

87x6

Gas density monitor with switching contacts



Product description

Swiss based Trafag offers precise, reliable and maintenance-free instruments developed for density monitoring of SF₆ and related alternative gases. Monitoring is based on the gas density reference principle. Thus offering the most reliable solution on the market by directly monitoring the insulating gas density.

Applications

- High voltage technology
- Medium voltage technology
- SF₆ and variety of alternative mixed gases

Features

- Exact switching output at all temperatures
- Fully temperature compensated by design
- No contact bouncing
- Independent, galvanically separated circuits
- Suitable for highly dynamic measurements
- Maintenance free indoor and outdoor use

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

**UK
CA** S.I. 2016 No. 1101; S.I. 2016 No. 1091

✓ RoHS/Reach compliant

Technical Data

Measuring principle	Absolute pressure reference gas measuring system
Measuring range	0 ... 1250 kPa abs. @ 20°C
Output signal	Floating change-over contact (SPDT)
Quantity of switchpoints	1 ... 4 microswitches
Ambient temperature	-40°C ... +80°C

Additional information

Data sheet www.trafag.com/H72511
Instructions www.trafag.com/H73511

Ordering information/Type code

		XXXX	XX	XXXX	XX	XX	XX
Custom build code	Gas density monitor with microswitches						
	One microswitch	8716					
	Two microswitches	8726					
	Three microswitches	8736					
	Four microswitches	8746					
Wire terminal block	Standard wire terminal		20				
Pressure connection	Threaded, axial and radial types			1XXX			
	Flanged and cap nut, axial and radial types			2XXX			
	Compartment immersion types			5XXX			
Code number	Determined by Trafag					XX	
Options	Basic density indicator dial with two colour sectors without markings						60
	Density indicator dial with scale according to customer specification						61
	Low pressure indicator						66
	Microswitch 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 ¹⁾						13
	Blank plug M25x1.5, brass, nickel-plated ¹⁾						04
	Blank plug M25x1.5, PA ¹⁾²⁾						05
	Process gas damping element ³⁾						49
	Integrated valve for monitor test with DN8 coupling						
	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						
	Standard filling port orientation						F3
	Filling port orientation 180°						F0
	Filling port orientation 270°						F1
	Filling port orientation 90°						F2
Accessories	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

¹⁾ Select if EMC-cable gland is procured locally

²⁾ Without IP compatibility, not for use in operation

³⁾ Available with pressure connections 2000, 2001, 2045

Further customised parameterisation to be indicated

Process gas	SF ₆ , SF ₆ - based mixed gas, customer specific alternative gas (gas mixtures to be indicated in mol-%)
Units for indicator dial	kPa, MPa, bar, psi, kg/m ² , kg/cm ² , absolute (standard) or relative (optional) units ¹⁾ , optionally available dial indication dual units
Switchpoint @ 20°C	For each microswitch, indicate switching point p@20°C. Standard factory setting is for decreasing pressure. Optionally, setting for increasing pressure is available. Factory setting for decreasing or increasing pressure available Standard setting is for decreasing pressure Especially for outdoor installations 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.

¹⁾ 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 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

Monitoring	Principle	Reference gas chamber, sealed: Absolute pressure system, no influence due to ambient pressure changes, fully temperature compensated by design ¹⁾
	Range	0 ... 1100 kPa abs. @ 20°C with low pressure indicator option 0 ... 1250 kPa abs. @ 20°C without low pressure indicator option
	Output	Floating change-over contact (SPDT)
	Accuracy	Refer to density indicator and microswitch sections
Microswitch	Output signal	Floating change-over contact (SPDT)
	Resistive load (Inductive load)	AC - 250 V/10 (1.5) A DC - 250 V/0.1 (0.05) A, 220 V/0.25 (0.2) A, 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 1 Mio. mechanical, more than 10'000 with maximum load
	Effect of vibration	4 g / 20 ... 100 Hz effects no contact bounce at 5 kPa minimum distance from set switchpoint
Switchpoint setting	Factory adjustment	According to customer specification, ²⁾ standard setting is for decreasing pressure
	Lowest switchpoint setting	120 kPa abs. @ 20°C
	Highest switchpoint setting	0 ... 1100 kPa abs. @ 20°C with low pressure indicator option 0 ... 1250 kPa abs. @ 20°C without low pressure indicator option
	Distance from the lowest to the highest switchpoint	Up to 180 kPa @ 20°C ³⁾
	Switching differential	3 ... 7 kPa typ. (15 kPa max.) if lowest to highest switchpoint distance is up to 130 kPa 5 ... 10 kPa typ. (20 kPa max.) if lowest to highest switchpoint distance is > 130 ... 180 kPa

¹⁾ Depending on process gas requirements, the fully sealed reference gas chamber contains up to 0.001 kg of SF₆. 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

²⁾ 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

³⁾ 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

Temperature range		+20°C	-30°C ... +50°C	-40°C ... +60°C
First alarm switchpoint setting pressure abs. @ 20°C ¹⁾				
≤ 650 kPa	[kPa max.]	± 8	± 10	± 12
> 650 kPa ... 1000 kPa	[kPa max.]	± 8	± 12	± 14
> 1000 kPa	[kPa max.]	± 10	± 15	± 16
High pressure alarm ^{1) 2)}				
≤ 1000 kPa	[kPa max.]	± 10	± 16	± 20
> 1000 kPa	[kPa max.]	± 10	± 17	± 21

¹⁾ While no liquefaction occurs and the insulation gas is completely gaseous

²⁾ Only applicable if factory adjustment includes high-alarm switchpoint above filling pressure

