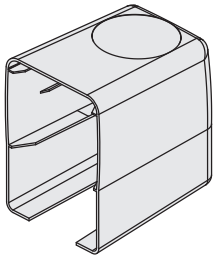
Microswitch wire terminal, 13-pins <sup>1)</sup>



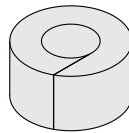
Housing cover with dial window <sup>2)</sup>



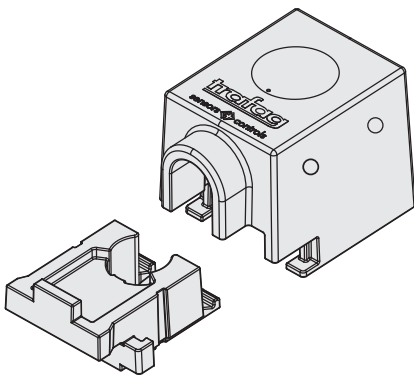
Housing cover without dial window <sup>2)</sup>



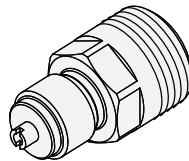
Weather protection cover  
(Trafag part no.: C16354)



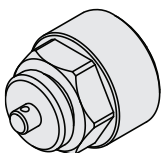
Thermal insulation ring for probe housing  
(Trafag part no.: D34570)



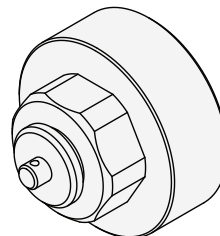
Thermal foam cover with drain holes  
(Trafag part no.: C16421)



Pressure connection adapter 2300 - G1/2" male  
(Trafag part no.: C30931)



M26x1.5 protective cap for test and re-filling valve  
2 x O-Ring IIR mounted inside  
(Trafag part no.: C30645)



M45x1.5 protective cap for filling valve  
(Trafag part no.: C35800)

<sup>1)</sup> Please contact us for more details

<sup>2)</sup> Please identify if microswitch cable outlet is required. For options see ordering information

# Reliable quality

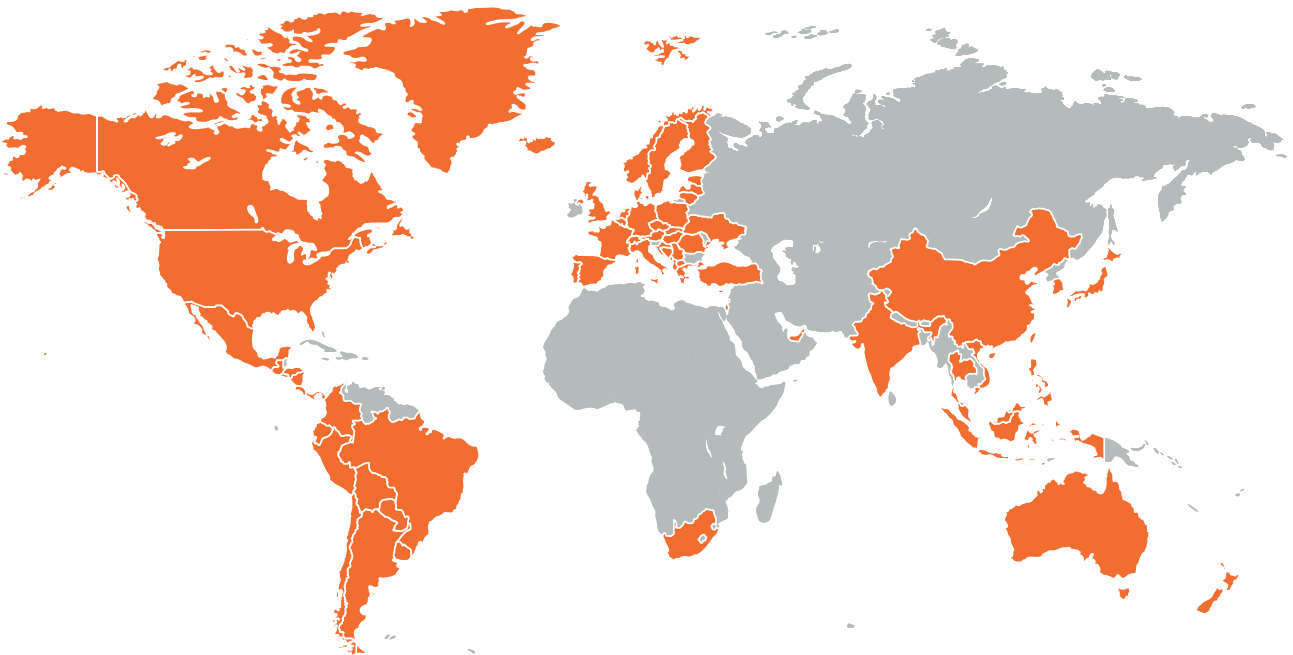
## Worldwide represented, globally trusted, Swiss based

Trafag develops, manufactures and markets accurate, robust, and maintenance-free instruments for monitoring SF<sub>6</sub> and alternative insulating gases in high and medium voltage switchgear. Trafag also offers a wide range of pressure and temperature monitoring products for various applications.

All innovative products and key components are designed in-house by Trafag's research and development departments in Switzerland, Germany and India and are then produced in the

manufacturing sites in Switzerland, Germany, Czech Republic, and India. Strict quality management in accordance with ISO 9001 and ISO 14001 ensure that Trafag products meet the required quality and sustainability standards.

Trafag is headquartered in Switzerland, was founded in 1942 and has an extensive sales and service network in more than 40 countries worldwide.



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Pressure transmitters



Electronic pressure switches



Mechanical pressure switches



Pressure gauge



Thermostats



Temperature transmitters



Gas density