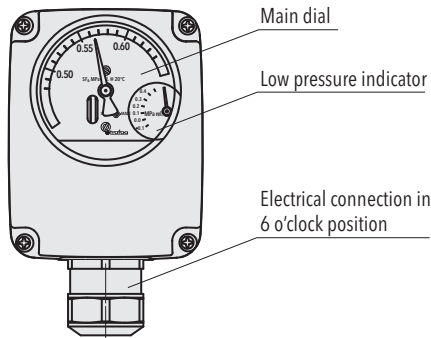
Density indicator

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

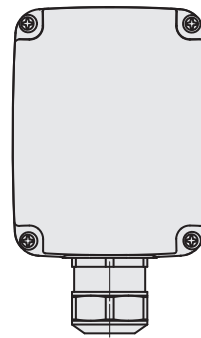
¹⁾ Typically ranges are from lock-out switchpoint to filling pressure (no high-alarm), or from lock-out switchpoint to high-alarm switchpoint

Density indicator

Main dial and low pressure indicator

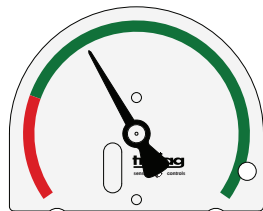


Gas density monitor without indication dial

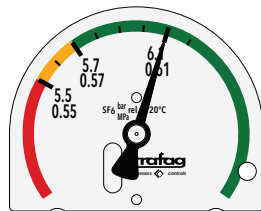


Density indicator dial according to customer specification

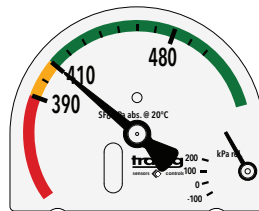
Availability of a full variety of units including dual range indication, this also includes dial rotated by 90°/180°/270°.



87x6.XX.XXXX.XX.60.XX.XX

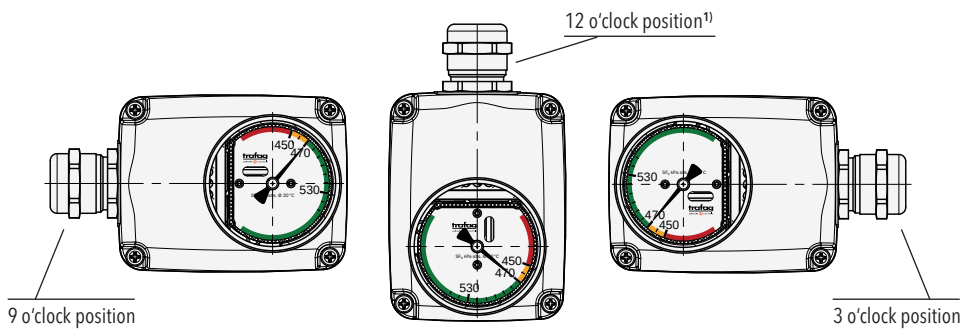


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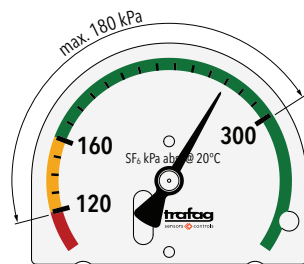
87x6.XX.XXXX.XX.60.61.66.XX

Customized dial orientation based on electrical connection position

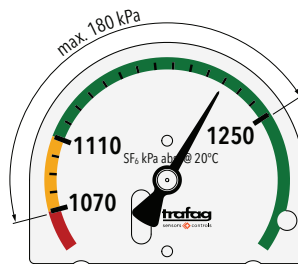


¹⁾ Should only be used for indoor applications while using neither a weather protection cover nor a thermal foam cover

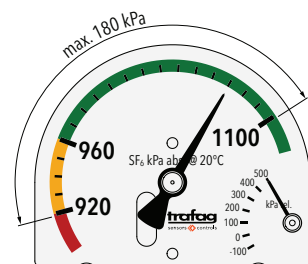
Maximum switchpoint range



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

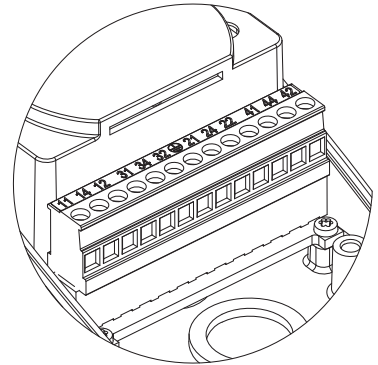
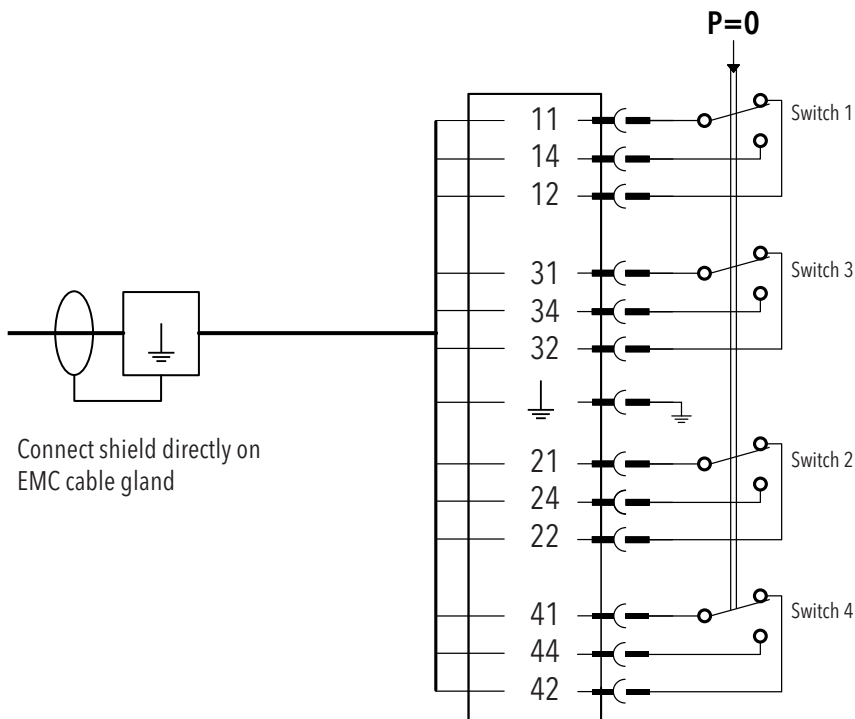
General specifications

Environmental conditions	Ambient temperature	-40°C ... +80°C
	Protection ¹⁾	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 ≤ 650 kPa abs. @ 20°C: 1300 kPa abs. > 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 6 bar rel. helium, leakage detection rate < 7·10 ⁻⁸ mbar · l/s
Mechanical data	Process gas wetted material	Process connection and measuring system: 1.4404, 1.4435, 1.4571 (AISI316L, AISI316Ti) Test and re-filling valve: 1.4404 (AISI316L), CuZn39Pb3 (C38500) Sealing: IIR
	Housing	AlSi10Mg, powder coated
	Screwed cable gland	Brass nickel plated, PA as option
	Dial	Dial face and pointer: Aluminium sheet Window: PMMA
	Weight	Gas density monitor: ~ 800 ... 1000 g Gas density monitor with integrated test or re-filling valve ~ 1100 ... 1300 g

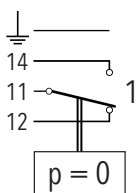
¹⁾ While using appropriate cable gland and/or mating connector mounted according to instruction

Electrical connections

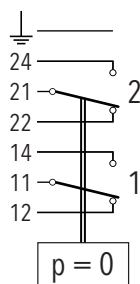
Number of microswitches according to customer application



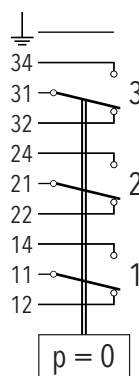
Microswitch in non-pressurised condition ($p_{rel} = 0$)



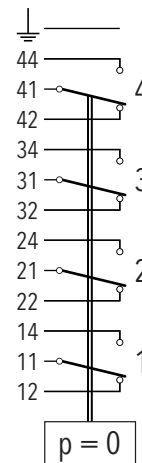
8716.XX.XXXX.XX...



8726.XX.XXXX.XX...



8736.XX.XXXX.XX...

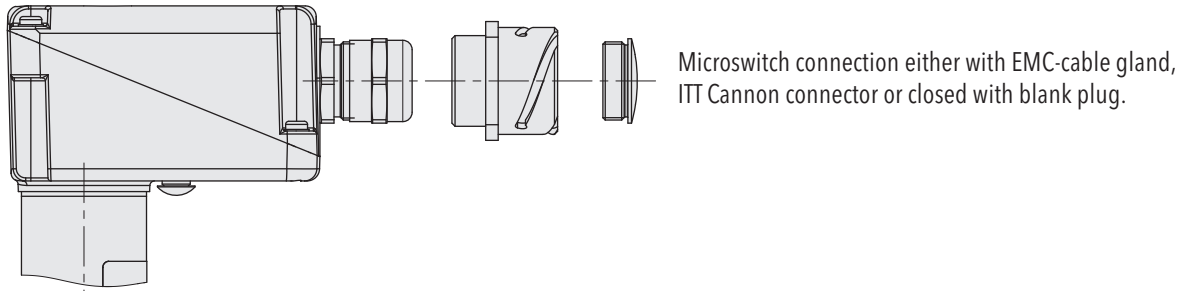


8746.XX.XXXX.XX...

 Connected with all electrically conductive elements of the density monitor

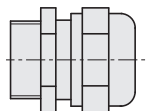
Connections for microswitch

EMC-cable gland	See ordering information
Wire terminal	Plugable, 0.2 ... 2.5 mm², 13-pins
Connector option	ITT Cannon



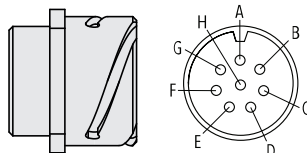
Electrical connection

EMC-cable gland ¹⁾



87x6.XX.XXXX.XX.XX.XX.XX
Type code 07 ... 17,
see ordering information

ITT Cannon connector ^{2) 3)}



87x6.XX.XXXX.XX.12.XX.XX

Blank plug ¹⁾



87x6.XX.XXXX.XX.XX.XX.XX
Type code 04 ... 13,
see ordering information

¹⁾ IP 65 and IP 67 protection, exceptions are indicated in ordering information/type code

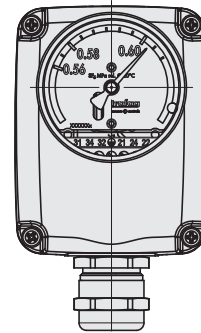
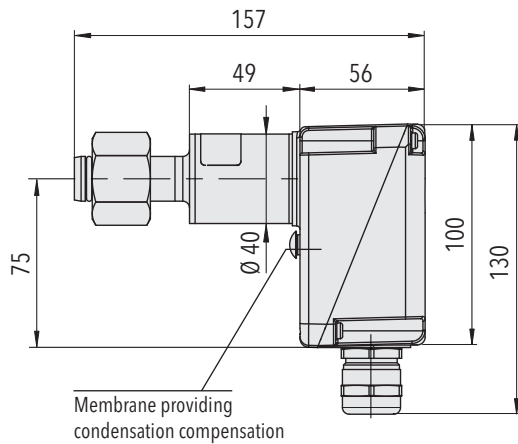
²⁾ IP 65 and IP 67 protection while using an equivalent mating connector mounted according to instruction

³⁾ Please contact us for standard pin-out and more details.

Monitor internal wiring provided. Sheltering options are limited to weather protection cover (46) and/or thermal insulation ring (06) for probe housing

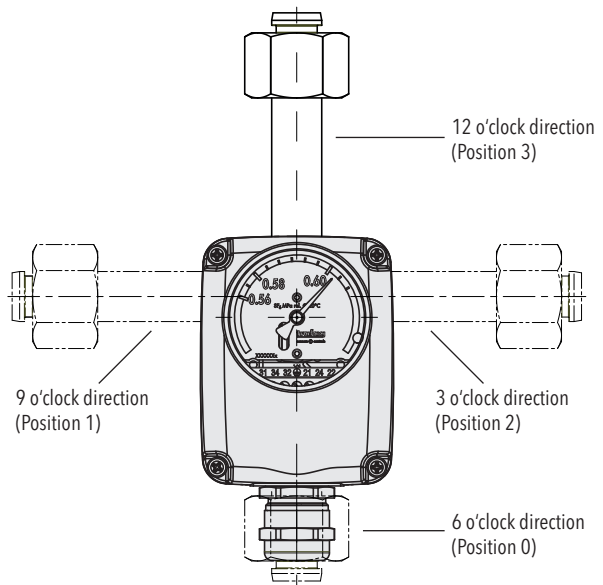
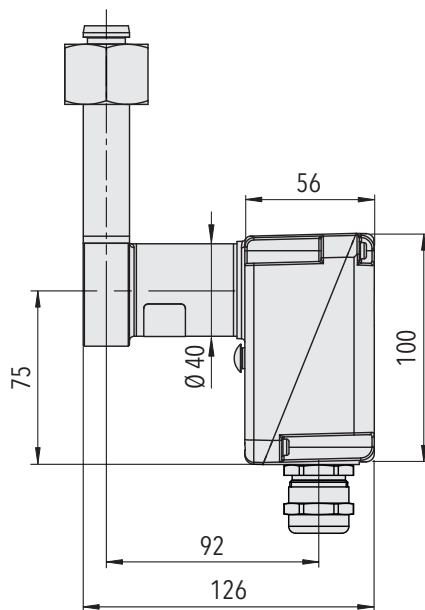
Main dimensions of density monitor

Example model with axial process connection



87x6.20.2XXX.XX.XX.XX.XX

Example model with radial process connection



87x6.20.2XXX.XX.XX.XX.XX

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

Position 0: 87x6.21.XXX0.XX.XX.XX.XX

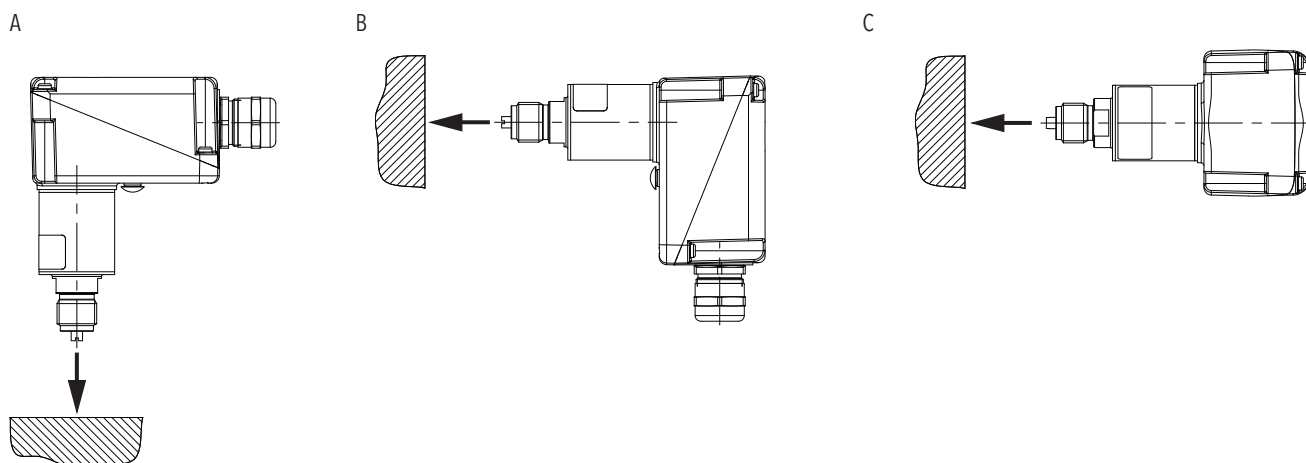
Position 1: 87x6.21.XXX1.XX.XX.XX.XX

Position 2: 87x6.21.XXX2.XX.XX.XX.XX

Position 3: 87x6.21.XXX3.XX.XX.XX.XX

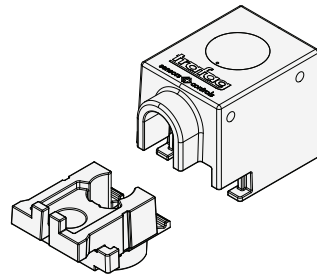
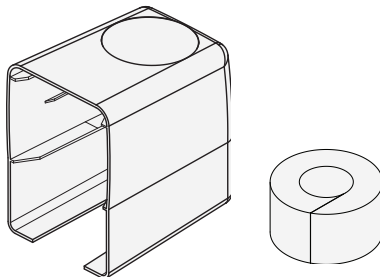
Installation

	Indoor application	Outdoor application	Outdoor application with rapidly changing or extreme weather conditions
Installation orientation	No limitations, any orientation possible	A, B, C ¹⁾	A, B, C ¹⁾
Recommended option	None	• Weather protection cover (46) • Thermal insulation for probe housing (06)	• Thermal foam cover (37) • Compartment immersion type process connection (5XXX)



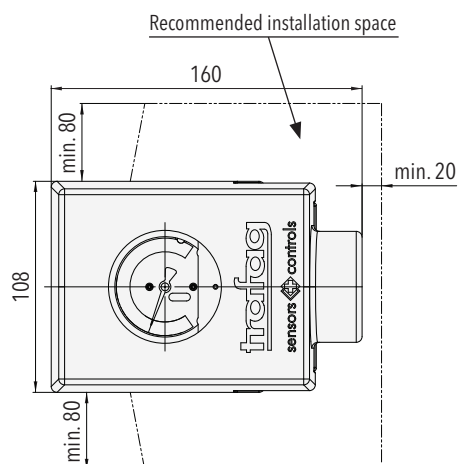
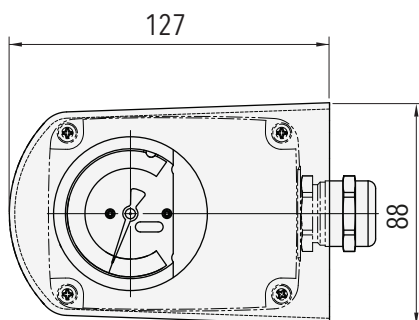
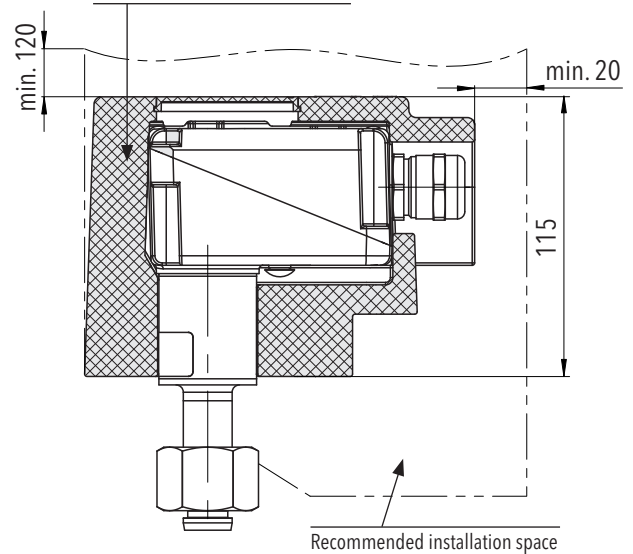
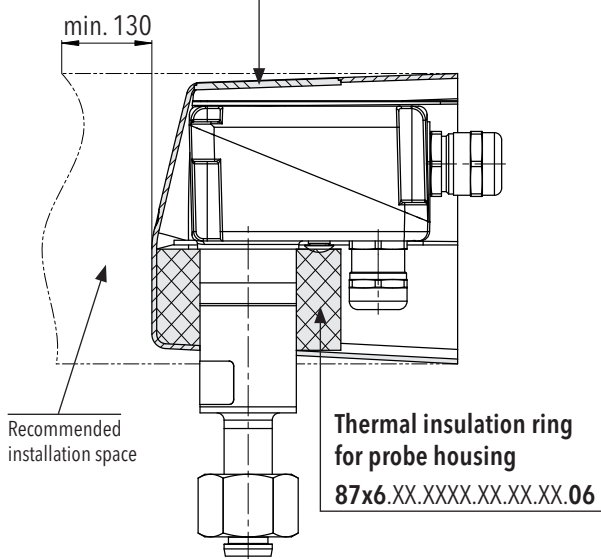
¹⁾ Or any orientation in between. A vertical upside down installation shall be avoided

Sheltering options



Weather protection cover
87x6.XX.XXXX.XX.XX.XX.46

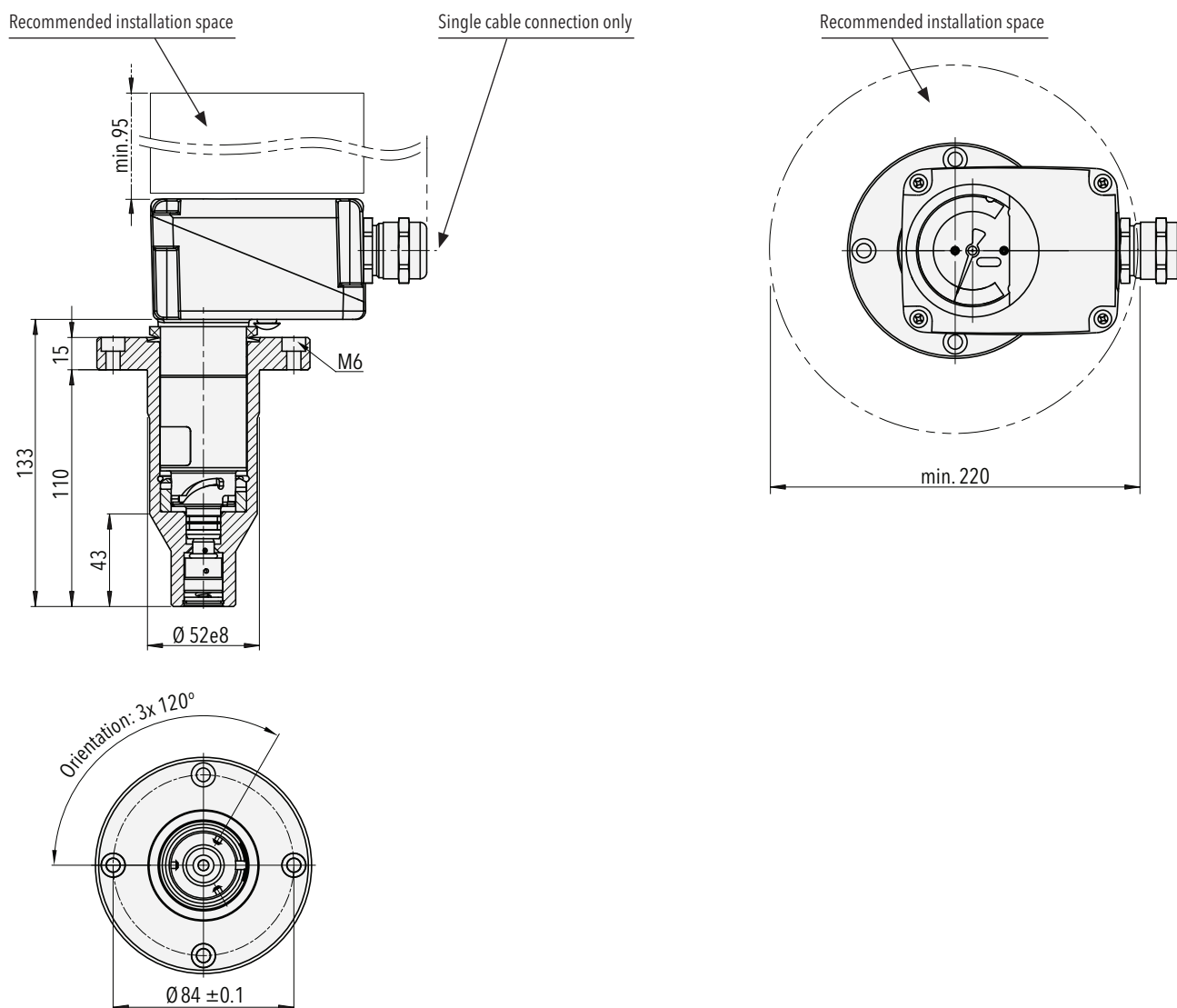
Thermal foam cover
87x6.XX.XXXX.XX.XX.XX.37



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 the reference chamber is located.

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

Compartment immersion process connection

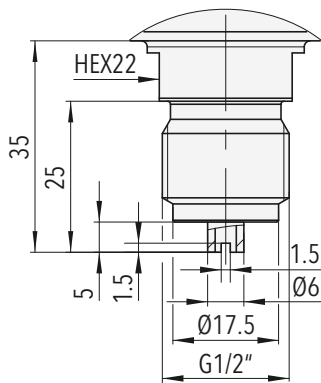


87x6.XX.5XXX.XX.XX.XX.XX

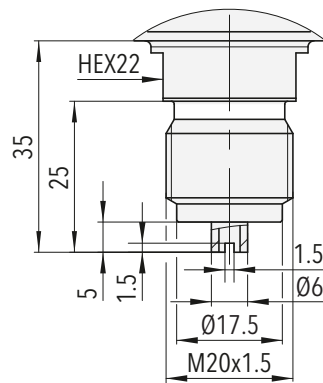
The in-compartment installation (5xxx) is aimed to match process gas and monitor probe temperature. Bayonet fitting allows installation while process is pressurised.

Process connections

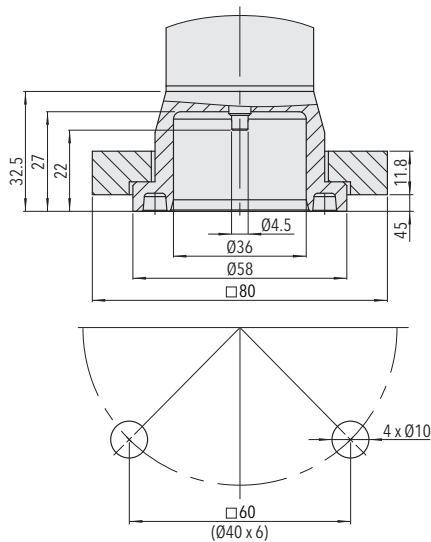
Axial process connections



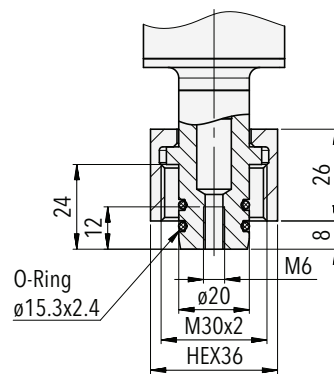
87x6.XX.1000.XX.XX.XX.XX
Axial threaded connection G1/2"



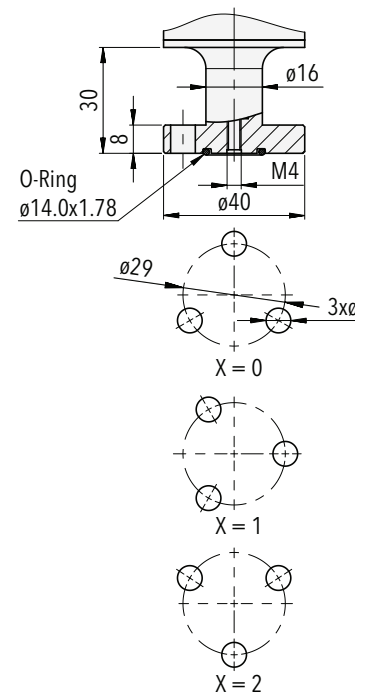
87x6.XX.1120.XX.XX.XX.XX
Axial threaded connection M20x1.5



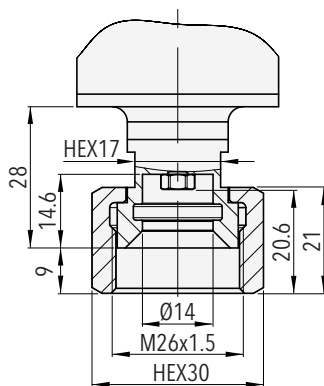
87x6.XX.2000.XX.XX.XX.XX
Axial flanged connection



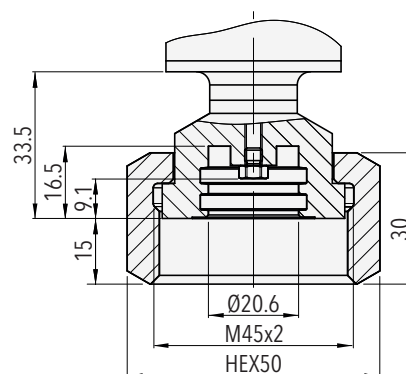
87x6.XX.2300.XX.XX.XX.XX
Axial cap nut connection



87x6.XX.220x.XX.XX.XX.XX
Axial flanged connection



87x6.XX.2550.XX.XX.XX.XX
Axial connection DN8

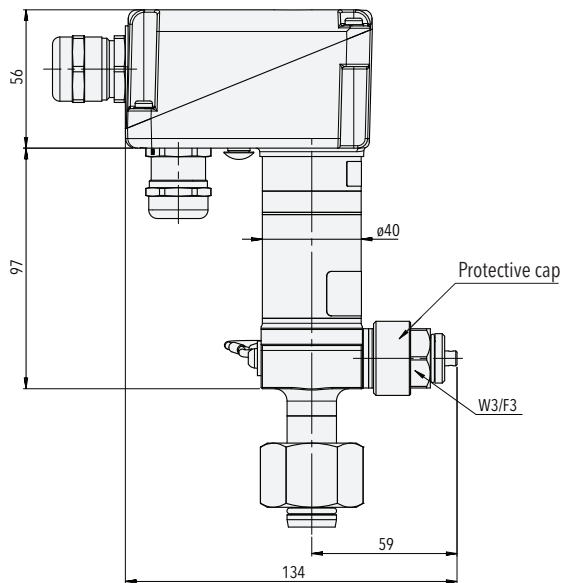


87x6.XX.2570.XX.XX.XX.XX
Axial connection DN20

Integrated test valve DN8

Integrated maintenance and re-filling valve DN8

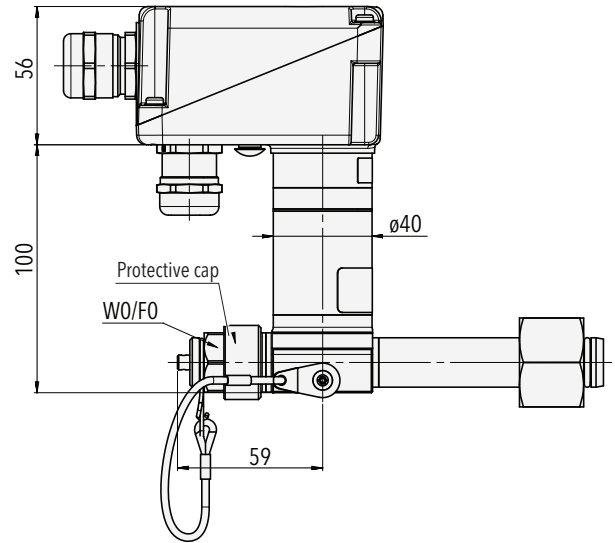
Example model with axial process connection



87x6.XX.XXXX.XX.W0/W1/W2/W3.XX.XX

Test valve allows in-situ monitor 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

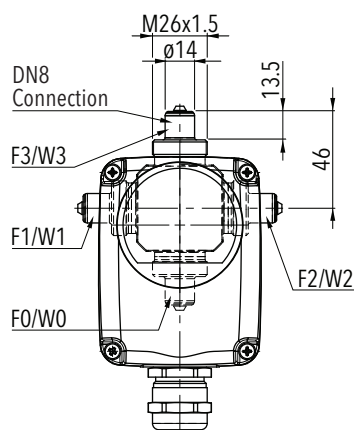


87x6.XX.XXXX.XX.F0/F1/F2/F3.XX.XX

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 ¹⁾

please specify when ordering

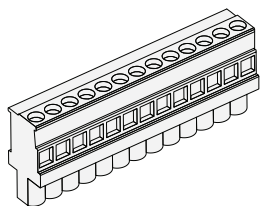


- F3/W3 (12 o'clock, Standard orientation)
- F0/W0 (6 o'clock, 180° orientation)
- F1/W1 (9 o'clock, 270° orientation)
- F2/W2 (3 o'clock, 90° orientation)

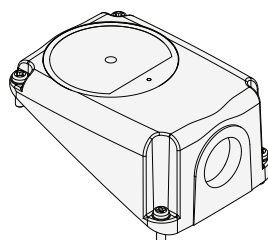
¹⁾ While using weather protection cover or thermal foam cover, the indicated installation spaces should be followed.
See section installation and sheltering options

Operating specification for test and re-filling valve:

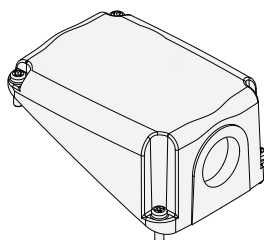
Opening and closing shall be limited to temperature range of -25°C ... +50°C.
Mechanical lifetime min. 250 actuation cycles.



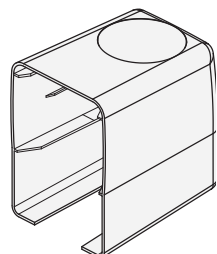
Standard microswitch wire terminal, 13-pins ¹⁾



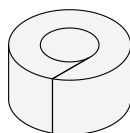
Housing cover with dial window ²⁾



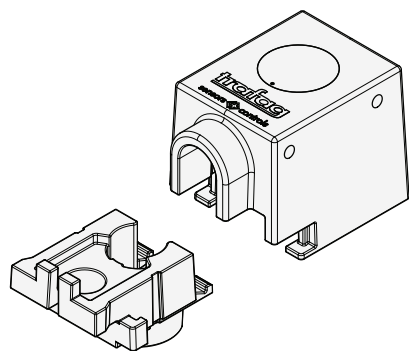
Housing cover without dial window ²⁾



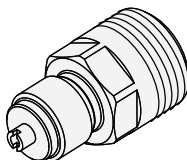
Weather protection cover
(Trafag part no.: C16354)



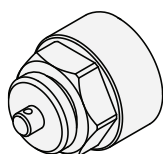
Thermal insulation ring for probe housing
(Trafag part no.: D34570)



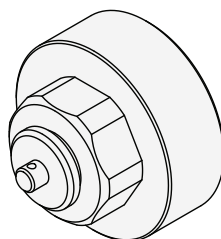
Thermal foam cover with drain holes
(Trafag part no.: C16421)



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)

¹⁾ Please contact us for more details

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

Reliable quality

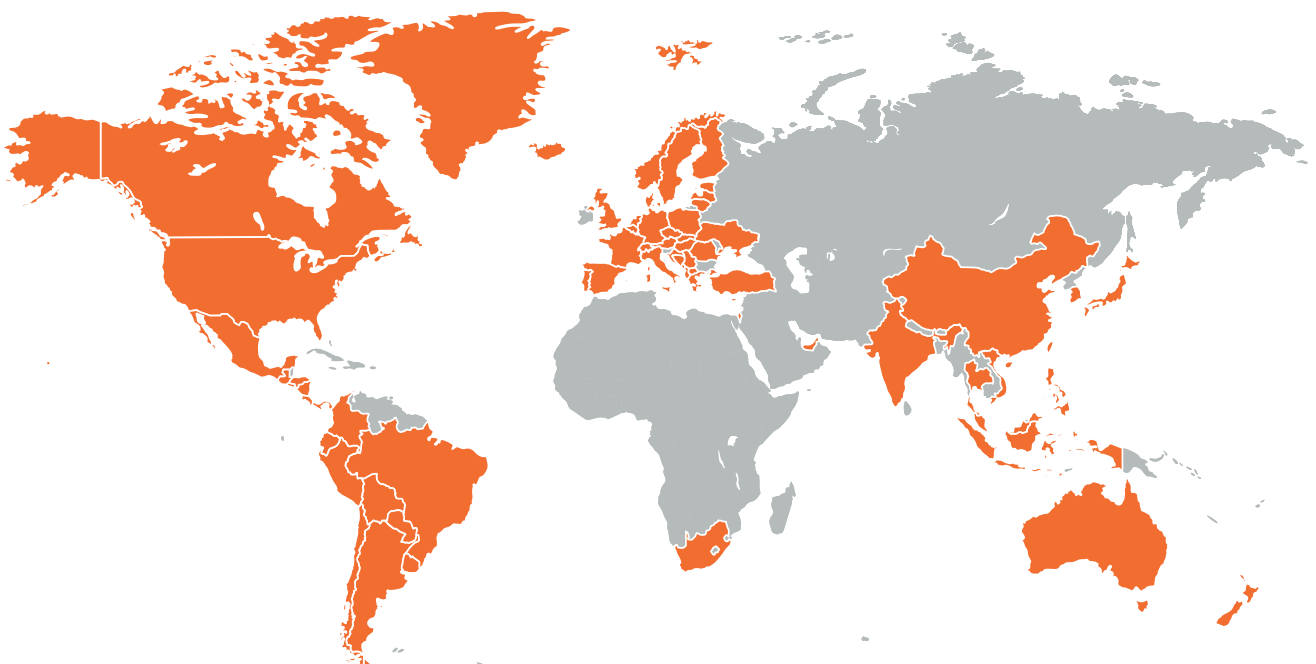
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Pressure transmitters



Electronic pressure switches



Mechanical pressure switches



Pressure gauge



Thermostats



Temperature transmitters



Gas density